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INSTALLATION RESTORATION PROGRAM
STAGE 2-1
REMEDIAL INVESTIGATION
VOLUME 1: TEXT AND PLATES

BEALE AIR FORCE BASE
MARYSVILLE, CALIFORNIA 95903-5000

CH2MHILL
3840 ROSIN COURT , SUITE 110
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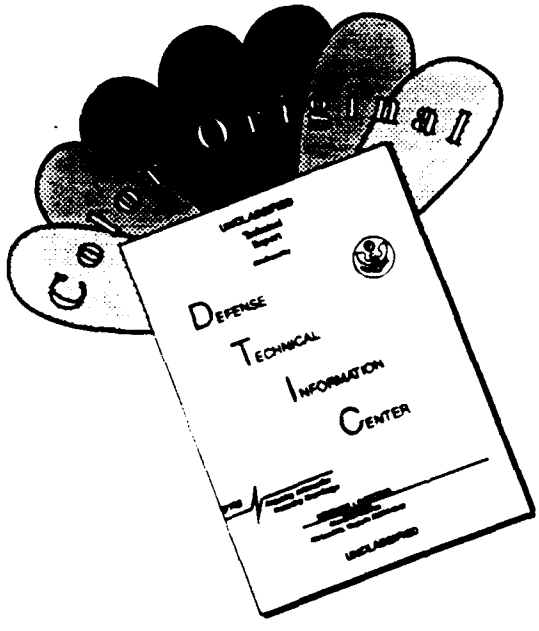
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As part of the ongoing Installation Restoration Program at Beale Air Force Base, California, 24 sites of concern have been identified. During the IRP Stage 2-1 Remedial Investigation, which is the subject of this technical report, 16 of the 24 sites were investigated through sampling and analysis of environmental media. Two of the 24 sites were investigated using surface geophysics only, and 1 of the sites was the subject of records search activities only. The remaining 5 sites did not receive any IRP actions during IRP Stage 2-1.

This technical report summarizes the activities accomplished and results obtained during IRP Stage 2-1 Remedial Investigation, through four quarterly rounds of water sampling. Included in this report are discussions of the IRP program origin and objectives, environmental setting of Beale AFB, field and laboratory investigation methods, results obtained, and recommendations for future IRP actions. Eleven appendices are included which present data and relevant information regarding Stage 2-1 activities.

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FOR
BEALE AIR FORCE BASE, CALIFORNIA 95903-5000

HEADQUARTERS STRATEGIC AIR COMMAND (HQ SAC/DEVC)
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This report was prepared under the supervision of Robert E. Pexton, California Registered Geologist CRG #4457.

Robert E Pexton
Signed

March 29, 1991
Dated

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ES. EXECUTIVE SUMMARY

ES.1 SUMMARY OF IRP PROGRAM AT BEALE AIR FORCE BASE

Beale Air Force Base is located at the boundary of the Sacramento Valley and foothills of the Sierra Nevada, approximately 10 miles east of Marysville, California and 40 miles north of Sacramento, California. Figure ES-1 shows the location of Beale AFB.

In 1984, the Installation Restoration Program, Phase I: Records Search was conducted to evaluate potential environmental concerns at the base. This study identified 16 sites of concern, two of which were later combined for a net of 15 sites. In 1985, three additional sites were added to the IRP list and the Phase II, Stage 1: Confirmation/ Quantification Study was initiated to determine if contaminants were actually present at the IRP facilities. The final report for Phase II, Stage 1 was released in May 1987.

Preparation of Remedial Investigation (RI) Workplans for Stage 2-1 activities was initiated in October 1987 and four new IRP sites were added to the list, bringing the total number of sites to 22. Just prior to the start of Stage 2-1 RI activities, two additional sites were added, bringing the IRP site list to the current total of 24 sites.

Activities completed under Stage 2-1: Remedial Investigation, which are the subject of this report, include surface soil and waste sampling and analysis, subsurface soil sampling and analysis, installation of groundwater monitoring wells, sampling and analysis of groundwater and surface water on a quarterly basis for a period of 1 year, geophysical investigations at four sites, and a soil gas/ ambient air study at one site. All soil and waste sampling and installation of all but one of the monitoring wells was completed between October 1988 and April 1989. One monitoring well was installed in August 1989 and the final quarterly water sampling was completed in December 1989.

ES.2 DESCRIPTION OF BEALE AFB IRP SITES

There are currently 24 IRP sites at Beale AFB. Figure ES-2 shows the location of the sites. The sites include four landfills, three fuel spill areas, two above ground fuel storage areas, two sites associated with photographic

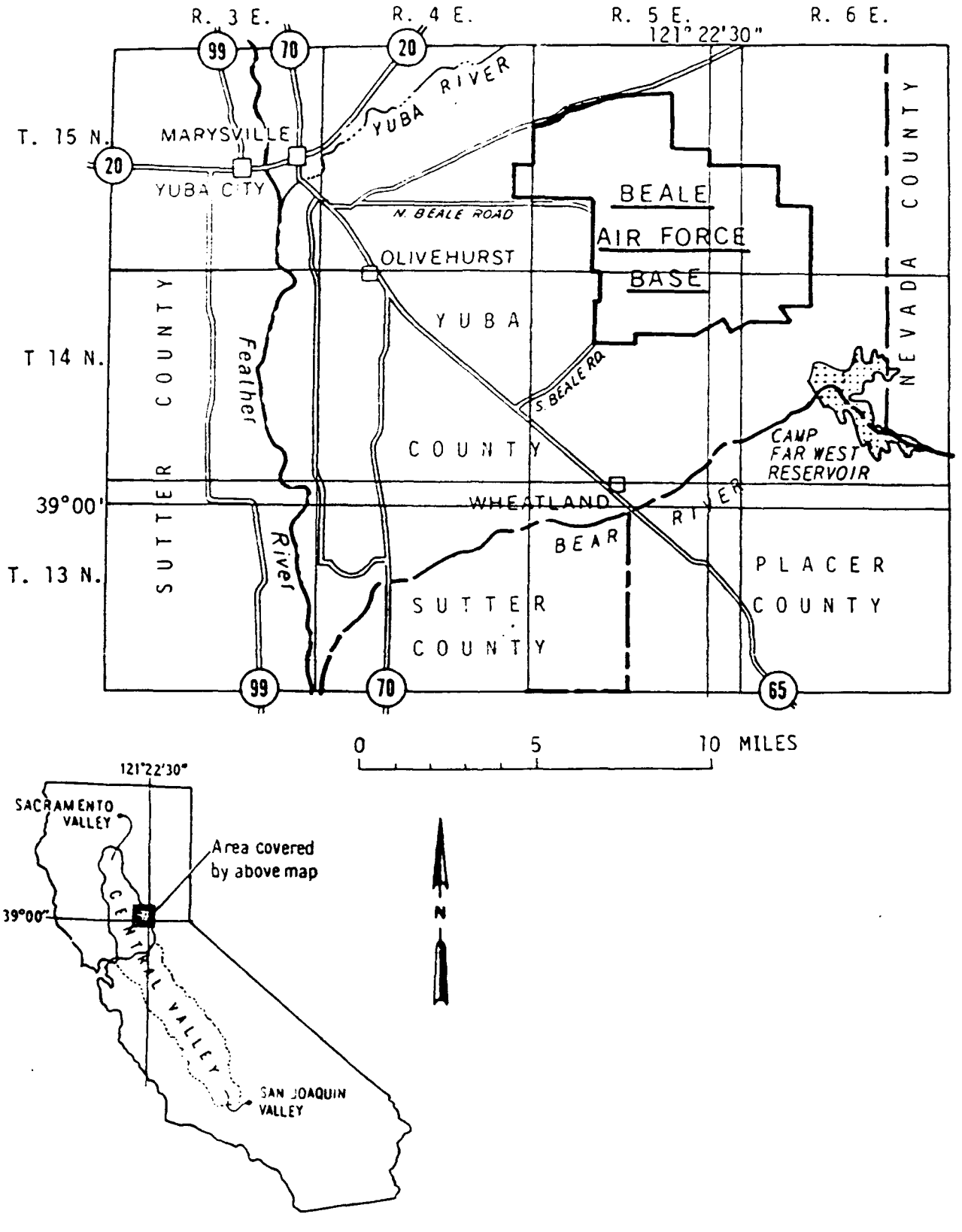
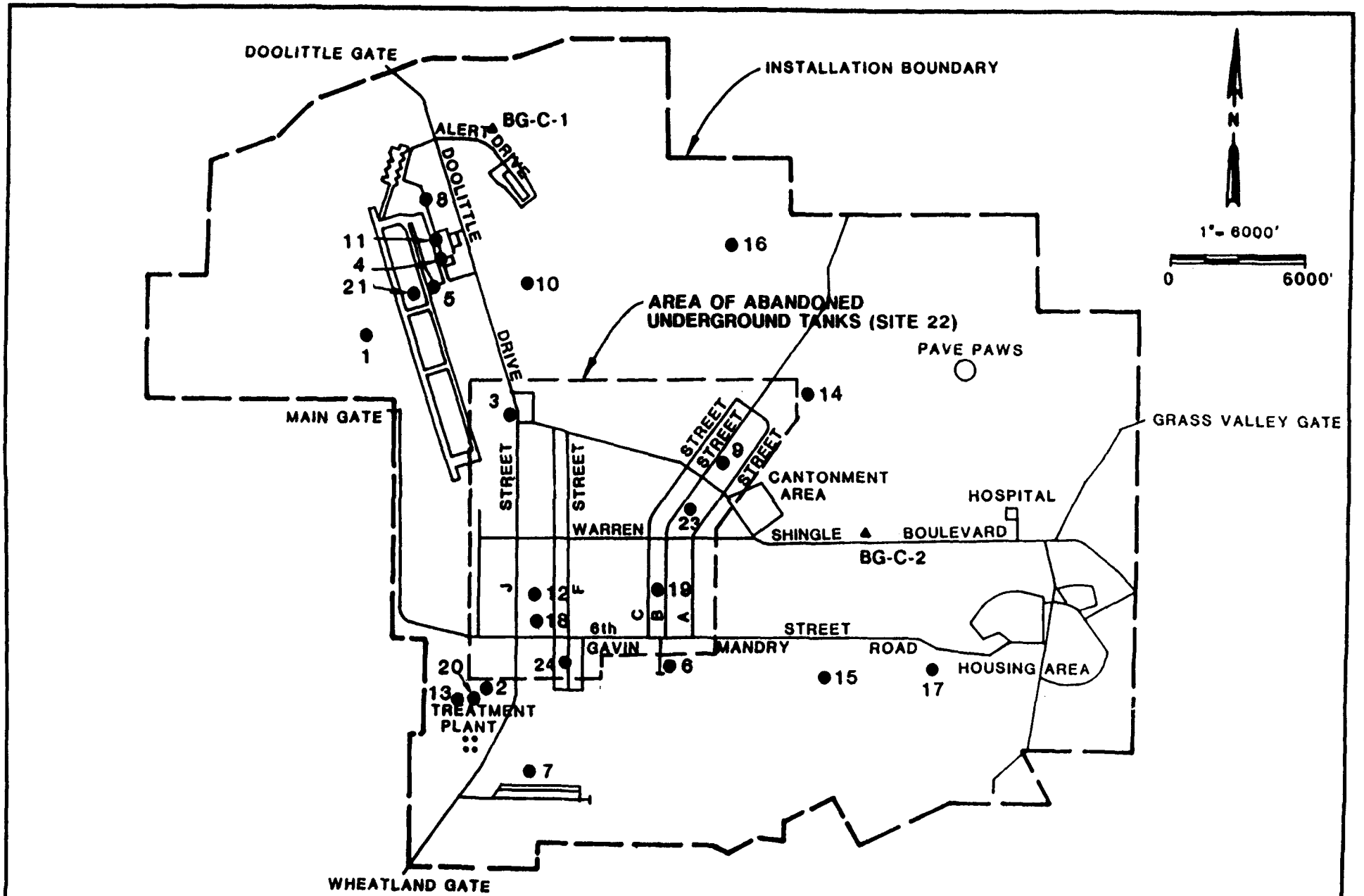


FIGURE ES-1

LOCATION OF BEALE AIR FORCE BASE

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SOURCE: BEALE AIR FORCE BASE INSTALLATION RESTORATION PROGRAM REPORTS
(ENGINEERING SCIENCE, 1984; AeroVironment, 1987)

FIGURE ES-2
IRP SITE LOCATIONS

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wastewater treatment, two engine test cells, two pesticide/herbicide buildings, one fire training area, and eight other sites of various types. One of these miscellaneous sites is actually a wide area of the base where over 750 abandoned underground storage tanks are suspected. Table ES-1 lists the 24 IRP sites, a brief description of each site, and the waste types suspected for each site.

ES.3 INVESTIGATIVE PROCEDURES

Remedial investigation activities in Stage 2-1 included collecting surface soil and waste samples using hand-augering techniques. In some cases, two samples were collected from hand-augered holes to evaluate near surface vertical migration. A total of 84 hand augered holes were dug to sample surface soils and wastes.

Deeper soil investigations were conducted using hollow-stem auger drilling techniques and split-barrel samplers with brass sleeves. At several sites, the holes were drilled at 30 degrees from vertical to sample soils beneath waste areas without disturbing the wastes and creating potential migration pathways. A total of 52 soil borings were drilled, ranging from 10 to 60 feet in depth.

During prior studies at Beale AFB, 24 groundwater monitoring wells were installed. An additional 26 monitoring wells were installed as part of Stage 2-1 activities. Well drilling was accomplished using a reverse air circulation, dual-tube percussion hammer method. Wells were constructed of a 20-foot-long, stainless steel, wire-wrap screen with a 5-foot stainless steel pipe section below the screen to serve as a sediment trap. The well casing was Schedule 40 PVC. Each well head was either constructed with a protective steel casing and concrete pad or was completed flush with the ground surface using a concrete vault. All wells were completed with 4-inch-diameter casings and screens, with the exception of one test well at Site 19. This Site 19 well, 19-C-4, was completed with 6-inch-diameter casings and screens and was used for a 72-hour pump test.

Table ES-2 presents the number of wells, borings, and hand-augers completed at each of the IRP sites during Stage 2-1. The table does not include five vapor wells installed at Site 15 to assess landfill gas characteristics and migration.

Table ES-1
BEALE AFB IRP SITES SUMMARY

	Site	Description	Potential Waste Types
1.	West Drainage Ditch	Receives surface runoff from flight line and runway area.	Jet fuel Oil Solvents
2.	Photo Wastewater Treatment Plant (PWTP), Injection Wells, and Sludge Basins	Physical and chemical treatment of photo processing wastewater. Between 1966 and 1986, PWTP effluent was discharged into three injection wells. Since 1974 two unlined sludge ponds have been used for drying PWTP clarifier sludge. The PWTP is no longer used and is being decommissioned.	Pentachlorophenol Photo processing chemicals Trace metals Phenolics Benzene Oil and grease Chromium
3.	Fire Protection Training Areas	Fire prevention training exercises have been conducted in two areas approximately 200 feet apart. Waste oils, spent solvents, and aviation fuels were applied to the ground and ignited. There are two 25,000-gallon underground storage tanks in the area.	Waste oils Solvents Jet fuel
4.	Battery Shop Dry Well	Twenty-four gallons per month of neutralized lead-acid battery wastes were discharged to this dry well adjacent to the battery shop.	Neutralized battery acid (lead and inorganic compounds)
5.	SR-71 Shelter Drainage	Approximately 300 gallons per week of JP-7 jet fuel leaked onto hangar floors and shelter apron area. JP-7 jet fuel drained partly to an oil water separator and partly to the soil and gravel area between SR-71 shelter and flightline.	Jet fuel Solvents
6.	Landfill No. 2	The landfill occupies 56 acres and was used for refuse disposal between early 1950s and 1980. In addition, approximately 380 cubic yards of sludge from PWTP (Site 2) and small amounts of petroleum and chemicals were also disposed here. Currently used for construction and grounds maintenance debris.	Domestic and base refuse PWTP sludge Chemicals
7.	Army Biological Production Area	Area used for biological test site of wheat stem rust. Stock was incinerated and plowed into soil.	Freon, ethylene oxide, metals(?), TCE(?)
8.	J-57 Test Cell	Jet aircraft engines were tested here. Soils were stained in drainage ditch.	Jet fuel Petroleum distillates Soaps
9.	Entomology Building 2560	Gravel basin received drainage from pesticides and herbicides stored and mixed. Pesticide containers were also rinsed here.	Pesticides Herbicides
10.	J-58 Test Cell	SR-71 aircraft engines were tested here. Soils are stained in drainage ditch.	Jet fuel Petroleum distillates Soaps Oil Trichloroethylene (TCE)
11.	Aircraft Ground Equipment Maintenance Area	Aircraft ground support vehicles are known to leak oil and hydraulic fluids. Soils are stained in the ditch receiving drainage from support vehicles parking lot.	Oil Hydraulic Fluid Fuel (gasoline)

Table ES-1
(Continued)

Site	Description	Potential Waste Types
12. Entomology Building 440	Pesticides and herbicides were stored and mixed in and around the building.	Pesticides, herbicides
13. Landfill No. 1	This landfill occupies 4 acres and received refuse in the 1940s. The source and composition of wastes is unknown. The site is no longer in use.	Unknown
14. Transformer Drainage Pit	Between 1977 and 1979 transformers were drained here before repair.	Transformer oil PCBs
15. Landfill No. 3	This landfill occupies a 40-acre site. It has been in operation since 1981 and accepts domestic garbage and refuse.	Domestic garbage and refuse
16. Explosive Ordnance Disposal Area	Unused ordnances are detonated in two bunkers or in an open field in this area. Diesel fuel and wood are used to burn smaller ordnances. The burned metal portion of the ordnances are placed in a trench.	Detonated munitions, explosives, flares, and pyrotechnics debris
17. Best Slough	Empty drums were found in area.	Unknown.
18. Bulk Fuel Storage Facility	Diked above ground fuel storage tanks.	Jet fuel Diesel fuel Motor gasoline Unleaded gasoline No. 2 fuel oil
19. Photo Waste Emergency Holding Basin	During overflow conditions photo wastes were diverted to this holding basin with compacted clay bottom and cement sides. Basin is no longer in use.	PCP treated photo wastewater
20. Grease Pit (Sanitary Treatment Plant)	Unlined pit used to dispose sewage plant clarifier skimmings.	Oil and grease Organic solvents
21. JP-7 Above Ground Fuel Storage Tanks (Flightline)	Diked above ground fuel storage tanks.	Jet fuel
22. Abandoned Underground Storage Tanks	Old base area maps show 753 abandoned underground storage tanks in the area previously occupied by Camp Beale.	Fuel oil Gasoline
23. Ninth Transportation Shop	Repair shop and parking area for refueling trucks.	Jet fuel Diesel Oils
24. Landfill No. 4	Trench fill 1960s-1970s. Contents unknown.	Demolition debris Domestic refuse

Table ES-2
SUMMARY OF STAGE 2-1 DRILLING AND AUGERING BY SITE

	SITE	Number of Wells	Number of Soil Borings	Number of Hand Augers
1.	West Drainage Ditch	5	0	12
2.	Photo Wastewater Treatment Plant, Injection Well, and Sludge Basins	1	7	14
3.	Fire Protection Training Areas	1	10	3
4.	Battery Shop Dry Well	0	1	0
5.	SR-71 Shelters Drainage Area	1	4	5
6.	Landfill No. 2	1	5	0
7.	Army Biological Production Area	0	0	0
8.	J-57 Test Cell	0	0	0
9.	Entomology Building 2560	0	1	0
10.	J-58 Test Cell	0	0	0
11.	Aircraft Ground Equipment Maintenance Area	0	3	0
12.	Entomology Building 440	0	0	0
13.	Landfill No. 1	6	5	0
14.	Transformer Drainage Pit	0	0	0
15.	Landfill No. 3	0	5	0
16.	Explosive Ordnance Disposal (EOD) Area	1	0	3
17.	Best Slough	0	0	0
18.	Bulk Fuel Storage Facility	2	3	36
19.	Photo Waste Emergency Holding Basin .	4	3	3
20.	Grease Pit (Sanitary Treatment Plant)	0	1	3
21.	JP-7 Aboveground Fuel Storage Tanks (Flightline)	1	0	5
22.	Abandoned Underground Storage Tanks	0	0	0
23.	Ninth Transportation Refueling/ Maintenance Shop	1	4	0
24.	Landfill No. 4	0	0	0
25.	Background Wells	2	0	0
	TOTAL	26	52	84

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Samples collected during Stage 2-1 were analyzed according to site specific needs ranging from screening analyses for specific contaminants to detailed characterization of both organic and inorganic constituents. Table ES-3 presents the number of soil and sediment samples collected and analyzed during Stage 2-1, including the tests performed on these samples. Table ES-4 presents the same information for water samples.

In addition to sampling and analysis activities, Stage 2-1 included a geophysical investigation at four of the IRP sites and records search activities to develop background information for two of the IRP sites.

Stage 2-1 did not include risk assessment or feasibility study activities.

ES.4 SIGNIFICANCE OF FINDINGS

Results of Stage 2-1 activities combined with information obtained during previous studies indicate that the IRP sites at Beale AFB have a wide range of environmental impacts and concerns. These range from potentially serious groundwater contamination with nearby potential receptors, to sites with no contaminants detected. Table ES-5 lists significant findings for each of the IRP sites. Note that this table is a summary and is not intended to include all findings and potential concerns. Those findings listed are perceived to be the most significant. However, information not summarized in Table ES-5 should not be considered unimportant.

ES.5 RECOMMENDATIONS

Table ES-6 presents a summary of recommendations for the next stage of IRP work at Beale AFB. The table lists the sites, current category of site status, and the general actions needed. Categories are defined as: Category 1--requires no further actions, Category 2--requires additional activities, Category 3--remedial action selected, site ready for mitigation.

Table ES-3
SUMMARY OF SOIL, SEDIMENT, AND AIR SAMPLE ANALYSES BY SITE
FOR STAGE 2-1 REMEDIAL INVESTIGATION

PARAMETER	ANALYTICAL METHOD	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 9	Site 11	Site 13
Oil & Grease	SW9071									
Petroleum Hydrocarbons (Gasoline/Diesel)	CALIF	24	53	58	5	29	27	5	6	29
ICP Screen (23 metals, exclude Boron and Silica)	SW3050/SW6010	24	53	58	5		27	5	6	29
Mercury	SW7471		53	58			27	5		24
Organochlorine Pesticides and PCBs	SW3550/SW8080							5		
Chlorinated Phenoxy Acid Herbicides	SW8150							5		
Volatile Organic Compounds	SW8240	24	53	58			27	5	6	28
Semivolatile Organic Compounds	SW3550/SW8270	24	53	58			27		6	29
Soil Moisture Content	ASTM D2216	24	53	58	5	29	27	5	6	29
Soil pH	SW9045				5					
Polychlorinated Dibenzo-p-dioxins (PCDDs) and polychlorinated Dibenzofurans (PCDFs)	SW8280		1							
Explosives	USATHAMA Method 48									
Ignitability	SW1010			58						
Cyanide, Total	SW9010		53							
Air Samples Analyses	Calif ADDL002									

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Table ES-3
(Continued)

PARAMETER	ANALYTICAL METHOD	Site 15	Site 16	Site 18	Site 19	Site 20	Site 21	Site 23
Oil & Grease	SW9071					8		
Petroleum Hydrocarbons (Gasoline/Diesel)	CALIF	29	3	45	21		5	20
ICP Screen (23 metals, exclude Boron and Silica)	SW3050/SW6010	29	3	45	21	8		20
Mercury	SW7471	29	3		21	8		
Organochlorine Pesticides and PCBs	SW3550/SW8080							
Chlorinated Phenoxy Acid Herbicides	SW8150							
Volatile Organic Compounds	SW8240	29	3	45	21	8		20
Semivolatile Organic Compounds	SW3550/SW8270	29	3		21	8		
Soil Moisture Content	ASTM D2216	29	3	45	21	8	5	20
Soil pH	SW9045							
Polychlorinated Dibenzo-p-dioxins (PCDDs) and polychlorinated Dibenzofurans (PCDFs)	SW8280				1			
Explosives	USATHAMA Method 4B		3					
Ignitability	SW1010					8		
Cyanide, Total	SW9010							
Air Samples Analyses	Calif ADDL002	2						

ES-4
SUMMARY OF GROUNDWATER AND SURFACE WATER (GW/SW) ANALYSES BY SITE
FOR STAGE 2-1 REMEDIAL INVESTIGATION

PARAMETER	ANALYTICAL METHOD	Site 1 GW/SW	Site 2 GW/SW	Site 3 GW/SW	Site 4 GW/SW	Site 5 GW/SW	Site 6 GW/SW	Site 11 GW/SW	Site 13 GW/SW
Alkalinity-Carbonate, Bicarbonate & Hydroxide (Field Test)	A403	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Specific Conductance (Field Test)	E120.1	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
pH (Field Test)	E150.1	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Total Dissolved Solids	E160.1	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Temperature (Field Test)	E170.1	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Common Anions (Chloride, Fluoride, Sulfate)	E325.3	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
	E340.2	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
	E375.2	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Nitrogen, Nitrate-Nitrite	E353.2	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Petroleum Hydrocarbons (Gasoline/Diesel)	CALIF	24/20		12/0	2/0	4/4	12/4	2/0	30/4
ICP Screen (23 metals, exclude Boron and Silica)	SW3005/SW6010	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Arsenic	SW7060	24/20	24/0	12/0			12/4		30/4
Lead	SW3005/SW7421	24/20	24/0	12/0	2/0		12/4	2/0	30/4
Mercury	SW7470		24/0	12/0			12/4		30/4

GW = GROUNDWATER
SW = SURFACE WATER

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ES-4
(Continued)

PARAMETER	ANALYTICAL METHOD	Site 1 GW/SW	Site 2 GW/SW	Site 3 GW/SW	Site 4 GW/SW	Site 5 GW/SW	Site 6 GW/SW	Site 11 GW/SW	Site 13 GW/SW
Selenium	SW7740		24/0	18/0			12/4		30/4
Purgeable Halocarbons	SW5030/SW8010	28a/20	18/0	18/0		4/4	12/4	2/0	35a/4
Purgeable Aromatics	SW5030/SW8020	24/20	18/0	18/0			12/4	2/0	30/4
Semivolatile Organic Compounds	SW3510/SW8270	24/20	18/0	18/0			11/3	2/0	29/4
Chemical Oxygen Demand (COD)	A508A						12/4		30/4
TNT, RDX, Picric Acid	USGS01								
Cyanide, Total	SW9010		18/0						

GW = GROUNDWATER
SW = SURFACE WATER
a: Includes off-base well samples for third and fourth sampling rounds.

ES-4
(Continued)

PARAMETER	ANALYTICAL METHOD	Site 15 GW/SW	Site 16 GW/SW	Site 18 GW/SW	Site 19 GW/SW	Site 21 GW/SW	Site 23 GW/SW	BACK-GROUND GW/SW
Alkalinity-Carbonate, Bicarbonate & Hydroxide (Field Test)	A403	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Specific Conductance (Field Test)	E120.1	16/0	4/0	4/0	15/4	2/0	2/0	7/0
pH (Field Test)	E150.1	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Total Dissolved Solids	E160.1	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Temperature (Field Test)	E170.1	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Common Anions (Chloride, Fluoride, Sulfate)	E325.3 E340.2 E375.2	16/0 16/0 16/0	4/0 4/0 4/0	4/0 4/0 4/0	15/4 15/4 15/4	2/0 2/0 2/0	2/0 2/0 2/0	7/0 7/0 7/0
Nitrogen, Nitrate-Nitrite	E353.2	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Petroleum Hydrocarbons (Gasoline/Diesel)	CALIF	16/0	4/0	4/0	15/4	2/0	2/0	7/0
ICP Screen (23 metals, exclude Boron and Silica)	SW3005/SW6010	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Arsenic	SW7060	16/0	4/0		15/4			7/0
Lead	SW3005/SW7421	16/0	4/0	4/0	15/4		2/0	7/0
Mercury	SW7470	16/0	4/0		15/4			7/0

GW = GROUNDWATER
SW = SURFACE WATER

TBLES4CJL.WK1

ES-4
(Continued)

PARAMETER	ANALYTICAL METHOD	Site 15 GW/SW	Site 16 GW/SW	Site 18 GW/SW	Site 19 GW/SW	Site 21 GW/SW	Site 23 GW/SW	Back-Ground GW/SW
Selenium	SW7740	16/0	4/0		15/4			7/0
Purgeable Halocarbons	SW5030/SW8010	16/0	4/0	4/0	15/4	2/0		7/0
Purgeable Aromatics	SW5030/SW8020	16/0	4/0	4/0	15/4		2/0	7/0
Semivolatile Organic Compounds	SW3510/SW8270	16/0	4/0		15/4			7/0
Chemical Oxygen Demand (COD)	A508A	16/0			15/4			7/0
TNT, RDX, Picric Acid	USGS01		4/0					

GW = GROUNDWATER
SW = SURFACE WATER

TBLES4DJL.WK1

Table ES-5
SIGNIFICANT IRP STAGE 2-1 FINDINGS

	Site	Stage 2-1 Findings
1.	West Drainage Ditch	• Ditch sediments contaminated with TFH and metals • Groundwater contaminated with TCE • Significant potential for migration
2.	Photo Wastewater Treatment Plant	• Soil near Injection Well No. 2 contaminated with TCE • Groundwater contaminated with TCE • Sludge pond sediments contaminated with metals and dioxin • Significant potential for migration
3.	Fire Protection Training Area	• Soil contaminated with TFH, volatile organics, and lead • Contamination not detected in groundwater • Significant potential for migration (soil to groundwater)
4.	Battery Shop Dry Well	• Soil contaminated with metals • Groundwater contamination not detected
5.	SR-71 Shelters Drainage Area	• Ditch sediments contaminated with TFH • Surface water contaminated with TFH • Groundwater contaminated with TCE • Significant potential for migration
6.	Landfill No. 2	• Groundwater contamination not detected • Low levels of organic compounds in soil
7.	Army Biological Production Area	• No testing performed
8.	J-57 Test Cell	• No testing performed
9.	Entomology Building 2560	• Previous chlordane detection not confirmed • Minimal potential for migration
10.	J-58 Test Cell	• No testing performed
11.	Aircraft Ground Equipment Maintenance Area	• Soil contaminated with TFH • Groundwater contamination not detected • Minimal potential for migration
12.	Entomology Building 440	• No testing performed

Table ES-5
(Continued)

Site		Stage 2-1 Findings
13.	Landfill No. 1	• Soil contaminated with volatile organics • Groundwater contaminated with volatile organics • Probable migration of contaminants in groundwater
14.	Transformer Drainage Pit	• No testing performed
15.	Landfill No. 3	• Groundwater contamination not detected except low level TFH in fourth quarter • Contamination detected in landfill gas • Contamination detected in downwind air sample--source unconfirmed
16.	Explosive Ordnance Disposal Area	• Soil in trench contaminated with metals • Explosive compounds and TFH-gas detected in fourth quarter
17.	Best Slough	• No buried drums detected
18.	Bulk Fuel Storage Facility	• Soil in bermed tank areas contaminated with TFH, volatile organics and metals • Groundwater contamination not detected
19.	Photo Waste Emergency Holding Basin	• Soil contamination mainly confined to the EHB clay liner • Groundwater contaminated with TCE and carbon tetrachloride--source unconfirmed • Metals contamination of fourth round surface water - source unknown
20.	Grease Pit	• No soil contamination detected beneath Grease Pit
21.	JP-7 Above Ground Fuel Storage Tanks (Flightline)	• Soil contaminated with TFH • Groundwater contaminated with TFH • Significant potential for migration
22.	Abandoned Underground Fuel Storage Tanks	• Magnetometers tentatively identified buried tanks at 55 of 80 locations
23.	Ninth Transportation Refueling/Maintenance Shop	• Soil contaminated with TFH • Groundwater contaminated with TFH • Significant potential for migration
24.	Landfill No. 4	• No testing performed • Site visit and interviews with base personnel indicate past landfill activity

Table ES-6
RECOMMENDED ACTIVITIES

	SITE	Recommendation[a] Category	Recommended[b] Stage 2-2 Actions	Additional RI Activities[c]
*1.	West Drainage Ditch	2	RI/M/RA/FS	o Determine downstream extent of soil contamination. o Determine depth of soil contamination. o Determine down gradient groundwater contamination. o Continue groundwater monitoring.
**2.	Photo Wastewater Treatment Plant, Injection Well, and Sludge Basins	2	M/RA/FS	o Continue groundwater monitoring.
3.	Fire Protection Training Areas	2	RI/M/RA/FS	o Determine extent of soil contamination in FPTA No. 1. o Continue groundwater monitoring.
4.	Battery Shop Dry Well	2	M	o No additional RI. o Continue groundwater monitoring.
*5.	SR-71 Shelters Drainage Area	2	M/RA/FS	o Add wells if TCE in groundwater is confirmed. o Continue groundwater monitoring.
6.	Landfill No. 2	2	M/RA	o No additional RI. o Continue groundwater monitoring.
7.	Army Biological Production Area	1	NO ACTION	o No additional RI.
8.	J-57 Test Cell	2	RI/M	o Additional soil sampling. o Additional groundwater monitoring.
9.	Entomology Building 2560	1	NO ACTION	o No additional RI.
10.	J-58 Test Cell	2	RI/M/RA	o Determine extent of soil contamination. o Additional groundwater monitoring.
11.	Aircraft Ground Equipment Maintenance Area	2	M/RA	o No additional RI. o Continue groundwater monitoring.
12.	Entomology Building 440	1	NO ACTION	o No additional RI.
**13.	Landfill No. 1	2	RI/M/RA/FS	o Determine extent of groundwater contamination. o Continue groundwater monitoring. o Sample off-base domestic wells.
14.	Transformer Drainage Pit	2	RI	o Determine vertical extent of soil contamination.

Table ES-6
(Continued)

SITE	Recommendation[a] Category	Recommended[b] Stage 2-2 Actions	Additional RI Activities
15. Landfill No. 3	2	M	o No additional RI. o Continue groundwater monitoring.
16. Explosive Ordnance Disposal (EOD AREA)	2	RI/M	o Collect additional groundwater data with new wells. o Continue groundwater monitoring.
17. Best Slough	1	NO ACTION	o No additional RI.
18. Bulk Fuel Storage Facility	2	RI/M	o Determine extent of soil contamination. o Continue groundwater monitoring. o Add another downgradient and upgradient well.
19. Photo Waste Emergency Holding Basin	2	M	o No additional RI. o Continue groundwater monitoring. o Add additional downgradient wells.
**20. Grease Pit (Sanitary Treatment Plant)	1	NO ACTION	o No additional RI.
*21. JP-7 Aboveground Fuel Storage Tanks (Flightline)	2	RI/M	o Determine extent of groundwater contamination. o Determine vertical extent of soil contamination. o Continue monitoring existing well.
22. Abandoned Underground Storage Tanks	2	RI	o Excavate at suspected tank locations. o Sample soil beneath pulled tanks.
23. Ninth Transportation Refueling/ Maintenance Shop	2	RI/M	o Determine extent of soil contamination. o Continue groundwater monitoring.
24. Landfill No. 4	2	RI	o Determine if soil beneath trenches is contaminated. o Determine if groundwater is contaminated.

* Sites 1, 5, and 21 are considered an operable unit and all actions taken on these sites should be coordinated.
** Sites 2, 13, and 20 are not considered an operable unit but are in geographic proximity. Some actions taken at these sites may be coordinated.
[a] Category 1: No further action.
Category 2: Additional activities needed.
[b] RI: Remedial Investigation
M: Monitoring
RA: Risk Assessment
FS: Feasibility Study
[c] Activities may be completed as separate RI tasks or, in some cases, as part of the FS process.

TBL-ES6.RI

I. INTRODUCTION

1.1 AIR FORCE INSTALLATION RESTORATION PROGRAM

1.1.1 PROGRAM ORIGIN

1.1.1.1 History of Legislation

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the "Superfund" Act. This act sets forth responsibility for the identification and cleanup of contaminated sites within the United States and its possessions. The Superfund Act also designated the U.S. Environmental Protection Agency (EPA) as the policy and enforcement agency.

In 1980, the National Contingency Plan (NCP) was issued to provide response guidance and a process by which to report contaminant releases, identify and quantify contamination, and select appropriate remedial actions. The NCP describes the responsibility of the federal government, state governments, and parties responsible for the release.

In 1983, President Reagan signed Executive Order 12316, which delegated the role as lead agency to various federal agencies (Department of Defense [DOD], Department of Energy [DOE]) to conduct investigations and implement cleanup when they are the sole or co-contributor to contamination on or off their properties.

In October 1986, President Reagan signed into law the Superfund Amendments and Reauthorization Act (SARA) of 1986. This law extends the requirements of CERCLA but modifies CERCLA with respect to the goals of cleanup and the process leading to the selection of a remedy. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action which only contains or isolates the contaminant. SARA also provides for greater interaction with the public and state agencies and extends EPA's role in evaluating the health risks associated with the contamination. Under SARA, early determination of the applicable or relevant and appropriate requirements (ARARs) is required, and potential remediation alternatives should be considered at the initiation of a remedial investigation/feasibility study (RI/FS). Figure 1-1 is a diagram of the remedy selection under SARA.

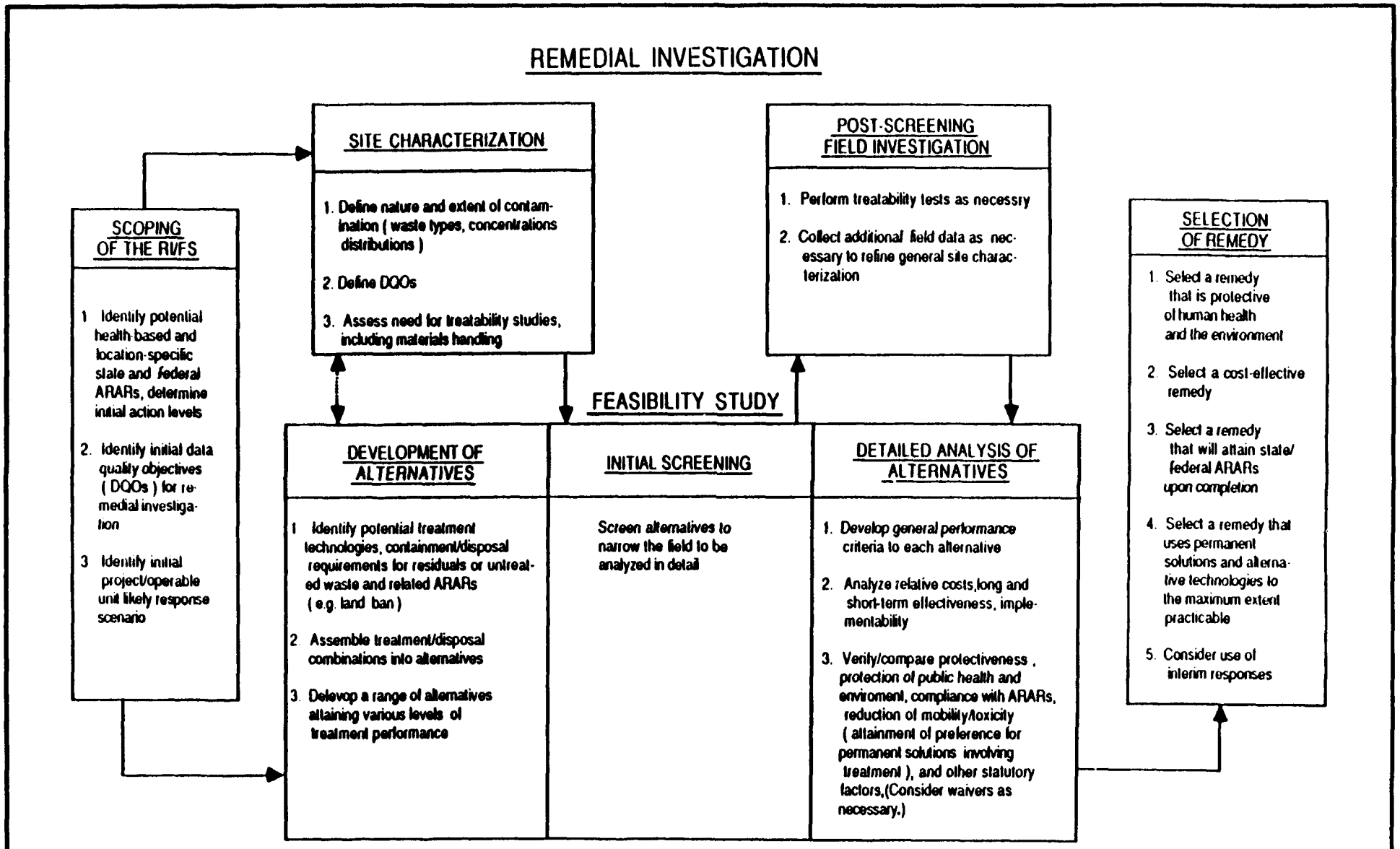


FIGURE 1-1
REMEDY SELECTION PROCESS UNDER SARA

In July 1987, President Reagan signed Executive Order 12580, which replaced EO 12316. This order delegated responsibility to conduct site investigations and cleanups at federal facilities to the secretaries of various agencies. This order defined relationships between various federal and state agencies. EPA was assigned the role of lead agency for oversight of all sites on the National Priority List (NPL), including federal facilities such as Air Force bases. In cases where lead-agency responsibility is assigned to state agencies, usually for non-NPL sites, EPA's role is primarily to provide review and comment for work activities and to serve as a facilitator in dispute resolutions.

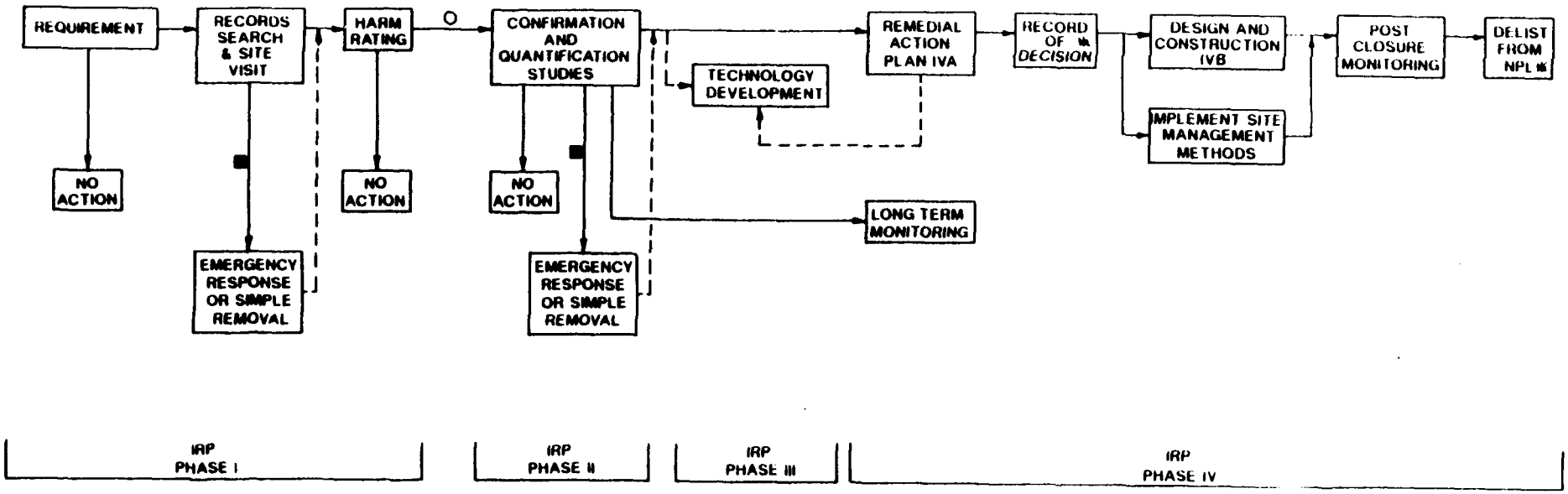
In addition to federal requirements, several sites at Beale AFB were also subject to State of California requirements under the Toxic Pit Cleanup Act (TPCA) and the Calderon Bill. The California Regional Water Quality Control Board required a hydrogeologic assessment report (HAR) for the Photowastewater Emergency Holding Basin at Beale AFB (Site 19) under TPCA. The California Department of Health Services required a Solid Waste Assessment Test (SWAT) report for the landfills at Beale AFB under the Calderon Bill. Activities to meet these requirements were included in investigations at Beale AFB.

1.1.1.2 History of Installation Restoration Program (IRP)

The Air Force Installation Restoration Program (AFIRP) predated CERCLA and was initiated to identify potentially contaminated sites, investigate these sites, and evaluate and select appropriate remedial actions. AFIRP was originally organized into the following four phases (see Figure 1-2):

- Phase I - Records Searches
- Phase II - Confirmation and Quantification Studies
- Phase III - Technology Development
- Phase IV - Remedial Action Plans and Implementation

Phase I Records Searches were installation-wide studies that identified and assessed past disposal sites. File material, site visits, and interviews provided the information for these initial assessments. These assessments considered whether or not each site posed hazards to public health or to the environment. If a site presented little or no apparent hazard, it did not proceed to subsequent phases. If a site presented an imminent threat to public health, an



LEGEND

- ---→ OPTIONAL TRACK
- * FOR NATIONAL PRIORITY LIST SITES
- O USAF SITES MAY PROCEED TO PHASE II WHETHER INCLUDED ON THE NATIONAL PRIORITY LIST OR NOT
- ■ EMERGENCY RESPONSES CAN BE INITIATED IN ANY PHASE BUT ARE IMPLEMENTED AS PHASE IV ACTIONS

SOURCE: USAF (789), 1987

FIGURE 1-2
PAST AIR FORCE
INSTALLATION RESTORATION PROGRAM

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emergency response, which was considered a Phase IV action, was taken. If sampling and evaluation were required to confirm the suspected hazard, Phase II studies were initiated. Sites identified in Phase I were rated by the U.S. Air Force's (USAF's) Hazard Assessment Rating Methodology (HARM), a system that ranked the site for its potential hazards to people and environmental resources.

Phase II Confirmation and Quantification Studies evaluated the presence or absence of contamination, determined the extent and degree of contamination, and provided the basis for selecting the appropriate type of remedial action. During this phase, groundwater, soil, and sediment samples were usually collected and analyzed. Geologic profiles were typically defined by drilling. Remote sensing techniques were sometimes used to define the size and location of the waste disposal area.

If these studies revealed no contamination that threatened human health or the environment, then the results were documented and no further action was taken on the site. Phase II sampling at some sites did not detect enough contamination to justify costly remediation projects as determined by preliminary risk assessments and feasibility studies, but the development of future threats was still a possibility. The approach used for such sites was typically long-term monitoring, which included continued site surveillance by a program of water, soil, or sediment analysis. Sites which were shown to be a threat typically proceeded to Phase IV.

Phase III Technology Development efforts were not undertaken for each site but were intended to improve site investigation and cleanup technology through research, development, and testing. Phase III was initiated for sites that could not be controlled with proven technology or for sites that were suitable for evaluating new technologies, such as in-place degradation of organic contaminants (such as JP-4) through enhancing the growth of naturally occurring soil bacteria.

Phase IV was conducted in two stages. Phase IV-A Remedial Action Plans (RAPs) documented the development, evaluation, and selection of alternatives to control the hazards posed by a waste disposal site. Selection of the best alternative was based on engineering feasibility, cost, environmental effects, public health effects, and compliance with regulatory requirements. Phase IV-B was implementation of the selected alternative and normally included design,

construction, and modified waste management methods. Long-term monitoring was often performed in association with site cleanup to ensure compliance with contaminant standards or achievement of cleanup goals.

In November 1986, in response to SARA and in consideration of various EPA guidance, USAF modified AFIRP to provide for an integrated RI/FS program. The intent is to conduct the RI/FS in parallel instead of serial fashion. The program now more closely resembles the EPA RI/FS process and includes ARAR determinations, identification and screening of technologies, and development of alternatives. It may include multiple field activities and pilot studies prior to the detailed final analysis of alternatives. In some instances, however, primarily as a function of available funding, the RI and FS portions of the process are accomplished in separate, non-concurrent tasks.

1.1.2 PROGRAM OBJECTIVES

The objective of the current AFIRP is to develop and select appropriate and cost-effective solutions to remediate contamination resulting from USAF operations which pose an existing or potential risk to human health or the environment. This objective is met through a well-defined and technically sound approach in accordance with CERCLA, NCP, and SARA. The solutions that are developed should provide the level of protection necessary to protect public health and the environment, meet the requirements of ARARs, and be technically feasible to implement at the specific site.

For the AFIRP to meet the overall program objective, project-specific objectives must be met. These include:

1. Develop a defensible database through good field practice and rigorous analytical procedures.

2. Develop and implement a quality assurance/quality control (QA/QC) program to assure the production of meaningful and defensible data.

3. Develop and adhere to site and laboratory safety programs to protect the health of personnel and prevent the release of contaminants.

4. Establish a rigorous procedure to identify, evaluate, and select appropriate solutions.

5. Establish a process to identify data gaps and develop appropriate additional or supplemental studies to collect necessary data. This includes additional field and/or analytical data collection as well as the evaluation of candidate technologies.

6. Develop and implement the program in compliance with appropriate federal regulations and available guidance.

7. Provide the public and regulatory agencies with information regarding the nature of the contamination, the effects upon the community, the progress of the program, and the preferred remedial alternative and its impacts.

1.1.3 PROGRAM ORGANIZATION

The current AFIRP process consists of several steps, including a preliminary site assessment, followed by either an RI/FS program or a no-action recommendation, screening of remedial alternatives, selection of a preferred remedial action alternative, and the design and implementation of the selected alternative (see Figure 1-3).

In the preliminary assessment, a survey of a base (USAF installation) or site within an installation is conducted to determine if past operations or disposal practices may have resulted in a potential release of contamination. This process includes a records search to document what potential contaminants were used, stored, and disposed and where such activities were conducted. If a release is suspected, an initial sampling and analytical program is recommended to confirm the presence and identify target contaminants.

This preliminary assessment phase has been completed nationwide, resulting in a determination of bases and sites on bases for which either an RI/FS program is recommended or a determination that there is no evidence of contamination and no further actions are required.

For those bases or sites within bases that require further action, an RI/FS program is developed. The RI/FS program involves a preliminary sampling and analysis effort leading to the development of alternatives. If necessary, a more detailed sampling and analysis effort is conducted to determine the extent of contamination and define exposure pathways to aid in the selection of alternatives. The RI/FS encompasses several key elements necessary to select an appropriate remedial action. These include:

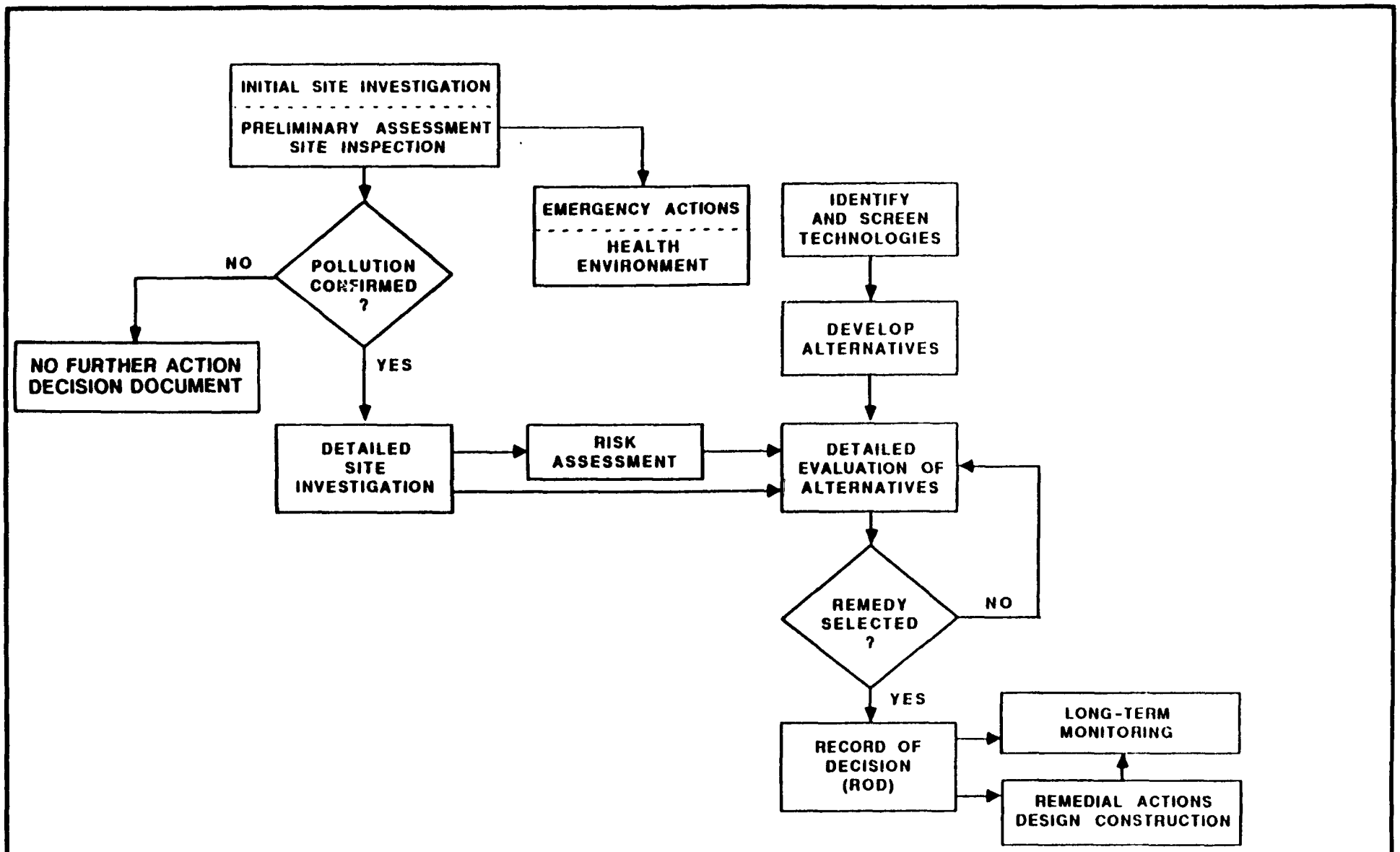


FIGURE 1-3

CURRENT AIR FORCE
INSTALLATION RESTORATION PROGRAM

1. Determination of the federal and state ARARs

2. Development of the data quality objectives (DQOs) consistent with the ARARs and achievable with acceptable field and analytical procedures

3. Performance of a field investigation of the impacted media along with collection of sufficient physical environment information to assess contamination movement and pathways and to support development of potential alternatives. The field investigation may be conducted in one or more stages depending on the results of the initial field work.

4. Determination of the hazards by quantifying the impact on receptors through the exposure pathways of surface water, groundwater, biota, and air. This determination meets the exposure and risk assessment requirement under CERCLA, NCP, and follows the steps in the Superfund Public Health Evaluation Manual.

5. Determination of those sites where the results of the field investigation and risk assessment indicate no significant threat to human health or welfare or the environment, and a preparation of a Technical Document to Support No Further Action.

6. Development of a set of potential alternatives consisting of appropriate technologies that can remove or eliminate the contamination or control its migration. These alternatives should provide a range of reduction of the mobility, toxicity, or volume (MTV) associated with the contamination and meet or exceed the ARARs.

Initial screening of alternatives is conducted using screening criteria of effectiveness, implementability, and cost. If necessary, field or bench scale testing is conducted to better assess alternatives. A more detailed analysis is then conducted to evaluate alternatives in terms of effectiveness, compliance with ARARs, reduction of MTV, schedule, reliability, and capital and operation and maintenance (O&M) cost.

At the completion of the RI/FS process, which is the functional equivalent of the selection of a remedy process as outlined in NCP and through EPA guidance or SARA, a preferred alternative is selected. A Record of Decision (ROD) for

the site and the alternative can be prepared using the information and recommendation contained in the Final IRP Technical Report.

The final phase of the AFIRP consists of the design and implementation of the selected remedial action alternative. It may be necessary at the design stage to obtain additional technology-related data in order to finalize the design and to specify equipment or system operating criteria. The product of the design effort is a specification package that will be used to select remediation contractors for implementation at the site.

1.1.4 PROGRAM DOCUMENTS

All IRP work conducted under the guidance of the U.S. Air Force Human Systems Division (USAF-HSD), previously Occupational and Environmental Health Laboratory (USAFOEHL), follows procedures and information provided in the applicable documents listed in Table 1-1. In addition to guidance documents, the results of work performed as part of the IRP at applicable USAF installations are recorded in detail in technical reports that delineate all findings from each investigative stage of the IRP. These reports become program documents upon acceptance by USAF and applicable agencies.

1.2 TIME PERIOD AND DURATION OF THIS AND PREVIOUS IRP PROGRAMS

Previous IRP activities at Beale AFB include the Phase I - Records Search and the Phase II, Stage 1 - Confirmation/ Quantification Study. Additional environmental studies have also been conducted at some of the Beale IRP sites. This section discusses the time and duration of these previous studies and the current Stage 2-1 Remedial Investigation. A timeline, given on Figure 1-4, shows major activities in the IRP process at Beale AFB.

In January 1984, Engineering-Science, Inc. conducted field work for Phase I - Records Search. The Phase I report was issued in April 1984, and identified 16 potentially contaminated sites. The report recommended monitoring at six of the sites. Table 1-2 lists all of the IRP sites and indicates when they were added to the IRP program.

In January 1985, the Air Force combined two of the original sites, the photo wastewater treatment plant and the photo waste injection wells, into one site and added three new

Table 1-1
APPLICABLE DOCUMENTS FOR THE IRP

Code	Document
1.1 Public Laws	
United States Code	
PL 96-510	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980
PL 99-499	Superfund Amendments and Reauthorization Act (SARA) of 1986
1.2 Regulations	
Code of Federal Regulations	
40 CFR 136.3e, Table II	Required Containers, Preservation Techniques, and Holding Times
40 CFR 136, Appendix A	Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater
40 CFR 136, Appendix B	Definition and Procedure for the Determination of the Method Detection Limit
40 CFR 136, Appendix C	Inductively Coupled Plasma - Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes Method 200.7
40 CFR 300.61-300.71 (Subpart F)	National Contingency Plan (NCP)
Federal Register	
Vol. 51, No. 114, 13 June 1986	Toxicity Characteristic Leaching Procedure (TCLP)
1.3 Presidential Documents	
Executive Orders	
EO 12088	Federal Compliance with Pollution Control Standards (13 Oct 1978)
EO 12580	Superfund Implementation (23 Jan 1987)

Table 1-1
(continued)

Code	Document
1.4 Manuals	
U.S. Environmental Protection Agency	
EPA-330/9-S1-002	NEIC Manual for Groundwater/Subsurface Investigations at Hazardous Waste Sites
	Superfund Exposure Assessment Manual (January 1986)
EPA-540/1-86-060	Superfund Public Health Evaluation Manual (October 1986)
EPA-600/4-79-020	Methods for Chemical Analysis of Water and Wastes (1983)
SW-846	Test Methods for Evaluating Solid Waste, Third Edition (1986)
American Public Health Association (PHA), American Water Works Association (AWWA), and Water Pollution Control Federation (WPCF)	
16th Edition	Standard Methods for the Examination of Water and Wastes
American Society for Testing and Materials (ASTM)	
D-1452	Soil Investigation and Sampling by Auger Boring
D-1586	Penetration Test and Split-Barrel Sampling of Soils
D-2487	Unified Soil Classification System (USCS)
D-2488	Recommended Practices for Visual-Manual Description of Soils
Annual Book of ASTM Standards	Section 11, Water and Environmental Technology

Table 1-1
(continued)

Code	Document
1.5 Handbooks	
U.S. Environmental Protection Agency	
EPA-600/4-82-029	Handbook for Sampling and Sample Preservation of Water and Wastewater (1982)
1.6 Guidance Documents	
U.S. Environmental Protection Agency	
EPA-540/G-85-002	Guidance on Remedial Investigations under CERCLA
EPA-540/G-85-003	Guidance on Feasibility Studies under CERCLA
1.7 Journals	
Analytical Chemistry	
Vol. 55, pp. 2210-2218, Dec. 83	Principles of Environmental Analysis

Source: USAFOEHL/TS, 1987

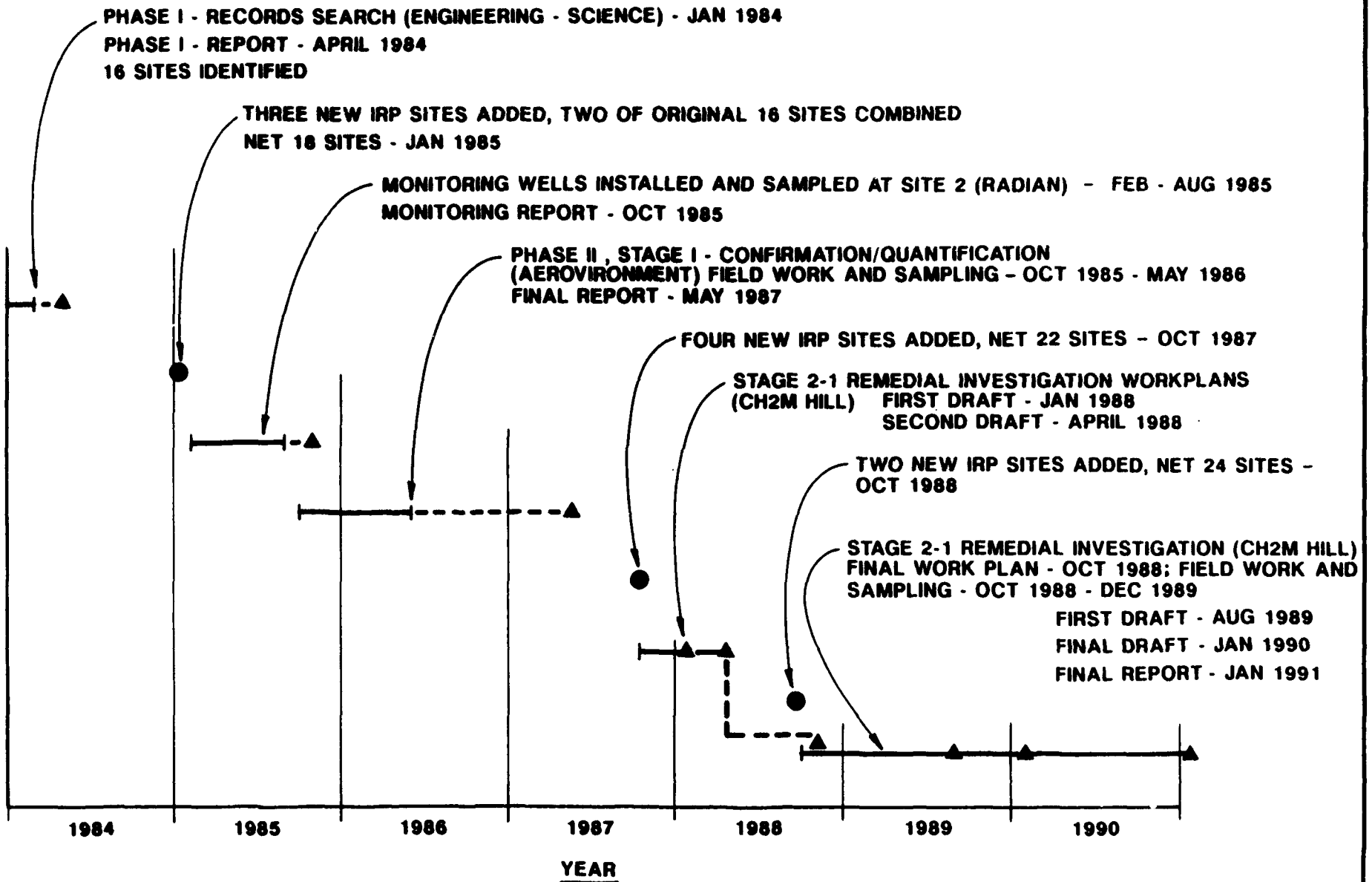


FIGURE 1-4
TIMELINE OF IRP AT BEALE AFB

Table 1-2
IRP SITES AND DATES ADDED TO IRP PROGRAM

Site	Identified in Phase I Records Search[a] April 1984	Added Prior to Phase II, Stage 1 Investigation January 1985	Added Prior to Stage 2-1 Work Plans Development September 1987	Added Prior to Stage 2-1 Investigation September 1988
1. West Drainage Ditch	X			
2. Photo Wastewater Treatment Plant	X			
3. Fire Training Area	X			
4. Battery Shop Dry Well	X			
5. SR-71 Shelter Drainage	X			
6. Landfill No. 2	X			
7. Army Biological Area	X			
8. J-57 Test Cell	X			
9. Entomology Building 2560	X			
10. J-58 Test Cell	X			
11. Aircraft Ground Equipment Maintenance	X			
12. Entomology Building 440	X			
13. Landfill No. 1	X			
14. Transformer Pit	X			
15. Landfill No. 3	X			
16. Explosive Ordnance Disposal Area		X		
17. Best Slough		X		
18. Bulk Fuel Storage		X		
19. Emergency Holding Basin			X	
20. Grease Pit			X	
21. JP-7 Fuel Tanks (Flightline)			X	
22. Abandoned Underground Storage Tanks			X	
23. Ninth Transportation Shop				X
24. Landfill No. 4				X
Total	15[a]	18	22	24

[a]Sixteen sites originally identified in Phase 1. Two sites, the Photo Wastewater Treatment Plant and the Photo Waste Injection Wells were combined to become Site 2, yielding a net total of 15 sites.

sites, the Explosive Ordnance Disposal Area, Best Slough, and the Bulk Fuel Storage Area to the IRP list.

During 1985, the California Department of Health Services (DHS) and the California Regional Water Quality Control Board (RWQCB) determined that all 18 identified sites should be investigated and, in September 1985, AeroVironment began the Phase II, Stage 1 Confirmation/Quantification study of the 18 sites. Field and analytical work continued through May 1986, and the final Phase II, Stage 1 report was issued in May 1987. This report recommended that no additional IRP activities be conducted at 13 of the 18 sites. For the remaining 5 sites, additional IRP actions were recommended.

In early 1987, the state agencies agreed that no action would be required at two of the 18 sites (Entomology Building 440 and the Army Biological Area), but additional investigation would be necessary at the remaining 16 sites. CH2M HILL was tasked by USAFOEHL, in September 1987, to prepare workplans, quality assurance project plans, and site safety plans for additional IRP activities. At the same time, four new IRP sites were added (the Photo Waste Emergency Holding Basin, Grease Pit, Flightline JP-7 above ground tanks, and the basewide abandoned underground storage tanks), bringing the total number of sites to 22. Draft workplans were completed in January 1988, and the draft final workplans were submitted to the agencies in April 1988.

After evaluation of available funding and comments by the agencies, it was determined by the Air Force that IRP activities would be initiated for 17 of the 22 sites. Two additional sites were then added (the Ninth Transportation Shop and a newly identified Landfill No. 4), bringing the IRP site total to 24, and the number of sites to be investigated to 19. Table 1-3 shows the 24 IRP sites and the current status of each site in the IRP process.

In September 1988, CH2M HILL was tasked to begin the Stage 2-1 Remedial Investigation (Delivery Order given in Appendix B). The first task, finalization of workplans, was completed in early October and field work was initiated in late October. The final sampling for this investigation was completed in December 1989, with laboratory analyses being completed in January 1990. Reports that have been or will be generated for this investigation are listed in Table 1-4 and include the RI technical report and state compliance reports required by the Toxic Pit Cleanup Act (TPCA) and Calderon Act Solid Waste Assessment Test (SWAT).

Table 1-3
CURRENT SITE STATUS IN IRP PROCESS

Site	Records Search	Preliminary RI	Additional RI	Risk Assessment	Preliminary FS	Detailed FS	Alternative Selected	Decision Document	Remedial Action
1. West Drainage Ditch	X	X	XX	XXX	XXX				
2. Photo Wastewater Treatment Plant	X	X	XX	XXX	XXX				
3. Fire Training Area	X	X	XX						
4. Battery Shop Dry Well	X	X	XX	XXX	XXX				
5. SR-71 Shelter Drainage	X	X	XX	XXX	XXX				
6. Landfill No. 2	X	X	XX	XXX	XXX				
7. Army Biological Area	X	X	N/A	N/A	N/A	N/A	X	XX	N/A
8. J-57 Test Cell	X	X							
9. Entomology Building 2560	X	X	XX	XXX	XXX				
10. J-58 Test Cell	X	X							
11. Aircraft Ground Equipment Maintenance	X	X	XX	XXX	XXX				
12. Entomology Building 440	X	X	N/A	N/A	N/A	N/A	X	XX	N/A

Legend: X = Completed in previous studies
XX = Conducted in this stage (Stage 2-1)
XXX = To be completed in Stage 2-2, if necessary
N/A = Not applicable
(blank) = To be completed in future tasks, if necessary

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Table 1-3
CURRENT SITE STATUS IN IRP PROCESS
(Continued)

Site	Records Search	Preliminary RI	Additional RI	Risk Assessment	Preliminary FS	Detailed FS	Alternative Selected	Decision Document	Remedial Action
13. Landfill No. 1	X	X	XX	XXX	XXX				
14. Transformer Pit	X	X							
15. Landfill No. 3	X	X	XX	XXX	XXX				
16. Explosive Ordnance Disposal Area	X	X	XX	XXX	XXX				
17. Beat Slough	X	X	XX				XX	XX	N/A
18. Bulk Fuel Storage	X	X	XX	XXX	XXX				
19. Emergency Holding Basin	X	XX		XXX	XXX				
20. Grease Pit	X	XX		XXX	XXX				
21. JP-7 Fuel Tanks (Flightline)	X	XX		XXX	XXX				
22. Abandoned Underground Storage Tanks	XX	XX		XXX	XXX				
23. Ninth Transportation Shop	XX	XX		XXX	XXX				
24. Landfill No. 4	XX			XXX	XXX				

Legend: X = Completed in previous studies
XX = Conducted in this stage (Stage 2-1)
XXX = To be completed in Stage 2-2, if necessary
N/A = Not applicable
(blank) = To be completed in future tasks, if necessary

In addition to IRP activities associated with the major Phases/Stages discussed above, additional work was conducted at Site 2 - Photo Wastewater Treatment Plant in 1985. Radian Corporation began installing four groundwater monitoring wells in February 1985 and completed well sampling in August 1985. A report summarizing the groundwater sampling results was completed in October 1985.

Table 1-4
REPORTS FOR STAGE 2-1 ACTIVITIES

Report	First Draft	Second Draft	Final
Remedial Investigation Technical Report (all sites)	August 1989	January 1990	January 1991
TPCA Waste Characterization Report (Sites 2, 3, 20)	February 1989	N/A	March 1989
TPCA Hydrogeologic Assessment Report (Site 19)	July 1989	December 1989	January 1991
SWAT Report (Sites 6, 13, 15)	June 1989	December 1989	January 1991

1.3 BASE DESCRIPTION, HISTORY, AND WASTE MANAGEMENT PRACTICES

1.3.1 DESCRIPTION OF THE INSTALLATION

Beale Air Force Base is in Yuba County between the Bear and Yuba Rivers, 10 miles east of Marysville, California (Figure 1-5). It is approximately 40 miles north of Sacramento and 130 miles northeast of San Francisco, California. The base is comprised of approximately 22,944 acres of land in the Sacramento Valley and the lower foothills of the Sierra Nevada. The western portion of the base is relatively flat, annual grassland, while the eastern portion of the base ranges in elevation from 70 to 400 feet, with valley and foothill woodlands.

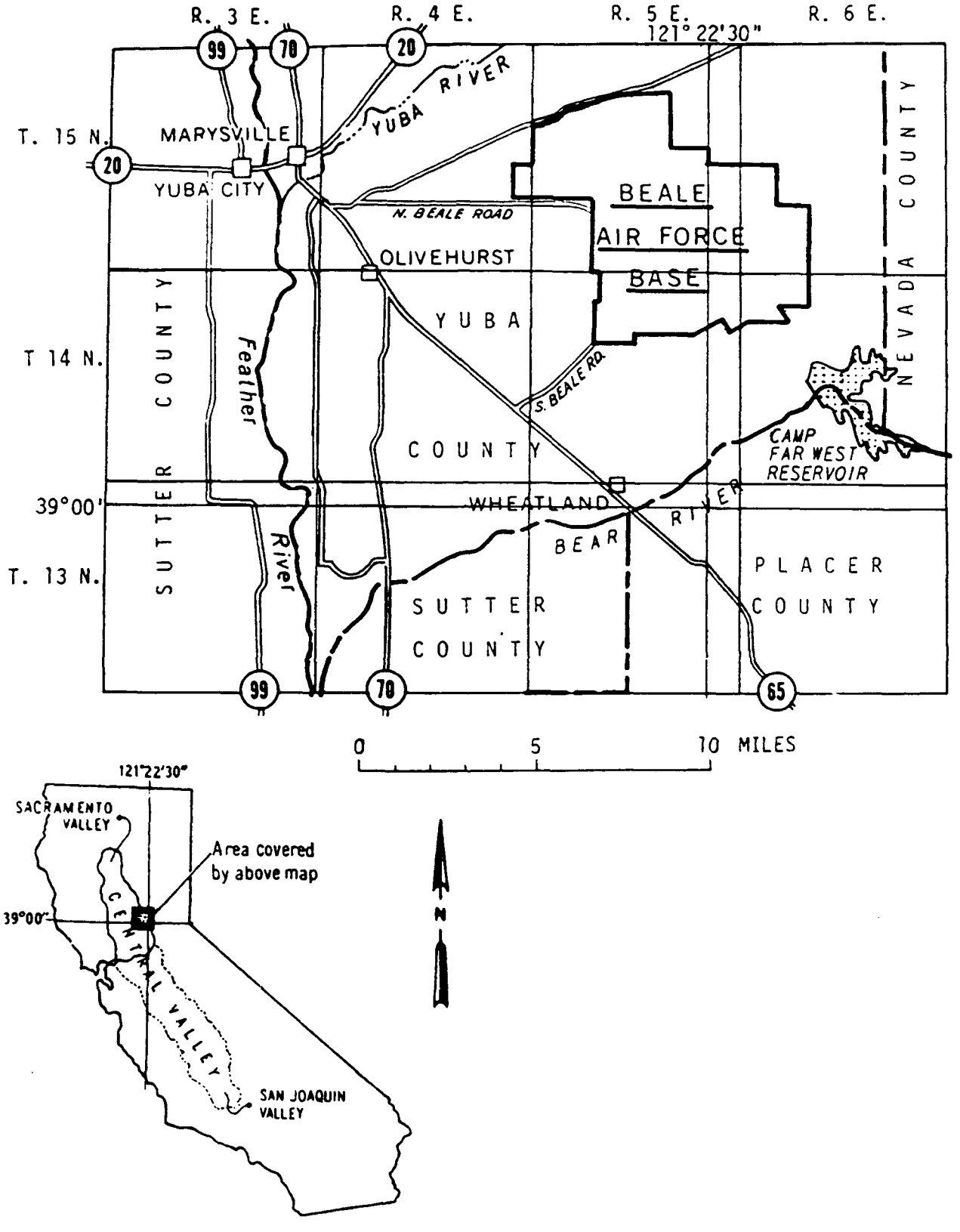


FIGURE 1-5

LOCATION OF BEALE AIR FORCE BASE

SOURCE: GROUNDWATER CONDITIONS AT BEALE AIR FORCE BASE AND VICINITY, CALIFORNIA. U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 80-204. PAGE, 1980

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1.3.2 BASE HISTORY[1]

The Department of Defense installation that is now Beale Air Force Base (AFB) opened in October 1942 as the U.S. Army's Camp Beale. The 13th Armored Division was the first unit to actively train there. However, during the course of World War II, the 81st and 96th Infantry Divisions also trained there. In addition, the camp was used as a personnel replacement depot and prisoner-of-war encampment. It was the site of a 1,000-bed hospital and, at the end of the war, was used as the west coast separation center.

During World War II, the camp supported a military population of more than 60,000 personnel. In 1947, Camp Beale was declared surplus by the War Department, and the War Assets Administration assumed custody. In early 1948, it was transferred to the USAF. Until 1951, the base was used for bombardier-navigator training.

In 1951, the Department of the Air Force redesignated the Beale Bombing and Gunnery Range as "Beale Air Force Base." During its early USAF years, it underwent a number of jurisdictional changes, being at times part of the Air Training Command, the Aviation Engineer Force, and finally the Strategic Air Command. By 1958, Beale's first runway was operational.

In July 1959, Beale received its first KC-135 jet Stratotanker, which was assigned to the 903rd Air Refueling Squadron of the 456th Bombardment Wing. In September 1959, Beale became the support base for three Titan I missile sites. In 1960, B-52s were assigned to the base. In 1965, the Titan I missile program was inactivated, and the 4200th Strategic Reconnaissance Wing, which would man and maintain the SR-71, was activated.

In 1976, as a result of a major reorganization at Beale, all B-52 aircraft were reassigned. At the same time, the 9th Strategic Reconnaissance Wing gained U-2 aircraft and the 99th Strategic Reconnaissance Squadron. The 9th Strategic Reconnaissance Wing (SRW) flies three unique aircraft, the SR-71, the TR-1, and the U-2. Training missions, principally, are flown from Beale. The mission of the wing is to

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[1]The information presented in this section was taken primarily from the Engineering-Science Phase I IRP Report and onsite observations and interviews during Phase II - Stage 1. References are given in Appendix C.

provide the capability of sustaining continuous reconnaissance operations and to develop and maintain a capability of conducting peacetime global reconnaissance operations.

In 1979, a phased-array radar system was installed. The 10-story radar is a detection and early warning system for sea-launched ballistic missile attacks on the continental United States.

1.3.3 PAST WASTE MANAGEMENT PRACTICES

Sources of hazardous wastes at Beale AFB have included the following activities:

- Industrial operations
- Pesticide utilization
- Fire protection training
- Management of fuels
- Spill management
- Hazardous waste treatment and storage

These activities, the types of wastes generated, and past waste management practices are described below.

1.3.3.1 Industrial Operations

Industrial operations at Beale AFB consist primarily of aircraft and vehicle maintenance and repair activities. The wastes generated include contaminated jet fuel, waste oils and lubricants, acid and alkaline cleaning solutions, solvents, paint strippers, and paints.

In the past, flammable chemicals such as oils, fuels, and solvents were burned in the fire protection training areas. In the late 1960s, this practice was limited to fuels because stricter air pollution control regulations were imposed.

After this time, waste solvents and oils were accumulated in two 2[illegible]000-gallon underground storage tanks at the fire training area and hauled off site by contractors of the Defense Property Disposal Office (DPDO), now the Defense Reutilization and Marketing Office (DRMO). Contaminated jet fuels were recycled, downgraded, or burned in fire protection training exercises.

In the past, unknown quantities and types of chemical wastes were reported to have been disposed by discharge to the sanitary or storm sewers. Other wastes were allowed to run off

onto surface soils directly adjacent to maintenance facilities, and in some cases, wastes were discharged directly to the land. Some oils, paints, and solvents were disposed in the base landfills. Sludge from the photo wastewater treatment plant was disposed in the base landfills from 1967 to 1978.

1.3.3.2 Pesticide Utilization

The pest control program at Beale AFB involves routine and specific job order applications of pesticides. Pesticides are stored in a locked and covered area of the Entomology Shop in Building 2560. Before 1981, the Entomology Shop was located in Building 440. Some herbicides were stored and applied by the Pavement and Grounds Shop (Building 2565) prior to 1980.

Prior to 1987, pesticide equipment rinsing and cleaning at Building 2560 occurred on gravel-covered natural ground at the side of the building, allowing the rinse water to either evaporate or seep through the gravel into the ground. However, concerns about the underground contamination potential of this practice resulted in the construction of a bermed, concrete washing and mixing area and a 500-gallon holding tank. Pesticide mixing and equipment rinsing has been a closed-system operation within this new facility since August 1987.

Currently, empty pesticide and herbicide containers are usually triple-rinsed and taken to the base landfill consistent with the provisions in 40 CFR 165.9. If triple-rinsing is not feasible, the empty container is turned in to the DRMO at McClellan AFB. Rinse water from triple rinsing is contained and used for dilutent in the preparation of future pesticide/herbicide mixtures.

1.3.3.3 Fire Protection Training

The Base Fire Department has historically operated two fire protection training areas. The first was operated from 1958 to 1971, and the second from 1972 to 1988.

The first area was located approximately 500 feet west of the intersection of J and 27th Streets. Until the late 1960s, combustible waste chemicals were accumulated in a shallow 2-foot-deep basin in the training area. These chemicals reportedly included waste oils, spent solvents, and aviation fuel. Chemicals were accumulated weekly and burned in the basin. Other chemicals were accumulated in

55-gallon drums and burned in the same basin. The basin area did not have a liner system nor was there any preapplication of water to prevent waste chemicals from percolating into the soil. The materials were applied directly to the soil and ignited.

The second fire protection training area was located about 250 feet northwest of the first. Only contaminated jet fuel was burned, and the burn area was first saturated with water before the fuel was applied to impede fuel infiltration. Following direction by the EPA, fire protection training activities ceased in this area and it is being decommissioned.

Fire training is currently conducted on a smaller scale using a concrete-lined pit located approximately 400 yards west of the second fire protection training area.

1.3.3.4 Management of Fuels

The fuel management system at Beale AFB has historically involved the handling of substantial volumes of jet fuels, diesel fuel, motor vehicle gasoline, unleaded gasoline, and No. 2 fuel oil. Fuels are delivered by pipeline, train, or truck to on base storage tanks. Jet fuels are pumped through a pipeline to hydrant systems for refueling aircraft. Trucks are also used to refuel aircraft.

Currently, fuel storage tanks are checked on a periodic basis to determine if cleaning is required. When cleaning is required, the tanks are emptied to other available storage. Contaminated fuel is recycled or used in fire protection training. An off base contractor conducts the tank cleaning operations and removes and disposes of any resulting sludges.

1.3.3.5 Spill Management

Historically, small spills of fuels and oils have occurred in maintenance and shop areas. These spills were contained with absorbent materials, washed into oil-water separators (connected to the sanitary sewer), or washed down storm drains. Fuel spills occurring along the flightline areas were washed down with large volumes of water. This water was either channeled directly into the surface drainage system or allowed to evaporate.

1.3.3.6 Hazardous Waste Storage

Several areas around Beale AFB have been designated for the storage of hazardous waste. Many hazardous wastes, such as oils and solvents, have been temporarily stored in drums and bowsers at the point of generation. When a sufficient quantity of these wastes have been accumulated, they have been transferred to bulk hazardous waste storage areas, which include drum storage areas and aboveground and underground storage tanks.

1.4 SITE-SPECIFIC BACKGROUND INFORMATION

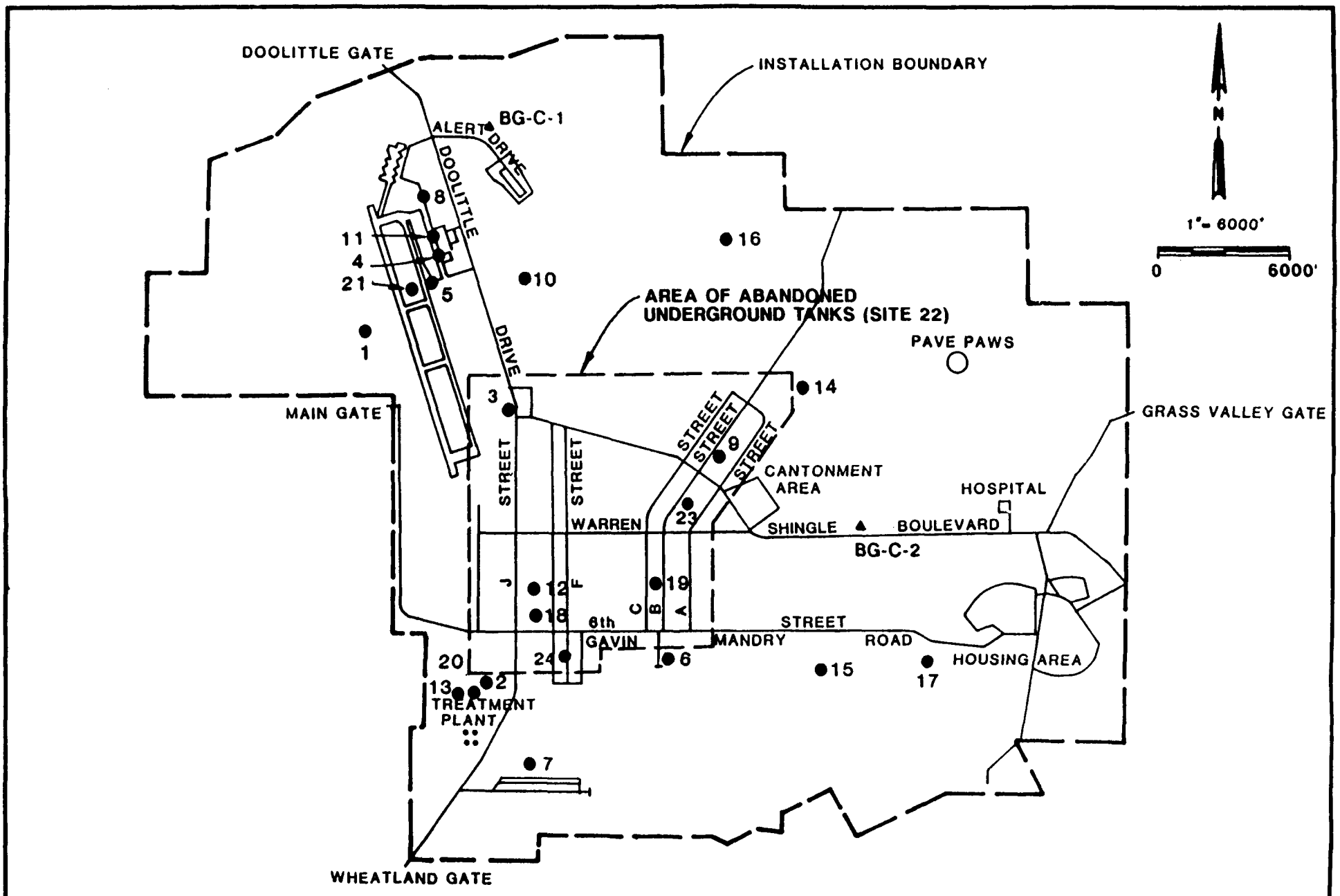
This section describes the 24 sites of concern at Beale AFB. The locations are illustrated in Figure 1-6 and, in greater detail, in Plate 1. Site names are listed in Table 1-5. For each site, setting and location; waste sources, types, and concentrations; migration pathways; and potential receptors are discussed. These descriptions are based on data collected through the Phase II - Stage 1 (AeroVironment) study. Information given in the site descriptions does not include results for the current Stage 2-1 study. These results are given in Section IV of this report.

1.4.1 SITE 1: WEST DRAINAGE DITCH

1.4.1.1 Site Setting and Location

The West Drainage Ditch (Figure 1-7) drains runoff from the flightline and surface runoff from the runway area. Three 66-inch-diameter pipes discharge through a headwall about 2,000 feet west of the flightline, into a ditch filled with vegetation. Since 1984, oil absorbent booms have been placed immediately downstream from the headwall. The headwall structure is being upgraded incorporating a cement apron and a weir that will detain floating hydrocarbon products. Construction is scheduled to be completed in January 1991. Past surface water quality data indicated oil and grease and trans-1,2 dichloroethane in water discharged to the ditch. Banks of the ditch are oil stained for about 75 feet downstream of the headwall.

West Drainage Ditch is located less than 1,000 feet from the base boundary. Ditch water occasionally flows off base during the wet season (October through April). This presents a potential for environmental contamination outside the base boundary. The site is also less than 1 mile from off base



SOURCE: BEALE AIR FORCE BASE INSTALLATION RESTORATION PROGRAM REPORTS (ENGINEERING SCIENCE, 1984: AeroVironment, 1987)

FIGURE 1-6
IRP SITE LOCATIONS

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Table 1-5
IRP SITES AT BEALE AFB

Site Number	Site Name
1	West Drainage Ditch
2	Photo Wastewater Treatment Plant, Injection Well, and Sludge Basins
3	Fire Protection Training Areas
4	Battery Shop Dry Well
5	SR-71 Shelters Drainage Area
6	Landfill No. 2
7	Army Biological Production Area
8	J-57 Test Cell
9	Entomology Building 2560
10	J-58 Test Cell
11	Aircraft Ground Equipment Maintenance Area
12	Entomology Building 440
13	Landfill No. 1
14	Transformer Drainage Pit
15	Landfill No. 3
16	Explosive Ordnance Disposal (EOD) Area
17	Best Slough
18	Bulk Fuel Storage Facility
19	Photo Waste Emergency Holding Basin

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Table 1-5
IRP SITES AT BEALE AFB
(Continued)

Site Number	Site Name
20	Grease Pit (Sanitary Treatment Plant)
21	JP-7 Aboveground Fuel Storage Tanks (Flightline)
22	Abandoned Underground Storage Tanks
23	Ninth Transportation Refueling/Maintenance Shop
24	Landfill No. 4

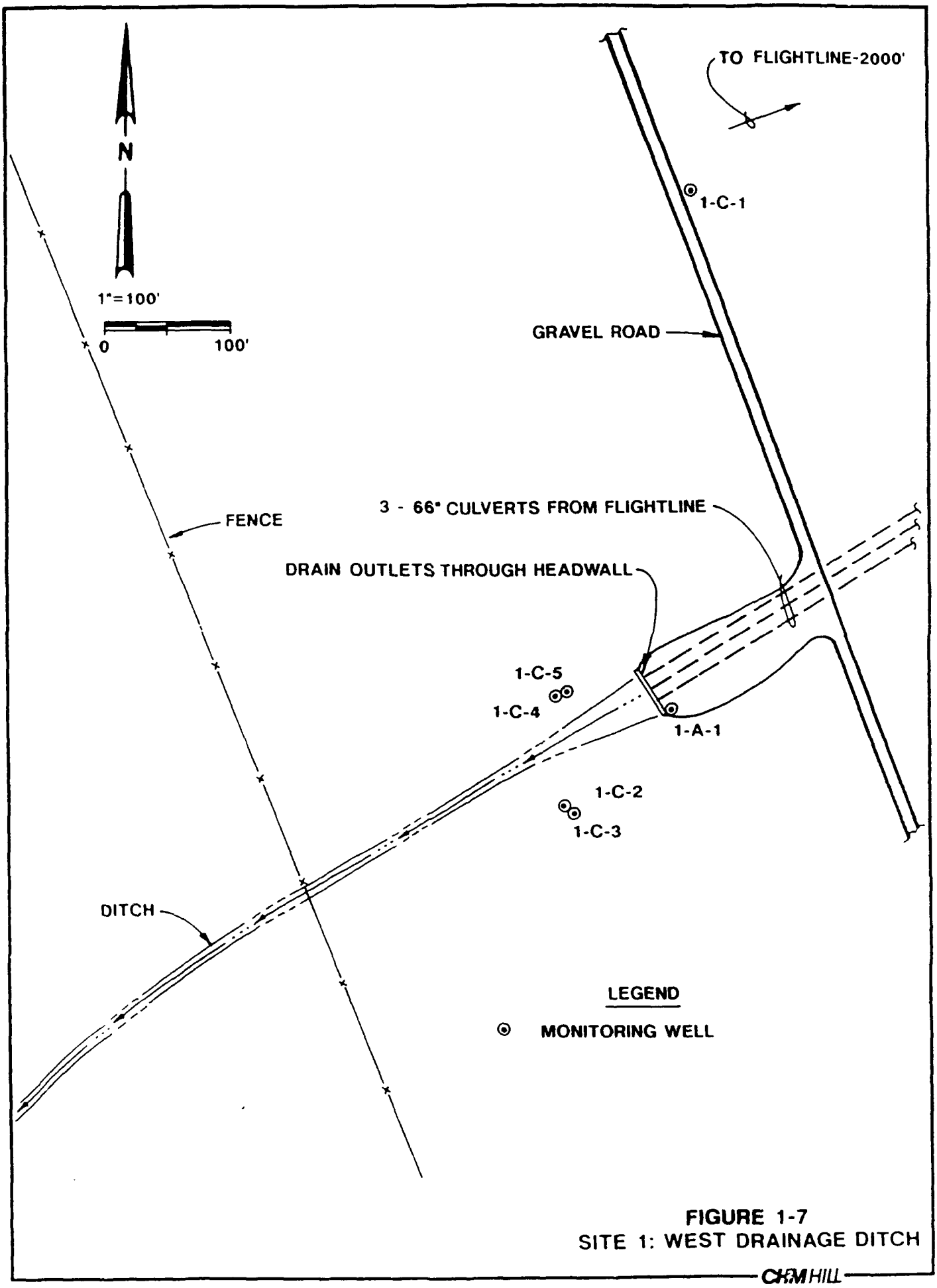


FIGURE 1-7
SITE 1: WEST DRAINAGE DITCH

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residences along North Beale Road that use groundwater for domestic purposes. Surface soils in the area are medium-textured clay with characteristically low permeability.

1.4.1.2 Waste Sources, Types, and Concentrations

Runoff from the flightline and runway area, including the SR-71 shelter area (Site 5), is the main source of contaminants. It is composed of jet fuel, oil, and solvents. Up to 18,000 ug/l (ppb) of oil and grease was detected by AeroVironment in the surface water near the drain outlet to the ditch. Bottom sediment contained up to 33,000 mg/kg (ppm) of oil and grease and 410 mg/kg (ppm) of lead. Although not detected in surface water samples, trichloroethylene (TCE) concentrations of 100 ug/l (ppb) were found in groundwater.

1.4.1.3 Migration Pathways

Contaminants are carried to the West Drainage Ditch via underground culverts from the flightline area. Fuels, oils, and solvents, dissolved or suspended in water, are discharged to the drainage ditch.

Contaminants exist in surface water and are carried downstream during high flow conditions. Contaminants are present in ditch sediments. The Stage 1 report speculated that contaminated sediments may be a result of deposition of contaminated suspended soils discharged from the drainage culvert. The degree and extent of vertical soil contamination is unknown.

Samples from AeroVironment well 1-A-1 indicates that the groundwater was contaminated with TCE, which is a mobile compound and may have been either carried downward with percolating ditch water or transported in the groundwater from upgradient sources. The extent of this contamination is unknown.

1.4.1.4 Potential Receptors

If groundwater contamination affects the quality of water in base production wells, the base population could potentially be exposed to contamination through groundwater ingestion. Likewise, if groundwater contamination affects any off base private wells, neighboring residents, their livestock, and crops could potentially be exposed. The 9 base production wells, about 6,000 feet west of the site, range in depth

from about 300 to 400 feet. The screened intervals range in depth from 112 to 330 feet (Page, 1980). Well head elevations were not available.

Because the West Drainage Ditch area is not fenced, wildlife could potentially use the contaminated surface water and thereby be exposed.

1.4.2 SITE 2: PHOTO WASTEWATER TREATMENT PLANT, INJECTION WELLS, AND SLUDGE BASINS

1.4.2.1 Site Setting and Location

The photo wastewater treatment plant (PWTP) was used from 1966 to 1990 to treat photo development wastewater. It is located on the southwest portion of the base and receives wastes from the photo laboratory (Building 2145) 2.5 miles to the northeast. The site is illustrated in Figure 1-8 and an analysis of wastewater components is given in Table 1-6.

Average waste flow was 20,000 gallons per day. Treatment processes included equalization, chemical flocculation, settling, and filtration. Three injection wells were used for PWTP effluent disposal until injection was discontinued in April 1986. In 1989 the injection wells were completely pressure grouted and abandoned. The zone of injection (1,000 to 1,200 feet below land surface) is not part of past or proposed IRP studies. Since 1986, PWTP effluent has been pumped to the sanitary treatment plant. In addition, two unlined sludge ponds were used for PWTP sludge disposal from 1974 to 1990.

The photo laboratory now has a closed loop water system and no longer discharges water to the PWTP. The PWTP is being decommissioned. Use of the unlined sludge ponds was discontinued in April 1990. Beale AFB is going through RCRA closure for the ponds with a Federal Facilities Compliance Agreement with the USEPA.

Concern at Site 2 results from the unlined ponds and the discharging of pentachlorophenol-treated PWTP effluent onto the ground around the PWTP and near the injection well heads. From 1967 until 1984, whenever the treatment plant shut down for maintenance, 500 to 2,000 gallons of effluent treated with pentachlorophenol (PCP) were discharged onto the ground in the vicinity of the injection wells. This procedure was conducted 12 times a year to flush out corrosion in the pipelines.

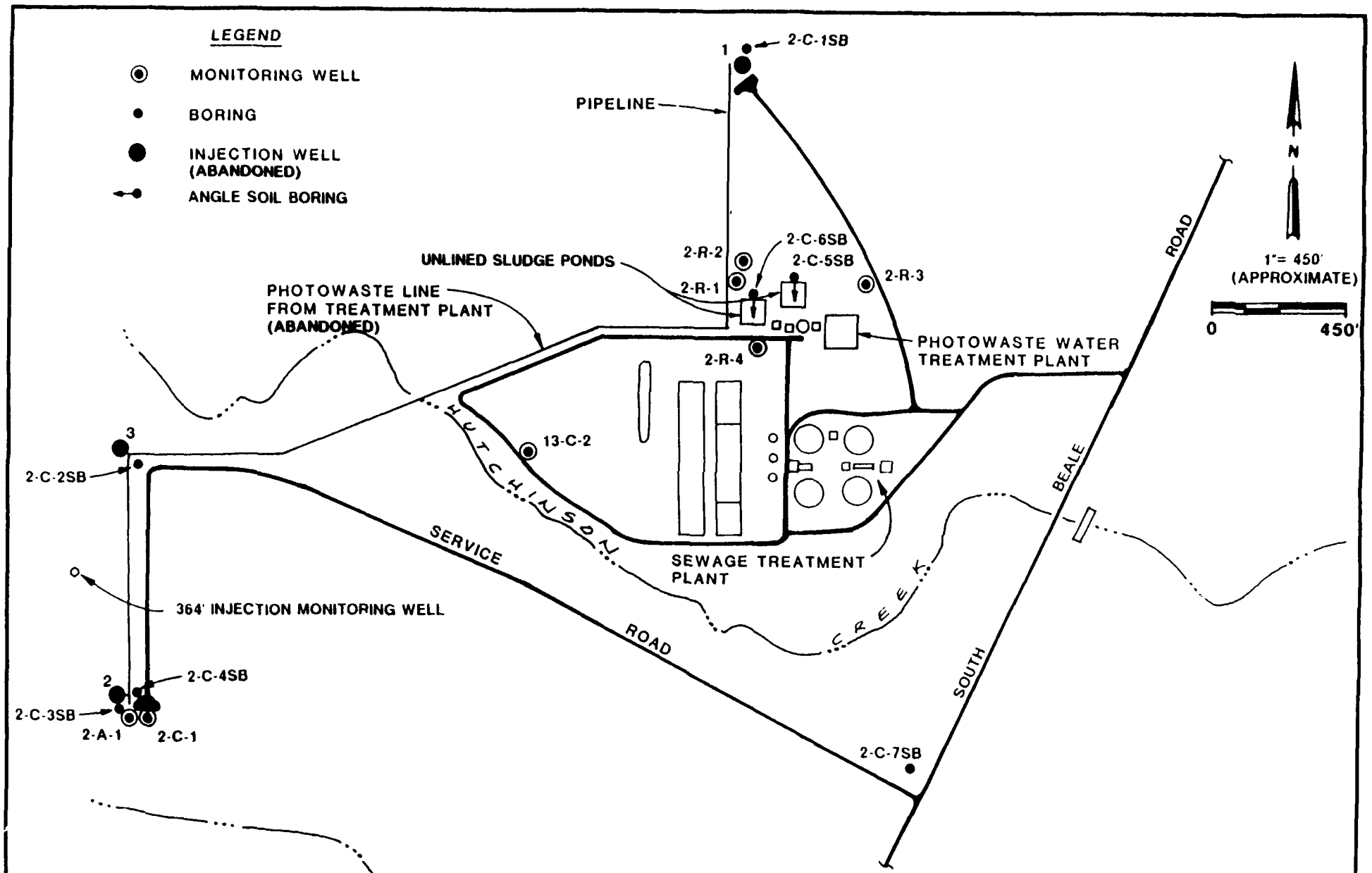


FIGURE 1-8
SITE 2: PHOTO WASTEWATER TREATMENT PLANT INJECTION WELLS AND SLUDGE PONDS

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Table 1-6
PHOTOWASTE SUMP SAMPLE ANALYTICAL RESULTS

Parameter	Value (mg/l)
pH (pH units)	7.8
Specific Conductivity (umhos/cm)	1,050
Thiosulfate	760
Biochemical Oxygen Demand	148
Chemical Oxygen Demand	2,000
Hydroquinone	0.039
Total Suspended Solids	10
Total Dissolved Solids	960
Cyanide (free)	ND[a]
Cyanide (total)	ND
Boron (total)	0.0248
Chromium (total)	0.008
Chromium (+6)	0.0011
Bromide	2.0
Silver	2.24
Zinc	0.060
Iron	0.38
Potassium	79
Sodium	34
Cadmium	0.030
Total Organic Carbon	200

[a]ND = Not detected

NOTE: Sample collected in August 1982.

This site (plant, ponds, and injection wells) is approximately 500 feet from the base boundary and less than 500 feet from Hutchinson Creek.

1.4.2.2 Waste Sources, Types, and Concentrations

Discharge of PCP-treated effluent on the ground surface and disposal of PWTP sludge in unlined ponds are the main waste sources. Waste types include photo wastes containing trace metals, phenolics, benzene, oil and grease, and PCP. During the AeroVironment study no PCP was found in the upper 12 feet of soil near the injection well heads. In one sample from 16.5 feet below ground surface (BGS), PCP concentration measured 30 mg/kg (ppm). Insufficient information exists regarding groundwater near the injection well heads, though 2 ug/l (ppb) of phenol was measured in one groundwater sample of first water encountered (100 feet BGS). Concentrations measured in groundwater downgradient of the sludge ponds show 5 ug/l (ppb) phenol, 80 ug/l (ppb) chromium, and 0.9 ug/l (ppb) benzene. Sludges and soils beneath the sludge ponds were not sampled in previous IRP studies.

1.4.2.3 Migration Pathways

Chemicals in photo wastewater, including PCP, may have contaminated soils in the vicinity of the injection well heads due to line discharges. PCP was detected at 16.5 feet below land surface at one well head. The horizontal and vertical extent of this impact is unknown. Contaminants may have been carried downward through surface soils and accumulated on top of a clay layer.

Photo waste sludges are stored in unlined ponds. When first pumped to the ponds, the sludge has a high water content. Also, during winter months, precipitation adds water to the ponds. Contaminants may have percolated into the soils beneath the ponds and possibly to groundwater. Although groundwater in the area does contain contaminants, the source(s) of these contaminants have not been confirmed.

Spillage of photo wastewater in the vicinity of the PWTP may have carried contaminants into the soil.

1.4.2.4 Potential Receptors

Potential human receptors are base personnel associated with the PWTP, and users of the off base domestic well directly west of the site.

1.4.3 SITE 3: FIRE PROTECTION TRAINING AREAS

1.4.3.1 Site Setting and Location

Training exercises have been conducted at Fire Protection Training Area (FPTA) No. 1 and FPTA No. 2 since 1958. Because they are located within 250 feet of each other, they have been combined into one IRP site for the purpose of evaluation. The site is illustrated in Figure 1-9.

From 1958 to 1971, the fire department conducted live fire training exercises at FPTA No. 1. This site is located in the half-acre adjacent to the intersection of J and 27th Streets. Until the late 1960s, combustible waste chemicals were accumulated in a shallow, unlined 2-foot-deep basin in the FPTA. These chemicals were reported to have included waste oils, spent solvents, and aviation fuel. These chemicals were burned weekly in the basin. Other chemicals were accumulated in 55-gallon drums and burned in the same basin. The basin area did not have a liner, nor was there any pre-application of water to prevent the percolation of waste chemicals into the soil. The materials were applied directly to the soil and ignited (Engineering-Science, 1984). There is currently no visual evidence of FPTA No. 1. FPTA No. 2, located northwest of FPTA No. 1, began operating in 1972 when use of FPTA No. 1 was discontinued. FPTA No. 2 consists of a shallow unlined basin 150 feet in diameter surrounded by a 12-inch berm. Inside the basin is a mock aircraft which was used for fire training exercises. About 100 feet south of the mock aircraft is an unlined basin designed to hold liquid drained from FPTA No. 2. Fire training exercises involved simulated fires in and around the mock aircraft, using contaminated jet fuel on an area first saturated with water. Residual fuel and water are left in the unlined basin south of the FPTA.

Following direction by the EPA, fire protection training activities ceased at FPTA No. 2 in 1988 and it is being decommissioned. Fire training is currently conducted on a smaller scale using an 8-foot by 10-foot concrete-lined pit located approximately 400 yards west of FPTA No. 2.

There are two 25,000-gallon underground storage tanks located at the FPTA. They are designated as the north tank and the south tank. The north tank contains jet fuel that was used by the base fire department for live fire training in the adjacent fire pit. The south tank has traditionally

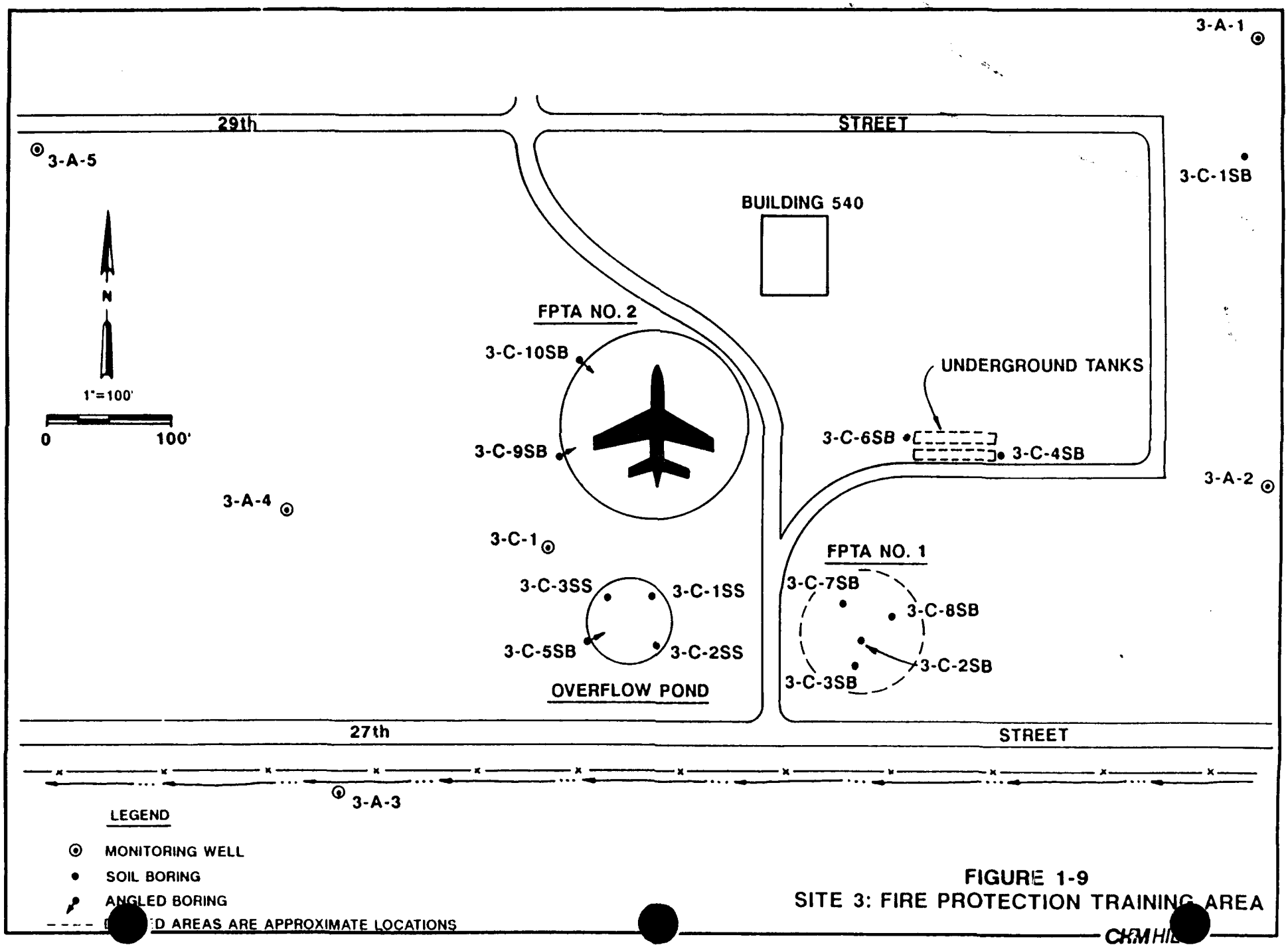


FIGURE 1-9
SITE 3: FIRE PROTECTION TRAINING AREA

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contained contaminated fuel, hydraulic fluid, and waste solvents. Underground fuel lines run from the tanks to the fuel nozzles at the airplane mock-up in the fire pit.

The only recorded spill incident at the FPTA occurred in May 1983. Fluid from the north tank was inadvertently pumped out of the tank and onto the ground. The intent was to provide additional tank capacity for a leak check. Three months earlier, the base had analyzed its contents (through lab facilities at USAFOEHL, presently AFSC) and reported that liquid from the north tank contained lead and chromium levels of 10 and 5.5 mg/l (ppm), respectively. The discharge of this liquid onto the ground subsequently created concern about soil contamination with lead and chromium. Appropriate regulatory agencies were notified of the spill. Subsequent soil testing did not indicate the need for any remedial action.

The site is located within 1 mile of the base boundary. Surface soils in the vicinity of the FPTA contain clay, which has relatively low permeability.

1.4.3.2 Waste Sources, Types, and Concentrations

Contaminant sources at this site are the fire training pits, spills associated with the pits, and underground storage tanks. Contamination types are waste oils, spent solvents, and jet fuel. No contamination was detected in groundwater samples from five AeroVironment wells during IRP Phase II, Stage 1 sampling. Oil and grease were detected in surface soils inside the berm at FPTA No. 2 and near the underground tanks. Oil and grease concentrations between the surface and 16-feet depth measured 800 mg/kg (ppm). Volatile organics (xylene) measured 1 mg/kg (ppm). Soils inside FPTA No. 2 exhibited oil and grease concentrations up to 4,900 mg/kg (ppm), petroleum hydrocarbons up to 4,600 mg/kg (ppm), and volatile aromatics at detectable levels (AeroVironment, 1987). No previous information was available for FPTA No. 1 as it was not located or sampled during the Stage 1 investigation.

1.4.3.3 Migration Pathways

Hydrocarbon contaminants have been introduced to the surface soils at three locations. At each of these locations, contaminants have probably caused soil impacts but the horizontal and vertical extent is unknown. It is possible that contaminants may spread horizontally on clay layers reported to be present in this area (AeroVironment, 1987).

Groundwater contamination has not been detected in existing wells but it is possible that the wells are incorrectly positioned or are too far away from the source.

1.4.3.4 Potential Receptors

Potential receptors include firefighters in training and base personnel handling wastes in pits and waste disposal. Groundwater contamination is a possibility, even though it was not observed during Phase II, Stage 1 activities. If groundwater is, or becomes contaminated, domestic well users west of the base may become receptors.

1.4.4 SITE 4: BATTERY SHOP DRY WELL

1.4.4.1 Site Setting and Location

From 1972 to 1983, approximately 24 gallons per month of neutralized lead battery acid were discharged to this dry well (AeroVironment, 1987), which is adjacent to the Battery Shop (Building 1088; see Figure 1-10). The neutralized acid may have had high lead concentrations. The dry well is 4 feet in diameter and approximately 20 feet in depth, and is filled with cobblestones. Use of the dry well was discontinued in 1983.

1.4.4.2 Waste Sources, Types, and Concentrations

The source of waste at Site 4 was the discharge of neutralized lead battery acid. The waste type is lead and inorganic compounds from the battery acid. No contamination was detected in groundwater samples from the one monitoring well installed by AeroVironment.

1.4.4.3 Migration Pathways

Relatively low volumes (approximately 24 gallons per month) of waste fluids were disposed of in the dry well. A discolored zone detected between 45 to 50 feet BGS may have been caused by the horizontal migration of waste fluids on top of a clay lens or within a higher permeability unit (AeroVironment, 1987). Color may be due to precipitation of metals.

Groundwater contamination has not been detected in the one existing well. Either contaminants did not reach groundwater in measurable concentrations, or contaminants have been transported downgradient and are no longer present in the site area because the source of contaminants no longer

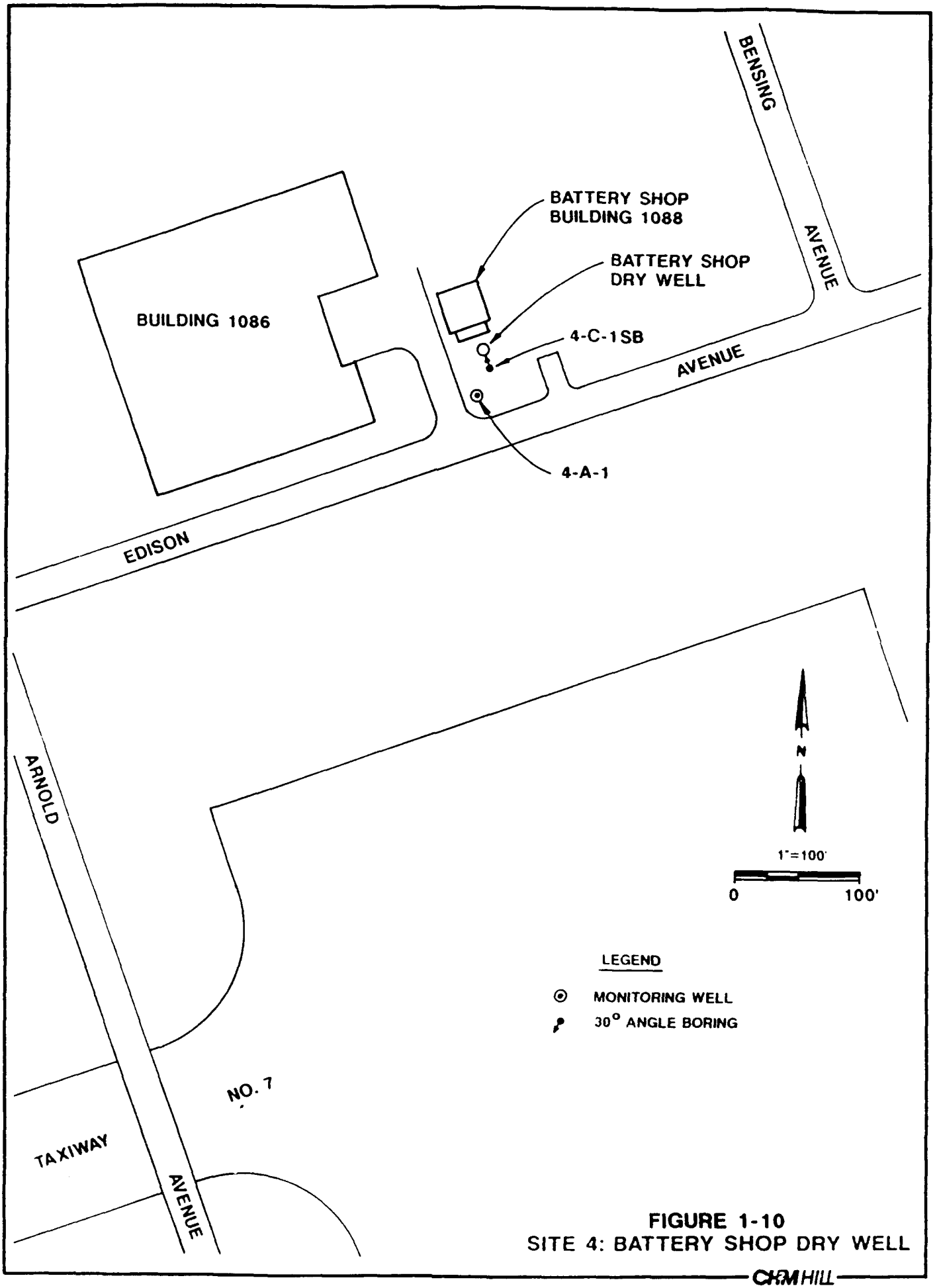


FIGURE 1-10
SITE 4: BATTERY SHOP DRY WELL

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exist. It is also possible that the one well is improperly positioned to intercept contamination. Groundwater flow is estimated to be to the west southwest at Site 4.

1.4.4.4 Potential Receptors

If the fluids disposed of down the dry well have contaminated groundwater, users of domestic wells to the west of the base or users of the base supply wells may be receptors. Based on waste types and quantities, this is considered to be unlikely.

1.4.5 SITE 5: SR-71 SHELTERS DRAINAGE AREA

1.4.5.1 Site Setting and Location

From 1966 to 1989, ground operation of SR-71 aircraft resulted in about 300 gallons per week of JP-7 jet fuel being leaked onto the hangar floors and shelter apron area (Engineering Science, 1984). Some fuel ran off the taxiway into an oil-water separator. Water from the separator was discharged via pipelines to the West Drainage Ditch (Site 1). Runoff also flowed onto soil and gravel between the SR-71 shelter apron and flightline taxiways (Figure 1-11).

1.4.5.2 Waste Sources, Types, and Concentrations

JP-7 jet fuel leakage was the principal waste source at Site 5. Based on IRP Phase II, Stage 1 findings, hydrocarbon concentrations in the soil ranged from 400 to 4,000 mg/kg (ppm), with highest concentrations present in the north borings near the storm drain inlet. Depth of contamination is unknown. No contamination was detected in sampled groundwater.

1.4.5.3 Migration Pathways

Petroleum contaminants were transported to the surface soils by precipitation runoff and SR-71 hangar floor washing operations. In the past, all of the contaminants either percolated into the soils or were transported to the drainage culvert leading to the West Drainage Ditch (Site 1). Surface soil contaminants have been detected but the vertical and horizontal extent is unknown.

Currently, runoff water is channeled by curbs and lined ditches to an oil/water separator. It is not known how effective these flow controls are in preventing further soil

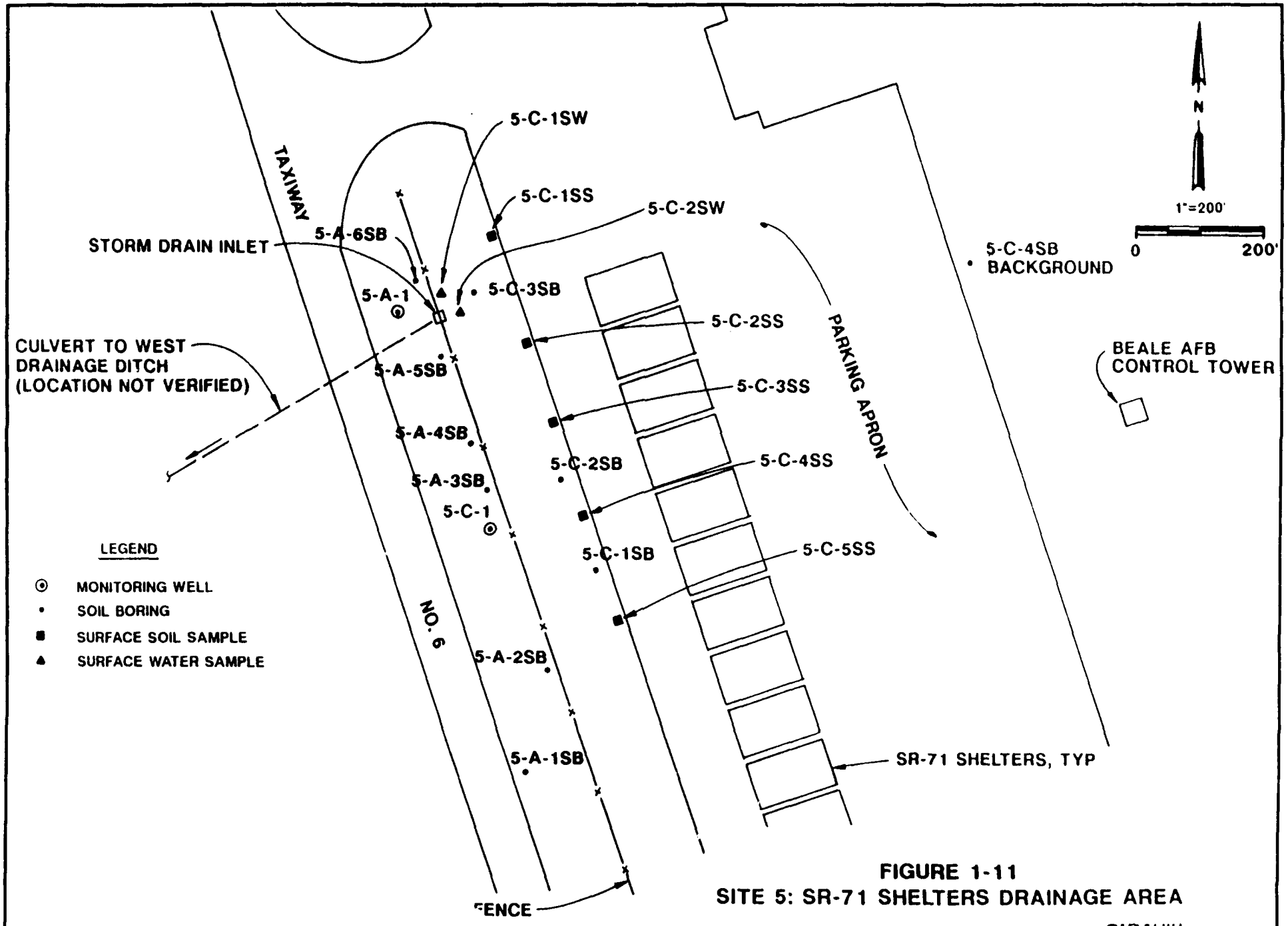


FIGURE 1-11
SITE 5: SR-71 SHELTERS DRAINAGE AREA

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contamination. The oil/water separator and associated curbs and channels were upgraded in 1990 to more effectively capture runoff from a larger area. Oil absorbing booms have been installed around the oil/water separator.

Contaminants in the soil may be carried by percolation of surface water to the groundwater, although no contamination has been detected in the one existing well (5-A-1) installed by AeroVironment.

1.4.5.4 Potential Receptors

Base personnel working in the area are the primary potential human receptors at this site. However, this site is upstream from and contributes flow to Site 1, the West Drainage Ditch. Contaminants from Site 5 may be carried to Site 1 where they may be transported by surface water flow or percolate into ditch sediments and downward to groundwater. Therefore, Site 5 has the same potential receptors as Site 1.

1.4.6 SITE 6: LANDFILL NO. 2

1.4.6.1 Site Setting and Location

Landfill No. 2 occupies 56 acres in the southern sector of the base. It is located just south of 6th Street near the intersection with Earle Road. It was used primarily for refuse disposal from the early 1950s until 1980. Between 1967 and 1978, about 380 cubic yards of sludge from the photo wastewater treatment plant (Site 2) were disposed here. Small amounts of chemicals and petroleum were also disposed in Landfill No. 2 (Engineering Science, 1984). It is now used to dispose of dirt, wood, and other construction and grounds maintenance debris. Site 6 is shown in Figure 1-12.

1.4.6.2 Waste Sources, Types, and Concentrations

Domestic and base refuse, PWTP sludge, and some chemical waste are the waste sources and types found at Landfill No. 2. No groundwater contamination was detected in samples from two AeroVironment wells (6-A-1 and 6-A-2).

1.4.6.3 Migration Pathways

Water percolating into the landfill, especially during winter months, may cause leachate generation and migration through subsurface soils to groundwater. No groundwater

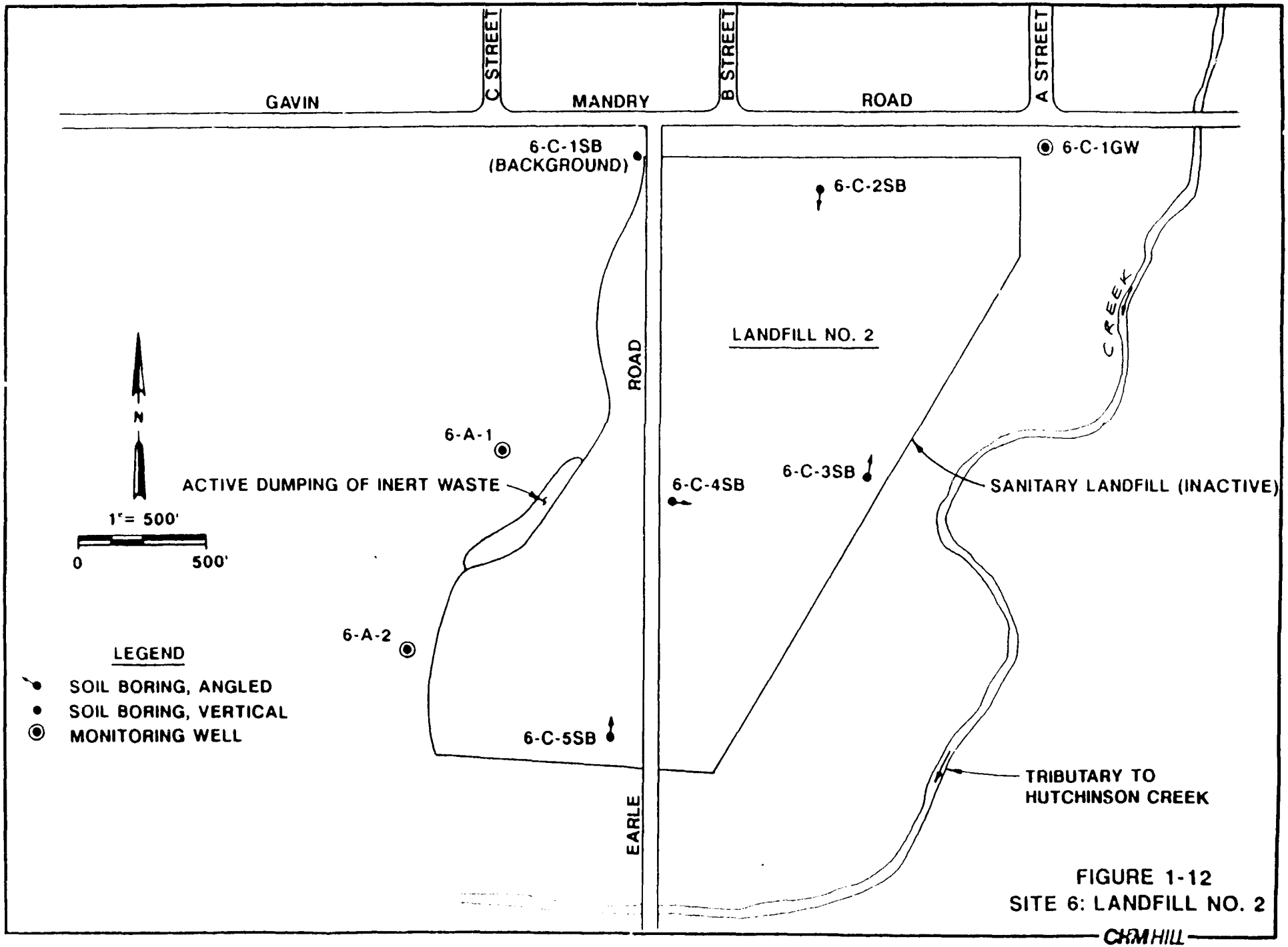


FIGURE 1-12
SITE 6: LANDFILL NO. 2

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contamination has been detected in wells installed during Phase II, Stage 1.

Landfill gas may also be present within the landfill and may migrate into surrounding soils, especially in coarse-grained soil.

1.4.6.4 Potential Receptors

Landfill No. 2 is no longer used for municipal refuse disposal and landfill trenches have been covered. Dirt, wood, and debris cover parts of the surface of the landfill. Because the landfill is inactive (except for inert wastes) and is covered, no potential receptors exist unless groundwater is, or becomes contaminated. If groundwater is or becomes contaminated, domestic well users west of the base may be potential receptors.

1.4.7 SITE 7: ARMY BIOLOGICAL PRODUCTION AREA

1.4.7.1 Site Setting and Location

The area that once served as the Army Biological Production site is adjacent to the Base Rod and Gun Club, east of the sewage treatment plant.

From 1962 to 1969, the U.S. Army produced wheat stem rust at a biological test site located adjacent to Building 1154, in the southwest corner of the base. In 1969, the production stocks remaining at Beale were destroyed and the material was rendered inactive by chemical treatment and incineration. The residual ash was assayed and plowed into the soil at the site to a depth of 6 inches. The destruction process was accomplished successfully by standards of that time, in cooperation with federal and state agricultural authorities.

The site is currently used as the Base Gun Club. Game birds are housed in large pens throughout the site.

1.4.7.2 Waste Sources, Types, and Concentrations

Sources of wastes include the chemicals used at the site during wheat stem rust production. Types are freon, ethylene oxic and possibly heavy metals and solvents such as trichloroethylene (TCE). Analysis of surface soils in the area for volatile organic compounds and heavy metals indicated that no contaminants were found at concentrations above background levels, with one exception. One sample showed a silver concentration of 12 mg/kg (ppm). AeroViron-

ment concluded that background level of silver was approximately 4 mg/kg (ppm). No further action is being taken at this site.

1.4.7.3 Migration Pathways

Apparently, potential contaminants were either destroyed during incineration, attenuated by the soils, or have been degraded since disposal. No contaminants were detected, and therefore, discussion of migration pathways is not applicable.

1.4.7.4 Potential Receptors

Discussion of potential receptors is not applicable for Site 7 because no contaminants were detected.

1.4.8 SITE 8: J-57 TEST CELL

1.4.8.1 Site Setting and Location

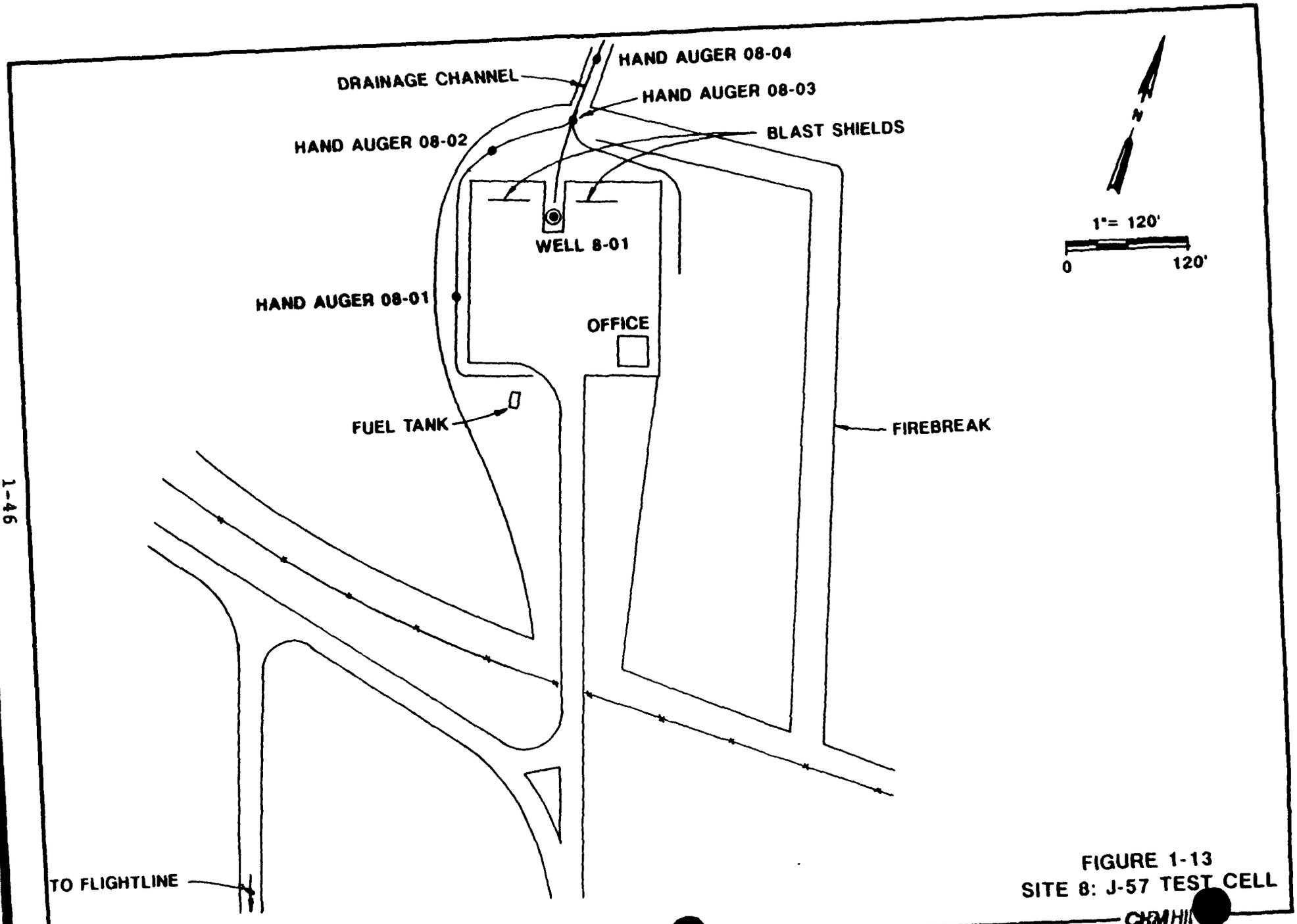
The J-57 Test Cell, which is decommissioned, is adjacent to Building 1247 at the north end of the flightline. It is presently used as a hazardous waste storage facility. Engines from all aircraft flown at Beale, except the SR-71, were tested here. The drainage ditch at this site received runoff from the engine test stand. Soils in the drainage ditch are stained from site runoff. Shop personnel estimate that these discharges have occurred since 1958, but can only confirm their occurrence since 1966. Site 8 is shown in Figure 1-13.

1.4.8.2 Waste Sources, Types, and Concentrations

Spills and runoff from jet engine tests were the main sources at this site. Types of wastes are jet fuel, petroleum distillates, and soaps. Though contamination was not detected in groundwater samples from the one AeroVironment well, 700 mg/kg (ppm) oil and grease and 1,400 mg/kg (ppm) petroleum hydrocarbons were measured in soils.

1.4.8.3 Migration Pathways

During engine repairing and testing, fuels, oils, and solvents were spilled onto the concrete pad. These contaminants were carried to the small ditch around the site by rainfall runoff or cleaning operations. Contaminants percolated into subsurface soils with the water, but



SOURCE: AeroVironment, 1987

FIGURE 1-13
SITE 8: J-57 TEST CELL

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vertical extent is unknown. When sufficient runoff exists, contaminants may flow along the ditch and be discharged to the field north of the site.

1.4.8.4 Potential Receptors

Base personnel involved with jet engine testing, were the most direct potential receptors. If groundwater is or becomes contaminated, base and domestic well users to the west may be potential receptors. If surface water carries contaminants from the site, downstream users and wildlife may be potential receptors.

1.4.9 SITE 9: ENTOMOLOGY BUILDING 2560

1.4.9.1 Site Setting and Location

Site 9 was originally a gravel basin located adjacent to Building 2560, inside the fenced Civil Engineering Facility. From 1981 to 1987, rinsate and spillage from storing and mixing pesticides and herbicides and cleaning pesticide containers were discharged onto this gravel area and allowed to evaporate or drain into the soil. Grass does not grow in a small area downhill from the gravel area. This could be the result of the discharges. The gravel basin next to Building 2560 has been covered (1987) with a concrete basin and berm preventing rinsate from contacting surface soils. A roof was built over the concrete basin in 1990. Soils may contain clay which helps retard vertical contaminant migration, but increases surface runoff. Site 9 is shown in Figure 1-14.

1.4.9.2 Waste Sources, Types, and Concentrations

Rinsate and spillage from storing and mixing pesticides and herbicides and from cleaning pesticide containers are the waste sources at this site. Waste types include herbicides and pesticides. Chlordane was the only pesticide detected during the IRP Phase II, Stage 1 work. Its concentration in soil was 0.9 mg/kg (ppm) at 1.5 feet, 0.1 mg/kg (ppm) at 6.5 feet. Base personnel question these results, claiming that records show chlordane was not used at this facility.

1.4.9.3 Migration Pathways

Pesticide and herbicide rinsate was previously discharged to the gravel area and may have percolated into subsurface soils. However, only chlordane was detected and that result was suspect. Contaminants may have precipitated in the

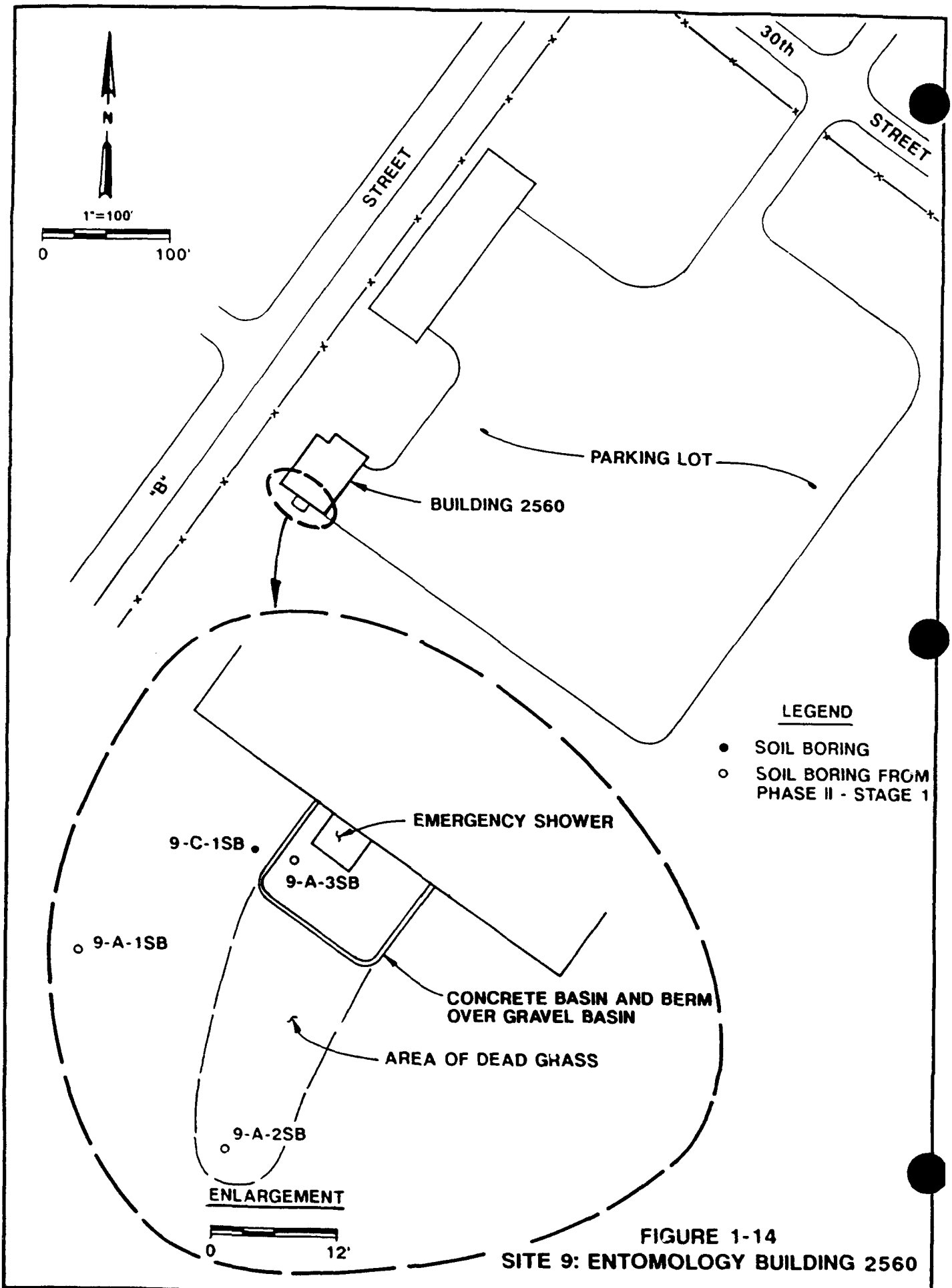


FIGURE 1-14
SITE 9: ENTOMOLOGY BUILDING 2560

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first foot of soil and, therefore, were not detected in deeper samples. It is unlikely that contaminants would have percolated to deeper depths, leaving near-surface soils essentially clean. Groundwater at the site has not been sampled, and does not need to be sampled unless deeper soil borings show evidence of vertical migration of contaminants.

1.4.9.4 Potential Receptors

The gravel area next to Building 2560 has been covered with a concrete basin preventing contact with surface soils. Potential receptors include base and domestic well users to the west, if groundwater has been contaminated. These wells are at least 3 miles downgradient from Site 9. The apparent low levels of contaminants, if any, and the distance to wells make exposure to well users highly unlikely.

1.4.10 SITE 10: J-58 TEST CELL

1.4.10.1 Site Setting and Location

The J-58 Test Cell was used to test the SR-71 jet engines until the SR-71 was returned. It is adjacent to Building 1154 just east of Doolittle Drive. The test cell has been closed. The drainage ditch at the test cell receives runoff from the test stand where tests were conducted. Soils in the adjoining ditch are stained from site runoff. Site 10 is shown in Figure 1-15.

1.4.10.2 Waste Sources, Types, and Concentrations

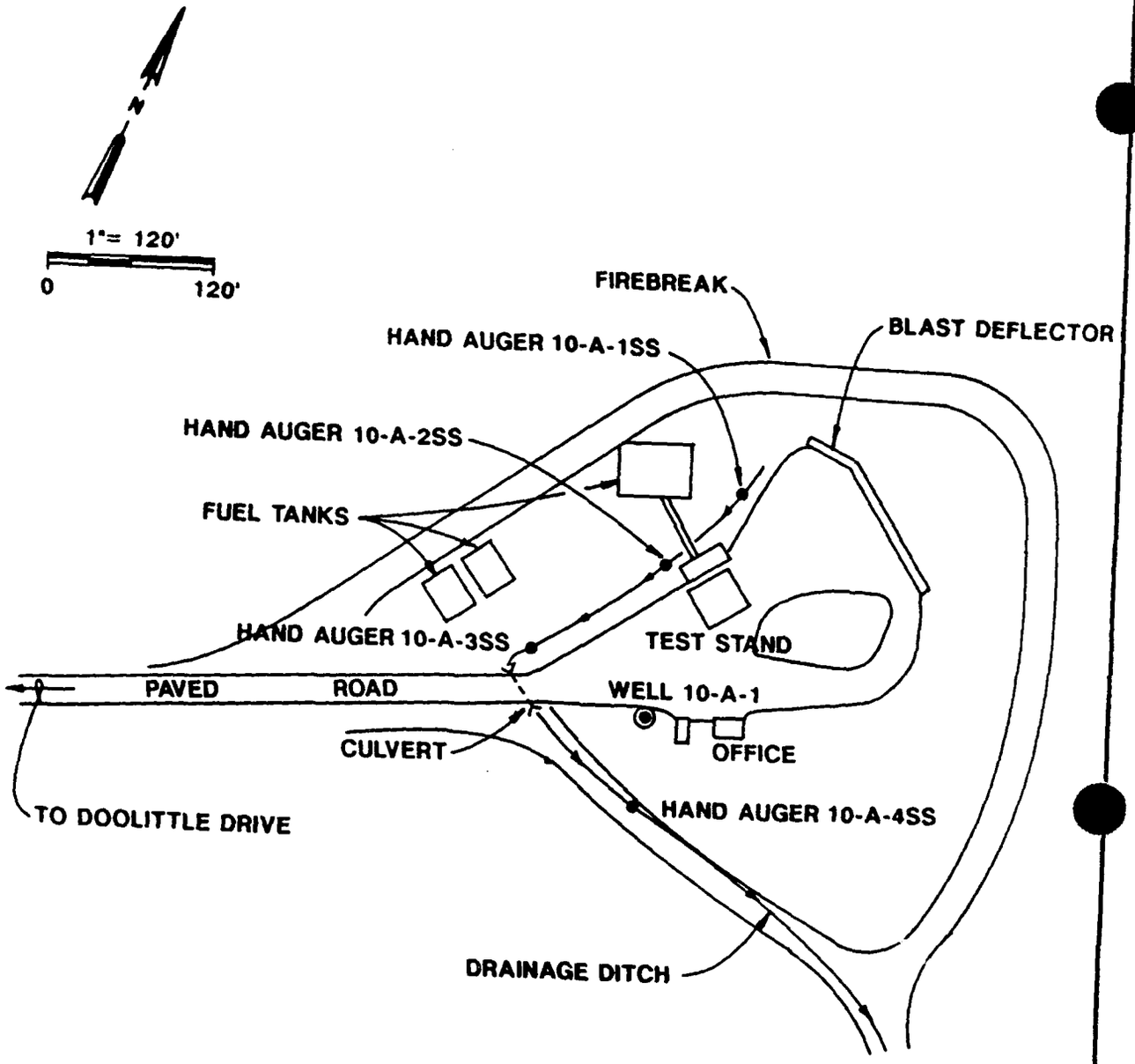
Spills and runoff from jet engine tests are the primary waste sources. Waste types are jet fuel, petroleum distillates, soap, oil, and TCE. No contamination was detected in the groundwater samples from the one AeroVironment well (10-A-1). Oil and grease concentrations in soil were 1,600 to 4,000 mg/kg (ppm), and petroleum hydrocarbons measured 1,600 to 4,700 mg/kg (ppm).

1.4.10.3 Migration Pathways

The source and migration of contaminants is essentially the same as for Site 8, J-57 Test Cell, except that runoff water is channeled to the south.

1.4.10.4 Potential Receptors

Base personnel involved with jet engine testing, were the most direct potential receptors. If groundwater is or



SOURCE: AeroVironment, 1987

FIGURE 1-15
SITE 10: J-58 TEST CELL

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becomes contaminated, base and domestic well users to the west may be potential receptors. If surface water carries contaminants from the site, downstream users and wildlife may be potential receptors.

1.4.11 SITE 11: AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA

1.4.11.1 Site Setting and Location

For the past 25 years, aircraft ground support vehicles have been parked on a paved area adjacent to the aircraft ground equipment (AGE) maintenance shop at Building 1225. These vehicles have been known to leak oil and hydraulic fluids. A drainage ditch behind Building 1225 shows evidence of staining, likely from fuel and oil contaminated runoff. Some of the stained soils were removed in 1984, although some discoloration is still visible. Cement berms and an oil/water separator have been installed to control runoff from operations. Site 11 is shown in Figure 1-16.

1.4.11.2 Waste Sources, Types, and Concentrations

Oil, hydraulic fluids, and fuels from aircraft ground support vehicles are the main sources. Oil, hydraulic fluids, and fuel (gasoline) are the waste types. During IRP Phase II, Stage 1, no contamination was detected in groundwater samples from the one AeroVironment well (11-A-1), or soils from the drainage ditch. Concentrations in surface soils near the pavement edge were up to 7,000 mg/kg (ppm) for oil and grease.

1.4.11.3 Migration Pathways

Fuels, oils, and possibly solvents leak from parked equipment onto the paved surface. Rainfall runoff or washing operations carry contaminants off the paved area and into surrounding soils. Surface water flowing from the site may carry contaminants, although soils in the ditch were not impacted, according to AeroVironment. Contaminants reportedly infiltrate into soils immediately adjacent to the pavement and may not reach the nearby ditch in measurable quantities.

1.4.11.4 Potential Receptors

Base personnel involved in AGE maintenance are the most direct receptors. If groundwater is or becomes contaminated, base and domestic well users to the west may be potential receptors. If surface water carries contaminants

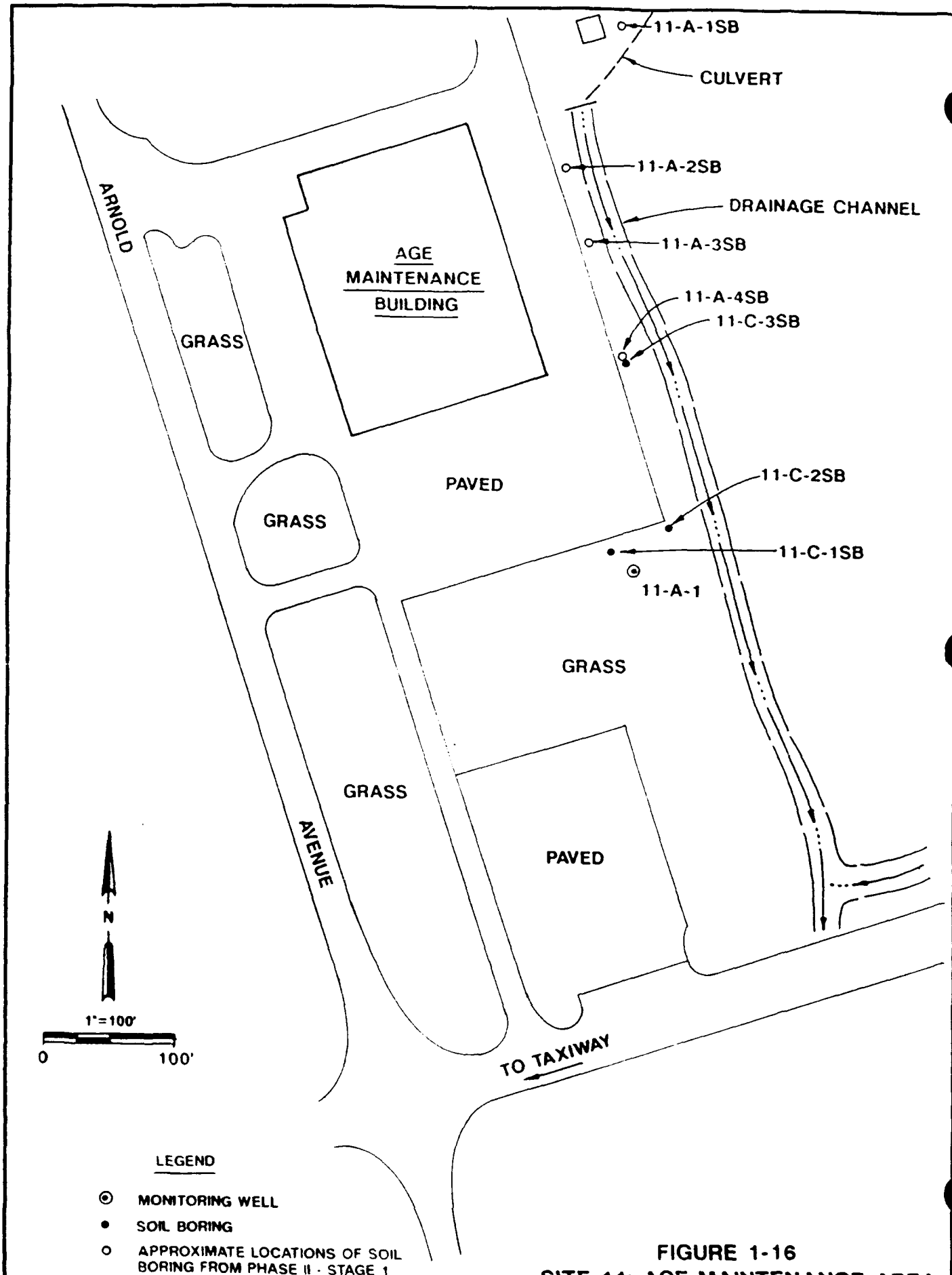


FIGURE 1-16
SITE 11: AGE MAINTENANCE AREA

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from the site, downstream users and wildlife may be potential receptors.

1.4.12 SITE 12: ENTOMOLOGY BUILDING 440

1.4.12.1 Site Setting and Location

The site consists of a mixing area adjacent to the southeast corner of Building 440 and a low-lying area 50 feet east of the southeast corner of the building. This building was used for storing and mixing chemicals used for pest control from 1965 to 1980 (Engineering Science, 1984). The soils around the buildings are relatively impervious clay, thus vertical migration is unlikely. The building is currently used by the base as an animal pound.

1.4.12.2 Waste Sources, Types, and Concentrations

Rinsate and spillage from storing and mixing pest control chemicals are the waste sources at this site. Waste types include herbicides and pesticides. No significant contamination was found in any of the soil samples taken at the site, nor was there any visual evidence or odor to indicate contamination problems. No further action is being taken at this site.

1.4.12.3 Migration Pathways

AeroVironment found no contamination at significant levels in soil samples collected. Because many herbicides and pesticides are stable and do not readily degrade, it is probable that contaminants were never present in the area sampled. Therefore, discussions of migration pathways is not applicable.

1.4.12.4 Potential Receptors

Because no contaminants were detected at Site 12, discussion of potential receptors is not applicable.

1.4.13 SITE 13: LANDFILL NO. 1

1.4.13.1 Site Setting and Location

Landfill No. 1 is on 4 acres in the southwestern sector of the base. It is west of the sludge dewatering beds at the sewage treatment plant and about 100 feet north of Hutchinson Creek. The Photo Wastewater Treatment Plant, the pipeline leading to abandoned Injection Wells Nos. 2 and 3,

and the Sanitary Treatment Plant Grease Pit are immediately adjacent to Landfill No. 1. Refuse was received here in the 1940s, but its source and composition are unknown. The site is no longer used, but subsidence typical of landfill aging has occurred in the northeast corner of the landfill. This may be due to abandoned pits used for disposal of sanitary treatment plant grease skimmings. Site 13 is shown in Figure 1-17.

1.4.13.2 Waste Sources, Types, and Concentrations

Unknown sources and types of refuse compose the wastes at this site. TCE concentrations in groundwater samples collected during Phase II, Stage 1, measured 0.4 to 106 ug/l (ppb), and perchloroethylene (PCE) concentrations measured 3.7 ug/l (ppb). AeroVironment reported that no contamination was detected in sediment from Hutchinson Creek, but pesticides from an unknown source were found in its surface water both upstream and downstream of the landfill. No significant levels of volatile organic compounds (VOCs) were evident in the creek.

1.4.13.3 Migration Pathways

Wastes deposited in the landfill may have included liquids which could migrate through subsurface soils to groundwater. Leachate may also be generated and transported by percolating rainwater. AeroVironment determined that groundwater contained solvent compounds but it is unknown if these originated from the landfill or from other nearby sources. Pesticides detected in the nearby stream water (Hutchinson Creek) are believed to be from another source. Landfill gas may also be generated within the landfill and may migrate into surrounding soils, especially in coarse-grained soil.

1.4.13.4 Potential Receptors

If groundwater impacts affect the water quality at off base private wells, neighboring residents and their stock and crops could potentially be exposed. Because the landfill is inactive and covered, there are no potential receptors on base, unless the soil cover is disturbed. Surface water contaminants detected by AeroVironment are believed to originate at sources other than Landfill No. 1 because they were found both upstream and downstream of the landfill.

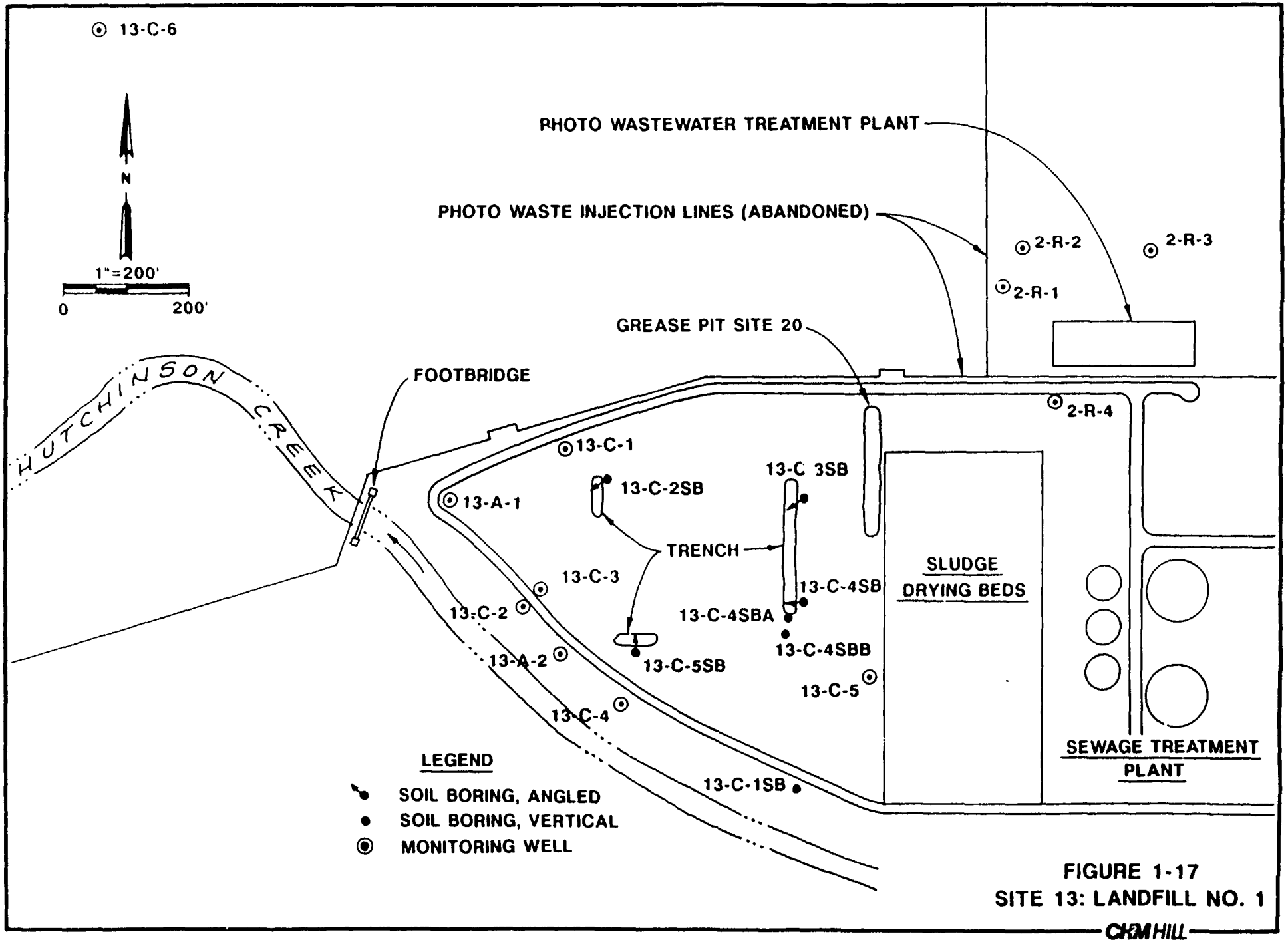


FIGURE 1-17
SITE 13: LANDFILL NO. 1

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1.4.14 SITE 14: TRANSFORMER DRAINAGE PIT

1.4.14.1 Site Setting and Location

The transformer oil drainage pit is in a diked area adjacent to 34th Street, near B Street. From 1977 to 1979, transformers were drained here before being taken to the shop for repair. Soils contain a clay layer. Some localized vegetation impact may have occurred as evidenced by two small non-vegetated areas. Site 14 is shown in Figure 1-18.

1.4.14.2 Waste Sources, Types, and Concentrations

Drainage of transformers has been the source of waste. Waste types are transformer oils contaminated with PCBs. In one soil sample taken from an unvegetated area during Phase II, Stage 1 activities, oil and grease concentrations were 38,000 mg/kg (ppm) and PCB Arochlor 1260 measured 5.3 mg/kg (ppm). In another sample in the same area, oil and grease concentrations were 1,900 mg/kg (ppm) but no PCBs were detected. No contamination was found in the other 10 sample locations, indicating localized contamination.

1.4.14.3 Migration Pathways

Contaminants in the form of oils containing PCBs were discharged directly to surface soils. These contaminants are not considered to be very mobile in the environment and probably remained in the upper portions of the soils. Most of the pit surface is covered by vegetation, limiting the potential for fugitive dust. The berm surrounding the pit prevented surface water discharge from the site. In 1990, some contaminated soil was excavated and taken to the Beale AFB soil holding area. The berms around the site were also removed.

1.4.14.4 Potential Receptors

Beale personnel and persons from the Beale mobile home camping facility 700 feet away could gain access to the site, which is not fenced, and contact surface soils.

1.4.15 SITE 15: LANDFILL NO. 3

1.4.15.1 Site Setting and Location

Landfill No. 3 occupies a 40-acre site east of Landfill No. 2, on 6th Street. It has operated since 1981 and currently accepts domestic garbage and refuse. The Regional

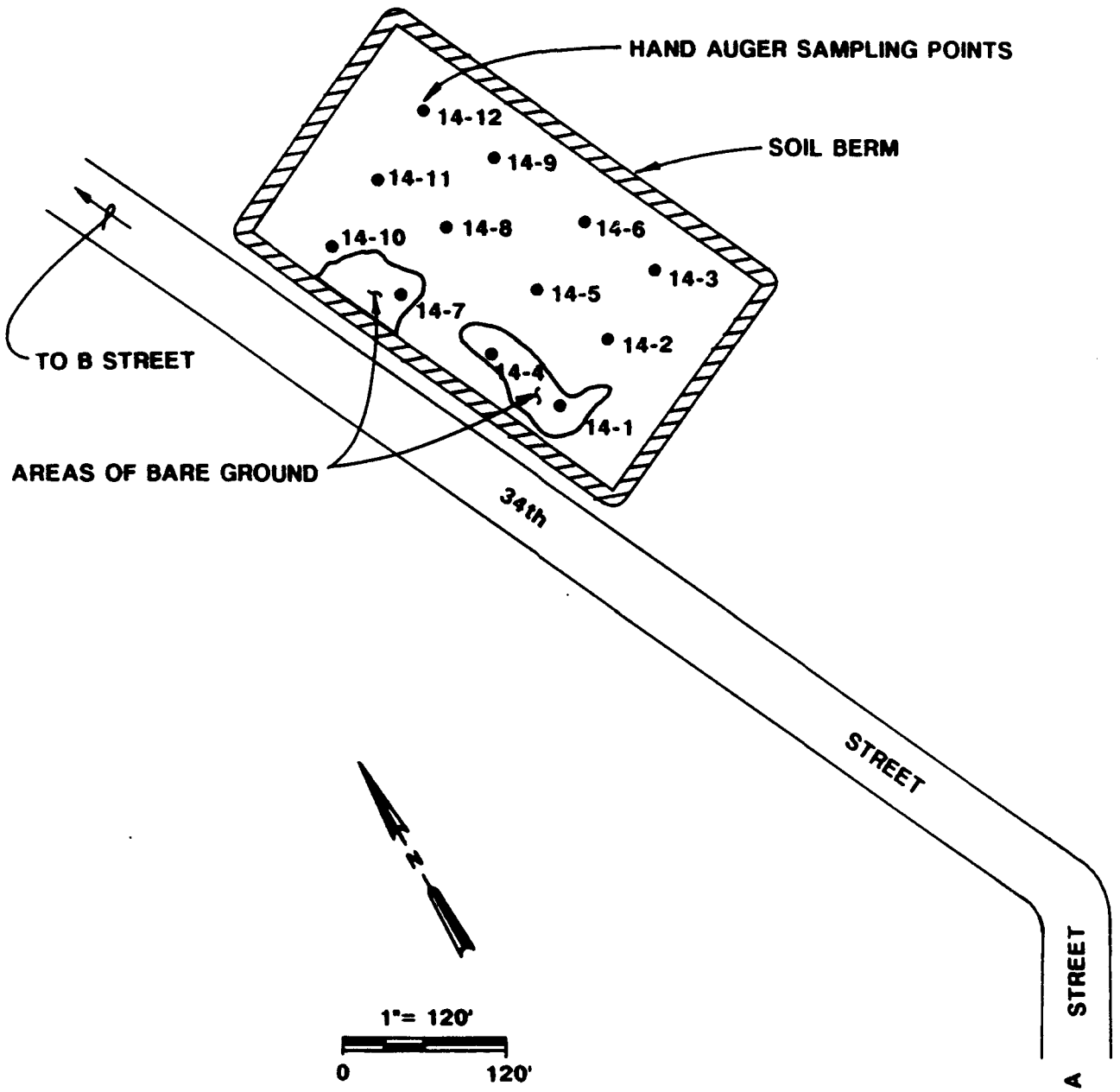


FIGURE 1-18
SITE 14: TRANSFORMER DRAINAGE PIT

SOURCE: AeroVironment, 1987

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Water Quality Control Board has permitted Landfill No. 3 as a Class III landfill.

The trench method is used for waste disposal at Landfill No. 3. Management practices include no chemical waste disposal, run-on and run-off control, and covering of waste daily. Soils are relatively impervious. Site 15 is shown in Figure 1-19.

1.4.15.2 Waste Sources, Types, and Concentrations

Domestic garbage and refuse are the main sources and types of wastes at this site. No groundwater contamination was detected by AeroVironment during Phase II, Stage 1.

1.4.15.3 Migration Pathways

Although no hazardous wastes are believed to have been deposited in this landfill, leachate may still be generated by percolating rainfall. Run-on and run-off controls help minimize leachate generation potential.

Leachate, if generated, may percolate through subsurface soils to groundwater. No groundwater contamination has been detected in existing wells.

Landfill gas may also be generated within the landfill and may migrate into surrounding soils, especially in coarse-grained soil.

1.4.15.4 Potential Receptors

Base personnel operating the landfill are potential receptors, primarily by exposure to landfill gas. If groundwater is or becomes contaminated, domestic well users to the west are potential receptors. These wells are at least 4½ miles downgradient.

1.4.16 SITE 16: EXPLOSIVE ORDNANCE DISPOSAL AREA

1.4.16.1 Site Setting and Location

The Explosive Ordnance Disposal (EOD) area is in a remote area off a series of dirt roads in the northern sector of the base. The EOD area consists of two bunkers for burning ordnance and a trench that measures approximately 70 feet by 15 feet by 10 feet deep. Unused ordnance (active munitions and explosives, flares, and pyrotechnics) from military bases around Sacramento are detonated in the bunkers or in

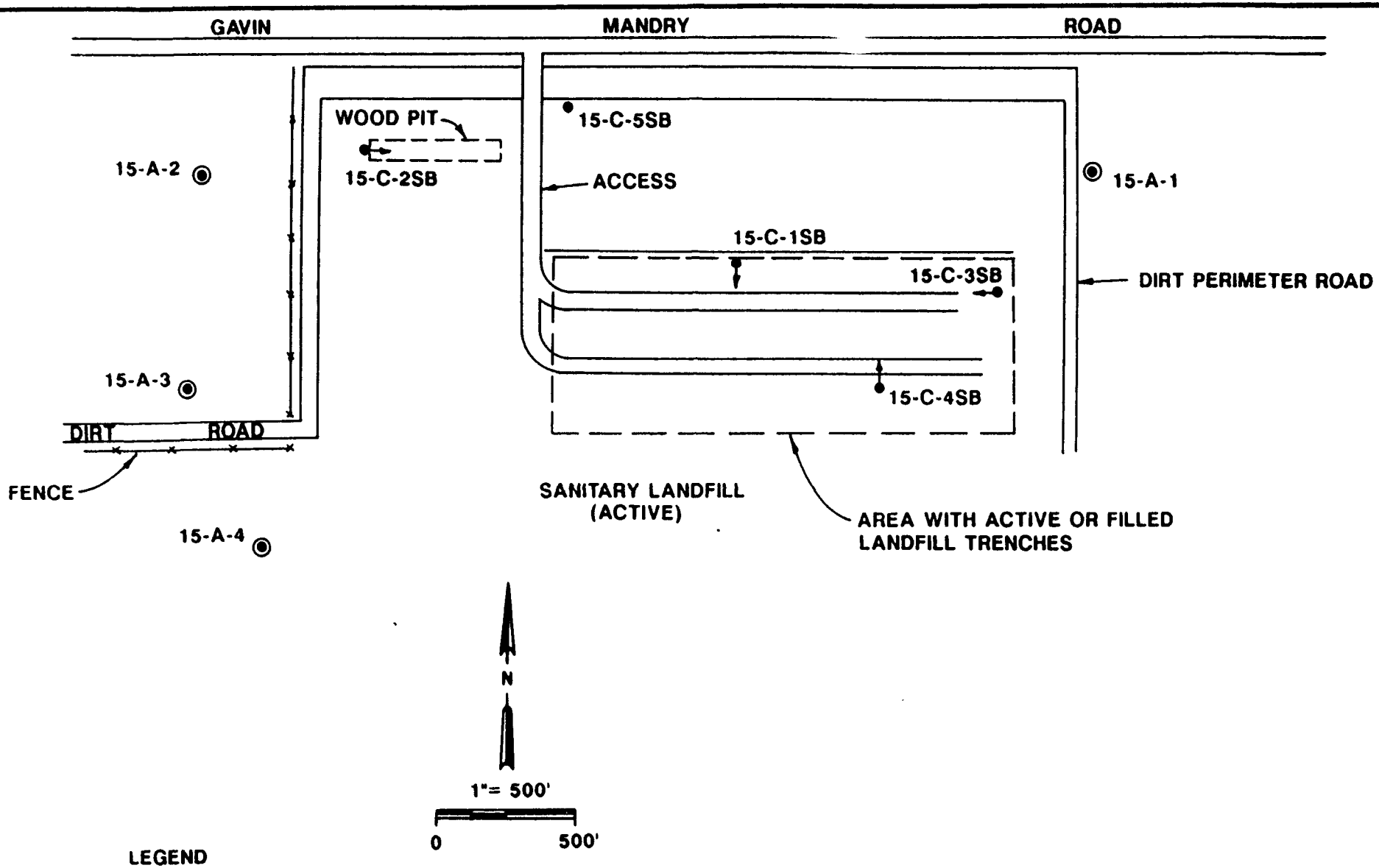


FIGURE 1-19
SITE 15: LANDFILL NO. 3

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the open field. Site 16 is shown in Figure 1-20. A draft RCRA Part B permit for the EOD was completed in 1990.

Diesel fuel and an underlying/overlying layer of wood are used to burn the smaller ordnance. No residual fuel remains after the fire burns itself out. After burning, remains are inspected and unburned ammunition is removed. The burned portion of the ordnance, primarily metal casings, is then disposed in the trench.

During precipitation, the disposal trench fills with water. The standing water provides a hydraulic head which would help move any contaminants in the trench down toward groundwater. Although surface soil consists of clay, the trench depth suggests this soil may have been breached.

1.4.16.2 Waste Sources, Types, and Concentrations

Munitions, explosives, flares, and pyrotechnics are the sources of waste at this site. Waste types include metals and explosive compounds. In the site soils sampled during Phase II, Stage 1, lead concentration was 14,000 mg/kg (ppm), chromium (total) was 2,000 mg/kg (ppm), and barium was 1,500 mg/kg (ppm).

1.4.16.3 Migration Pathways

Lead and chromium present in waste materials and detected in the pit-bottom soil samples are not very mobile through soils. However, little surface soil exists at Site 16 and metals have a lower attenuation in bedrock. Other potential contaminants, such as nitrogen compounds from explosive materials, may be more mobile and may have resulted in deeper impacts. No analyses were conducted for nitrogen species during Phase II, Stage 1.

Because no wells were installed during previous investigations, it was unknown if groundwater had been impacted at this site.

1.4.16.4 Potential Receptors

Base personnel conducting ordnance disposal operations are potential receptors due to contact with site surface soils. The site is remote from other base operations and access is limited. If groundwater is or becomes contaminated, discharge of contaminants to surface water via a spring located west of the site may occur. Should this occur, wildlife and livestock may be potential receptors.

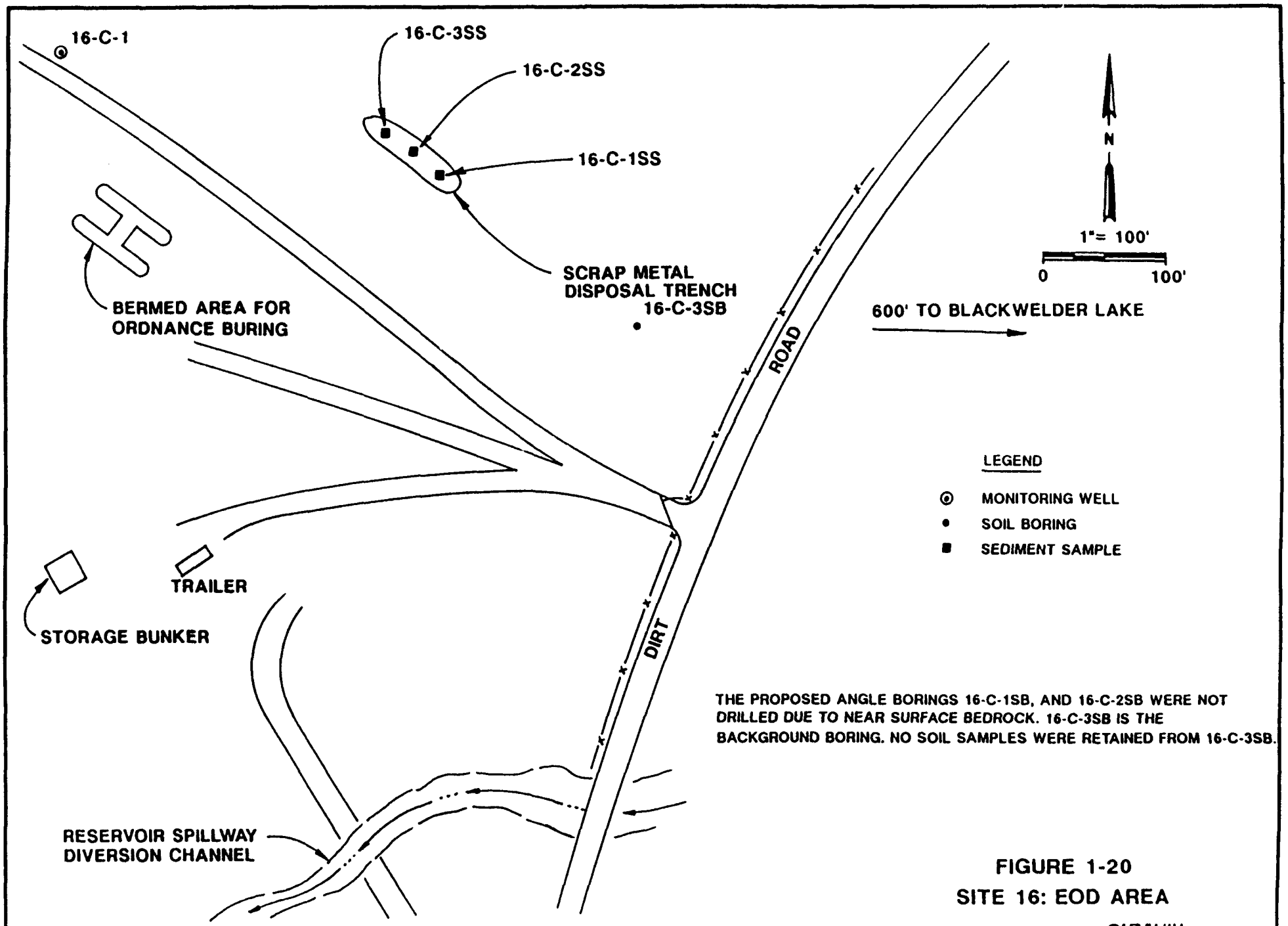


FIGURE 1-20
SITE 16: EOD AREA

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1.4.17 SITE 17: BEST SLOUGH

1.4.17.1 Site Setting and Location

Best Slough flows from east to west on the base before joining Bear River. The site, just south of Sixth Street and east of Landfill No. 3, was added to the IRP investigation because old empty drums were discovered in a 50- to 100-foot trench 50 feet west of the creek in January 1985. The site consists of four depressions, one of which contains approximately 25 empty drums. The drums were rusted and deteriorated. No information is available on what, if anything, the drums contained when they were dumped. Site 17 is shown in Figure 1-21.

1.4.17.2 Waste Sources, Types, and Concentrations

The source of waste at this site would have been the contents (if any) of the drums disposed there. Waste types are not known. Soil and surface water samples analyzed during the IRP Phase II, Stage 1 work did not show any contamination. Further, there were no odors, soil staining, or evidence of chemicals in or near the drums.

1.4.17.3 Migration Pathways

No contaminants were detected at this site. Either the drums discovered in the area were empty when disposed, or contaminants have been transported away or degraded. It is most likely that no contaminant source was present (i.e., drums were empty).

1.4.17.4 Potential Receptors

Because no contaminants were detected at Site 17, a discussion of potential receptors is not warranted.

1.4.18 SITE 18: BULK FUEL STORAGE FACILITY

1.4.18.1 Site Setting and Location

The bulk fuel storage facility, consisting of diked, aboveground storage tanks, is on the northeast side of the intersection of 6th and J Streets. It has operated since 1958. Fuels are delivered to and from the above ground tanks by pipeline, train, or truck. Fuels include jet fuel (AVGAS: JP-4, JP-7, and JPTS), diesel fuel, motor gasoline (MOGAS), unleaded gasoline, and No. 2 fuel oil. No major spills have

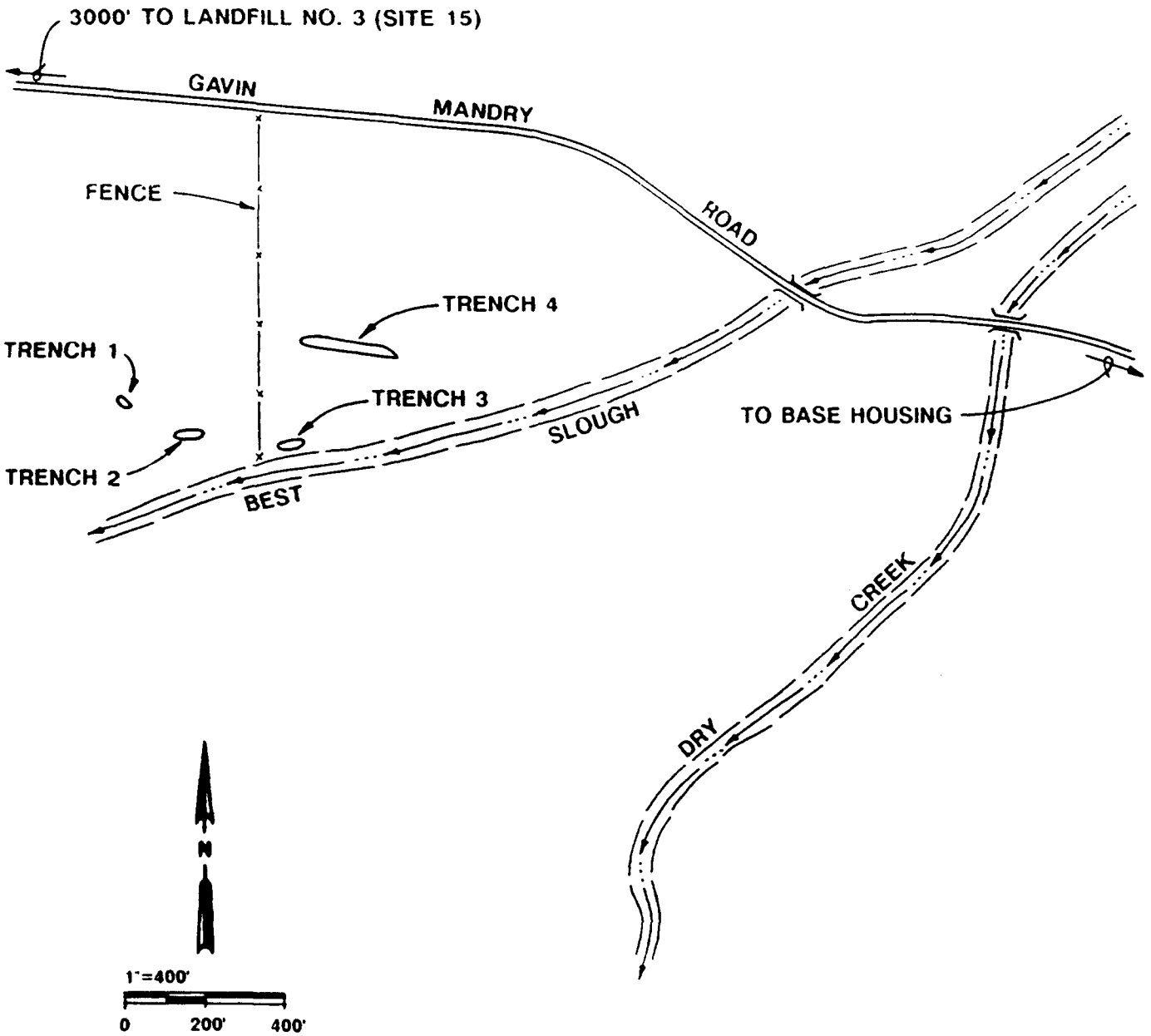


FIGURE 1-21
SITE 17: BEST SLOUGH

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been reported, but the site was evaluated because a number of minor spills have occurred while unloading rail cars. Site 18 is shown in Figure 1-22.

1.4.18.2 Waste Sources, Types, and Concentrations

Fuel loading and unloading activities, spills, and leaks are the waste sources here. Waste types are jet fuel, diesel fuel, motor gasoline, unleaded gasoline, and No. 2 fuel oil. Oil and grease concentrations were detected at 300 to 400 mg/kg (ppm) in surface soil samples collected in the drainage ditch by AeroVironment.

1.4.18.3 Migration Pathways

Fuel spills at unloading areas and within tank berm areas have occurred, and localized soil contamination probably exists. It is unknown how many areas have soil contamination or if contaminants migrated vertically through the soils to groundwater. Losses of hydrocarbons from other sources (pipeline leaks, tank bottom leaks) are often difficult to detect and locate. If such leaks have occurred, contaminants may have migrated vertically to groundwater.

If spills occurred within berm areas, water accumulating within the berms due to rainfall may become contaminated. Water accumulating in bermed areas is drained to surface water ditches or pumped onto flat soil areas. If major spills or tank leaks have occurred, subsurface hydrocarbon vapors may be present.

1.4.18.4 Potential Receptors

Base personnel operating the fuel storage and management facilities are potential receptors. If contaminants move or have moved into groundwater, base and domestic well users to the west may be potential receptors. If contaminants are allowed to flow out of the bermed areas, surface waters on base may receive contaminants. Stormwater drains to Hutchinson Creek 5,000 feet south of Site 18. Wildlife and downstream users may be potential receptors.

1.4.19 SITE 19: PHOTO WASTE EMERGENCY HOLDING BASIN

1.4.19.1 Site Setting and Location

The photo waste emergency holding basin is directly across B Street from the base photographic laboratory (see Figure 1-23). It was used intermittently to contain

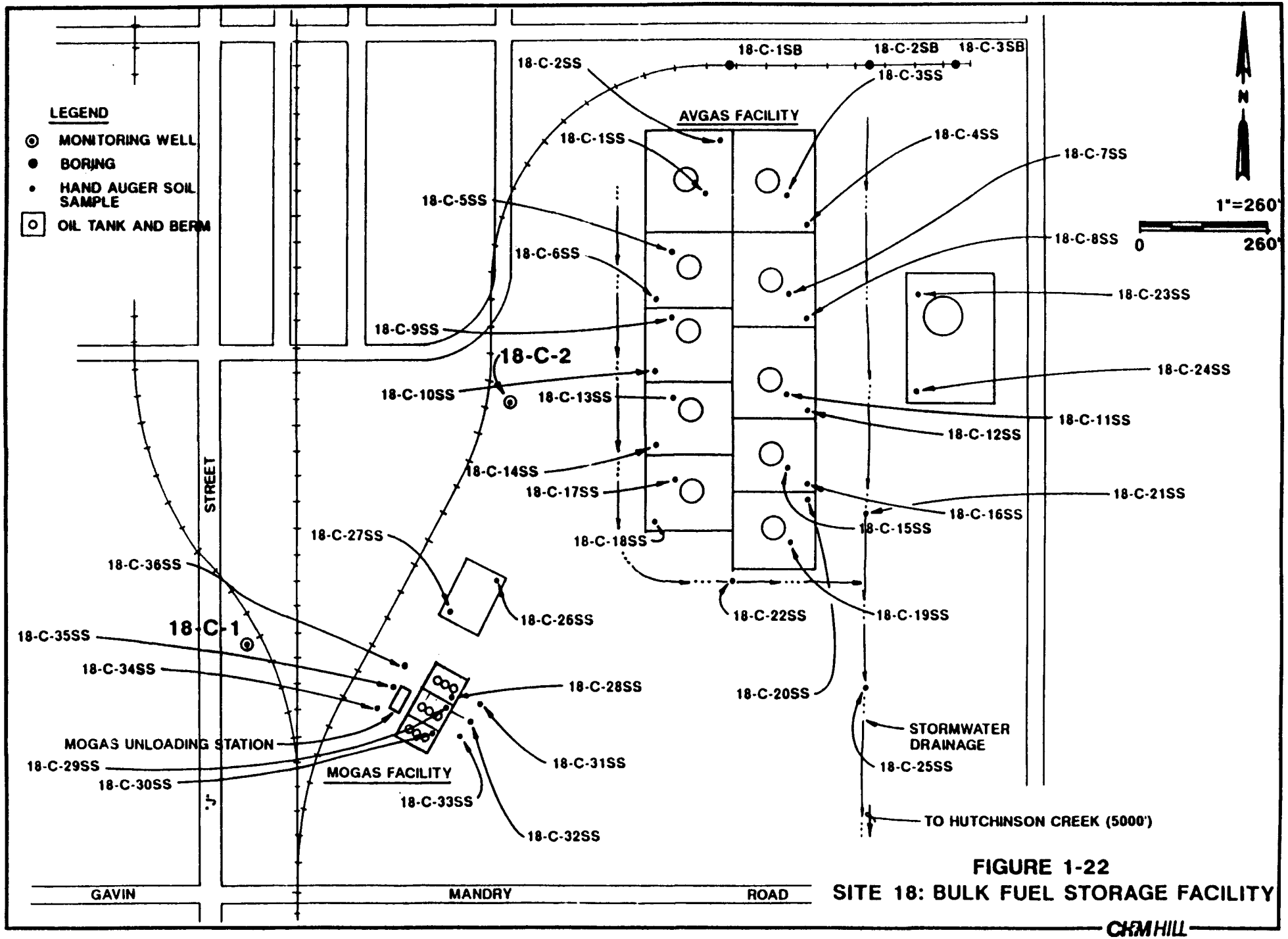


FIGURE 1-22
SITE 18: BULK FUEL STORAGE FACILITY

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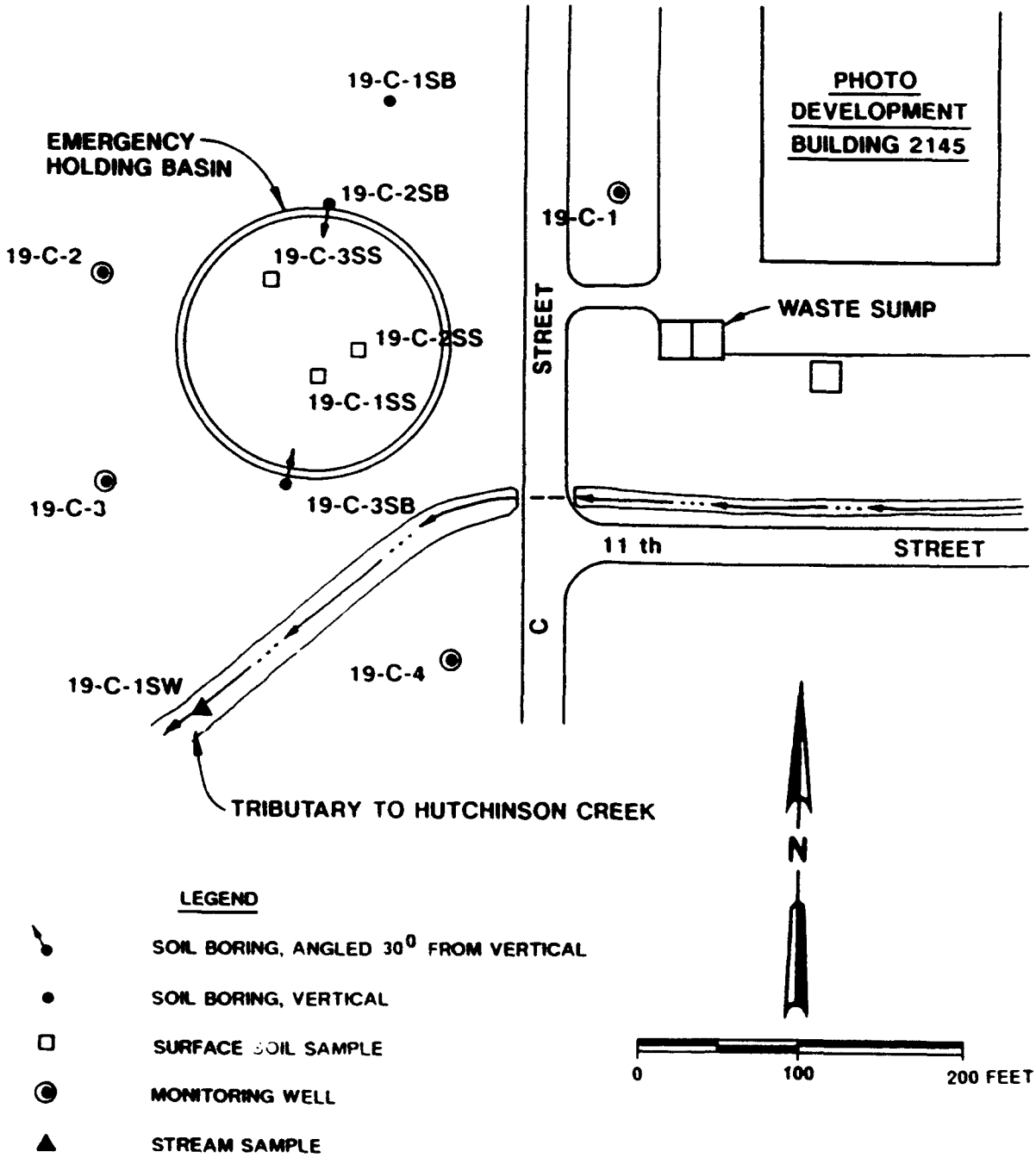


FIGURE 1-23
SITE 19: EMERGENCY HOLDING BASIN

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photographic laboratory discharges which were diverted from a concrete wet well during overflow conditions. The concrete wet well is used to hold laboratory discharges prior to their treatment at the photo wastewater treatment plant. The emergency holding basin has concrete sides, a compacted clay bottom, and is fenced. It is currently not in use. The photographic laboratory now has a closed loop water system and no longer discharges to the PWTP (Site 2).

1.4.19.2 Waste Sources, Types, and Concentrations

Wastewater discharges from the photo lab, which until 1986 included pentachlorophenol (PCP) addition for effluent treatment, are the sources here. Waste types include photo-processing wastes containing metals and residual PCP. Photo waste constituents are listed in Table 1-6 (Section 1.4.2). Basin soils were sampled by the RWQCB in 1987 and reported to contain hazardous levels of PCP. No ground-water sampling has been conducted at this site and no IRP activities were conducted prior to the Stage 2-1 investigation.

1.4.19.3 Migration Pathways

Because the emergency holding basin has a compacted clay bottom and concrete sides, and contained waste materials only intermittently, the likelihood for vertical migration is low. Surface clays may contain some contaminants, and organic compounds may have migrated partially or totally through the clay liner. If contaminants have penetrated the clay bottom, vertical migration toward groundwater may occur. Surface water is not considered to be a migration pathway because the emergency holding basin has never overflowed.

1.4.19.4 Potential Receptors

The emergency holding basin at Site 19 is fenced and, therefore, base personnel exposure to surface soils is minimized. If groundwater is or becomes contaminated, domestic well users to the west may be potential receptors. These wells are at least 2 miles from Site 19.

1.4.20 SITE 20: GREASE PIT (SANITARY TREATMENT PLANT)

1.4.20.1 Site Setting and Location

The grease pit is an unlined excavation located northwest of the sewage treatment plant (see Figure 1-24). It is used to dispose of sewage plant clarifier skimmings. The pit

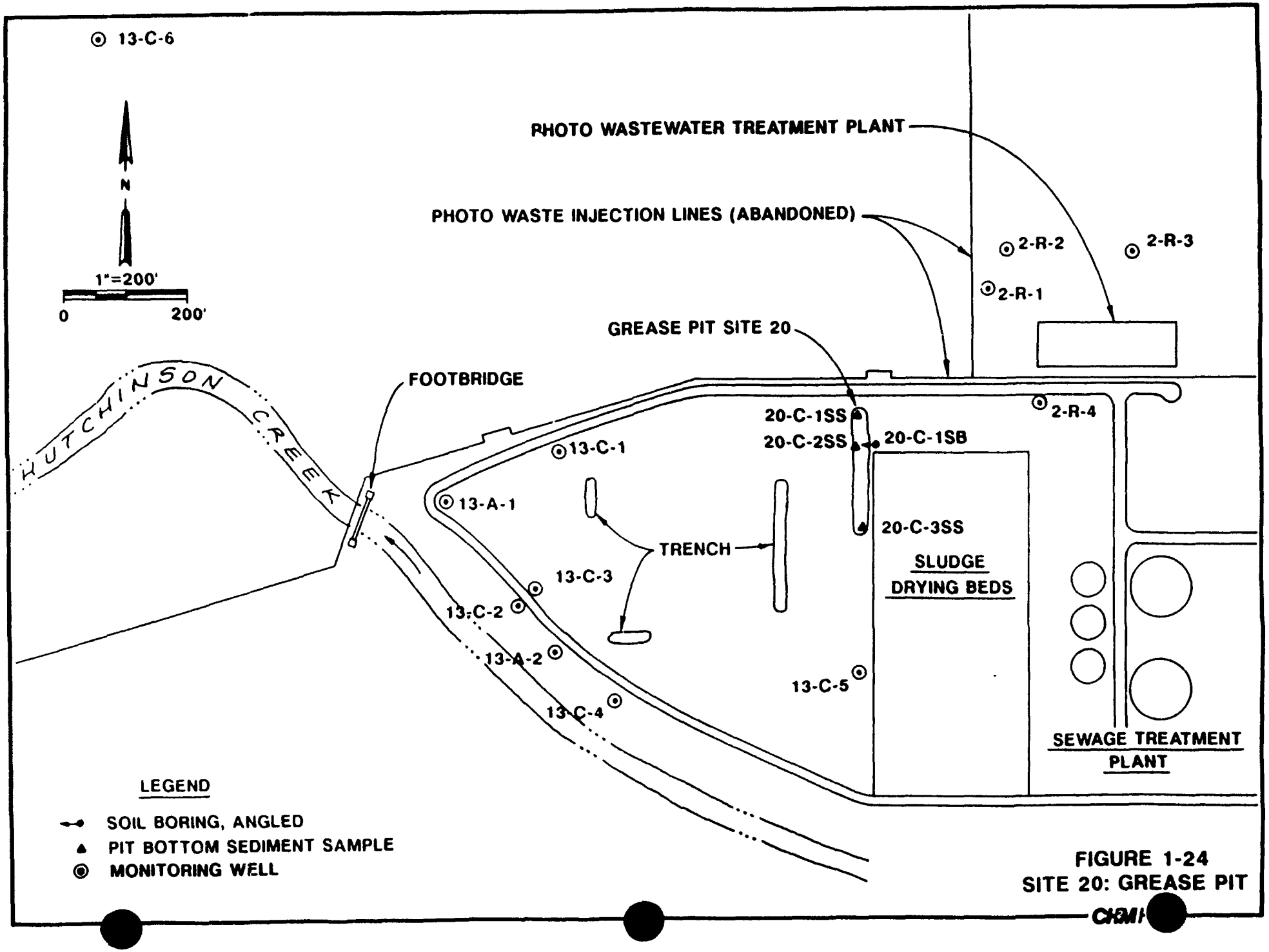


FIGURE 1-24
SITE 20: GREASE PIT

contains a liquid material with a foamy, greasy substance on the surface.

1.4.20.2 Waste Sources, Types, and Concentrations

Grease skimmings from the sewage treatment plant are the principal waste sources here. Pit fluid samples collected and analyzed by the RWQCB detected toluene at 1.8 mg/l (ppm), oil and grease at 6,800 mg/l (ppm), and total petroleum hydrocarbons at 15 mg/l (ppm). An area of subsidence located west of the active grease pit may be the location of a previous pit which has been backfilled.

1.4.20.3 Migration Pathways

Because the pit is unlined and contains fluid, the primary migration pathway is vertical migration through soils, and eventually to groundwater.

1.4.20.4 Potential Receptors

The grease pit site is just east of Landfill No. 1, where groundwater wells have indicated groundwater is contaminated with TCE. If groundwater contamination affects the quality of groundwater in the area, down gradient off base private wells (west of the base boundary) could potentially be affected. Potential receptors thus include neighboring residents and their crops and livestock. Base personnel could also be potential receptors if they were in direct contact with grease pit wastes.

1.4.21 SITE 21: JP-7 ABOVE GROUND FUEL STORAGE TANKS ON THE FLIGHTLINE

1.4.21.1 Site Setting and Location

The JP-7 above ground storage tanks are located between taxiway No. 6 and the main runway, west of Site 5, the SR-71 Shelter Drainage Area (see Figure 1-25). A bermed area, approximately 80 feet square, contains four 25,000-gallon above ground tanks. Stormwater accumulated within the bermed area is allowed to flow into a small ditch, which discharges to the field west of the tanks.

No previous IRP activities have been conducted at Site 21.

Many active underground fuel tanks and pipelines exist in the flightline area but are not included in current IRP activities.

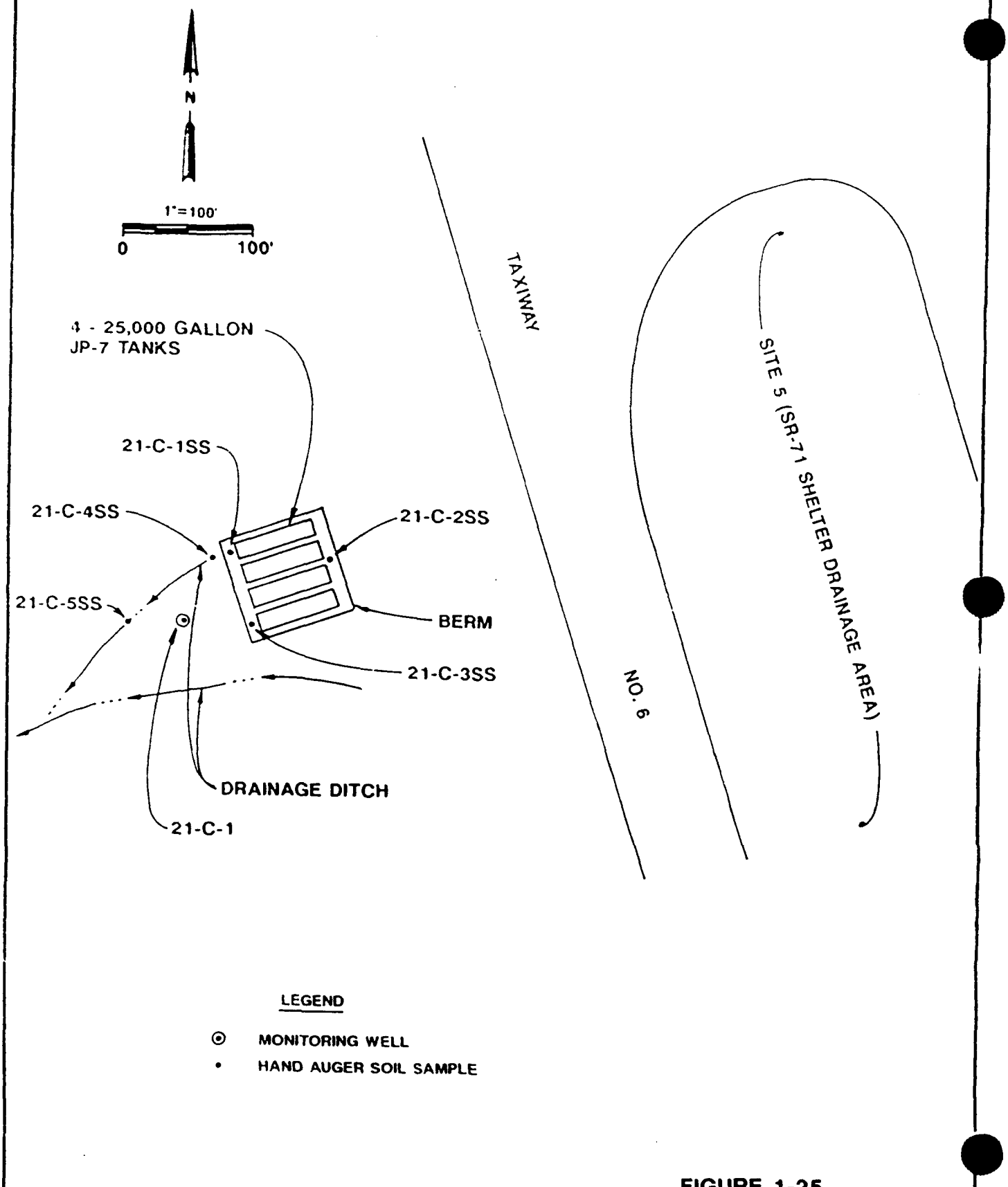


FIGURE 1-25
SITE 21: JP-7 STORAGE TANKS, ABOVE GROUND - FLIGHTLINE

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1.4.21.2 Waste Sources, Types, and Concentrations

The primary waste source is the accidental release of hydrocarbon fuels due to spillage or leaks. Waste type is limited to JP-7 jet fuel.

1.4.21.3 Migration Pathways

Fuels spilled in the berm area would soak into soils and, if enough fuel is lost, migration to groundwater would be possible. Migration of soluble components of the fuels may occur with infiltrating stormwater. Fuels entrained in stormwater could be discharged to the drainage ditch and nearby soils.

1.4.21.4 Potential Receptors

If significant fuel losses have occurred, groundwater quality may be impacted. The site is upgradient from both base and private water wells. Therefore, if groundwater has been contaminated, base personnel may ingest contaminated water, and persons, livestock, and crops off base may also be potential receptors. Base personnel working in the area may also be exposed to contaminated surface soils.

1.4.22 SITE 22: ABANDONED UNDERGROUND STORAGE TANKS

1.4.22.1 Site Setting and Location

There were approximately 750 underground storage tanks in the area of the base previously occupied by Camp Beale, a World War II Army base. These tanks stored fuel oil and gasoline. It is not known whether they were emptied, removed, or abandoned in place when the Army closed the camp.

A review of 1943 maps of Camp Beale showed the following tanks:

Gasoline Tanks

30	-	12,000 gallons	=	360,000 gallons
6	-	10,000 gallons	=	60,000 gallons
2	-	5,500 gallons	=	11,000 gallons
38				431,000 gallons

Fuel Oil Tanks

176	-	264 gallons	=	46,464 gallons
10	-	420 gallons	=	4,200 gallons
324	-	580 gallons	=	187,920 gallons
194	-	1,150 gallons	=	223,100 gallons
6	-	1,500 gallons	=	9,000 gallons
1	-	2,200 gallons	=	2,200 gallons
2	-	3,000 gallons	=	6,000 gallons
1	-	10,000 gallons	=	10,000 gallons
1	-	12,000 gallons	=	12,000 gallons
715				500,884 gallons

The area which encompasses the abandoned tank locations is shown on Figure 1-6, presented previously, and on Plate 1.

In 1990 Beale AFB removed 21 tanks from the area south of Warren Shingle Boulevard in the vicinity of A to C Streets prior to construction of facilities for the Navigation School. The tanks are believed to have been installed in the 1950s when Camp Beale was converted to Beale AFB. The removed tanks ranged in size from 150 to 10,000 gallons and soil cleanup was achieved when the tanks were removed.

1.4.22.2 Waste Sources, Types, and Concentrations

Underground storage of fuel oil and gasoline is the potential source of contamination at this site. Waste types are fuel oil, gasoline, and their constituents. No sampling has been done to determine concentrations.

1.4.22.3 Migration Pathways

Most of the abandoned underground tanks identified on old drawings were fuel oil tanks used to fire barracks furnaces. Although the buildings are no longer present, the tanks may possibly still exist. It is also possible that the tanks were not pumped dry and/or filled with inert material. The condition of these tanks is unknown, but because of age is probably poor.

The larger gasoline tanks (38) were possibly not properly abandoned either. It is more likely, however, that their contents were removed.

If tanks still exist and contained fuels, leaks probably occurred and soil and groundwater impacts may be present. Impacts may have been reduced due to natural biological degradation.

1.4.22.4 Potential Receptors

Leakage of storage tanks may contribute to soil and groundwater contamination. If groundwater is or becomes contaminated, base and domestic well users to the west of the base may be potential receptors.

1.4.23 SITE 23: NINTH TRANSPORTATION REFUELING/MAINTENANCE SHOP

1.4.23.1 Site Setting and Location

The transportation shop is located east of B Street between Warren Shingle Boulevard and Doolittle Drive. The site was used as a repair shop for fuel tank trucks. The site is mostly paved and has a large repair shop. An oil/water separator is present next to the shop. Site 23 is shown in Figure 1-26. No IRP activities have been conducted prior to Stage 2-1 activities.

1.4.23.2 Waste Sources, Types, and Concentrations

Suspected wastes are oils and fuels which may have leaked from trucks parked onsite. No evaluation of contamination has occurred, but stormwater runoff from the site contains minor amounts of oils and/or fuels.

1.4.23.3 Migration Pathways

Stormwater runoff may carry contaminants off the asphalt area and into soils surrounding the site. If enough contaminants enter the soils and percolate downward, groundwater may be impacted. Contaminants may also be carried by stormwater to surface water bodies on base.

1.4.23.4 Potential Receptors

Base personnel working at the site are potential receptors. If contaminants are transported to surface water bodies, wildlife, livestock, and humans exposed to contaminated surface water are potential receptors. If groundwater is or becomes contaminated, base and off base well users to the west may be potential receptors. The nearest wells are at least 2½ miles from Site 23.

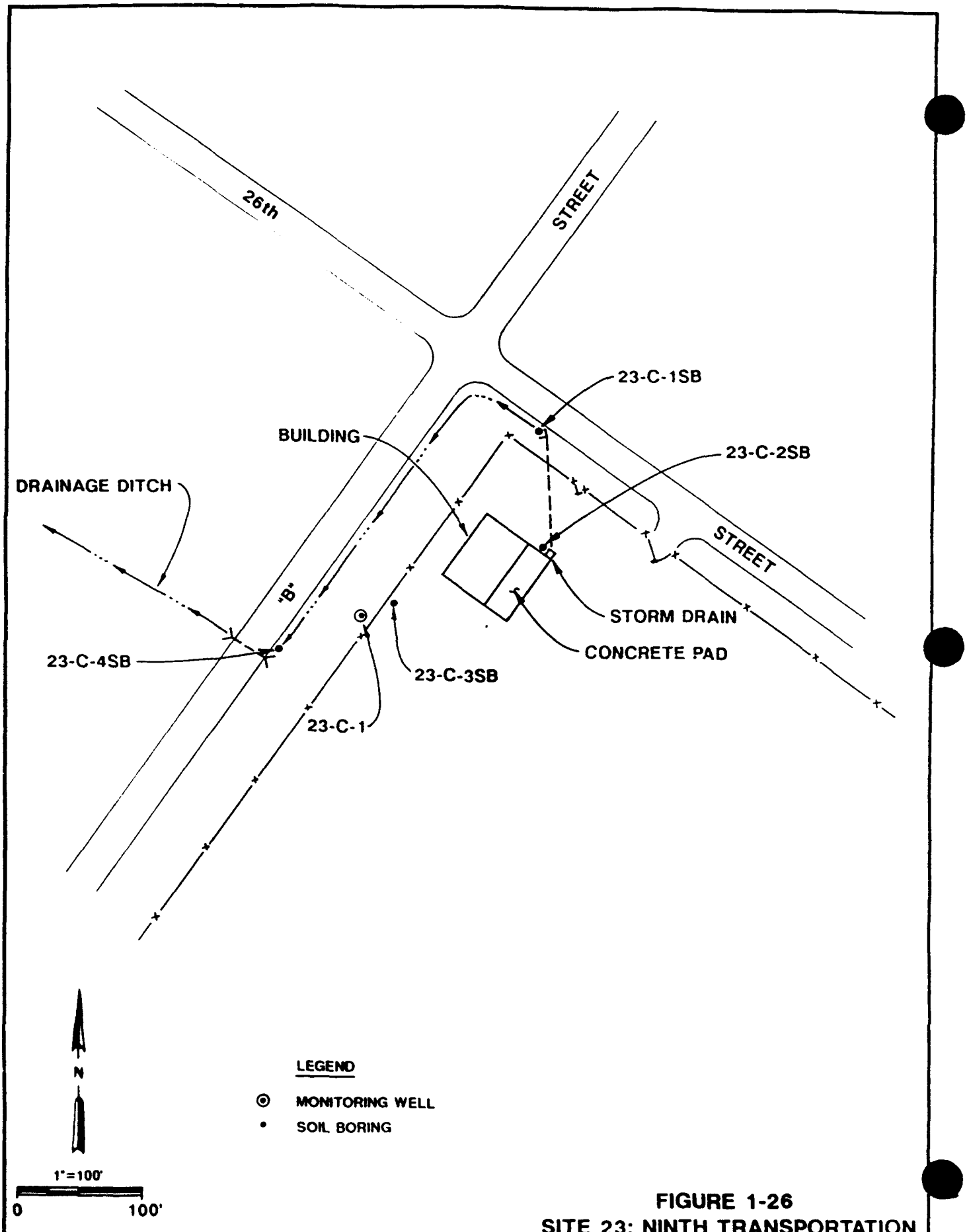


FIGURE 1-26
SITE 23: NINTH TRANSPORTATION REFUELING/MAINTENANCE SHOP

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1.4.24 SITE 24: LANDFILL NO. 4

1.4.24.1 Site Setting and Location

Landfill No. 4 is located east of F Street and south of Gavin Mandry Road. The site was a trench and fill operation and was probably active in the 1960s and possibly the 1970s. Site 24 is shown in Figure 1-27. No IRP activities have been conducted at Site 24 prior to Stage 2-1 activities.

1.4.24.2 Waste Sources, Types, and Concentrations

It was believed that Landfill No. 4 was originally intended for demolition debris (construction debris) and other inert, non-hazardous substances. The landfill may have received refuse and trash during later operations. It is unknown if contaminants are present.

1.4.24.3 Migration Pathways

If materials were deposited in the landfill other than inert refuse, contaminated leachate may develop and be transported by percolating storm water. This may cause groundwater contamination. No other migration pathways are believed to be present. The trenches are covered with soil, except for some construction wastes.

1.4.24.4 Potential Receptors

If groundwater is or becomes contaminated, domestic well users to the west may be potential receptors. It is unknown if contamination exists at Site 24.

1.5 SUSPECTED CONTAMINANTS

As stated in previous sections, contamination that may be present at Beale AFB originated from hydrocarbon fuels, solvents, domestic refuse, photo wastewater and sludge, pesticides, herbicides, ordnance disposal, and other releases of hazardous materials and wastes. Contaminants of concern vary among the sites. Table 1-7 presents the waste types and concentrations detected in previous investigations. Table 1-7 does not include results of the current Stage 2-1 investigation, which are presented in Section IV of this report.

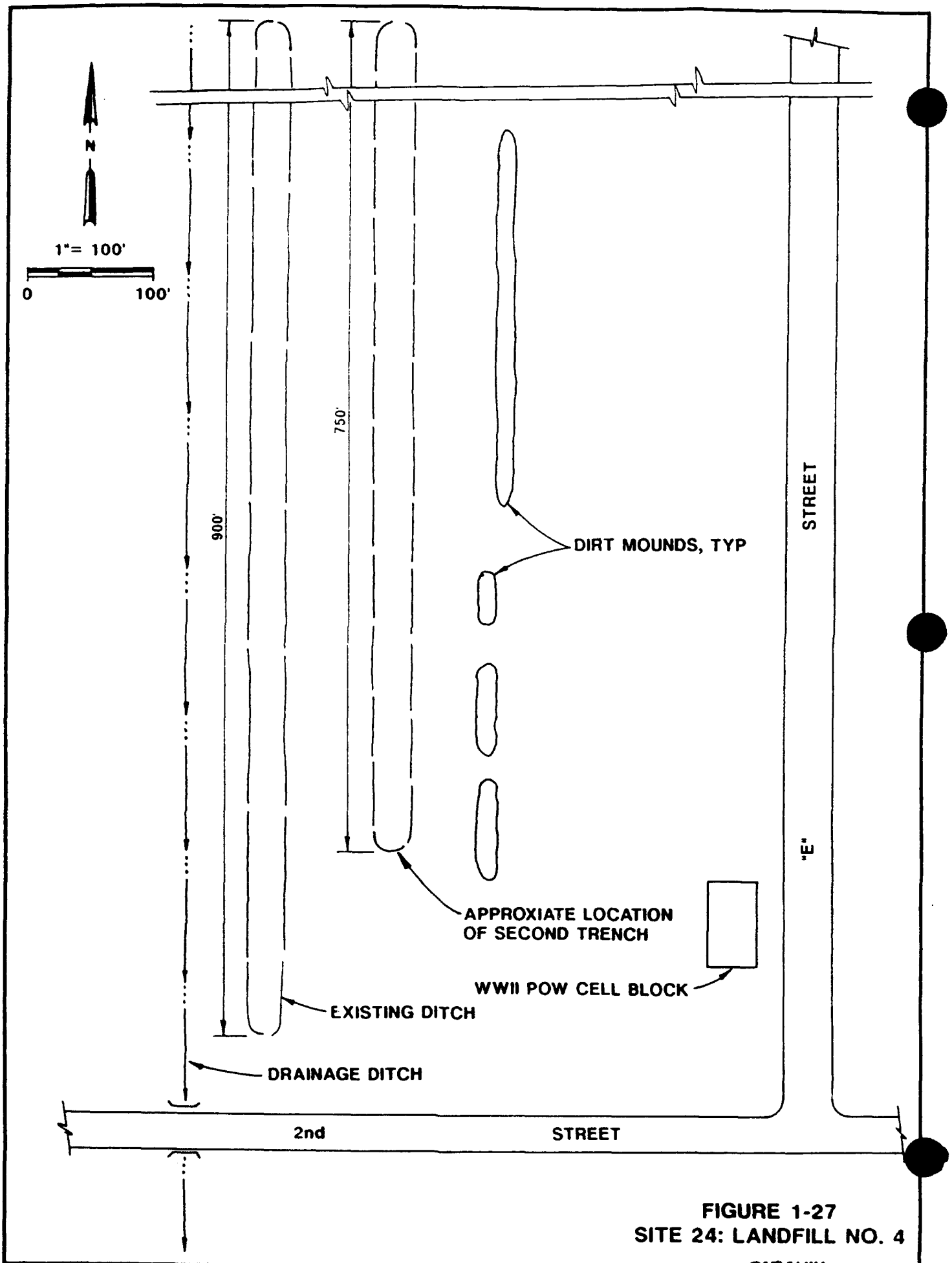


FIGURE 1-27
SITE 24: LANDFILL NO. 4

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Table 1-7
WASTE TYPES AND CONCENTRATIONS AT BEALF IRP SITES
IRP PHASE II, STAGE 1 SUMMARY

Site	Description	Waste Types	Maximum Concentrations Detected During Previous Investigations
1. West Drainage Ditch	Receives surface runoff from flight line and runway area.	Jet fuel Oil Solvents	Ditch Sediment: Oil and grease 33,000 mg/kg Lead 410 mg/kg Groundwater: Trichloroethylene 100 ug/l
2. Photo Wastewater Treatment Plant (PWTP), Injection Wells, and Sludge Basins	Physical and chemical treatment of photo processing wastewater. Between 1966 and 1986, PWTP effluent was discharged into three injection wells. Since 1974 two unlined sludge ponds have been used for drying PWTP clarifier sludge.	Pentachlorophenol Photo processing chemicals Trace metals Phenolics Benzene Oil and grease Chromium	Soil: PCP 30 mg/kg Groundwater: Phenol 5 ug/l Chromium 80 ug/l Benzene 0.9 ug/l
3. Fire Protection Training Areas	Fire prevention training exercises have been conducted in two areas approximately 250 feet apart. Waste oils, spent solvents, and aviation fuels were applied to the ground and ignited. There are two 25,000-gallon underground storage tanks in the area.	Waste oils Solvents Jet fuel	Soil: Oil and grease 4,900 mg/kg Xylene 1 mg/kg Petroleum hydrocarbons 4,600 mg/kg Groundwater: No contamination detected
4. Battery Shop Dry Well	Twenty-four gallons per month of neutralized lead-acid battery wastes were discharged to this dry well adjacent to the battery shop.	Neutralized battery acid (lead and inorganic compounds)	Groundwater: No contamination detected
5. SR-71 Shelter Drainage	Three hundred gallons per week of JP-7 jet fuel leaked onto hanger floors and shelter apron area. JP-7 jet fuel drained partly to an oil water separator and partly to the soil and gravel area between SR-71 shelter and flightline.	Jet fuel Solvents	Soil: Hydrocarbons 4,000 mg/kg
6. Landfill No. 2	The landfill occupies 56 acres and was used for refuse disposal between early 1950s and 1980. In addition, approximately 380 cubic yards of sludge from PWTP (Site 2) and small amounts of petroleum and chemicals were also disposed here. Currently used for construction and grounds maintenance debris.	Domestic and base refuse PWTP sludge Chemicals	Groundwater: No contamination detected
7. Army Biological Production Area	Area used for biological test site of wheat stem rust. Stock was incinerated and plowed into soil.	Freon, ethylene oxide, metals(?), TCE(?)	Soil: No contamination detected

Table 1-7 (continued)

Site	Description	Waste Types	Maximum Concentrations Detected During Previous Investigations
8. J-57 Test Cell	Jet aircraft engines were tested here. Soils were stained in drainage ditch.	Jet fuel Petroleum distillates Soaps	Soil: Oil and grease 700 mg/kg Petroleum hydrocarbons 1,400 mg/kg Groundwater: No contamination detected
9. Entomology Building 2560	Gravel basin received drainage from pesticides and herbicides stored and mixed. Pesticide containers are also rinsed here.	Pesticides Herbicides	Soil: Chlordane (one sample) 0.9 mg/kg No recorded chlordane use on the base.
10. J-58 Test Cell	SR-71 aircraft engines tested here. Soils are stained in drainage ditch.	Jet fuel Petroleum distillates Soaps Oil Trichloroethylene (TCE)	Soil: Oil and grease 4,000 mg/kg Petroleum hydrocarbons 4,700 mg/kg Groundwater: No contamination detected
11. Aircraft Ground Equipment Maintenance Area	Aircraft ground support vehicles are known to leak oil and hydraulic fluids. Soils are stained in the ditch receiving drainage from support vehicles parking lot.	Oil Hydraulic Fluid Fuel (gasoline)	Soils: Oil and grease 7,000 mg/kg Groundwater: No contamination detected
12. Entomology Building 440	Pesticides and herbicides were stored and mixed in and around the building.	Pesticides, herbicides	Soils: No contamination detected
13. Landfill No. 1	This landfill occupies 4 acres and received refuse in the 1940s. The source and composition of wastes is unknown. The site is no longer in use.	Unknown	Groundwater: TCE 106 ug/l PCE 3.7 ug/l Creek: Pesticides detected in creekwater. No contamination detected in creek sediments.
14. Transformer Drainage Pit	Between 1977 and 1979 transformers were drained here before repair.	Transformer oil PCBs	Sediment: Oil and grease 38,000 mg/kg PCB Arochlor 1260 (one sample) 5.3 mg/kg
15. Landfill No. 3	This landfill occupies a 40-acre site. It has been in operation since 1981 and accepts domestic garbage and refuse.	Domestic garbage and refuse	Groundwater: No contamination detected
16. Explosive Ordnance Disposal (EOD) Area	Unused ordnances are detonated in two bunkers or in an open field in this area. Diesel fuel and wood are used to burn smaller ordnances. The burned metal portion of the ordnances are placed in a trench.	Detonated munitions, explosives, flares, and pyrotechnics debris	Soils: Lead 14,000 mg/kg Chromium 2,000 mg/kg Barium 1,500 mg/kg

Table 1-7 (continued)

Site	Description	Waste Types	Maximum Concentrations Detected During Previous Investigations
17. Best Slough	Empty drums were found in area.	Unknown.	No contamination detected.
18. Bulk Fuel Storage Facility	Diked above ground fuel storage tanks.	Jet fuel Diesel fuel Motor gasoline Unleaded gasoline No. 2 fuel oil	Soil: Oil and grease 300-400 mg/kg
19. Photo Waste Emergency Holding Basin	During overflow conditions photo wastes are diverted to this holding basin with compacted clay bottom and cement sides.	PCP treated photo wastewater	Soils: PCP detected in soils (RWQCB) Groundwater: No sampling to date
20. Grease Pit (Sanitary Treatment Plant)	Unlined pit used to dispose sewage plant clarifier skimmings.	Oil and grease Organic solvents	Pit fluid (RWQCB samples) Toluene 1.8 mg/l Oil and grease 6,800 mg/l Total petroleum hydrocarbons 15 mg/l
21. JP-7 Aboveground Fuel Storage Tanks (Flightline)	Diked aboveground fuel storage tanks.	Jet fuel	No sampling to date
22. Abandoned Underground Storage Tanks	Old base area maps show 753 abandoned underground storage tanks in the area previously occupied by Camp Beale.	Fuel oil Gasoline	No sampling to date
23. Ninth Transportation Shop	Repair shop and parking area for refueling trucks.	Jet fuel Diesel Oils	No sampling to date
24. Landfill No. 4	Trench fill 1960s-1970s. Contents unknown.	Demolition debris Domestic refuse	No sampling to date

1.6 IDENTIFICATION OF FIELD TEAM

Field team members included CH2M HILL personnel (primarily from the Sacramento and Redding offices). Geophysics activities were directed by a CH2M HILL geophysicist from the Milwaukee, Wisconsin office. Figure 1-28 presents the team members for the project, including field team personnel and subcontractors.

1.7 OTHER PERTINENT INFORMATION

The following abbreviations and acronyms are used in this report.

AA	atomic adsorption
AFB	Air Force Base
AFSC	Air Force Human Systems Division
ARAR	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
AVGAS	aviation fuel
BETX	benzene, ethylbenzene, toluene, xylene
BGS	below ground surface
CARB	California Air Resources Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COD	chemical oxygen demand
DCE	dichloroethene
DHS	Department of Health Services (California)
DO	dissolved oxygen
DOD	Department of Defence
DQOs	data quality objectives
EOD	explosive ordnance disposal area
EHB	emergency holding basin
EPA	Environmental Protection Agency
FPTA	fire protection training area
GC	gas chromatograph
GC/MS	gas chromatograph mass spectrometer
HAR	Hydrogeologic Assessment Report
ICP	inductively coupled plasma emission spectrometer
IRP	Installation Restoration Program
LOQ	limit of quantification
MCL	maximum contaminant level
mg/kg	milligrams per kilogram (ppm)
mg/l	milligrams per liter (ppm)
MOGAS	motor gasoline
MTV	mobility, toxicity, or volume

mybp	million years before the present
NCP	National Contingency Plans
NGVD	National Geodetic Vertical Datum
OEHL	Occupational and Environmental Health Laboratory
OVA	organic vapor analyzer
PARCC	precision, accuracy, representativeness, completeness, comparability
PVC	polyvinyl chloride
ppb	parts per billion
ppbv	parts per billion by volume
ppm	parts per million
PWTP	photo wastewater treatment plant
QAPP	quality assurance project plans
QA/QC	quality assurance/quality control
RAP	remedial action plan
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RPD	relative percent difference
RTC	relative toxicity concentration
RWQCB	Regional Water Quality Control Board (California)
SAC	Strategic Air Command
SAL	state action level
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Survey
SDWA	Safe Drinking Water Act
SWAT	Solid Waste Assessment Test
SWRCB	State Water Resources Control Board (California)
STLC	soluble threshold limit concentration
TCE	trichloroethylene
TDS	total dissolved solids
TEF	toxicity equivalency factor
TFH	total fuel hydrocarbons
TPCA	Toxic Pits Cleanup Act
TTLC	total threshold limit concentration
TSP	total suspended particulate
ug/l	micrograms per liter (ppb)
USAF	United States Air Force
VOC	volatile organic compound
WET	waste extraction test

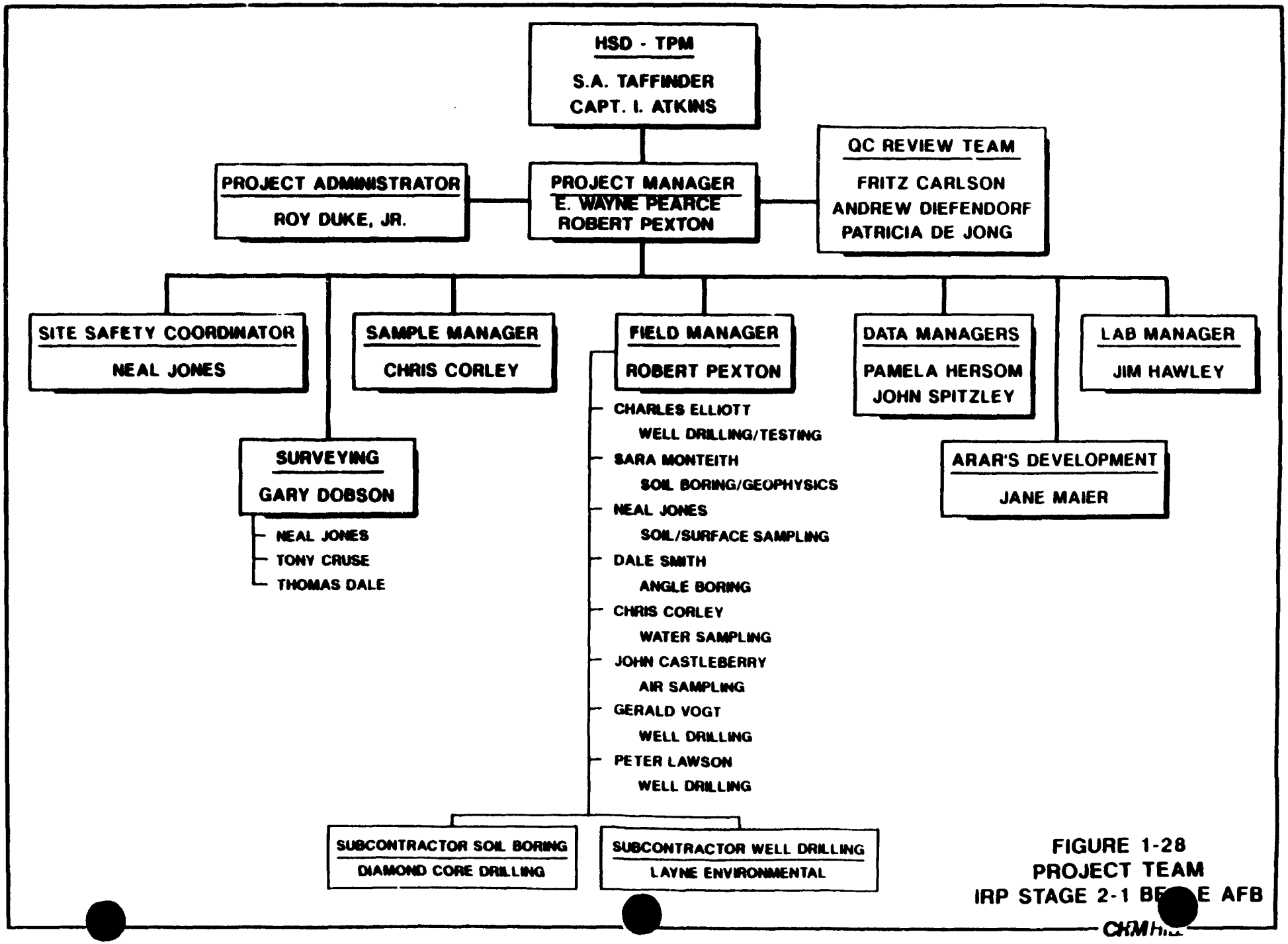


FIGURE 1-28
PROJECT TEAM
IRP STAGE 2-1 BE E AFB

CH2M Hill

II. ENVIRONMENTAL SETTING

Information included in this section has been summarized from several previous reports, existing literature, and current IRP Stage 2-1 activities. A reference list is provided in Appendix C. These references contain more detailed descriptions of environmental setting than are presented in this section.

2.1 GEOGRAPHIC SETTING

Beale Air Force Base is approximately 40 miles north of the City of Sacramento in the eastern part of the Sacramento Valley. The Sacramento Valley together with San Joaquin Valley to the south constitutes the Great Valley of California (Figure 2-1). Extending from Redding in the north to Bakersfield in the south, this valley is about 60 miles wide, bordered to the east by Sierra Nevada Foothills and to the west by the Coast Ranges.

2.1.1 PHYSIOGRAPHY (PHYSICAL GEOGRAPHY)

The elevation of Beale AFB ranges from 80 to 90 feet above the National Geodetic Vertical Datum of 1929 (NGVD) along the western and southwestern boundary, to more than 400 feet in the northeastern part of the base. The rise in elevation occurs along gently sloping hills common to the Sierra Nevada Foothills, which rise gradually to over 9,000 feet NGVD at the Sierra Nevada crests directly east of Beale AFB.

The Sacramento River drains the Sacramento Valley. It flows southerly to the Sacramento-San Joaquin Delta, and discharges through San Francisco Bay into the Pacific Ocean. The Feather River flows southward west of the base to a confluence with the Sacramento River just north of Sacramento. Both the Yuba River to the north of Beale Air Force Base and the Bear River to the south drain from east to west into the Feather River. Several small creeks flow from east to west across the base and are confluent with either the Bear River or the Feather River south of the base.

2.1.2 CULTURAL GEOGRAPHY

This section on cultural geography discusses land use, demography, population density, age distribution, family income, education level, socioeconomics, and public health and welfare at Beale AFB and in the surrounding area.

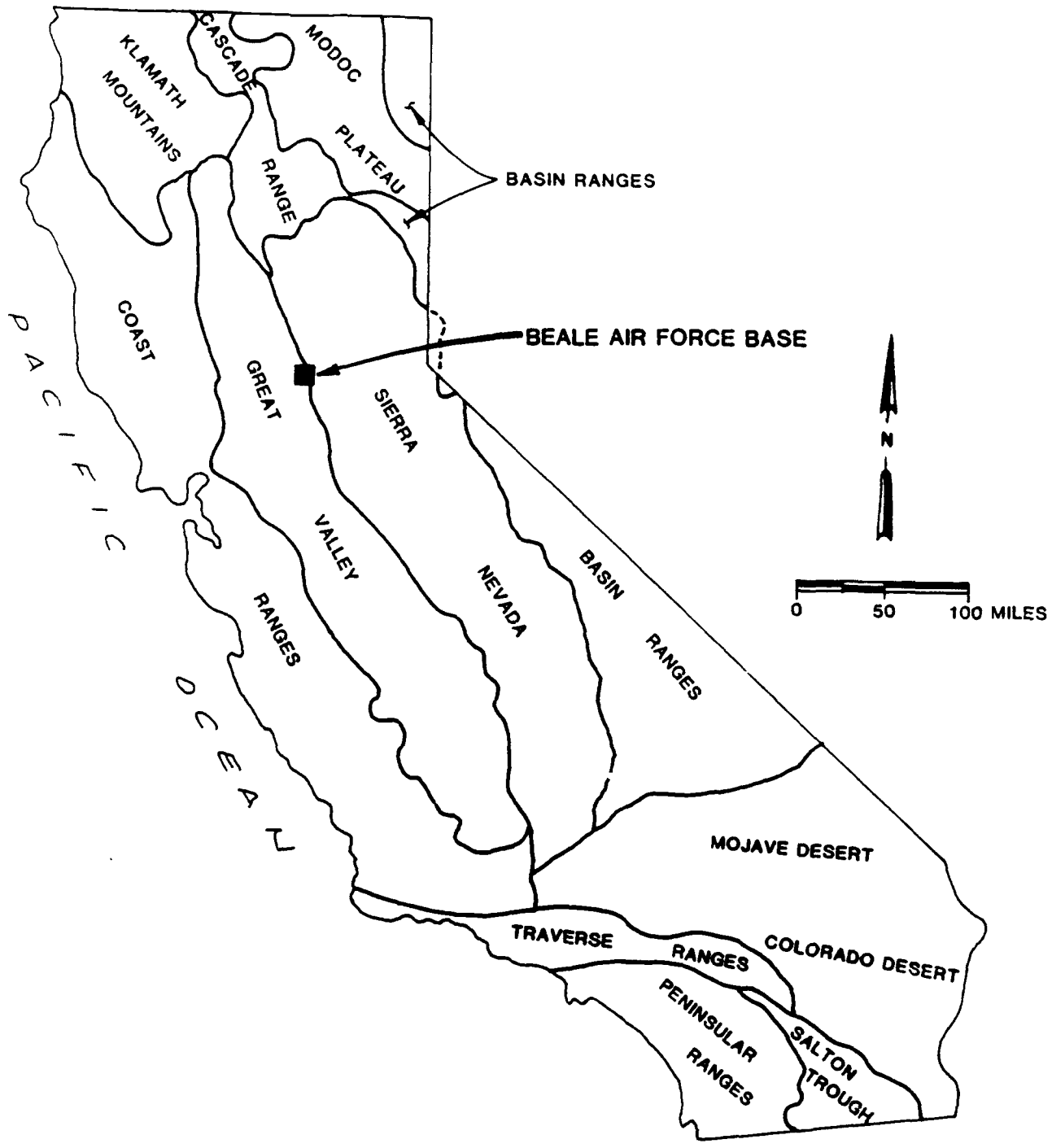


FIGURE 2-1

GEOGRAPHIC SETTING

CH2M HILL

2.1.2.1 Land Use

Beale Air Force Base is entirely within Yuba County. The Yuba County General Plan indicates that the primary land use around the base is agriculture, with 85 percent zoned Agriculture, Recreation, Timber Preserve, Forest Service, or Bureau of Land Management (Yuba County Planning Department, 1986). The major crops grown around Beale AFB are peaches, prunes, pears, walnuts, grain, rice, almonds, and alfalfa. Cultivation of the diverse range of agricultural products has been made possible by extensive and intensive irrigation. A pictorial representation of land use outside the base is given in Figure 2-2. A breakdown of the existing zoning is presented in Table 2-1.

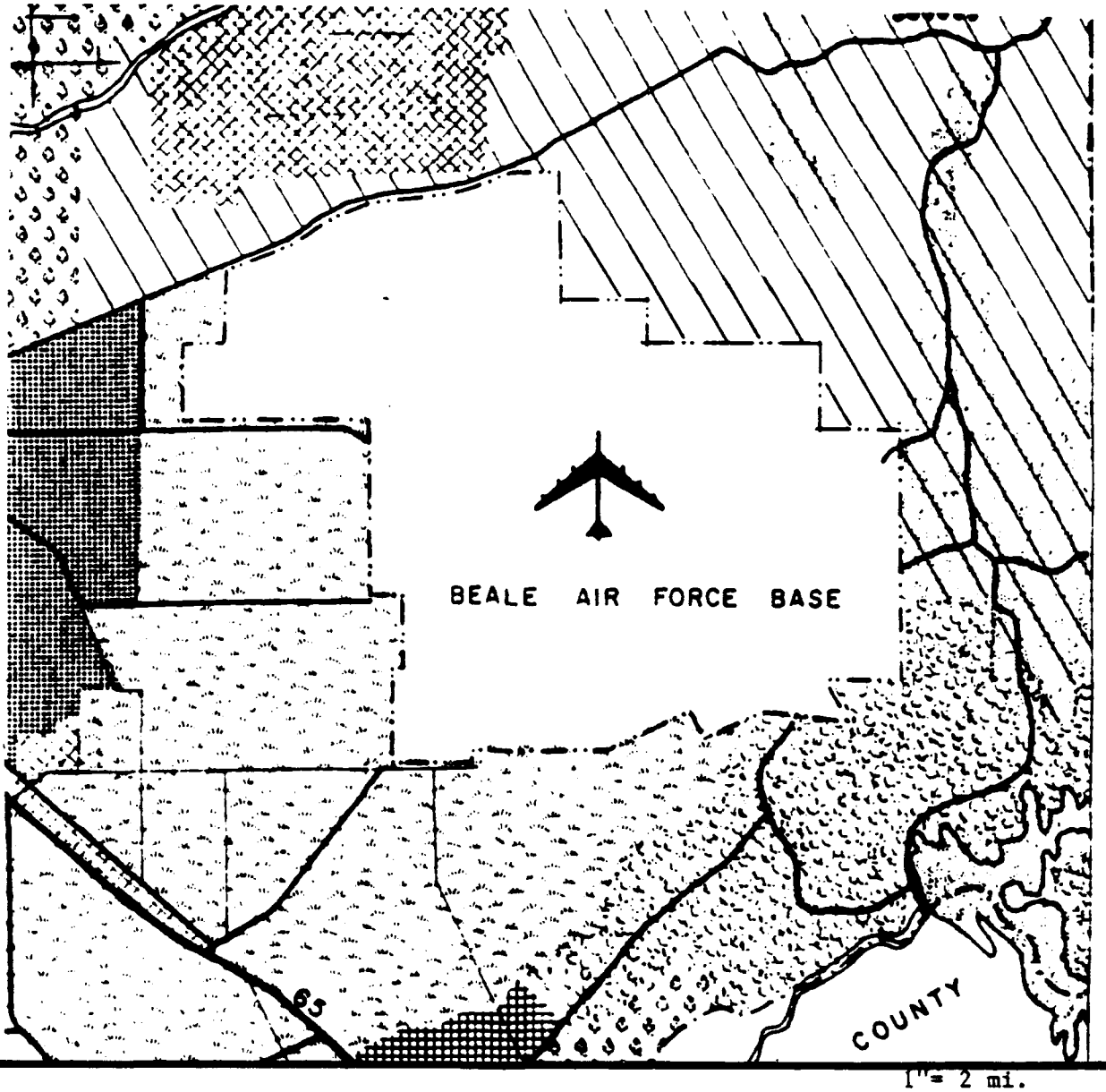
Table 2-1
EXISTING ZONING FOR YUBA COUNTY

Category	Total Acreage (Approximate)
Agriculture	222,710
Residential	7,270
Commercial	500
Industrial	9,200
Recreation	25,680
Timber Preserve	27,470
Planning Reserve	870
Flood Plain	--[a]
Public Facilities	--[a]
Airport	--[a]
Total Zoned Acres	293,630
Proposed Marysville Dam	21,000
Beale Air Force Base	22,944
U.S. Forest Service, BLM	72,000
Total Acres	409,574

[a]Overlay Zones

Source: Yuba County Planning Department, 1986

Beale AFB itself comprises 22,944 acres: 1,471 acres of improved grounds; 2,619 acres of semi-improved grounds; and



LAND USE

- OPEN SPACE RECREATION
- SECONDARY AGRICULTURE (10-20 ac./ dwelling)
- PLANNING RESERVE (20 yrs)
- PRIMARY AGRICULTURE (80-160 ac./ dwelling)
- INDUSTRIAL
- EXCLUSIVE AGRICULTURE (40-80 ac./ dwelling)
- PLANNING RESERVE (10 yrs.)

FIGURE 2-2

LAND USE

SOURCE: LAND USE ELEMENT YUBA COUNTY GENERAL PLAN

CH2M HILL

18,250 acres of unimproved grounds. Land under facilities (e.g., buildings, parking lots, paved areas, roads) totals 604 acres.

2.1.2.2 Demography

As indicated in Table 2-2, the 1985 population of Yuba County, including Beale AFB, was approximately 53,300. The population of Beale AFB varies between 5,000 and 8,000, and is currently about 6,000 persons.

Table 2-2
YUBA COUNTY POPULATION

Year	Population
1970[a]	44,736
1975[b]	44,952
1980[a]	49,733
1985[c]	53,296

[a]U.S. Bureau of Census
[b]1975 Special Census
[c]State Department of Finance

Source: Yuba County Planning Department, 1986

2.1.2.3 Population Density

In 1975, a Special Census was conducted throughout Yuba County. According to the census, 25,495 people (57 percent) resided within the urbanized areas of Marysville, Linda, and Olivehurst. The location of these urbanized areas with respect to Beale AFB is illustrated in Figure 1-5, given previously. Approximately 11 percent of the population were located in the foothill and mountainous communities of the County. Population information for Yuba County communities in 1975 is presented in Table 2-3.

2.1.2.4 Age Distribution

The 1975 Special Census indicates that persons aged 20 to 59 years make up the greatest portion of the county's population at 49.9 percent. However, in recent years, senior citizens and retired persons have been attracted to Yuba County because of the quiet, uncrowded atmosphere. The

Table 2-
POPULATION - 1975 SPECIAL CENSUS

Community	Population
Marysville	9,254
Linda	8,859
Beale Air Force Base	8,208
Olivehurst	7,382
Wheatland	1,365
Loma Rica	916
Brownsville	728
Oregon House	698
Browns Valley	601
Dobbins	469
Camptonville	443
Challenge	236
Smartville	200
Rackerby	200
Strawberry Valley	156
Total	44,952

Source: Yuba County Planning Department, 1986

Special Census indicates that over 10 percent of the population in Yuba County in 1975 were 60 years old or older (Yuba County Planning Department, 1986).

2.1.2.5 Family Income

The per capita personal income in Yuba County has historically been lower than the state as a whole. The primary reasons are seasonal employment in the agricultural industry and lower than average wages. Table 2-4 shows that approximately 70 percent of the households earned less than $10,000 per year and only 2 percent earned more than $35,000 in 1975. More recent information on wages is not available at this time.

2.1.2.6 Education Level

Information on education levels in Yuba County is not available at this time. Air Force personnel are required to have a high school education or general education diploma.

Table 2-4
INCOME DISTRIBUTION BY HOUSEHOLDS
(Unincorporated Areas)

Income	Number	Percent
$ 0 - $ 5,999 per year	3,666	36
$ 6,000 - $ 9,999 per year	3,345	33
$10,000 - $14,999 per year	1,953	19
$15,000 - $19,999 per year	883	9
$20,000 - $34,999 per year	384	4
$35,000 and over	114	2

Source: 1975 Special Census, Yuba County Planning Department, 1986

2.1.2.7 Socioeconomic

The most dominant economic force in Yuba County is agriculture, but only a small portion of the labor force is in the agricultural industry. Employment figures are compiled on a bi-county basis for Yuba and Sutter counties. The unemployment rate for Yuba-Sutter area in 1980 was 12.5 percent.

According to the information compiled by the California Employment Development Department, public service employees are the largest group in the labor force in this region.

Beale AFB has a significant economic impact on the region's communities. For fiscal year 1987, the Air Force and the Oak Ridge National Laboratory estimate that of the total economic impact of $427.6 million, $206.3 million stayed in the local area through payrolls, service and construction contracts with local businesses, and school impact funds. In addition to the 5,835 employees paid directly by the Air Force, an estimated 4,555 secondary jobs are created by the initial expenditure of Air Force funds and the subsequent secondary and tertiary expenditure of those funds between local businesses.

Under Public Law 81-874, Impact Aid, financial assistance is provided to local schools based on the number of students who are dependents of parents employed on federal property. During the school year 1985-1986, $1.6 million or 99 percent of the total federal funds received by local schools were the result of Beale students in the public school system.

2.1.2.8 Public Health and Welfare

Health care services in Yuba County are provided by one general hospital, Rideout Memorial Hospital; one emergency center, Rideout Emergency Center; two health clinics, Yuba General Medical Clinic and Yuba Feather Health Center; one convalescent hospital, Marysville Convalescent Hospital; one rest home, Feather River Manor; and two senior citizen housing developments. Other information on public health and welfare in Yuba County is not available.

2.2 GEOLOGY

2.2.1 GEOLOGIC SETTING

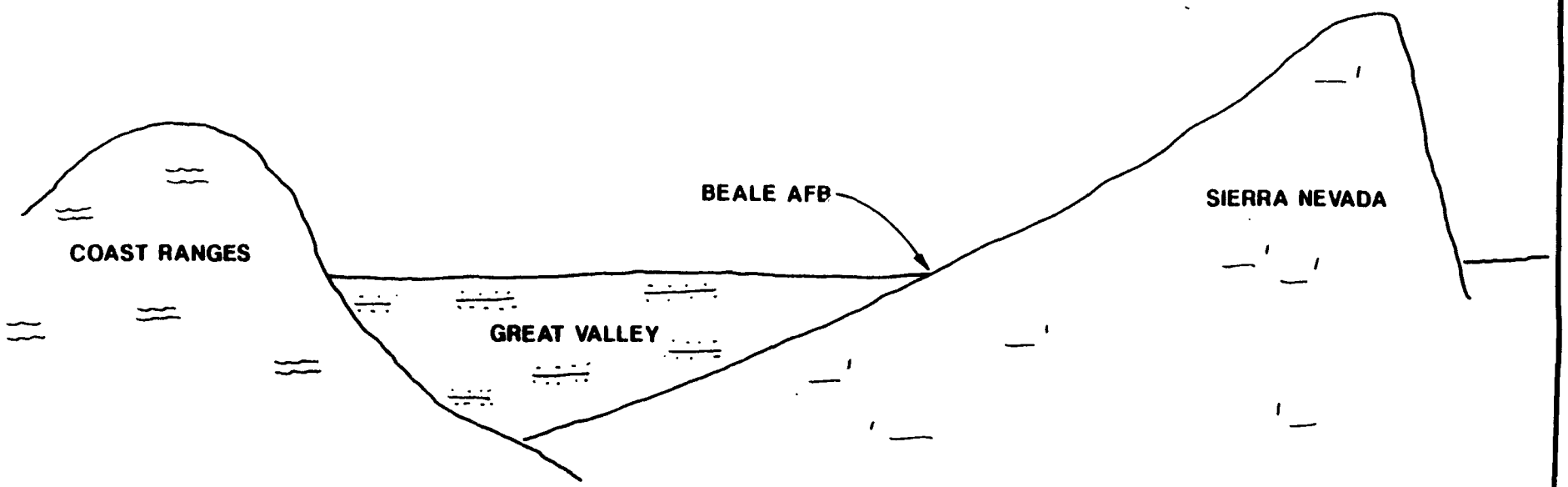
2.2.1.1 Geomorphology

Beale AFB lies on the boundary of two geologic provinces in California: the Great Valley Province and the Sierra Nevada Province (Figure 2-3). The Sierra Nevada Province is a strongly asymmetric mountain range. It has formed as a huge block of the earth's crust has been uplifted along a fault system on the east side of the range and tilted westward. This has resulted in the Sierra Nevada having a long gentle western slope and a steep eastern escarpment.

The Great Valley Province was formed as a structural downwarp between the Coast Range Province on the west and the Sierra Nevada Province on the east. It has been filled with alluvial deposits derived from the erosion of the Sierra Nevada and the Coast Ranges. Extending more than 400 miles from north to south and averaging about 60 miles across, the Great Valley comprises the Sacramento Valley in the north and the San Joaquin Valley in the south. On its eastern boundary the alluvial deposits of the Great Valley overlap bedrock of the Sierra Nevada block, which continues to slope gently to the west.

Because of its location on the boundary of the two provinces, Beale AFB displays characteristics of both the Great Valley and the Sierra Nevada. The western portion of the base is relatively flat grassland, characteristic of the Great Valley. Moving eastward, the plains transition to low rolling hills which gradually merge with the foothills of the Sierra Nevada.

Three geomorphic units characteristic of the Great Valley Province are present at Beale AFB. These include river



NOT TO SCALE

FIGURE 2-3
SCHEMATIC
GEOLOGIC SECTION ACROSS THE SACRAMENTO VALLEY

CH2M HILL

flood plains and channels, low alluvial plains and fans, and dissected uplands. These units are shown conceptually on Figure 2-4.

River plains and channels lie along the major drainages at Beale AFB. As these streams have meandered in recent geologic time, they have deposited sands and gravels along their channels, and silts and clays on their flood plains. Where present, these deposits may range in thickness up to about 100 feet on the western edge of the base. Low alluvial plains and fans comprise most of the western part of the base. This unit is generally flat to gently rolling and is composed of alluvial deposits of mainly Pleistocene age. Unlike the river flood plains and channels, little or no deposition is taking place on this surface. As a consequence, a mature soil profile has developed which contains cemented sediments in many locations. Surface water drainage on this unit is mainly southwesterly, normal to the trend of the Sierra Nevada (Olmsted and Davis, 1961).

Dissected uplands form the eastern edge of the Great Valley, and comprise most of the central portion of Beale AFB. This unit ranges from gently rolling land to dissected hills with relief of up to several hundred feet. Dissected uplands are composed of unconsolidated to semiconsolidated continental deposits mainly of Pleistocene and Pliocene age (Poland and Evenson, 1966). This surface is being eroded at the present time.

Moving eastward into the foothills of the Sierra Nevada at Beale AFB, the topography gets progressively steeper and outcrops consist of mostly older consolidated sedimentary rocks of Oligocene to Pliocene age. On the eastern boundary of the base are exposures of the crystalline basement rock of the Sierra Nevada, which range in age from Mesozoic to Paleozoic.

2.2.1.2 Geologic History

Much of the geologic history of California is associated with the formation and evolution of the Sierra Nevada mountains. The ancestral Sierra Nevada first formed with the intrusion of igneous granitic plutons into existing sedimentary rocks, during the Mesozoic Era (70-225 million years before present (mybp). These existing rocks, which were of Mesozoic and Paleozoic age, were extensively deformed and metamorphosed. Collectively, the intrusive activity and resultant uplifting is known as the Nevadan Orogeny. It resulted in the formation of the Nevadan Mountains, the

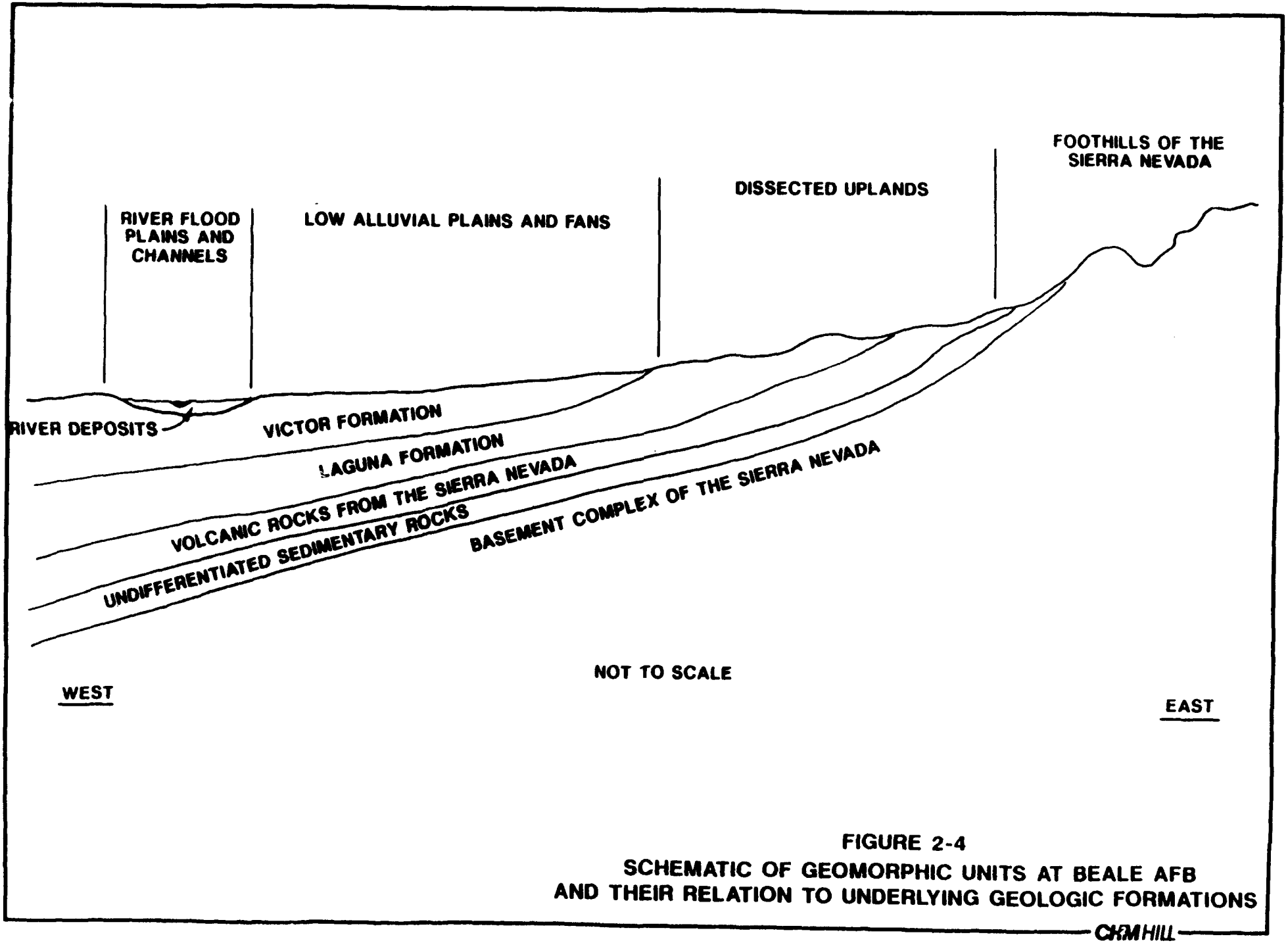


FIGURE 2-4
SCHEMATIC OF GEOMORPHIC UNITS AT BEALE AFB
AND THEIR RELATION TO UNDERLYING GEOLOGIC FORMATIONS

CH2M HILL

western slopes of which formed the edge of the continent at that time. Sediments from erosion of these newly elevated areas were transported by rivers and streams and deposited on a continental shelf area, later to become the location of the Great Valley.

Erosion of the original Nevadan Mountains continued through the Eocene epoch (40 mybp) and substantially lowered the elevation of the mountain range. Faulting, which has occurred since the Eocene, has rejuvenated the mountain-building process by elevating them to their present form as the Sierra Nevada. Erosion has continued to move sediments from the higher elevations to the Great Valley.

Approximately 40 mybp and simultaneous to the erosion of the original Nevadan Mountains, the Coast Mountain Ranges were first formed. This created a large closed marine basin (ancestral Great Valley) between the Nevadan Mountains to the east and the Coast Ranges to the west. This basin continued to receive sediments from both of these mountain ranges. By Pliocene time (7 mybp), most of the valley's seas had been drained via the Carquinez Straits near present San Francisco. Brackish and freshwater lakes replaced the marine waters. Alluvial fans developed along the eastern and western margins of the valley and the Great Valley evolved to its present form.

2.2.2 BEDROCK GEOLOGY

2.2.2.1 Description

Beale AFB is located along the boundary of the basement complex (ancient core of crystalline rock) of the Sierra Nevada and the sedimentary deposits of the Great Valley (Figure 2-3). The rocks of the Sierra Nevada range in age from Paleozoic to Mesozoic. The deposits of the Great Valley range in age from Tertiary to Quaternary. Figure 2-5 shows the geology of the base and its vicinity. A detailed geologic map of Beale AFB may be found in Page (1980).

Along the eastern boundary of the base, the Sierra Nevada basement complex outcrops sloping to the southwest. The complex consists of metamorphosed igneous and sedimentary rocks and intrusive igneous rock, and constitutes the bedrock in the vicinity of Beale AFB. These rocks are actually part of a belt of rocks which flank and predate the main granitic batholith of Sierra Nevada that lies to the east (Bateman and Wahrhaftig, 1966). The depth to the basement complex ranges to over 5,000 feet by the confluence of the

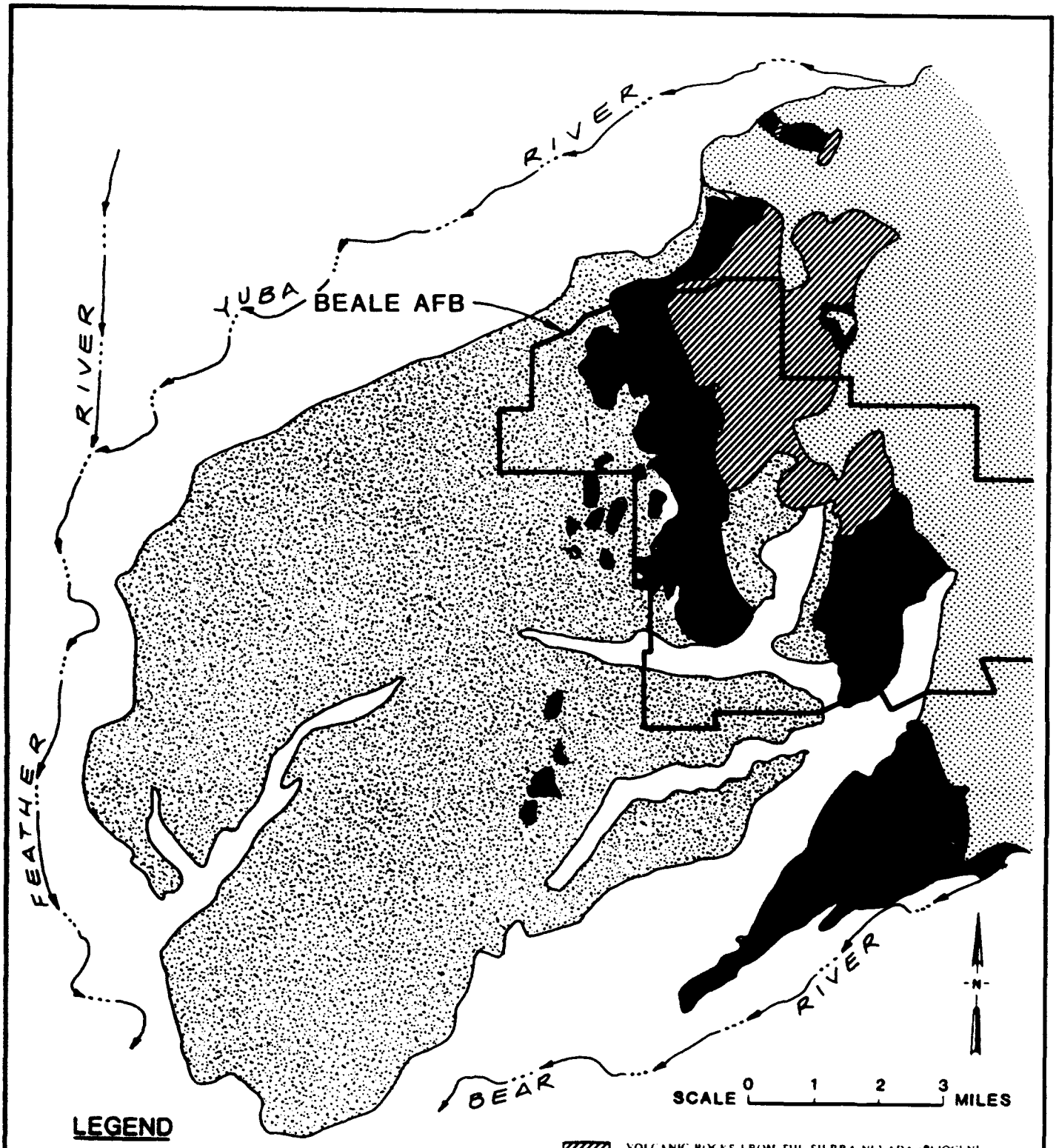


FIGURE 2-5
BASE GEOLOGY

SOURCE: ENGINEERING - SCIENCE, 1984

CH2M HILL

Bear and Feather Rivers. At Beale AFB and areas to the west there are no known water wells reaching into the basement complex, although a shallow monitoring well at Site 16 (the Explosive Ordnance Disposal Area) appears to enter this unit at a depth of 5 feet. The groundwater in the basement rocks is limited mainly to fractures (Page, 1980). The basement complex is overlain by fine-grained sedimentary marine rocks of Eocene Age which consist of clay, sandy clay, silty clay, sand and claystone. These rocks do not outcrop at the base, but have been identified in subsurface investigations at depths of between 315 to 865 feet (Page, 1980).

The fine-grained sedimentary rocks are overlain by undifferentiated sedimentary rocks of marine, non-marine, and deltaic origin. These sedimentary rocks only outcrop in a few isolated places on the base. However, they are found under the base at depths of up to 450 feet, sloping gently to the southwest and ranging in thickness from zero to about 150 feet. Only a few water wells are known to reach these deposits and they do not pump exclusively from these rocks (Page, 1980). The fine-grained sedimentary rocks and a portion of the undifferentiated sedimentary rocks are marine deposits that contain connate groundwater with a high concentration of total dissolved solids, ranging from about 500 mg/l to over 10,000 mg/l near their base (Black and Veatch, 1985). Thus, the top of these deposits constitutes the effective base of the potable groundwater reservoir.

Overlying the undifferentiated sedimentary rocks are volcanic rocks from the Sierra Nevada. These sedimentary deposits consist of dark, poorly to well consolidated alluvial volcanic siltstone, sandstone, conglomerate, and shale of Pliocene and Eocene age derived from volcanic rocks in the Sierra Nevada. The volcanic sediments outcrop mainly along the eastern part of Beale AFB and slope gently toward the southwest. They range in depth from zero to 270 feet, and in thickness from zero to 325 feet (Page, 1980).

2.2.2.2 Structure and Seismic Activity

The Great Valley is a large geosyncline with a southward tilt along a north-south trending axis. As described above, the basement crystalline complex of the Sierra Nevada slopes gently to the southwest, buried under the increasingly thick sedimentary deposits of the Great Valley. On the western side of the valley, the bedrock complex of the Coast Range rises abruptly against the Sierran rocks (Figure 2-3).

The most recent seismic activity in the vicinity of Beale AFB was the minor movement which took place along the Cleveland Hill Fault about 25 miles north of the base and accompanied the 1975 Oroville earthquake sequence (Black and Veatch, 1985). Other mapped faults in the area include the Highway 49 lineament about 20 miles east of Beale AFB and a shear zone located a few miles east of the base that trends in a northwesterly direction. There are no known active or inactive faults within the boundaries of Beale AFB (Black and Veatch, 1985).

2.2.3 SURFICIAL GEOLOGY

2.2.3.1 Unconsolidated Deposits

Unconsolidated deposits overlie consolidated sediments at Beale AFB, and these in turn lie over the basement complex of the Sierra Nevada. Figure 2-6 shows the locations of two deep geologic cross-sections (illustrated in Figures 2-7 and 2-8), and Plate 2 shows the locations of three shallower cross-sections (illustrated in Figures 2-9 through 2-11). The soil boring logs on which the shallow cross-sections were based are collected in Appendix D. Table 2-5 summarizes the stratigraphy underlying Beale AFB and describes the water-bearing characteristics of the geologic units. Because these formations were deposited over the crystalline basement complex of the Sierra Nevada which slopes to the southwest, the depth to the tops of the formations and the thickness of the formations increases toward the west. These relationships are shown in the deep cross-sections (Figures 2-7 and 2-8). Penetration resistances were recorded at various depths in soil borings, and are included with soil boring logs in Appendix D.

The first unit that overlies the volcanic rocks of the Sierra Nevada is the Laguna Formation and related continental deposits (the Arroyo Seco Gravels). This unit is exposed at the middle of Beale AFB, and comprises the materials that correspond to the dissected alluvial uplands geomorphic unit. The Laguna Formation deposits are predominantly fine-grained, poorly-bedded, somewhat compacted continental deposits, consisting of silt, clay and sand of Pleistocene and Pliocene age. The Arroyo Seco gravels are coarse-grained and poorly sorted. These gravels form a discontinuous cap on the Laguna Formation, and were mapped together with the Laguna Formation by Page (1980). The Laguna Formation ranges in thickness from zero to 180 feet and slopes gently to the southwest. Soils developed on the

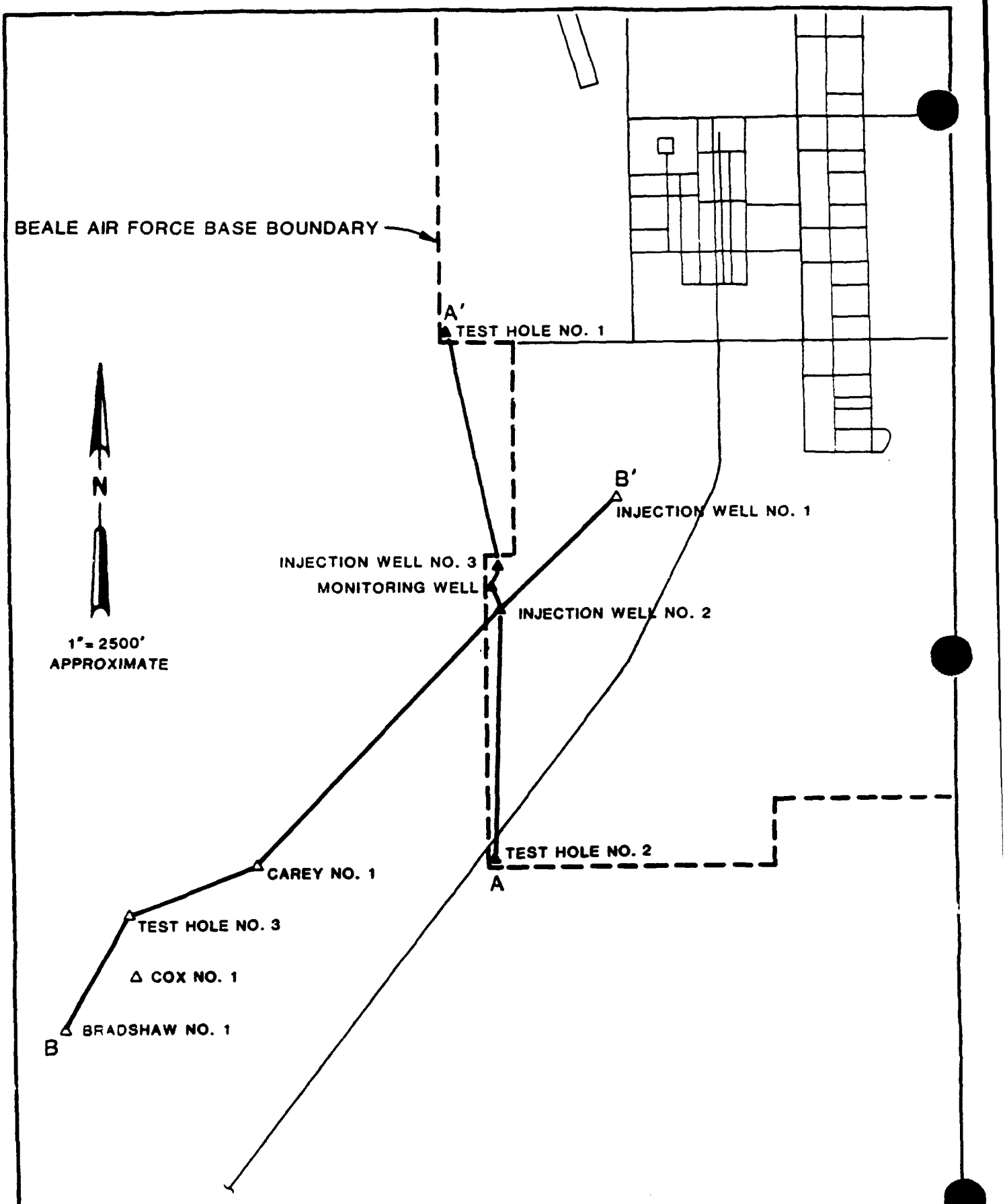
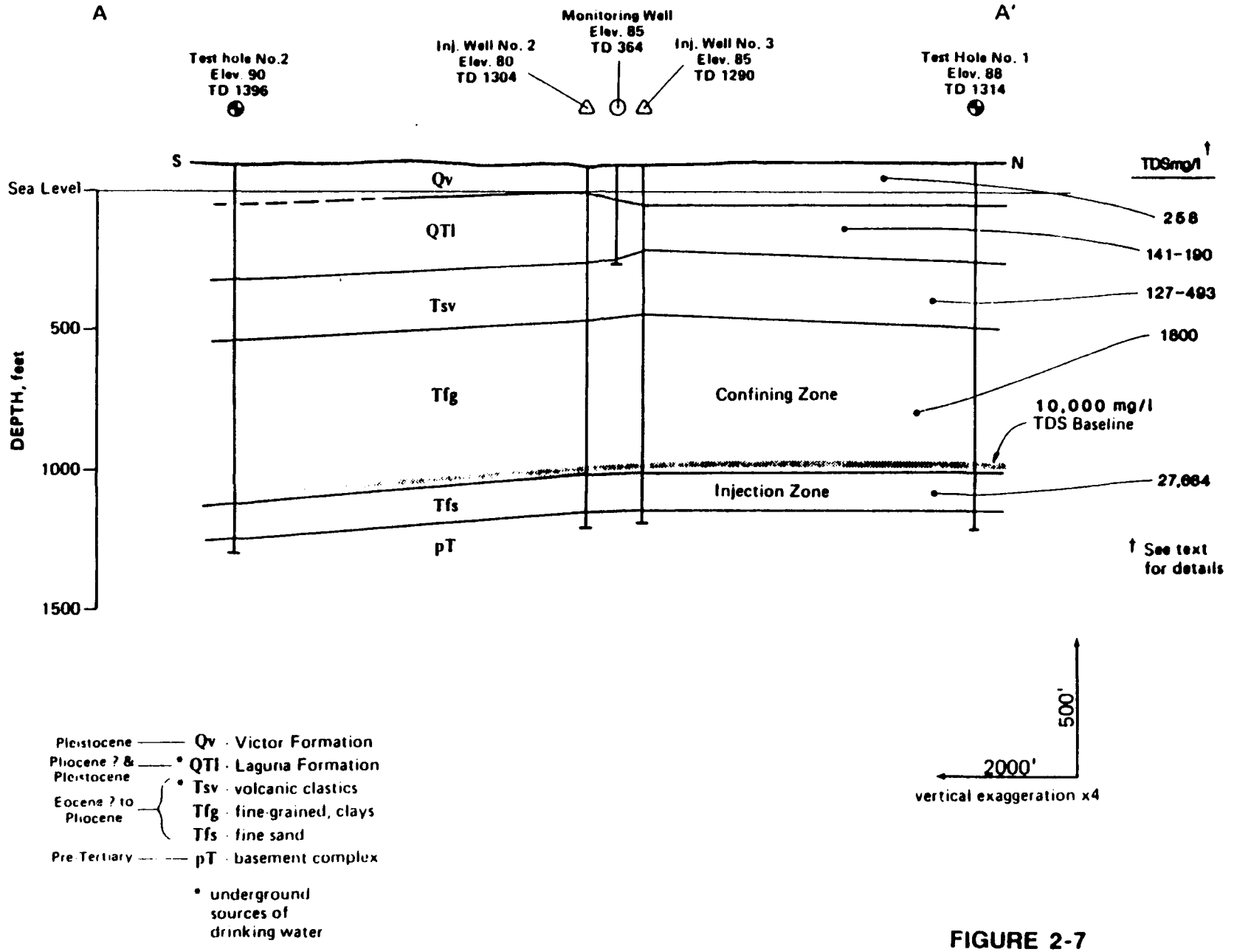


FIGURE 2-6
LOCATION OF DEEP STRATIGRAPHIC CROSS SECTIONS A-A', B-B'

SOURCE: BLACK & VEATCH (1985)

CH2M HILL



SOURCE: BLACK & VEATCH (1985)

FIGURE 2-7
DEEP STRATIGRAPHIC CROSS-SECTION A-A'

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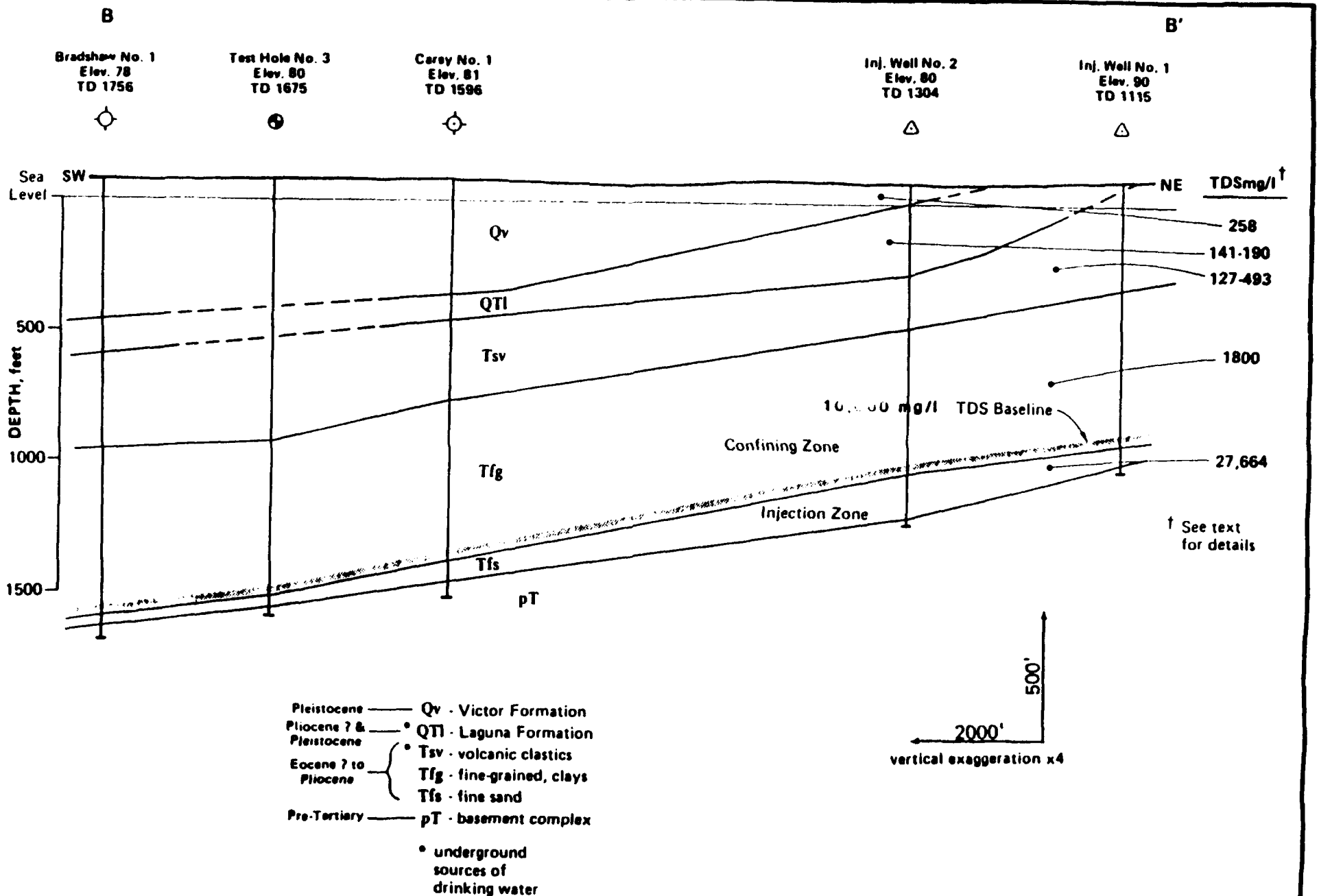
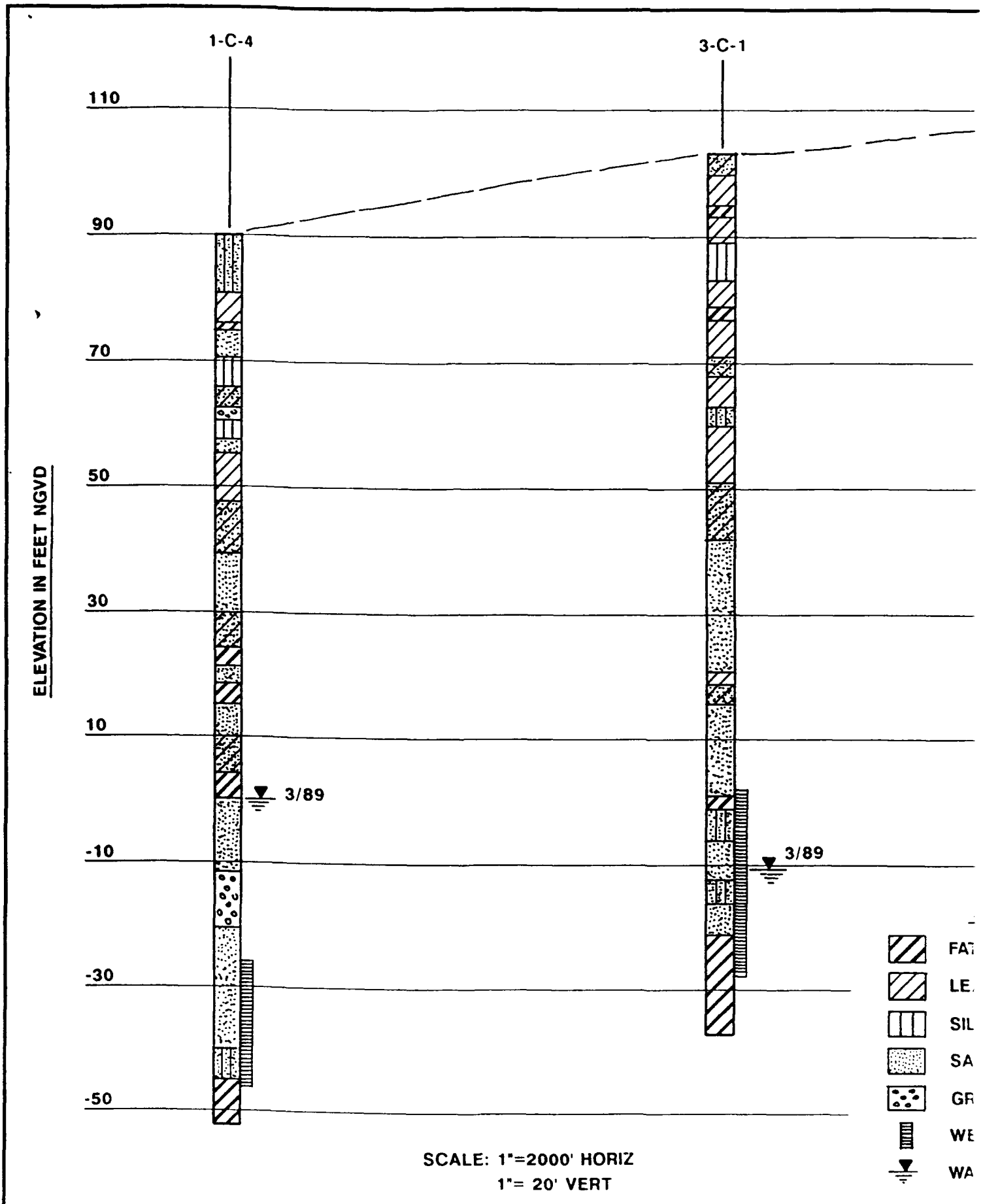


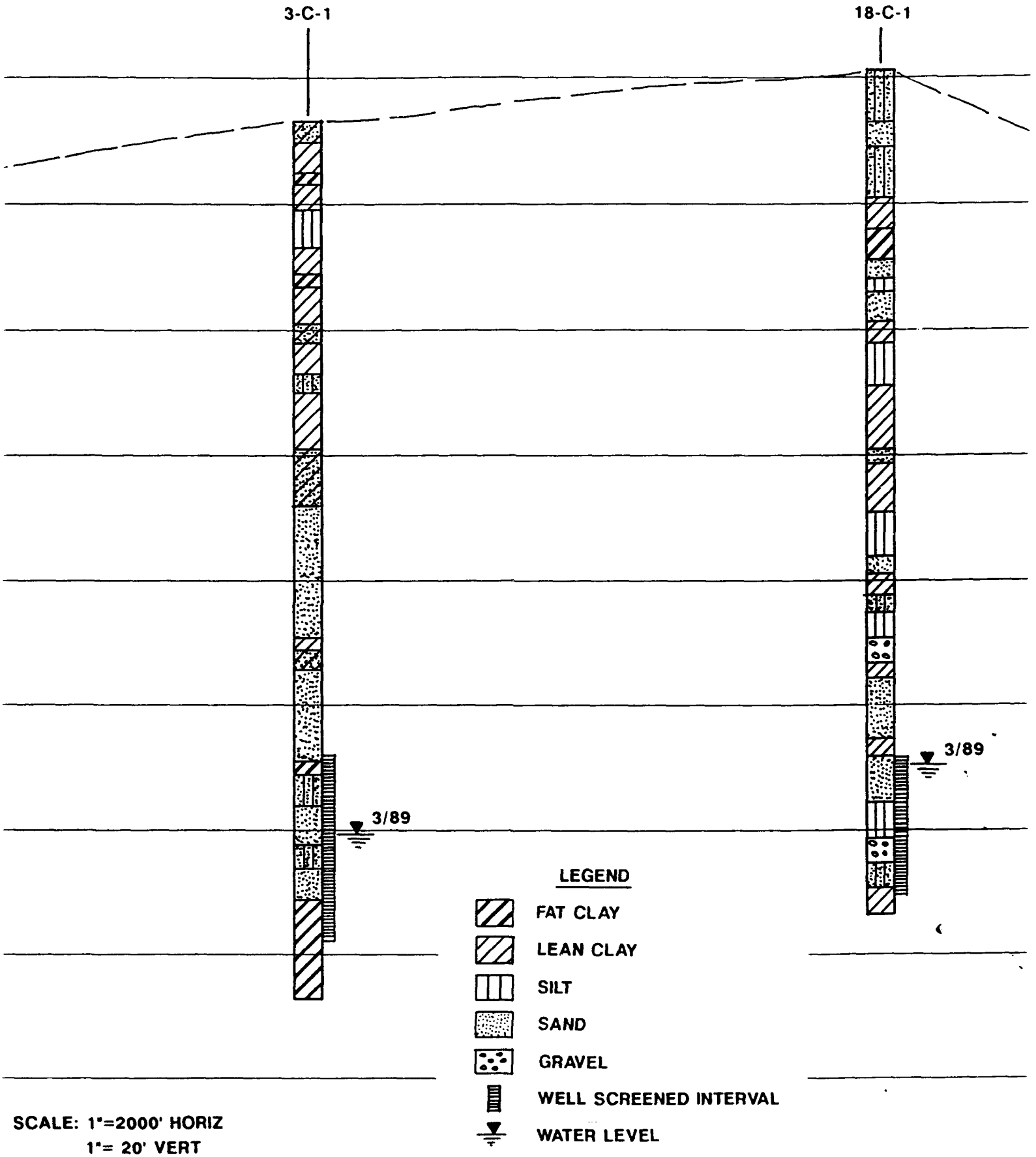
FIGURE 2-8
DEEP STRATIGRAPHIC CROSS-SECTION B-B'

SOURCE: BLACK & VEATCH (1986)



SCALE: 1"=2000' HORIZ
1"= 20' VERT

NOTE: SEE PLATE 2 FO



SCALE: 1"=2000' HORIZ
1"= 20' VERT

NOTE: SEE PLATE 2 FOR LOCATION OF CROSS SECTION

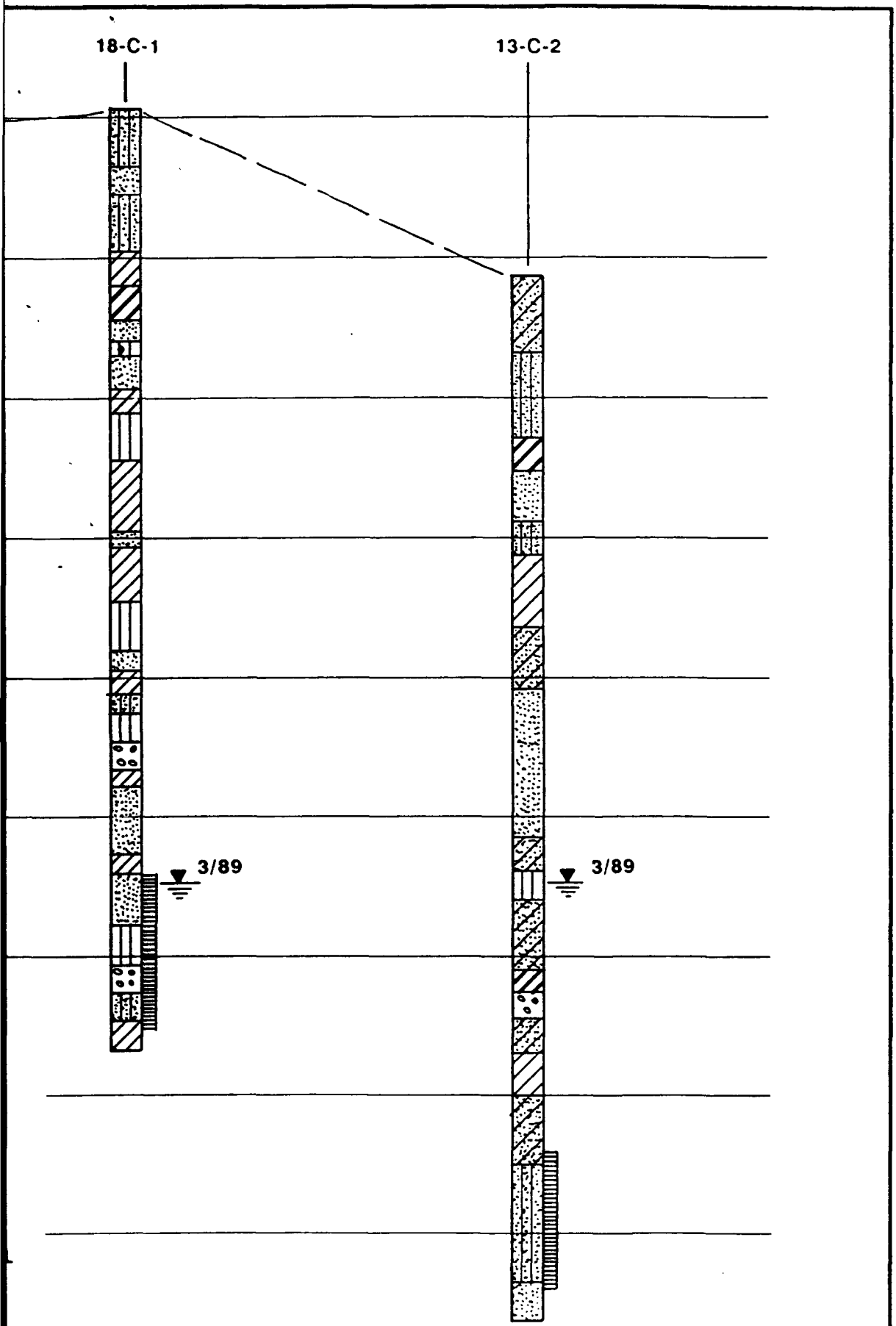


FIGURE 2-9
GEOLOGIC CROSS SECTION "A"
BEALE AIR FORCE BASE

SECTION

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307 3

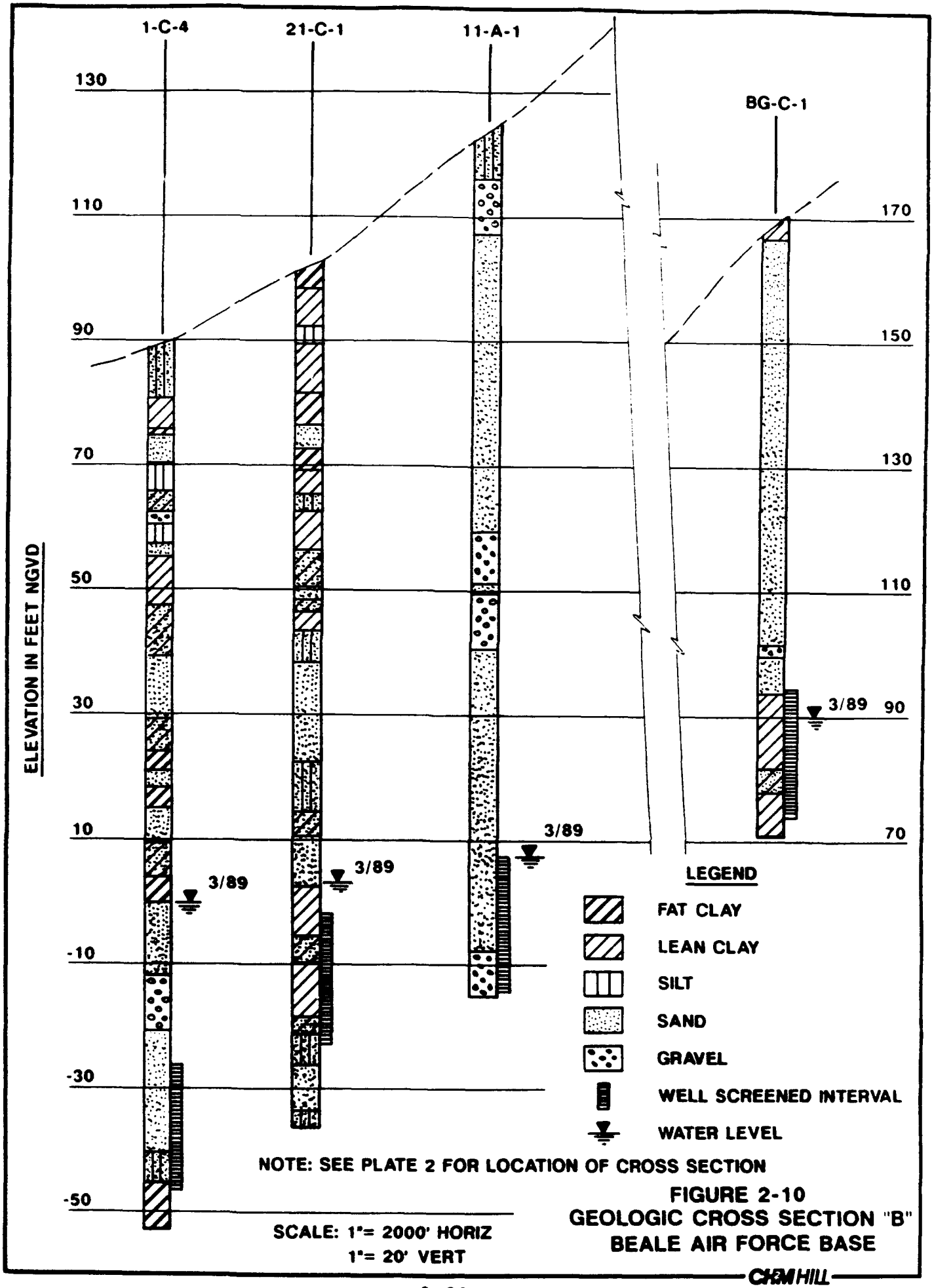


FIGURE 2-10
GEOLOGIC CROSS SECTION "B"
BEALE AIR FORCE BASE

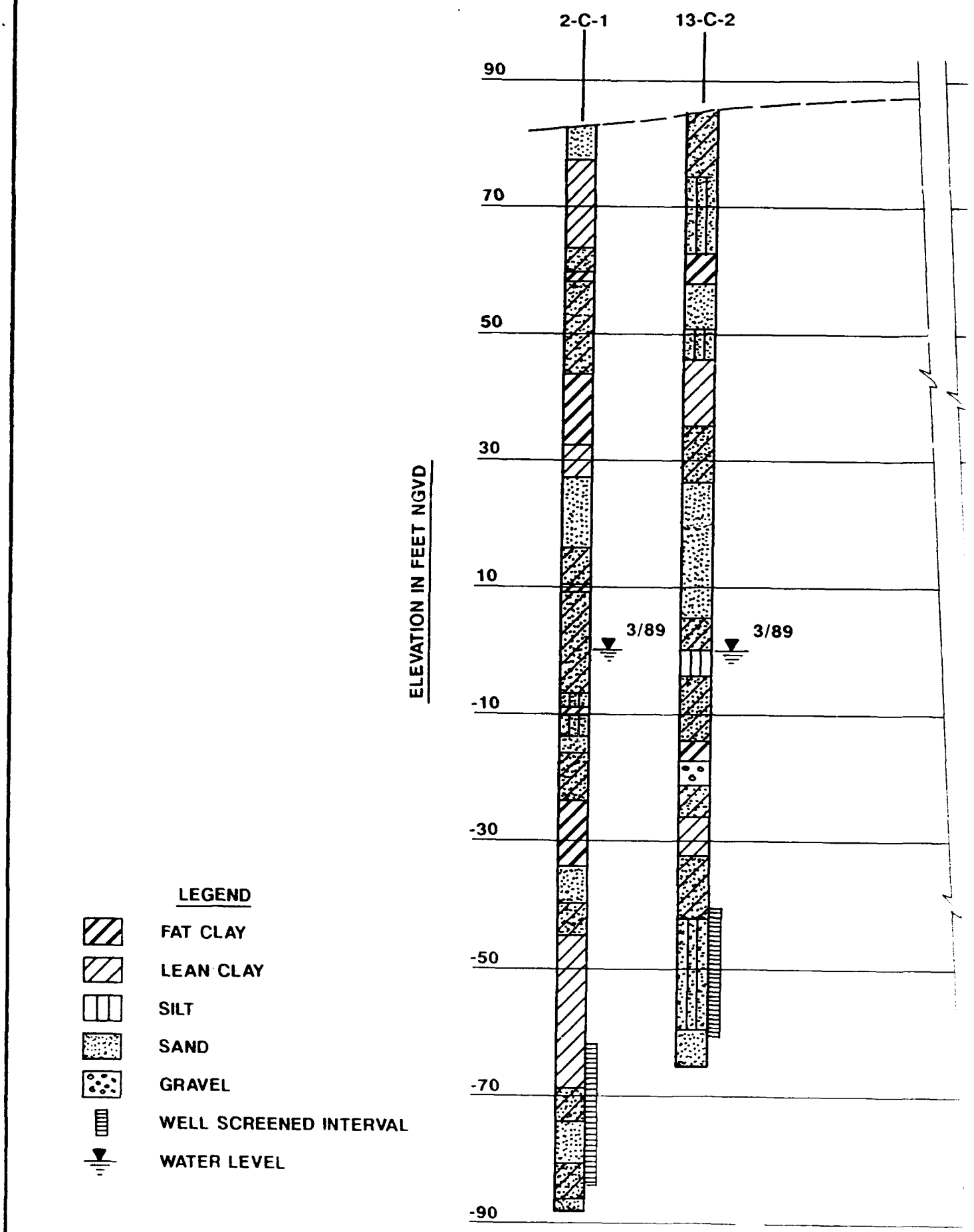
CHEM HILL

Table 2-5
GEOLOGIC UNITS NEAR BEALE AFB

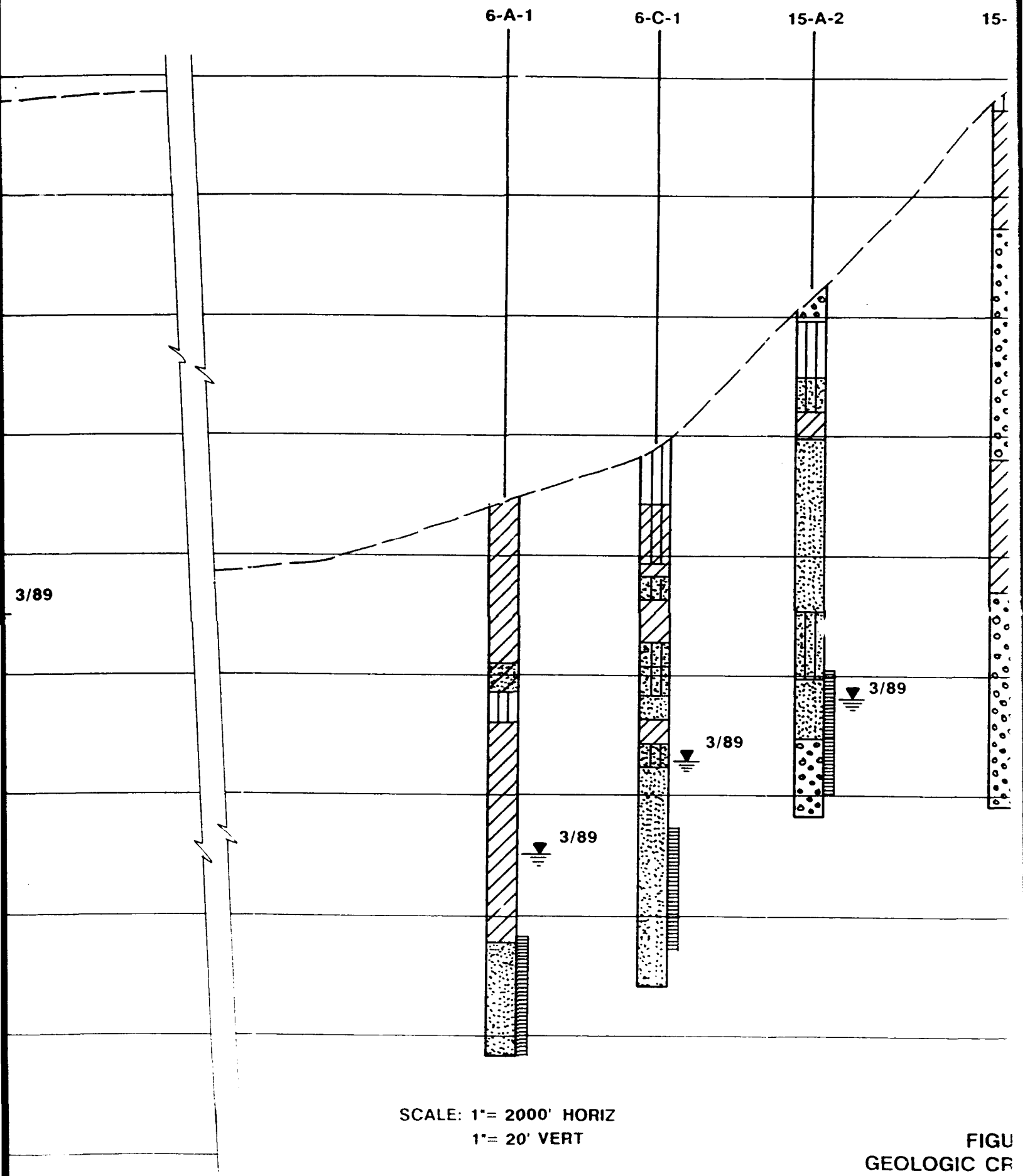
System and Series	Geologic Unit	Lithology	Thickness (feet)	Depth[a] (feet)	Water-Bearing Characteristics
QUATERNARY Holocene	River deposits	Continental deposits of silt, sand, and gravel, with minor amounts of clay	0-90	0-100(?)	Soils on river deposits have permeabilities of 15 to 80 gpd/ft^2.
QUATERNARY Pleistocene	Victor Formation	Continental deposits of silt, sand, and gravel	0-135	0-90	Most permeable deposits on east side of Sacramento Valley. Well yield ranges from 1,000 to 1,600 gpm. Soils on the Victor and related deposits contain hardpan.
QUATERNARY AND TERTIARY(?) Pleistocene(?) and Pliocene	Laguna Formation and related continental deposits	Continental fine-grained sediments to poorly-sorted gravels	0-180	0-175	Yields ranging from 100 to 3,100 gpm. Soils on the Laguna Formation contain hardpan.
TERTIARY Pliocene and Eocene(?)	Volcanics from the Sierra Nevada	Fluvial volcanic siltstone, sandstone, conglomerate	0-325	0-270	Wells perforated in the volcanics have yields ranging from 415 to 2,500 gpm.
TERTIARY Oligocene(?) and Eocene	Fine-grained sedimentary rocks	Clay, sandy clay, silty clay, sand, and claystone	---	315-865	Limited; top of unit is the effective base of groundwater reservoir.
	Undifferentiated sedimentary rocks	Marine, non-marine, and deltaic sedimentary rocks	0-150	0-455	Limited.
MESOZOIC AND PALEOZOIC	Basement complex	Metamorphosed igneous and sedimentary rocks and intrusive igneous rocks	---	1-5000	Limited to rock fractures. No known wells in the basement complex.

[a]Depth to the top of the unit.

Source: U.S.G.S., Page, 1980



NOTE: SEE PLATE 2 FOR LOCATION OF CROSS SECTION



SCALE: 1"= 2000' HORIZ
1"= 20' VERT

FIGU
GEOLOGIC CR
BEALE AI

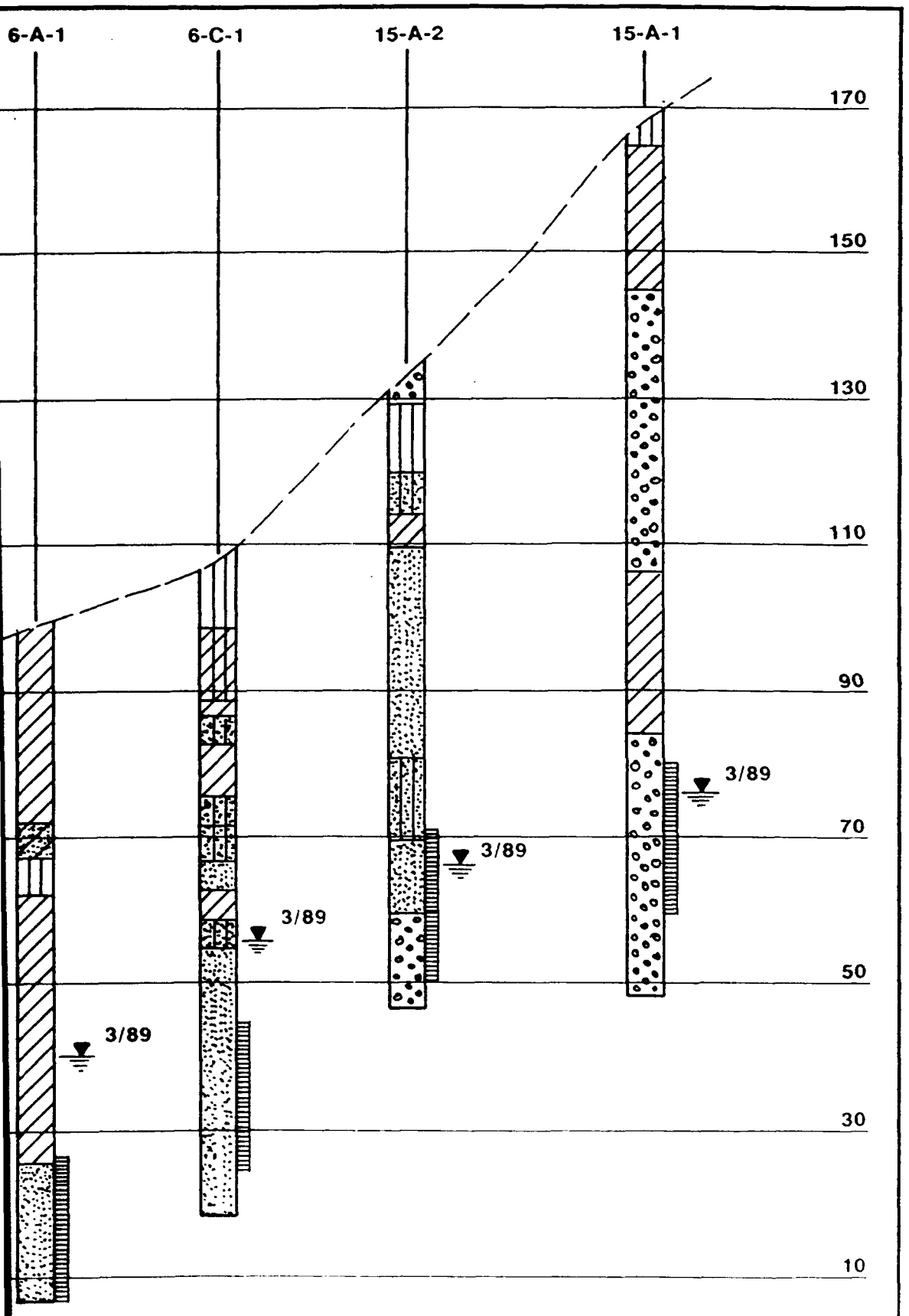


FIGURE 2-11
GEOLOGIC CROSS SECTION "C"
BEALE AIR FORCE BASE

Laguna Formation may contain cemented sediments which restricts the vertical flow of water in some places (Page, 1980).

Overlying the Laguna Formation and exposed along the western and southwestern base boundary is the Victor Formation. It comprises the materials of the low alluvial plains and fans geomorphic unit described in Section 2.2.1.1. The Victor Formation consists of heterogeneous mixtures of clay, silt, sand, and gravel of Pleistocene age deposited by meandering streams; in some places buried channel gravels may exist. As with the Laguna Formation, it contains layers of cemented sediments that restrict the vertical flow of water in places. The Victor Formation slopes gently to the southwest and ranges in thickness from zero to 135 feet (Page, 1980). This formation is very similar to the Laguna Formation both texturally and lithologically, and the two are difficult to tell apart in the subsurface. Both are highly productive for wells. Beale AFB obtains its water supply from the Victor Formation. Nearby wells west of the base obtain their water mainly from the unconsolidated deposits of the Victor Formation, Laguna Formation, and volcanic rocks from the Sierra Nevada (Rockwell, 1978).

The youngest and shallowest deposits at the base are river deposits consisting of silts, sands, and gravel. At Beale AFB, they are found along the Hutchinson and Dry Creek drainage course, and comprise the flood plain and river channel geomorphic unit. These Holocene-age alluvial deposits do not typically contain layers of cemented sediments (Page, 1980).

2.2.3.2 Soils

Soils at Beale AFB have been recently mapped by the Soil Conservation Service (SCS, 1985). The formation of soil at a particular location is controlled by the geology, landforms, relief, climate, and vegetation at that location. The resulting characteristics of a particular soil, such as its texture, permeability and mineralogy, may affect the movement of contaminants. Detailed soil maps, profile descriptions, and tables of engineering properties may be found in the Soil Survey (SCS, 1985).

Much of the western portion of the base is covered by San Joaquin loam. This is a moderately deep, moderately well-drained soil formed on old alluvial terraces at an elevation of between 60 and 130 feet NGVD. San Joaquin loam typically contains a layer of hardpan at a depth of between 20 and

40 inches. The infiltration rate is moderate (0.6 to 2.0 inches per hour) above about 16 inches in silt and silty clay, and very slow (less than 0.06 inches per hour) below this depth in clay.

Redding-Corning gravelly loams cover most of the central part of the base, including the flightline and cantonment areas. These soils are moderately deep to very deep and are well-drained. They form on old alluvial terraces at an elevation of between 110 and 250 feet. A layer of hardpan is commonly found at a depth of between 20 and 40 inches. The infiltration rate is moderate (0.6 to 2.0 inches per hour) in the upper 2 feet in clayey and silty sands and gravels. Below this depth the permeability is very slow in clays.

Pardee-Pardee Variant complex and Pardee gravelly loam covers much of the northeastern part of the base including the area around Site 16 (Explosive Ordnance Disposal Area). These are shallow, well-drained soils formed in gravelly and cobbly alluvium on old dissected alluvial terraces above unrelated igneous bedrock at an elevation of between 120 and 250 feet. The infiltration rates of the soils are moderately slow to moderate (0.2 to 2.0 inches per hour) in silty and clayey sands and gravels.

On the northeastern edge of the base in the foothills between elevations of about 125 and 1,100 feet are found Auburn-Argonaut loams. These soils are shallow to moderately deep and well-drained, formed in residuum from basic metavolcanic rock. Bedrock may be found at depths of 10 to 40 inches beneath the Auburn-Argonaut loams. Infiltration rates range from very slow to moderate (less than 0.06 to 2.0 inches per hour) in silts and clays.

Along the drainages at Beale AFB, including the unnamed creek which flows through Site 1 (West Drainage Ditch) and along Hutchinson Creek and its tributaries, are found Perkins loam and Conejo loam. These are very deep, well-drained soils formed on stream terraces in alluvium derived from mixed sources. Perkins loam tends to be found along the upper reaches of the drainages. Its permeability is moderately slow (0.6 to 2.0 inches per hour), and it is composed of silts and clays, with some silty and clayey gravel below about 5 feet in depth. Conejo loam is normally found in the lower reaches of the drainage courses. This soil shows a moderate infiltration rate (0.2 to 2.0 inches per hour) in silts and clays.

2.3 HYDROGEOLOGY

2.3.1 GROUNDWATER

2.3.1.1 Occurrence and Movement

Groundwater in the vicinity of Beale AFB flows mainly through the alluvial deposits of the Victor Formation, Laguna Formation, and volcanic rocks from the Sierra Nevada. Because of the complexity of the alluvial deposits, there are no clearly defined local aquifers. Alluvium comprises the sediments deposited by water in stream beds, flood plains, lakes, and fans. Stream channels constantly shift their positions and depositional erosional velocities through geologic time. The resulting alluvial deposits are characterized by extreme heterogeneity of particle size and distribution such that hydraulic properties are also highly variable. The meandering stream depositional environment produces relatively thin, laterally discontinuous channel deposits. Channel deposits of coarse-grained materials, which are narrow in cross-section, may be continuous for long distances in the direction of stream flow. Since groundwater flows preferentially through materials of higher hydraulic conductivity, these channel deposits may serve as primary contaminant migration pathways. However, these pathways may not be correlatable on geologic cross-sections constructed from soil boring logs.

The layered character of alluvial deposits causes the aquifer system to display a strong horizontal versus vertical anisotropy. Usually, horizontal hydraulic conductivities of aquifer materials will tend to be much greater. Because of the heterogeneity and anisotropy characteristic of alluvial systems both horizontally and vertically, aquifer characteristics such as hydraulic conductivity may vary by several orders of magnitude within a few feet in any given direction.

Subsurface investigations at Beale AFB have failed to detect large regional geologic features in the upper alluvial formations that influence groundwater flow. Coarse-grained deposits appear to be minor and embedded within fine-grained deposits, although a thick sequence of coarse sands and gravels was noted at several sites in the northern part of the base, particularly at Site 1.

The presence of fine-grained clays and silts causes groundwater to be confined or semiconfined locally. These clay and silt deposits tend to be lenticular and gradational

laterally. Near-surface groundwater may be perched in certain locations. With increasing depth, the groundwater typically exhibits greater degrees of confinement. Thus, the response of groundwater levels to pumping may be complex.

A summary of the lithology, thickness, and water-bearing characteristics of the geologic units at Beale is provided in Table 2-5. The base of the fresh-water aquifer may be considered to be the top of the fine-grained sedimentary marine deposits that lie over the basement complex (unit Tfg on Figure 2-8). The depth to the base of the this unit ranges from zero feet on the eastern edge to over 1,000 feet in the southwestern corner of Beale AFB. In the eastern part of the base, where the alluvial deposits are absent and the basement complex outcrops, groundwater is restricted to flow in fractures within the rock (Page, 1980).

Beale AFB is located along the eastern margin of the Sacramento Basin Hydrologic Area as designated by the California Department of Water Resources (DWR, 1980). Groundwater movement within this margin, at the turn of the century, was from the Sierra Nevada foothills in the east toward the Feather and Sacramento Rivers to the west. The river system thus served as discharge points for the groundwater. As a result of extensive groundwater extraction, primarily for crop irrigation since the turn of the century, the major discharge for the groundwater has been through well withdrawal. This has altered the direction of groundwater movement in many places throughout the Sacramento Valley, including areas near Beale AFB. The rivers no longer serve as groundwater discharge points. In fact, water from the river channels recharge the groundwater system.

Another source of recharge to the regional groundwater reservoir is along outcrops of the alluvial formations on the eastern edge of the Great Valley, which at depth constitute the major water supply aquifers. Percolation of rainwater or irrigation waters through these materials reaches the groundwater reservoir. However, only lands with sufficiently permeable soil will permit percolation. Soils containing cemented sediments restrict the downward movement of water locally (DWR, 1978). Recharge from groundwater in fractures of the consolidated rocks may also contribute water to the regional aquifer.

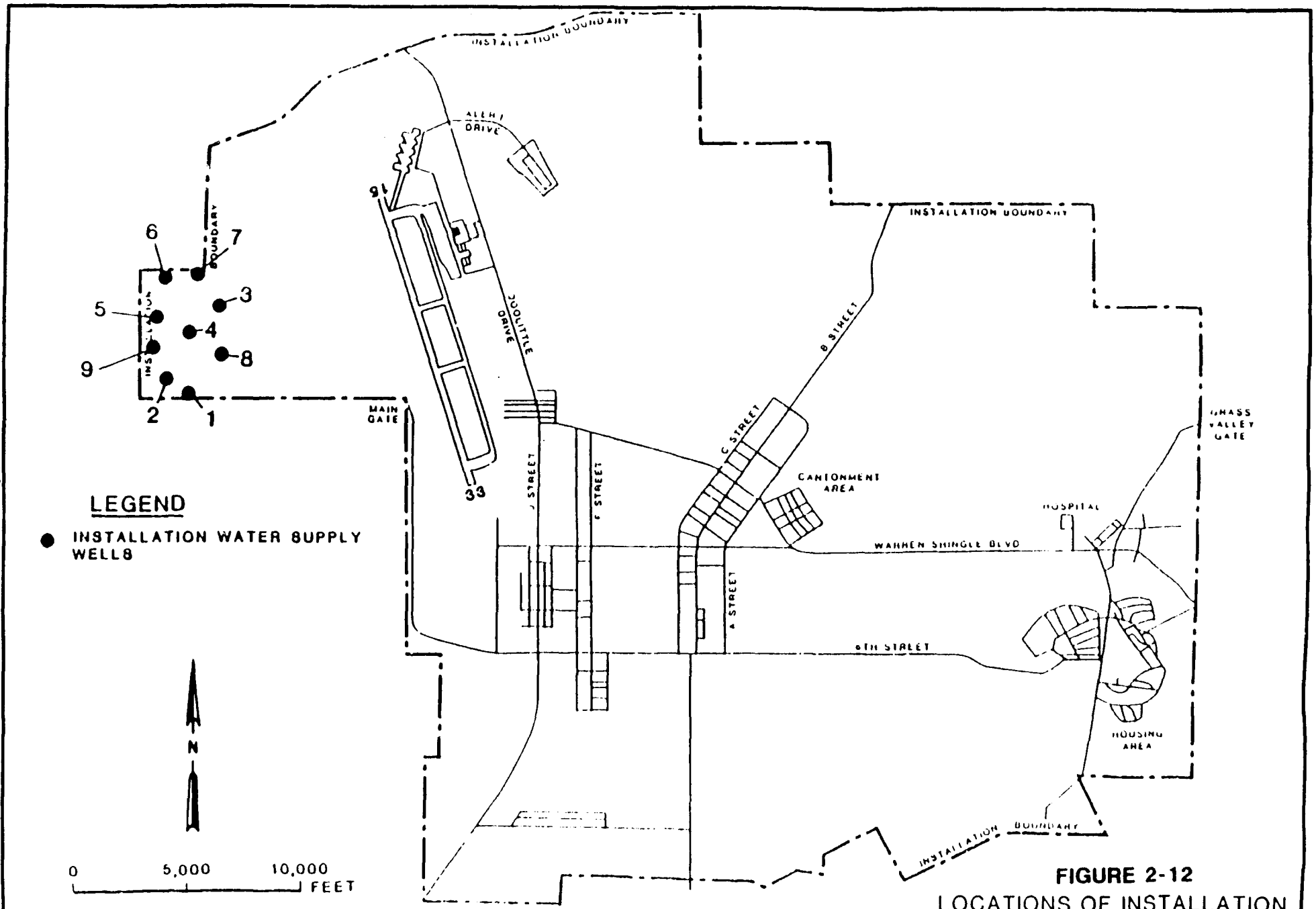
The primary regional discharge is to agricultural pumping west of Beale AFB. For the period 1966-71 and for 1975, the regional pumping discharge ranged from 96,000 to

129,000 acre-feet per year (Page, 1980). The primary source of pumping discharge at Beale AFB is from the nine water supply wells located in the northwest corner of the base (Figure 2-12). From 1960 to 1975 pumping from these wells ranged from 1,370 to 4,240 acre-feet per year. Table 2-6 gives construction details for the base water supply wells.

Figures 2-13 through 2-15 present regional groundwater elevation contours in 1976 and 1986. These figures show that groundwater in the vicinity of Beale AFB flows toward a large depression induced by pumping west of the base. Page (1980) locates the center of the depression in the northeast quarter of T14N, R4E and the northwest quarter of T14N, R5E. The figures show that recharge to the groundwater system is from the Yuba, Bear, and Feather Rivers, and from the eastern part of Beale AFB. The depression is probably not caused by intensive pumping from one or a handful of wells. Most likely the groundwater withdrawal is widespread regionally. The geometry of the depression appears to be a result of the availability of recharge from rivers on three sides. Recharge to the Beale AFB well field appears to be mainly from the Yuba River to the north.

In effect, all of Beale AFB is within the zone of groundwater recharge to the groundwater depression west of the base. Plates 3 and 4 show groundwater elevation contours plotted on water levels in March and November 1989. Flow lines throughout the base may be expected to converge on the groundwater depression. In addition, location within a zone of recharge implies that there is a vertical component of groundwater flow downward. Thus, contaminants that may enter the groundwater system in the vicinity of Beale AFB may move down gradient toward the depression. Plates 3 and 4 also demonstrate that the groundwater gradient becomes steeper toward the northeast at Beale AFB. This change reflects the dip of geologic materials in the region and represents a transition from the Great Valley to the foothills of the Sierra Nevada.

Groundwater levels have generally been declining since the onset of agricultural pumping. However, there is evidence that in recent years this trend has lessened and even begun to reverse. Based on a study of water levels in regional wells, Page (1980) concluded that in the 1960s water levels declined less rapidly than in earlier years, and in the 1970s declined only slightly. However, between 1977 and 1980, the water table declined sharply once more in response to drought and increased rice production. Since 1980, the



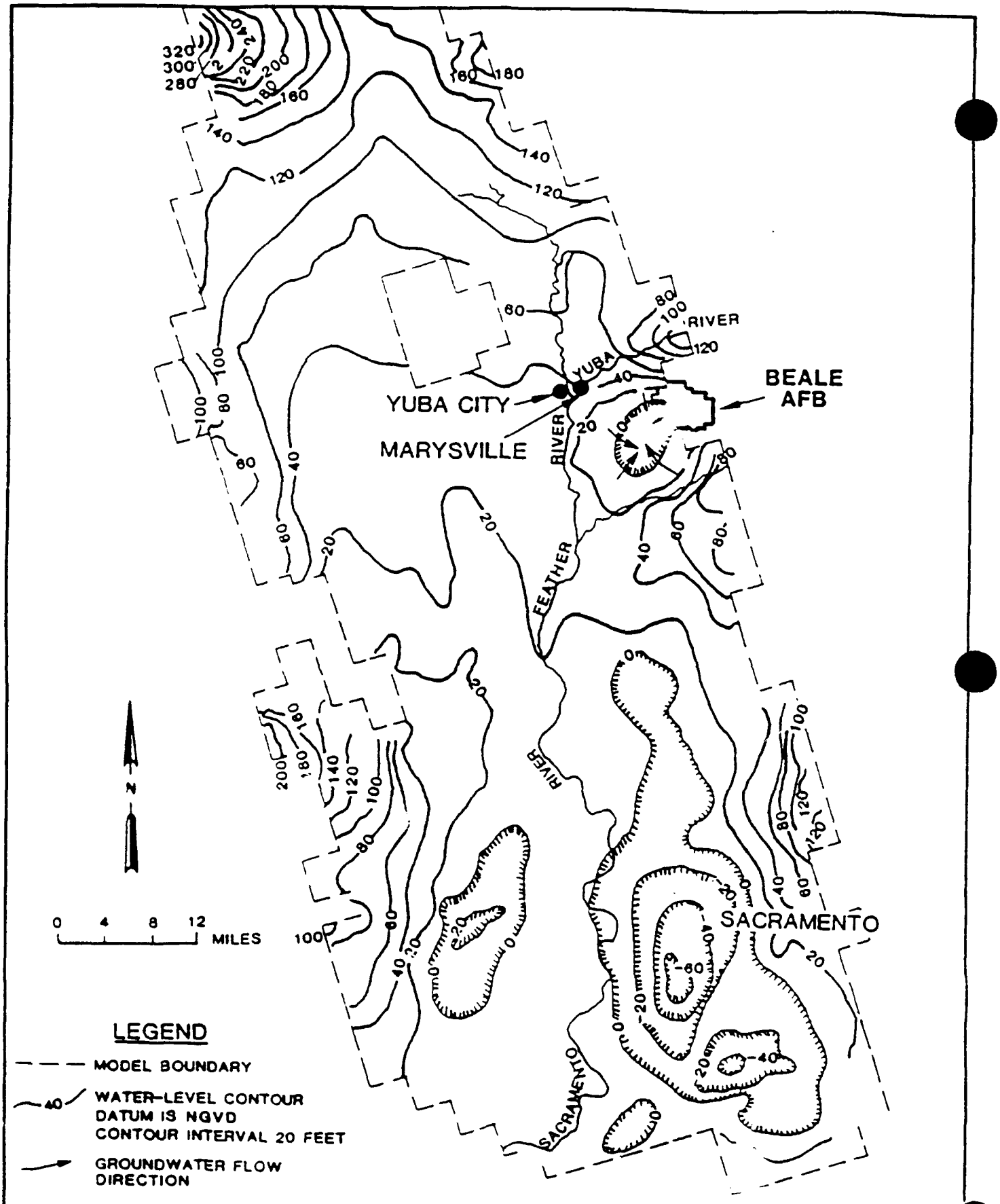
SOURCE: ENGINEERING-SCIENCE, 1984

FIGURE 2-12
LOCATIONS OF INSTALLATION SUPPLY WELLS

Table 2-6
CONSTRUCTION DETAILS FOR INSTALLATION
WATER SUPPLY WELLS

Installation Number	U.S.G.S. Number	Depth (feet)	Perforation Intervals (feet)	Casing Diameter (inches)
1	15N/4E-24R1	296	175-296	12/16
2	15N/4E-24R2	326	145-160	16
3	15N/5E-19F1	264	152-251	
4	15N/4E-24H1	405	158-288	16
5	15N/4E-24G1	299	112-154 210-224 238-280	16
6	15N/4E-24B1	313	130-156 192-213 235-241 252-264 289-299	16
7	15N/4E-24A1	300	140-270	16(?)
8	15N/5E-19L1	405	129-206 280-293	?
9	15N/4E-24K1	370	186-330	?

Source: Page, 1980.



NOTE: GROUND SURFACE ELEVATION VARIES BETWEEN 70 AND 200 FEET ABOVE NGVD AT BEALE AFB.

SOURCE: ENGINEERING - SCIENCE, 1984

FIGURE 2-13
REGIONAL GROUNDWATER CONTOURS-1976

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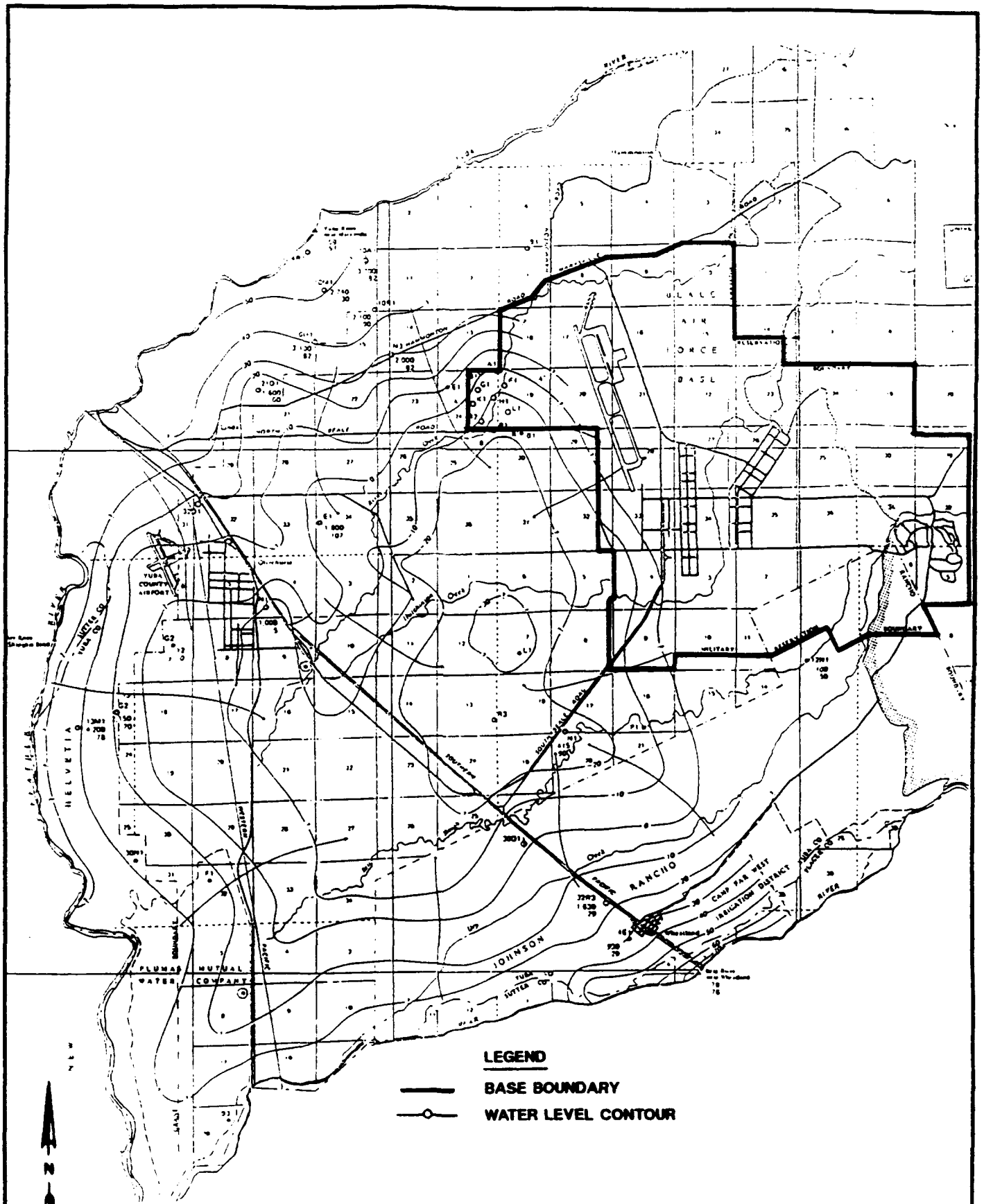
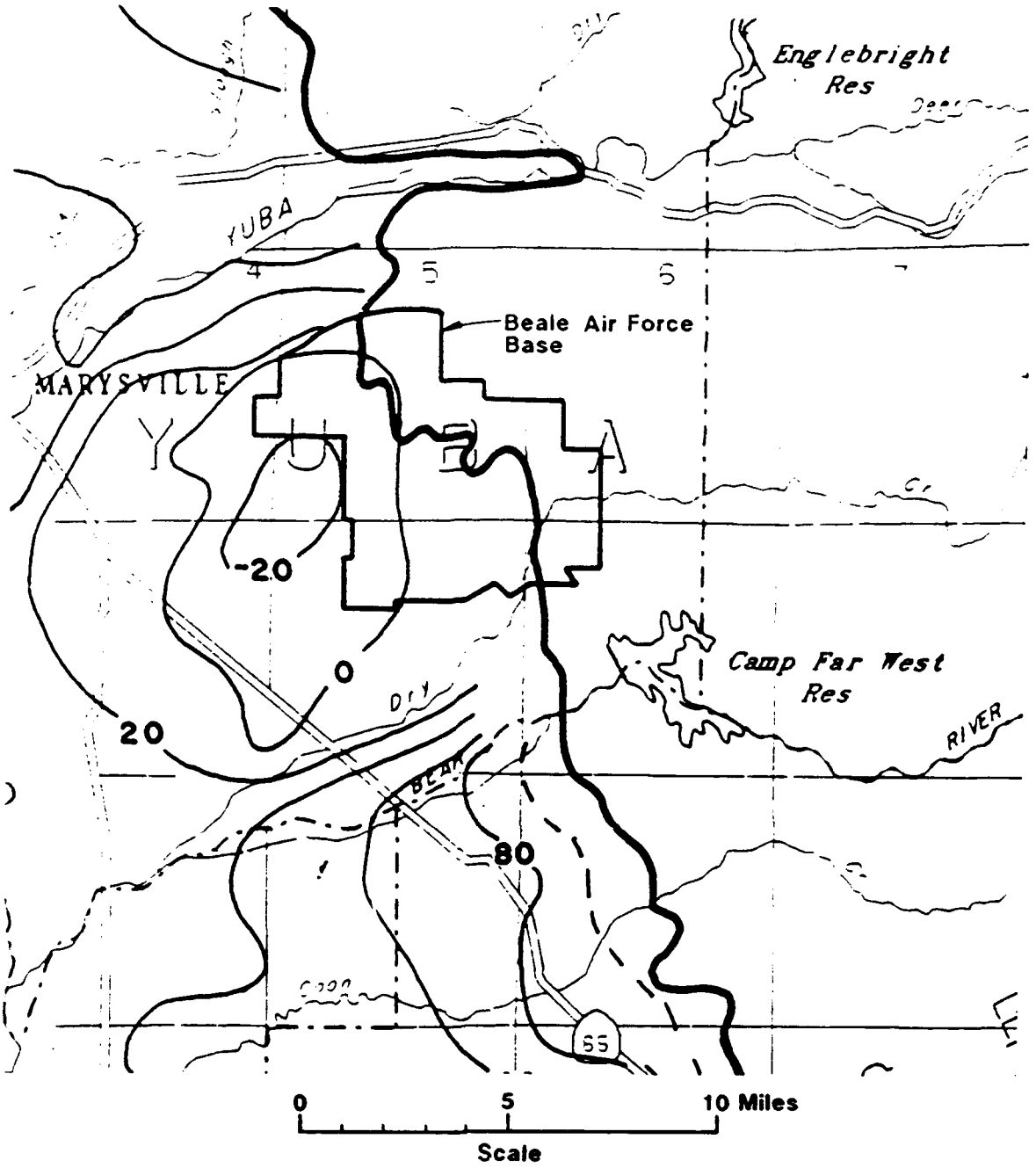


FIGURE 2-14
MAP OF BEALE AIR FORCE BASE AND VICINITY, CALIFORNIA SHOWING ALTITUDE OF WATER SURFACE IN THE UNCONFINED AQUIFER MARCH 1976

SOURCE: PAGE 1980

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Legend

20 — Groundwater Elevation Contour

Groundwater Basin Boundary From Bulletin 118-80

FIGURE 2-15
ELEVATION OF WATER IN WELLS, SPRING 1986

SOURCE: CALIFORNIA DWR, 1986

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water levels have actually begun to rise in response to increased precipitation during the early 1980s and decreased rice production (AeroVironment, 1987). In addition, the Brophy and South Yuba Water Districts constructed the Yuba-Goldfields Canal in 1984 and 1985. This canal delivers Yuba River water to about 20,000 acres of agricultural land west of Beale AFB, which has reduced the demand on groundwater for irrigation in the area.

Figure 2-16 presents a groundwater level hydrograph on data collected by the DWR between 1948 and 1986 from well 14N/05E-6B01, which is located near the center of the groundwater pumping depression west of the base. This figure shows that the water table in the well declined over 100 feet between 1948 and 1980. However, in recent years the water table has recovered nearly 40 feet.

A seasonal fluctuation in the groundwater level is also illustrated in Figure 2-16. This fluctuation varies from about 4 feet to as much as 20 feet in a year. Groundwater levels typically reach their lowest point in the fall, after the dry season and in response to the demands of irrigation pumping. The levels attain their highest point in spring, after the wet season and prior to the onset of agricultural pumping.

Figure 2-17 presents a groundwater level hydrograph on data collected by Beale AFB personnel between 1984 and 1989 in the deep monitoring well located at Site 2 between injection wells No. 2 and No. 3. This figure shows that the average annual groundwater level has risen about 20 feet during this time. Seasonal fluctuations have ranged from about 15 to 30 feet per year. Groundwater levels taken between April 1986 and May 1989 in monitoring wells installed during the Phase II, Stage 1 investigation show that water levels in wells located on the western edge of the base have risen as much as 20 feet (well 2-A-1) during this time.

Water levels were monitored quarterly in most Beale AFB monitoring wells as part of the Stage 2-1 investigation. Hydrographs of groundwater levels in monitoring wells are provided in Section IV. Appendix G provides a summary of groundwater level data collected during IRP Phase II, Stage 1 and Stage 2-1 investigations at Beale AFB. The hydrographs and data show that most wells on the western side of Beale AFB have shown a continual rise in groundwater levels between 1986 and the end of 1989. Where downturns occur, they appear to be temporary and seasonal. The

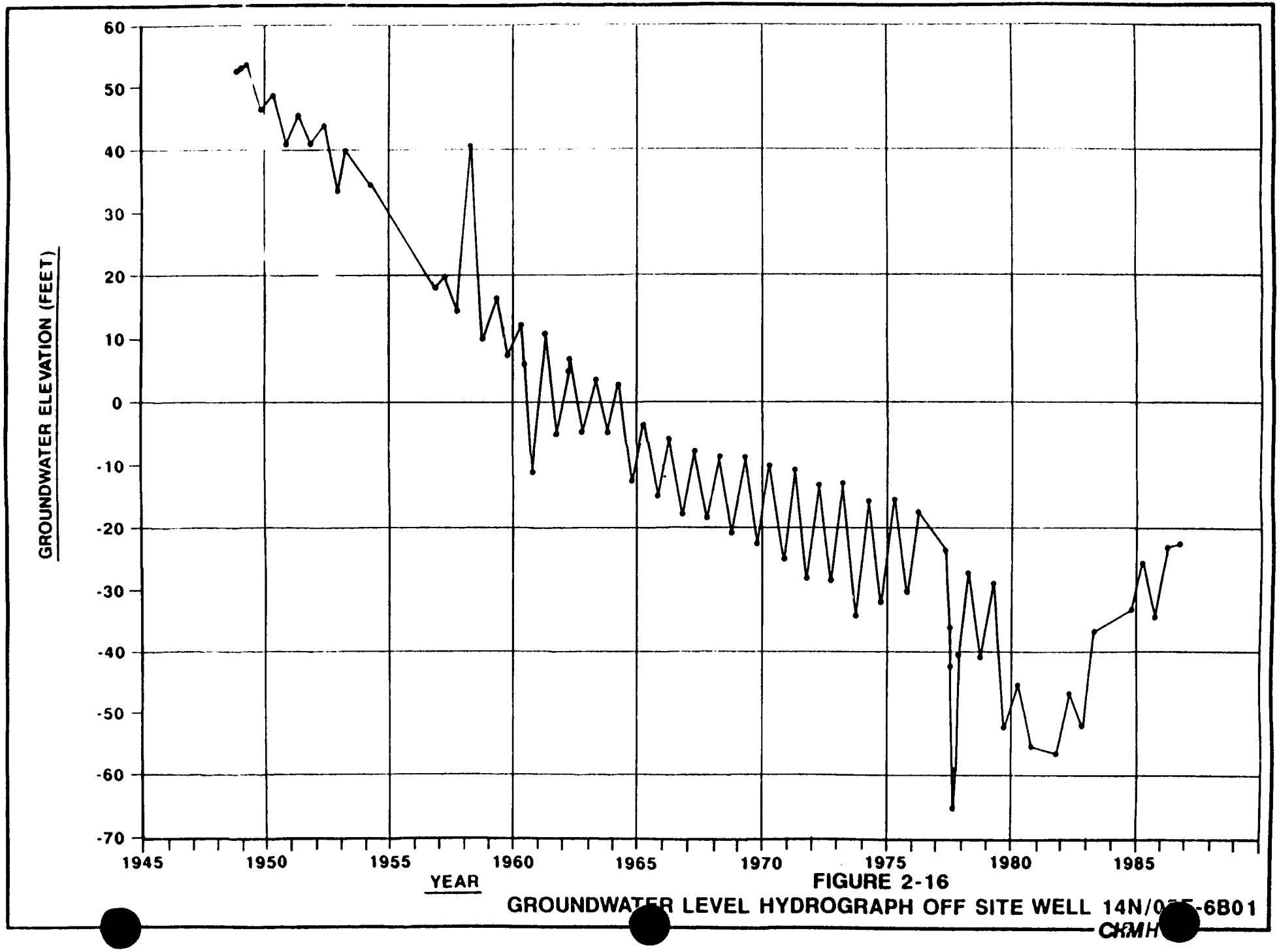


FIGURE 2-16

GROUNDWATER LEVEL HYDROGRAPH OFF SITE WELL 14N/0[illegible]-6B01

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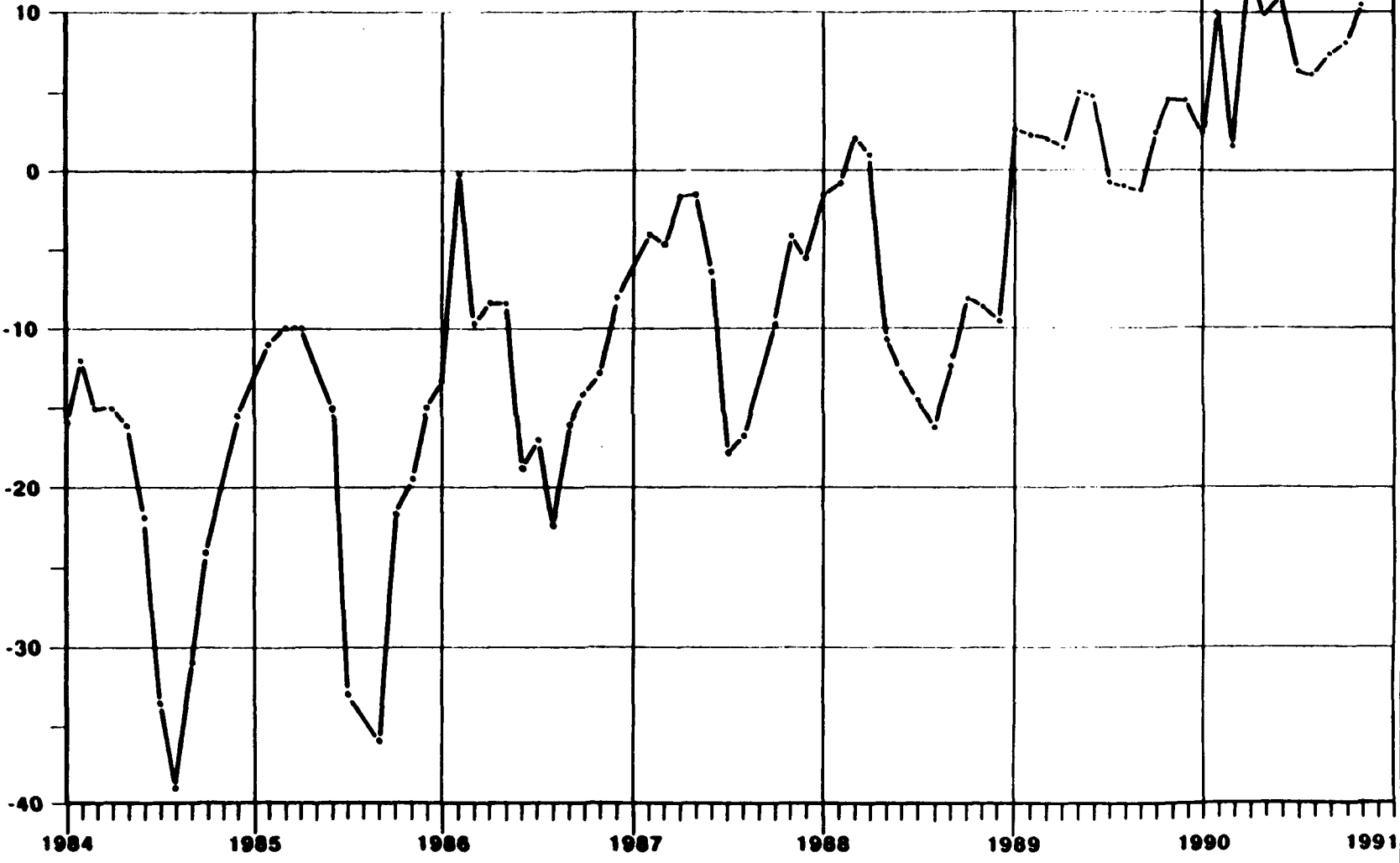


FIGURE 2-17
GROUNDWATER LEVEL HYDROGRAPH
INJECTION WELLS DEEP MONITORING WELL

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long-term rise in groundwater levels in Beale AFB monitoring wells appears to be part of the regional rise described above.

On the other hand, wells constructed on the eastern side of Beale AFB have shown relatively steady groundwater levels. Most of these wells lie along or east of the boundary at which the groundwater gradient increases (Plates 3 and 4). These include the background wells, and wells at Sites 3, 10, 16, 19, and 23. Wells at Sites 6 and 15 have also shown relatively steady levels, although the gradient does not appear to increase in this area. In the long term, as water levels rise in the vicinity of the groundwater depression west of Beale AFB, while remaining constant on the eastern half of the base, the groundwater gradient will decline. This will have the effect of reducing the groundwater flow velocity.

Aquifer tests were performed on new monitoring wells installed during the Stage 2-1 investigation at Beale AFB. A discussion of testing methodology and plots showing pump drawdown and recovery data are provided in Appendix E. A discussion of the results of the tests at each site may be found in Section IV. As described in Section IV and Appendix E, values of aquifer parameters derived from pumping tests should be regarded as estimates. Values of transmissivity derived from the tests ranged from 3.4 square feet per day to 26,000 square feet per day, while values of horizontal hydraulic conductivity ranged from 0.17 feet per day (6.0×10^{-5} cm/sec) to 630 feet per day (0.22 cm/sec). This variation reflects the heterogeneity of aquifer materials in which the monitoring wells are screened. Values derived for the storage coefficient ranged from 9.6×10^{-4} to 0.068, which reflects a variation from confined to unconfined aquifer conditions at Beale AFB.

Aquifer parameters derived during the 72-hour drawdown and 72-hour recovery test in pumping well 19-C-4 may be regarded as representative average values for the hydrogeological materials in the uppermost portion of the aquifer at Beale AFB. The average value for transmissivity obtained from this test was 1,700 square feet per day, while the average value of horizontal hydraulic conductivity was 28 feet per day (0.01 cm/sec).

Page (1980) estimated the transmissivity of the aquifer materials in which the Beale AFB production wells are screened by noting yields and assigning values to geologic materials described on drillers' logs. He arrived at an

average value of transmissivity of 12,000 square feet per day. He also estimated the storage coefficient to be 0.0003.

Plates 3 and 4 present groundwater level contours plotted on data collected from monitoring wells screened across the uppermost permeable zone at or near the surface of the water table throughout the base in March and November 1989. Figure 2-18 presents groundwater contours drawn on south Beale AFB wells in May 1989, while Figure 2-19 presents contours drawn on similar data for north Beale AFB wells. These contour plots all show that the groundwater gradient is steeper in geologic materials associated with the foothills of the Sierra Nevada on the east of the base. As groundwater enters the unconsolidated sediments of the Great Valley, the gradient lessens considerably. The gradient varies according to the permeability of the geologic materials and distance from the groundwater depression, from about 5 feet per 1,000 feet to about 30 feet per 1,000 feet, or 0.005 to 0.03.

The average linear velocity of groundwater flow may be estimated by the following form of Darcy's Law:

$$V = Ki/n$$

where:

V = Average linear velocity of groundwater flow (L/T)
K = Hydraulic conductivity (L/T)
i = Hydraulic gradient (L/L)
n = Effective transport porosity (dimensionless)

Using the average hydraulic conductivity derived from the 72-hour pump test of 28 feet per day, the measured hydraulic gradient of 0.005 in the unconsolidated sediments, and an estimated effective transport porosity of 0.20, the approximate average velocity of groundwater movement at Beale AFB is about 0.7 feet per day, or 260 feet per year.

2.3.1.2 Groundwater Quality

Groundwater quality parameters were measured in monitoring wells at Beale AFB during the Stage 2-1 Remedial Investigation. Results of these analyses and related quality control data are presented in Appendices A and F. The following discussion is primarily based on these results.

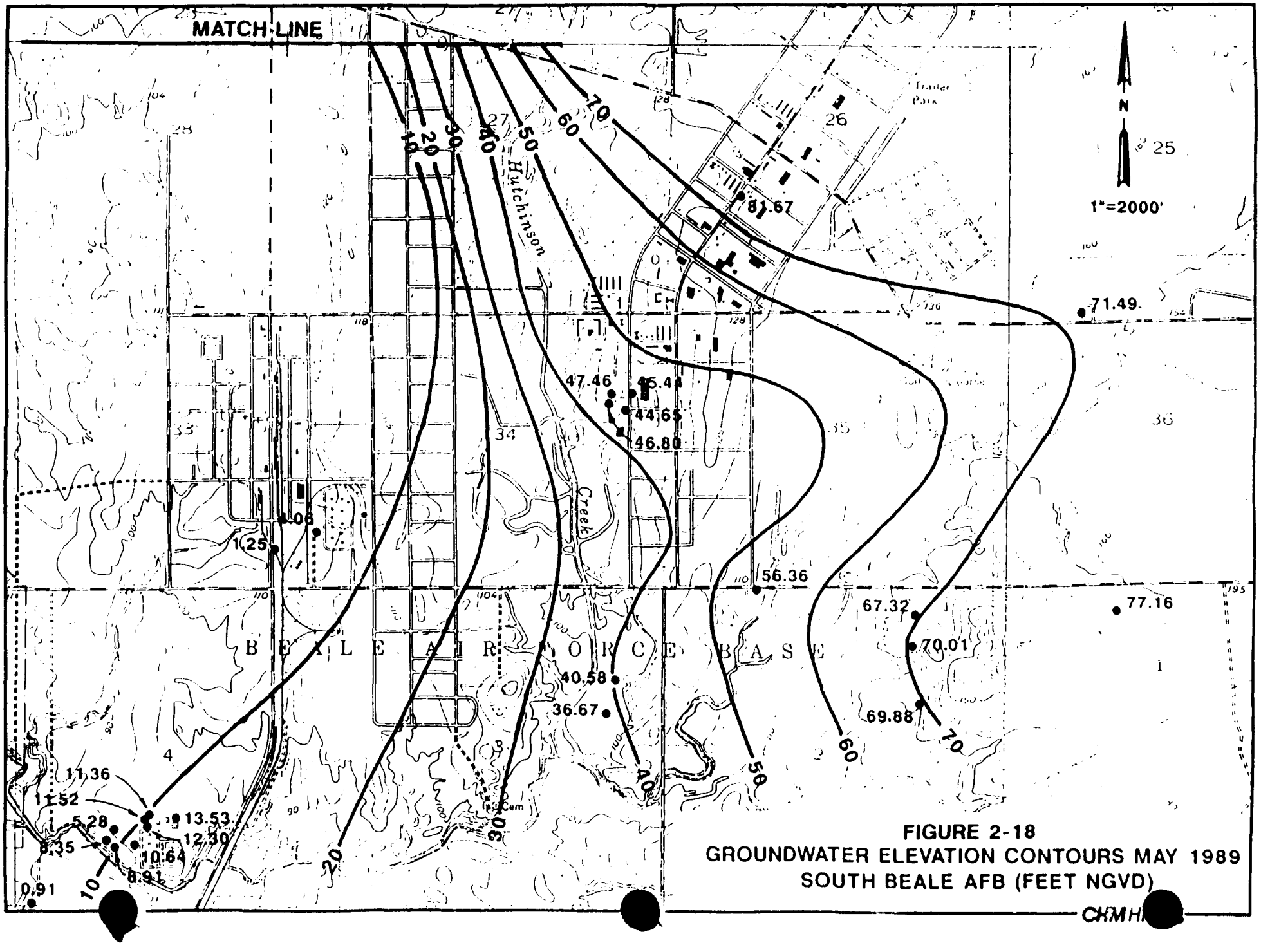


FIGURE 2-18
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGVD)

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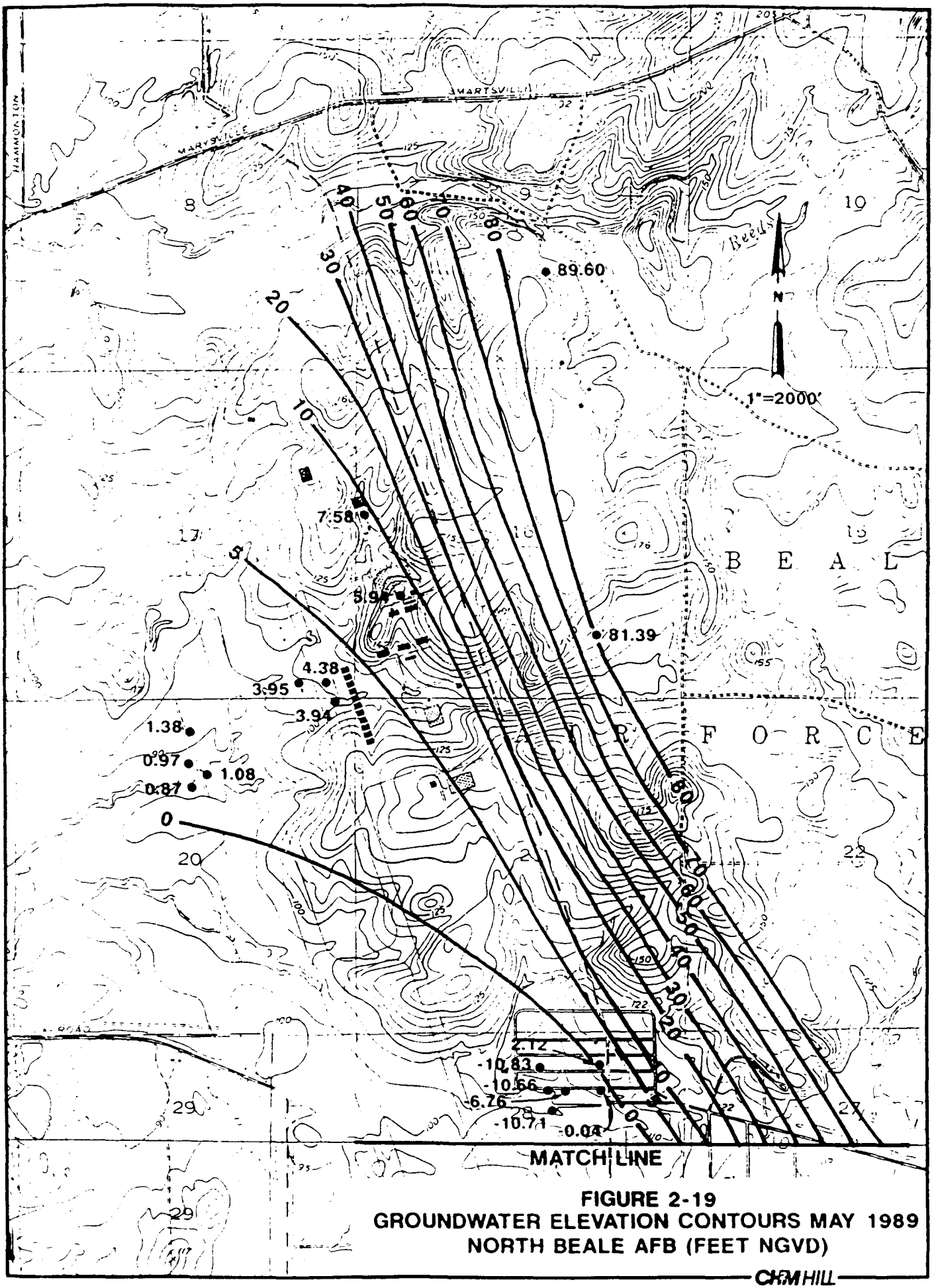


FIGURE 2-19
GROUNDWATER ELEVATION CONTOURS MAY 1989
NORTH BEALE AFB (FEET NGVD)

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Natural water quality at Beale AFB is generally good, with base water supply wells (Page, 1980) and most monitoring well samples meeting national primary and secondary drinking water standards. Groundwater has been contaminated at some IRP sites and is discussed later in this report. In the uppermost permeable saturated zone in which monitoring wells are screened, total dissolved solids (TDS) ranged from 160 to 360 mg/l in the first sampling round, below the secondary drinking water standard of 500 mg/l. Groundwater quality at Beale AFB is discussed below, addressing the northern, central, and southern areas of the base separately.

Groundwater in the northern part of the base in the vicinity of the flightline (Sites 1, 4, 5, 11, 21, and background well 1 located east of Doolittle Drive) is recharged in large part by infiltration from the Yuba River just north of the base boundary. This groundwater is low in TDS (161 to 233 mg/l compared to the secondary drinking water standard of 500 mg/l). Nitrate is generally less than 10 mg/l ranging from 3.4 to 12.5 mg/l (nitrate plus nitrite is expressed as nitrate in this report). These values are higher than those for pristine groundwater but lower than those for other areas at Beale AFB. They are well below the national primary drinking water standard of 45 mg/l as nitrate. Sulfate levels were low in the first sampling round, being under 9 mg/l except at Site 21 (30.8 mg/l) and at a Site 1 downgradient well (1-C-3) (23.4 mg/l). However, by the third sampling round sulfate had dropped to 9.3 mg/l in 21-C-1 and 8.0 mg/l in 1-C-3. These levels are all well below the 250 mg/l secondary drinking water standard. Chemical analyses from the first sampling round of representative wells in the northern part of Beale AFB are plotted on a Piper diagram (Figure 2-20). Groundwater type ranged from calcium-magnesium bicarbonate at background well 1 to sodium or sodium-calcium bicarbonate at the flightline. Groundwater at Sites 4, 5, and 11 all plotted close together on the Piper diagram. This indicates a similar recharge source for these wells, differing from background well 1, located 3,000 feet northeast of the flightline at a higher elevation.

Groundwater in the central part of Beale AFB (Sites 3, 18, 19, 23, and background well 2) is further from river recharge areas and may have a longer residence time, as suggested by the higher mineral content. In the first sampling round, the central area groundwater had higher TDS (260 to 385 mg/l) than in either the north or south areas. Nitrate was higher than the north area, possibly related to fertilizer or cattle grazing in the area or irrigation of the golf

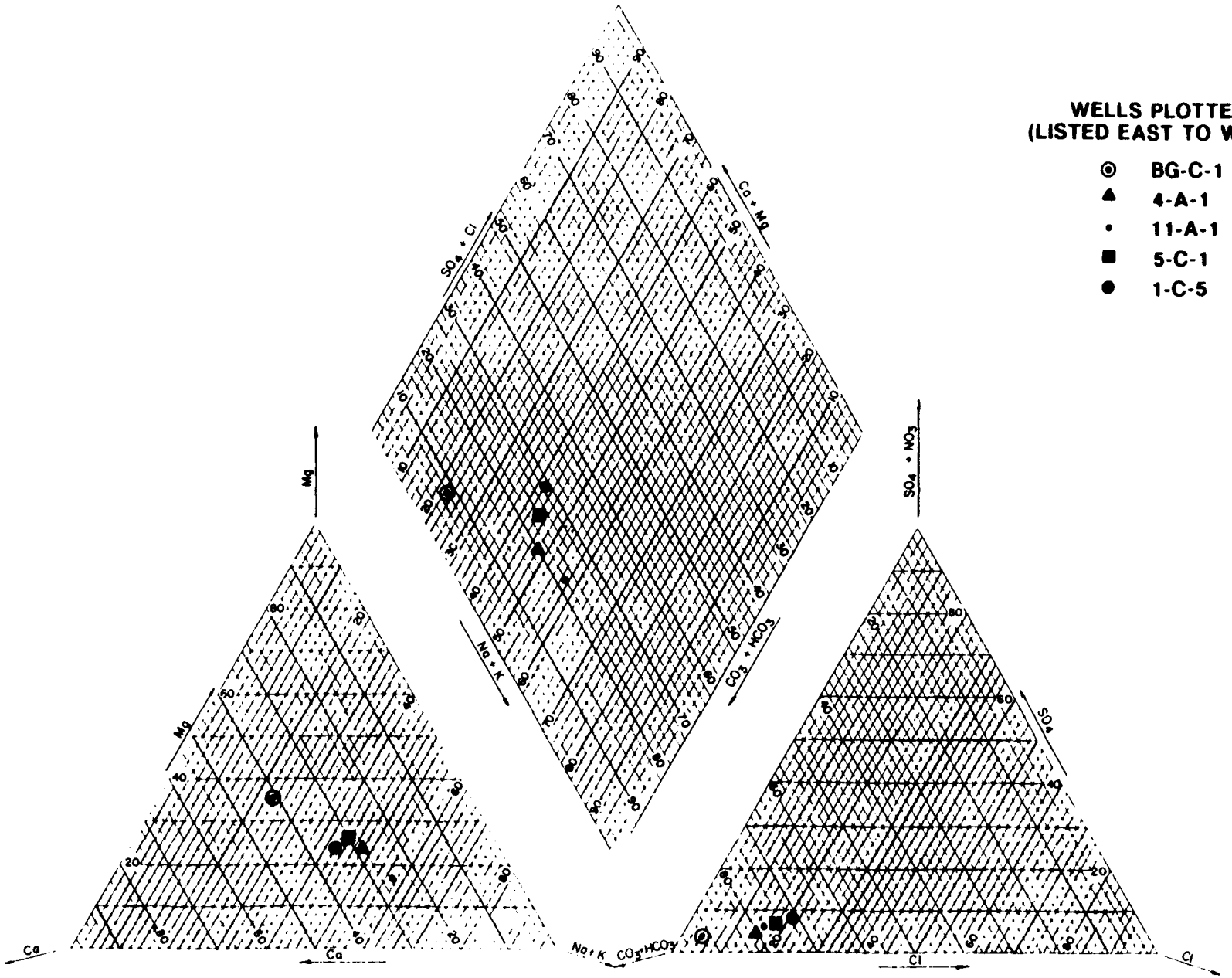


FIGURE 2-20
PIPER DIAGRAM OF GROUNDWATER QUALITY FOR THE NORTHERN PART OF BEALE AFB INCLUDING THE FLIGHTLINE AREA MARCH 1989

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course with grey water from the sewage treatment plant. Nitrate ranges from less than 10 mg/l at Sites 3 and 18, to 16.3 mg/l at background well 2, to 23.4 mg/l at Site 23. Sulfates ranged from under 10 mg/l in the western part of Site 3, to 10 to 15 mg/l in the eastern part of Site 3, to about 15 to 25 mg/l at Sites 19, 23 and background well 2, to 30 mg/l at Site 18. Sulfate levels increased in the third sampling round at Site 3 to 10 to 20 mg/l and at Site 18 to 43 to 65 mg/l. Chemical analyses from the first sampling round from representative wells in the central part of Beale AFB are plotted on a Piper diagram (Figure 2-21). Groundwater type varied in the central area, ranging from sodium bicarbonate at background well 2, to calcium bicarbonate at Site 23, to sodium-magnesium bicarbonate at Site 19, to sodium or sodium-chloride bicarbonate at Site 18. No significant pattern occurred on the Piper diagram except for an increase in chloride concentration moving east to west.

Groundwater in the southern part of Beale AFB (Sites 2, 6, 13, and 15) is recharged largely on base from infiltration from Dry Creek, Best Slough, and Hutchinson Creek; from precipitation east of the base; and to a lesser degree from the Bear River south of the base. In the first sampling round, TDS generally ranged from 192 to 292 mg/l except for anomalously high levels of 367 mg/l at a Site 6 downgradient well (6-A-1) and 435 mg/l at the background well at Site 2 (2-R-3). TDS levels were similar in later sampling rounds to TDS levels in the first round.

Nitrate was higher than in the north area, possibly related to fertilizer or cattle grazing in the area or irrigation of the golf course with grey water from the sewage treatment plant. Nitrate ranges from 5 to 12 mg/l at Site 15, from not detected to 17 mg/l at Site 6, and from 5 to 25 mg/l at Sites 2 and 13, near the sewage treatment plant. Sulfates range from 5 to 18 mg/l at Sites 15 and 6 except for the anomalously high value of 115 mg/l at downgradient well 6-A-2. At Sites 2 and 13, sulfate ranged from 11 to 48 mg/l except for the anomalously high 130 mg/l at background well 2-R-3. Nitrate and sulfate concentrations did not vary significantly in later sampling rounds.

Chemical analyses from representative wells in the southern part of Beale AFB are plotted on a Piper diagram (Figure 2-22). Groundwater type varied in the southern area, ranging from sodium and calcium-sodium bicarbonate at Site 15, to calcium-magnesium bicarbonate at Site 6, to mainly magnesium-calcium bicarbonate at Sites 2 and 13. No significant pattern or grouping of sites is apparent on the Piper

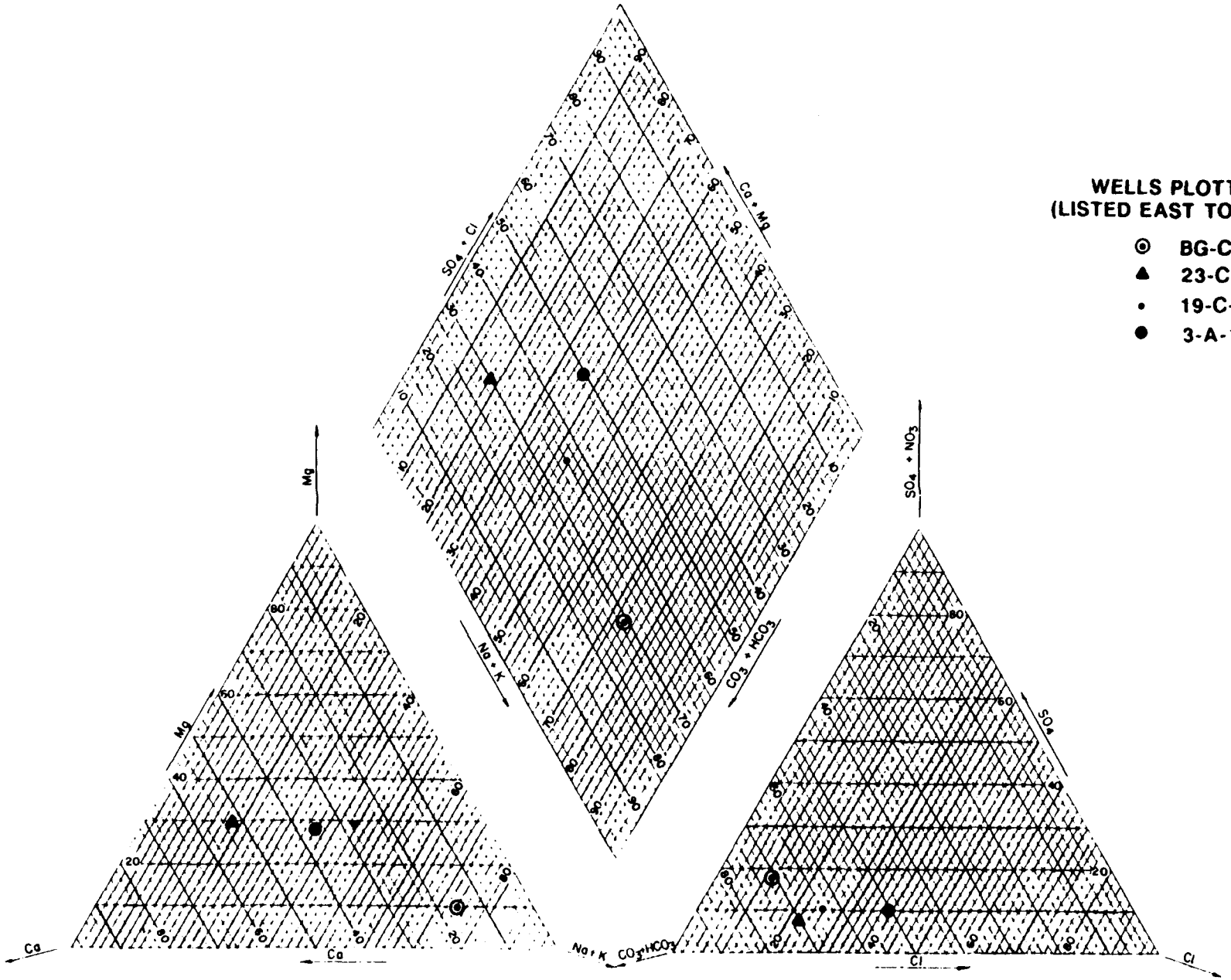


FIGURE 2-21
PIPER DIAGRAM OF GROUNDWATER QUALITY
FOR THE CENTRAL PART OF BEALE AFB MARCH 1989

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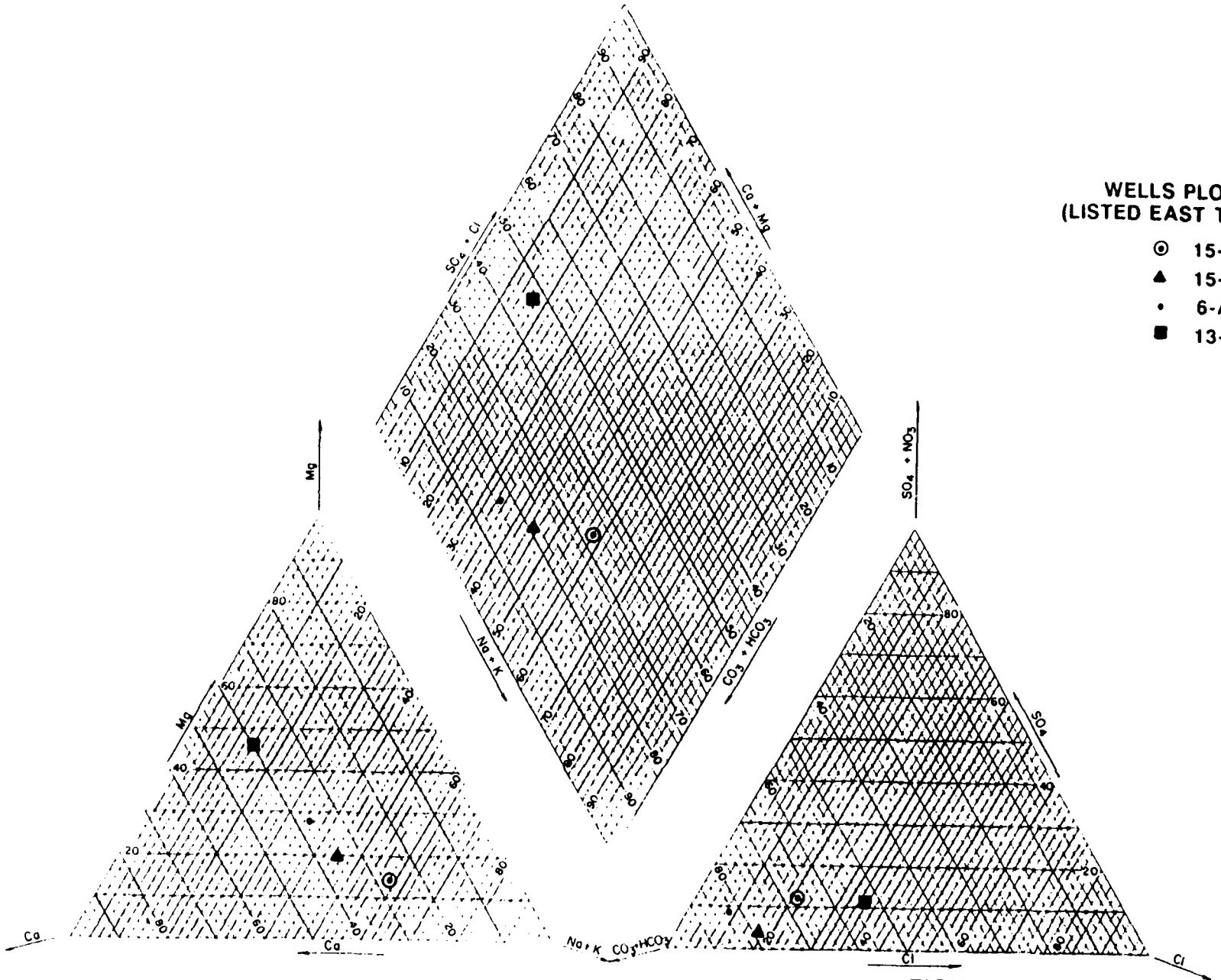


FIGURE 2-22
PIPER DIAGRAM OF GROUNDWATER QUALITY
FOR THE SOUTHERN PART OF BEALE AFB MAR 1989
CH2M Hill

diagram except that magnesium increased and sodium plus potassium decreased moving from east to west.

Water from supply wells at Beale AFB is generally of good chemical quality and did not have organic chemicals detected in it during the IRP Phase II, Stage 1 investigation (Page, 1980 and AeroVironment, 1987). However, water from six base water supply wells exceeded the national secondary drinking water standard for manganese of 0.05 mg/l in 1975. Dissolved manganese is objectionable in water because it affects taste, stains plumbing, and accumulates as deposits in distribution systems (Page, 1980). Manganese was also present in off base agricultural and water supply wells.

2.3.1.3 Groundwater Uses

Groundwater is pumped to supply the military needs of the Air Force and the domestic needs of base residents. Downgradient from Beale AFB, groundwater is used mainly as agricultural irrigation, and to a lesser extent to supply the domestic needs of rural residents between the base and the pumping depression. In 1978, the USGS canvassed the wells in an area bounded by the Yuba, Feather, and Bear Rivers and the Sierra Nevada foothills on the eastern border of Beale AFB (Rockwell, 1978). Of the 752 wells listed in that report, about 75 percent or 565 wells were described as irrigation wells. About 10 percent, or 77 wells, were described as domestic wells. The remainder included public supply (39 wells), institution (2 wells), industrial (6 wells), and stock (8 wells). Fifty-five wells were listed as "unused" (Rockwell, 1978). It should be noted that a large number of these wells are not directly downgradient from Beale AFB. In addition, since 1978 new wells have been constructed and old wells have probably been abandoned or used for different purposes.

2.3.1.4 Well and Pump Maintenance

A study of monitoring well and pump maintenance was not undertaken as part of the Stage 2-1 investigation. In addition, installation of pumps was not part of this investigation. However, during sampling of wells installed during the previous Phase II, Stage 1 investigation, corrosion was noted at the junction of the screen and the riser casing, particularly at Site 5. These wells were constructed with stainless steel well screen and mild steel riser casing. Apparently, the contact of these dissimilar metals is causing dielectric corrosion.

2.3.1.5 Well Inventory

The locations of Beale AFB monitoring wells are shown on Plate 2, while the locations of the Beale AFB production wells are shown on Figure 2-11. An inventory of wells in the vicinity of Beale AFB was performed by the U.S. Geological Survey (Rockwell, 1978) and discussed above in Section 2.3.1.3. Wells in the vicinity of Beale AFB were plotted by Engineering Science (1984) as shown on Figure 2-23. An update of the well inventory was not conducted as part of the Stage 2-1 investigation. A discussion of construction details of monitoring wells installed during Stage 2-1 is provided in Section 3.5. Construction details of wells installed during Phase II, Stage 1 is available in AeroVironment (1987). Details of wells installed at the Photo Wastewater Treatment Plant (Site 2) are available in Radian (1985).

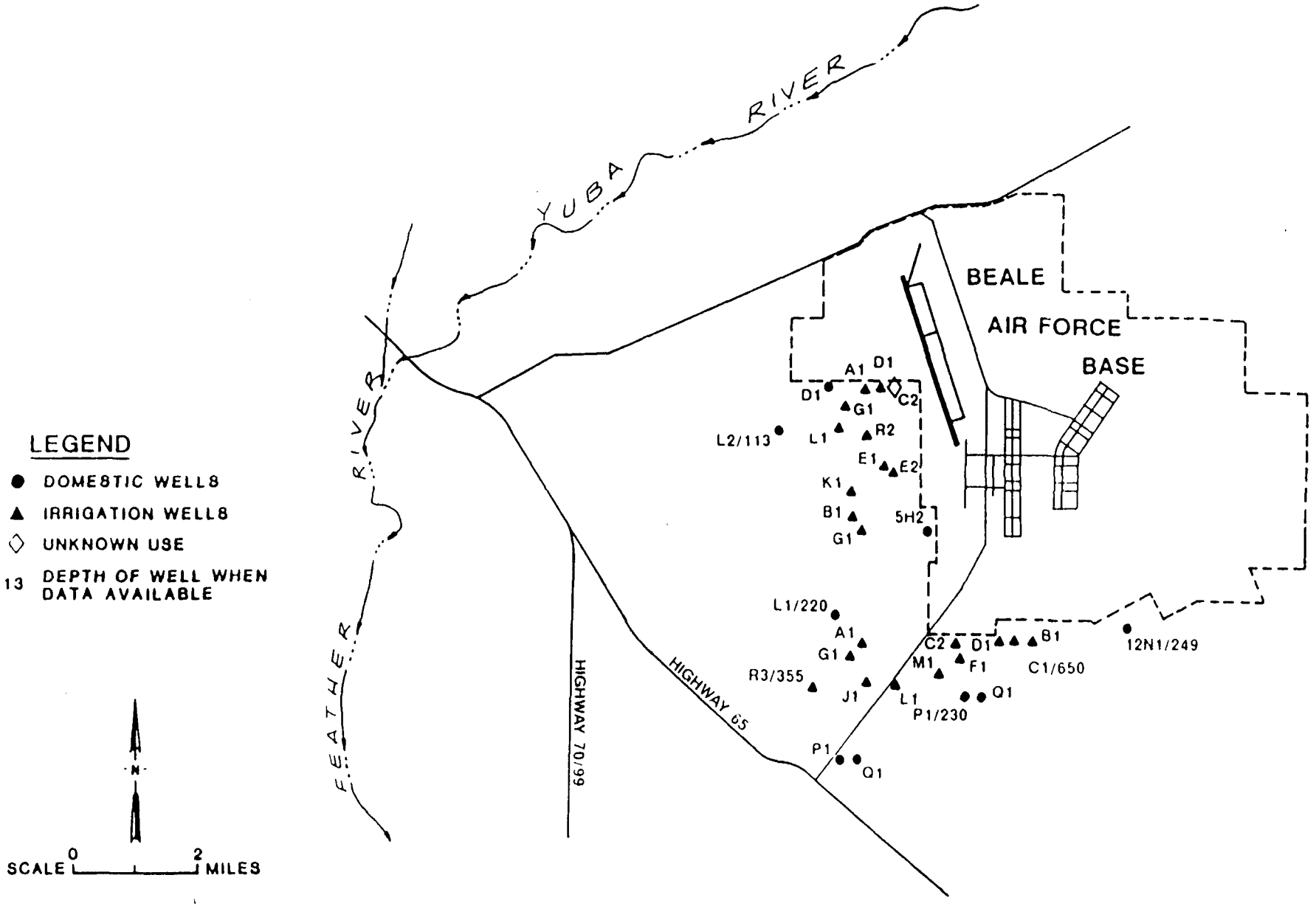
Groundwater levels are being monitored on a quarterly basis during the Stage 2-1 investigation. Appendix G contains data on groundwater levels in monitoring wells at Beale AFB. This appendix includes information on surveyed well head and ground surface elevations, depth-to-water and groundwater elevation data, and the screened intervals and total depths of each well. Soil boring logs kept for Stage 2-1 wells are available in Appendix D. Geophysical logging was not performed on any of the wells, nor were dedicated pumps installed.

2.3.2 SURFACE WATER

2.3.2.1 Occurrence and Flow

Surface water in the Sacramento Valley drains predominantly north to south and is eventually discharged westward, through the Carquinez Straits to the San Pablo Bay, San Francisco Bay, and the Pacific Ocean. The primary river within this drainage system is the Sacramento River.

At Beale AFB, drainage flows primarily from northeast to southwest, reflecting the surface topography in the area. The drainage comprises three main creeks and their tributaries: Dry Creek, Hutchinson Creek and Reeds Creek. Figure 2-24 illustrates the regional drainage in the vicinity of Beale AFB. Figure 2-25 shows the drainage on the base itself.



SOURCE: ENGINEERING - SCIENCE, 1984

FIGURE 2-23
LOCATIONS OF AREA WELLS

CH2M HILL

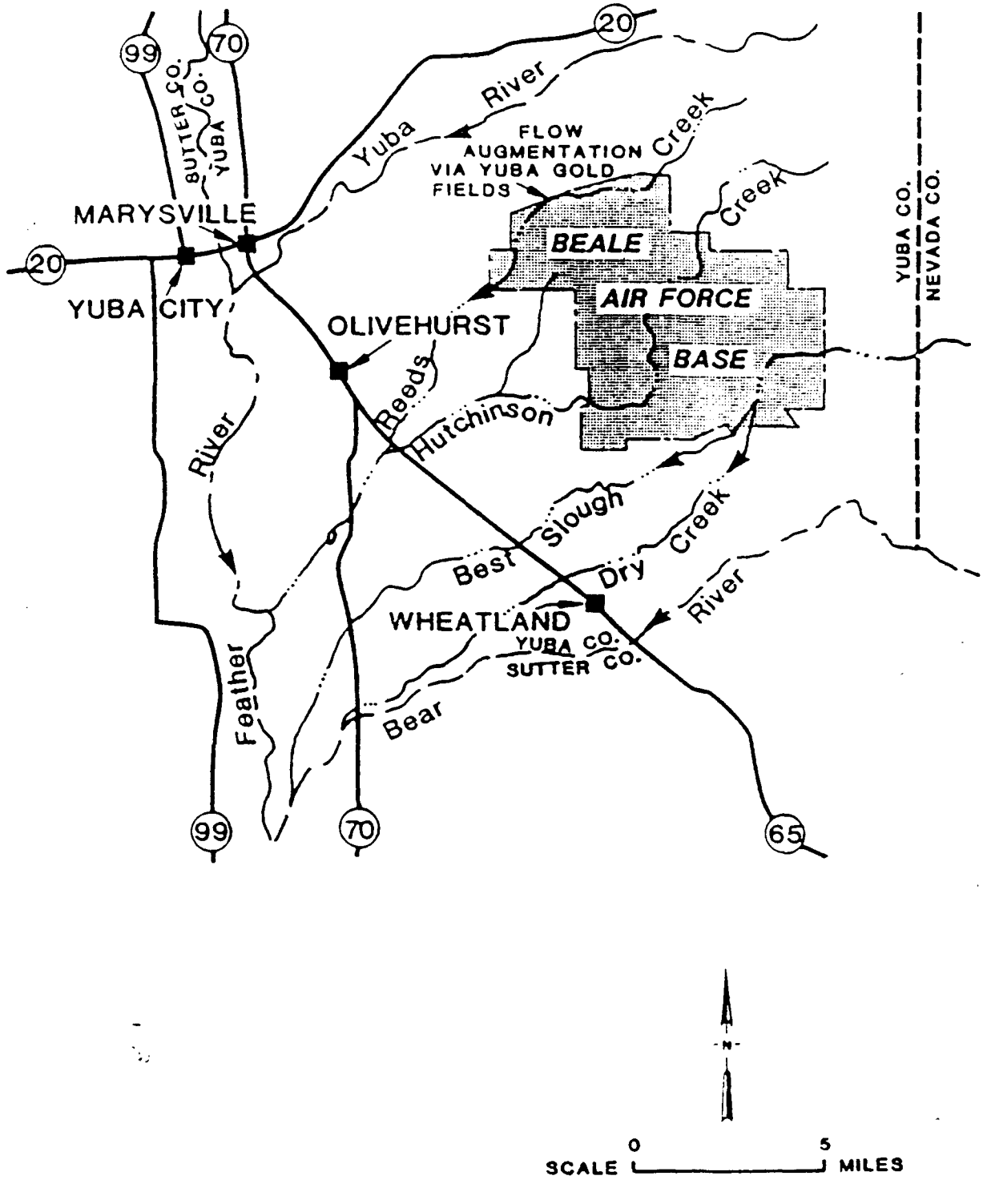
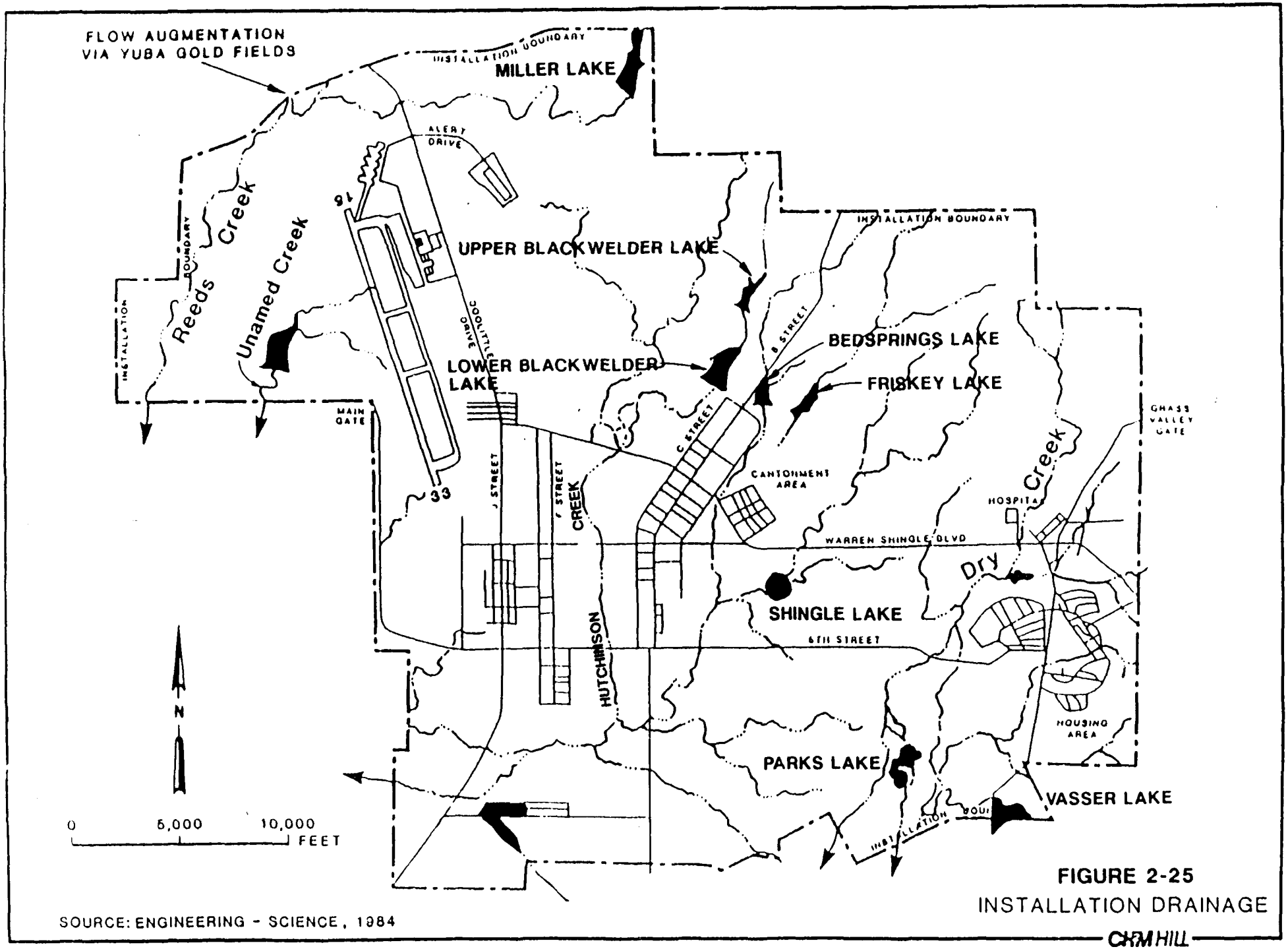


FIGURE 2-24
REGIONAL DRAINAGE

SOURCE: ENGINEERING - SCIENCE , 1984

CH2MHILL



SOURCE: ENGINEERING - SCIENCE, 1984

FIGURE 2-25
INSTALLATION DRAINAGE

CH2M HILL

Much of the runoff is conducted by numerous seasonal drainages--of the three main creeks, only Dry Creek in the southeast of the base normally flows all year. Because of the presence of locally impermeable clay substrates in the soil profile, vernal pools form over much of the base after winter rains. These pools and most of the creeks dry up in the summer. All of the creeks may provide recharge to the groundwater along certain reaches when they are flowing. Flows are not gaged in any of the streams at Beale AFB.

Dry Creek rises in the foothills about 10 miles east of Beale AFB and bifurcates into Dry Creek and Best Slough prior to leaving the base. Parks Lake and Vasser Lake are part of this system. In prehistoric times Dry Creek probably flowed into Hutchinson Creek (Raven et al, 1987). Today this drainage flows to the Bear River about 10 miles southwest of the base.

The cantonment area of the base is drained by Hutchinson Creek and its tributaries. Although this is the largest surface drainage system on the base itself, Hutchinson Creek flow is intermittent. Upper and Lower Blackwelder Lakes, Bedsprings Lake, Frisky Lake, and Shingle Lake are all part of this system.

Reeds Creek flows west along the northern base boundary from Miller Lake. Flows in Reeds Creek have been augmented at the northern base boundary from groundwater pumping discharges associated with dewatering of old hydraulic mine tailings being reworked by Yuba Gold Fields, Inc. along the Yuba River. The water from the gravel dewatering has been discharged to a canal that flows toward Reeds Creek at the base boundary. Opening and closing canal flap gates results in controlled releases of the canal flows to Reeds Creek. This flow augmentation scheme has been arranged by the Brophy Water District. Reeds Creek and Hutchinson Creek converge about 5 miles southwest of the base prior to flowing into Plumas Lake. The creek flows from this lake into the Feather River.

In addition to these main drainages, an unnamed creek east of Reeds Creek flows southwestward through Site 1, converging with Hutchinson Creek approximately 2 miles west of the base. This creek receives drainage from the flightline area and is known locally as the West Drainage Ditch where it flows through Site 1.

The Yuba River north of the base and the Bear River south of the base are tributaries to the Feather River. The Feather River flows south and converges with the Sacramento River at the Sutter County-Yolo County border.

2.3.2.2 Surface Water Quality

Water quality parameters were measured in surface water samples at Beale AFB (Figure 2-25) in the first quarterly sampling round of the Stage 2-1 Remedial Investigation. Results of these analyses and related quality control data are presented in Appendices A and F. The following discussion is primarily based on these results.

At the direction of the Air Force, upgradient surface water at Beale AFB was not sampled. Surface water was sampled at a tributary to Hutchinson Creek at Site 19, from a different tributary to Hutchinson Creek downstream from Site 6 and from Hutchinson Creek downstream of Site 13. Surface water was sampled at, and downstream, from Site 1.

TDS varied from 69 to 169 mg/l in the Hutchinson Creek samples. Surface water type varied in Hutchinson Creek ranging from sodium-calcium bicarbonate at Site 19, to magnesium-calcium bicarbonate at Site 6, to sodium-magnesium bicarbonate at Sites 13. Surface water at the west side drainage ditch (Site 1) had TDS of 157 mg/l and was a calcium-sodium bicarbonate type.

2.4 AIR QUALITY

2.4.1 AMBIENT QUALITY

Air quality in the Beale AFB area (Yuba County) is generally good. Yuba County is classified nonattainment for the ozone standard, primarily due to long-range transport of pollutants from large metropolitan areas such as Sacramento and San Francisco. Until recently Tehama County was considered "unclassified" for total suspended particulates (TSP) because of the high level of natural fugitive dust. The area is now classified to be in attainment of the federal TSP standards, but is not in attainment of the state standards for particulate matter less than 10 microns in aerodynamic diameter (PM 10).

Agricultural burning, which occurs primarily in the fall, contributes to local visibility problems. Otherwise, there have been no serious air quality issues in the Yuba County area (McBride, 1987).

2.4.2 POLLUTION CHARACTERIZATION

Both ambient air quality and pollution characterization are assessed in terms of the EPA Classification for Yuba County:

- Nonattainment for PM10 and ozone
- Attainment for oxides of sulfur (SOx), oxides of nitrogen (NOx), and carbon monoxide (CO)

The Yuba County Air Pollution Control District oversees point sources that generate in excess of 25 tons of pollutants per year. Beale AFB, with its maintenance operations and power generation boilers, represents one of these point sources. Sources of area emissions include burning of agricultural wastes and application of pesticides and herbicides. The other major emission source category is mobile source emissions from motor vehicles and aircraft.

2.5 NATURAL RESOURCES

2.5.1 MINERAL RESOURCES

Beale AFB has no known mineral resources currently worthy of exploitation. However, the Yuba gold fields, north of the west side of the base, are presently mined.

2.5.2 ENVIRONMENTAL RESOURCES

Beale AFB has 1,000 acres classified as oak woodland dominated by the blue oak and digger pine with an understory of annual grasses. Fish and wildlife management account for 18,250 acres and include grazing leases which total 12,200 acres. The lease areas are open to hunting and fishing by authorized persons during regularly designated seasons.

A biological survey conducted by the U.S. Department of Agriculture in 1985 indicated that 8,579 acres of wetlands exist on Beale AFB. These wetlands are protected as a unique, valuable resource. They include 7,853 acres of vernal pools, 418 acres of riparian marshes, 98 acres of man-made ponds and reservoirs, and 210 acres of riparian forest (USDA, 1985b).

The saddle club area is 375 acres in size and is adjacent to a state-managed wildlife area which has several miles of trails available for horseback riding. Five picnic areas and one 2-mile nature trail are maintained (Beale AFB, 1986).

2.5.3 OTHER

Beale AFB has eucalyptus groves which are harvested for firewood. Several remnant European olive orchards exist within the base cantonment area. These orchards were established over 20 years ago and produce a variety of olive no longer in commercial demand (Beale AFB, 1986).

2.6 CULTURAL RESOURCES

2.6.1 ARCHAEOLOGY

Fourteen known archaeological sites have been confirmed at Beale AFB (Wirth Environmental Services, 1987). These sites include bedrock milling stations (grinding stones) and chipping stations associated with the Nisenan/Maidu Indians, and remnants of historical structures, roads, and mining sites associated with 19th and 20th century homesteads, farmsteads, and mining operations.

2.6.2 HUMAN RESOURCES

Information on human resources in the area, other than the archaeological and historical sites discussed, is not currently available.

2.6.3 HISTORICAL

Documentary research has identified historical activity at 108 locations on Beale AFB (Wirth Environmental Services, 1987). The majority of these are historical structures, roads, and mining sites associated with 19th and 20th Century homesteads, farmsteads, and mining operations. Immigrants to California in the early 1840s and 1850s were often attracted by the promise of gold. They traveled across the Sierras through Donner Pass and into the Sacramento Valley on their way to the Yuba gold fields north of Beale AFB. The last few miles of trail passed through what is now Beale AFB. Faint remains of this trail can still be found and traced through the grasslands of Beale. Settlement along creeks and rivers in and around Beale occurred as the influx of the '49ers increased. By late 1850, almost every ravine, gully, creek bed, and river along the western edge of the Sierras was being worked by miners. There is still evidence of excavations and mine shafts scattered about the rolling hills and flatlands of Beale. The legacy of the gold fields still remains at Beale where 200,000 tons of material from the Yuba River gold dredge piles were used as a base for streets during World War II.

Another historical site of interest is the World War II prisoner of war camp constructed when the base was known as Camp Beale. Approximately 3,000 German prisoners were held in the camp during the war. Today, remnants of the camps and other war-related activities include foundations from the cantonment area, the POW camp, machine gun emplacements, an infiltration course, and tank traps.

2.7 BIOLOGY AND ECOLOGY

2.7.1 COMMUNITIES AND HABITATS

Vegetation on Beale AFB is predominantly annual grasslands, grading into valley and foothill woodland in the eastern portion of the base. Hutchinson Creek, Dry Creek, and Reeds Creek flow through the base. Riparian vegetation occurs along these water courses and around lakes on the base.

The annual grasslands plant community is characterized by a sparse to dense mixture of herbaceous species, dominated by non-native annual grasses and forbs. Native perennial grasses have been reduced significantly in areas now leased for cropland and cattle grazing. Dominant grasses include Bromus spp., Avena spp., Elymus spp., and Festuca spp. Annual grasslands are typically found on flat or rolling terrain or on slopes not exceeding 15 percent. Woody vegetation is extremely sparse.

A unique plant community exists in low-lying topographic depressions that form vernal pools in the wet season when they fill with water. Characterized by a shallow cemented sediment, the soils have adapted to ephemeral wet conditions. In spring, characteristic concentric rings of blooming wildflowers signal a vernal pool plant community.

The valley and foothill woodland community, or Blue Oak Savanna, is dominated by the blue oak (Quercus douglasii), with an understory of non-native grasses and forbs. This community is typified by scattered oaks on rolling hills. A scattering of shrubs is also present.

Riparian vegetation along creeks and lakes is characterized by dense stands of oaks (Quercus spp.), ash (Fraxinus spp.), willows (Salix spp.), poplar and cottonwood (Populus spp.), elderberry (Sambucus spp.), and buckeye (Aesculus spp.). There is also an assortment of mint, rushes, and sedges.

Seven lakes on base property support a viable warm water fishery. Crappie (Pomoxis spp.), bass (Micropterus spp.), bluegill (Lepomis macrochirus), red ear sunfish (Lepomis microlophus), channel catfish (Ictalurus punctatus), and bullhead (Ictalurus spp) are found in all lakes, which experience heavy fishing pressure from base personnel.

The Dry Creek-Best Slough drainage also supports a warm water fishery. Dry Creek is perhaps more important for its fall/ winter run of chinook salmon (Oncorhynchus tshawytscha). Beale AFB recently constructed a fish ladder on Dry Creek near the southeast base boundary to enhance salmon migration.

The vegetative communities support a variety of wildlife species. Annual grasslands and vernal pools provide habitat for the California vole (Microtus californicus), the black-tailed jack rabbit (Lepus californicus) the Valley pocket gopher (Thomomys bottae), the badger (Taxidea tasus), the coyote (Canis latrans), the western meadowlark (Sturnella neglecta), and the horned lark (Eremophila alpesstris). During the wet season, vernal pools attract surface feeding waterfowl such as mallard (Anas platyrynchus), pintail (Anas acuda), and green-winged teal (Anas carolinensis), along with shorebirds such as killdeer (Charadrius vocifera), black-necked stilt (Himantopus mexicanus), and longbilled curlew (Numenius americanus). A large wintering and year-round, resident population of predatory birds also inhabits these plant communities. Species include the northern harrier kestrel (Falco spp.), the short-eared owl (Asio flammeus), the burrowing owl (Speotyto cunicularia), the red-tailed hawk (Buteo jamaicensis), ferruginous hawk (Buteo regalis), barn owl (Tyto alba), great-horned owl (Bubo virginianus), and turkey vulture (Cathartes aura).

The woodlands are also inhabited by the aforementioned species. In addition, these areas support densities of non-game birds including (by common name) woodpeckers, sparrows, flickers, starlings, western fly catchers, and robins.

Lakes, ponds, and streams support a variety of wintering waterfowl such as Canada geese (Branta canadensis), whistling swan (Olor columbianus), cinnamon teal (Anas cyanoptera), widgeon (Mareca americanus), merganzers (Mergus spp.), western grebe (Aechmosphorus occidentalis), and ruddy duck (Oxyora jamaicensis). These areas also support populations of herons and egrets (by common name), and provide spring nesting on some sites.

Tall grass areas and drainages support a variety of upland game birds including quail (Lophortyx spp.), wild turkey (Meleagris gallopava), mourning dove (Zenaidura macroura), and ring-necked pheasant (Phasianus colchicus). These areas also provide habitat for an assortment of game and nongame mammals, including black-tailed deer (Odocoileus hemionus), skunk (Mephitis spp.), raccoon (Procyon lotor), tree squirrels (Sciurus spp.), ground squirrels (Citellus spp.), mink (Mustela vison), river otter (Lutra canadensis), muskrat (Ondatra zibethica), beaver (Castor canadensis), rabbits (Sylvilagus spp.), and bobcat (Lynx rufus).

2.7.2 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally sensitive areas on Beale AFB include any habitat or foraging areas suitable for the endangered species discussed in the following subsection. Further, the acreages designated wetlands and vernal pools on the base would be considered environmentally sensitive areas.

2.7.3 ENDANGERED SPECIES

The California Natural Diversity Data Base reports that no endangered or threatened plant or animal species inhabit Beale AFB (Engineering-Science, 1984). The bald eagle (Haliaeetus leucocephalus) and the peregrine falcon (Falco peregrinus) use the base for winter and spring foraging, but there are no known nesting locations. Since two species of endangered raptors occur on the base on a seasonal basis, the base natural resources manager has initiated a routine raptor survey to document occurrences.

The Aleutian Canada goose (Branta canadensis leucophareia) has been sighted within a 50-mile radius of the base and has the potential to occur on base in the winter. At the publication of the Natural Resources Conservation report for Beale Air Force Base in 1985, there had been no recorded observations. However, base personnel continue to monitor for Canadian goose presence and coordinate with state and federal agencies.

Habitat suitable for a newly listed endangered species, the valley elderberry long horn beetle (Desmocerus californicus dimorphus), potentially exists in riparian and wetlands areas of the base. The U.S. Fish and Wildlife Service has expanded the range of the beetle north of the Marysville area and surveys are continuing (Kohl, 1989).

2.7.4 ECONOMIC SPECIES

Economic species at Beale AFB include both domestic agricultural species and fish and wildlife species. The Beale Range Management Plan established more than 14,000 acres of grazing and croplands on the base (Beale AFB, 1986). Cattle and horses are the predominant grazing animals.

Wildlife species available for hunting include deer, rabbits, doves, quail, pheasant, turkey, tree squirrel, and jack rabbit. Lakes are populated with bass, crappie, bluegill, sunfish, catfish, and bullhead. In addition, Dry Creek has been stocked with Chinook salmon.

2.8 CLIMATOLOGY/METEOROLOGY

The climate of Beale AFB, and the Central Valley is generally described as "interior" Mediterranean. Typical features of this climate are warm to hot, dry, cloudless summers and cool, wet winters.

Another characteristic common to the Central Valley is the frequent occurrence of temperature inversions, both at the surface and aloft. These inversions, most prevalent during periods of high pressure domination, tend to prevent the air below them from dispersing vertically, resulting in air stagnation and higher pollutant concentrations. During the winter months, strong inversions at or near the surface often contribute to the formation of ground, or "tule" fog. This fog usually forms at night and dissipates by midday, but sometimes these fogs persist for several days, filling the entire Sacramento Valley to a thickness of several hundred feet. During the months of November through February, for example, an average of 64 days with visibility less than 7 miles is reported at Beale AFB. Despite these occasional periods of fog, the area has an abundance of sunshine with an average of about 235 clear days a year in the valley.

2.8.1 PRECIPITATION

Annual precipitation fluctuates widely in California, with drought conditions followed by heavy rainfall years, and vice versa. In the valley, the mean annual rainfall ranges from about 18 to 25 inches. In the foothills and mountains, the mean annual rainfall increases rapidly from about 25 inches to more than 80 inches. The mean annual precipitation rate for the Beale AFB area is 23.1 inches, based on data from 1960 to 1985. Table 2-7 contains a summary of precipitation data for Beale AFB.

Table 2-7
PRECIPITATION SUMMARY

Yearly	Precipitation (inches, 1960-1985) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean 23.1	4.1	3.4	3.1	1.8	0.4	0.2	0.1	0.1	0.4	1.5	4.1	3.2
Minimum 8.3	0.4	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Maximum 38.5	9.5	10.3	6.9	5.9	1.2	1.4	1.9	1.0	2.3	11.0	8.9	7.8
24-Hr. Maximum 3.5	2.9	3.5	2.5	2.2	1.1	0.7	1.8	0.4	2.0	5.5	3.2	2.1

Almost 95 percent of the rainfall at Beale AFB occurs during the period from October to April, when large-scale fronts progress inland from the Pacific Ocean. Snowfall at Beale AFB is rare and is more prevalent in the higher elevations to the east. During the summer months, precipitation at Beale AFB is virtually nonexistent, but convective thunderstorms periodically cause rain showers in the mountains to the east. The month with maximum precipitation is January, with an average of 4.1 inches. July and August, the driest months, both record averages of 0.1 inches.

Although a 5.5-inch, 24-hour rainfall occurred in October 1962, the USAF Technical Applications Center estimated the more typical 1-year, 24-hour rainfall event for Beale AFB would be 3.5 inches or less. This value may be used as an indicator of runoff and erosion and suggests moderate erosion and runoff potential. As shown in Table 2-7, 95 percent of the rainfall occurs during a 7-month wet season from October through April. During this period, rainstorms of moderate intensities occur frequently. Significant runoff occurs due to low permeability soils. However, the relatively low relief results in low to moderate erosion potential for most of the base.

2.8.2 TEMPERATURE

Mean winter temperatures (December through February) are in the upper-40s (degrees Fahrenheit), with typical daily lows near 40 and daily highs in the 50s. Winter extremes range from the 20s to near 80 degrees. The influence of the Pacific Ocean during the winter usually prevents severe cold episodes at Beale AFB. Mean summer temperatures (June through September) are in the 70s, with typical daily lows near 60 and daily highs in the 90s. Summer extremes range

from the high 40s to well over 100 degrees. An average of 17 days exceed 100 degrees each year. During spring and fall, mean temperatures are in the 50s and 60s, but can vary between winter- and summer-like patterns. Table 2-8 contains a summary of temperature data from Beale AFB.

Table 2-8
TEMPERATURE SUMMARY

	Temperature (°F, 1959-1981)											
Yearly	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean 62	46	51	54	58	67	74	79	77	74	64	53	45
Minimum 20	22	27	26	33	38	44	52	49	42	36	29	20
Maximum 114	77	79	86	90	102	111	114	111	109	101	85	75

Source: Beale Air Force Base Installation Restoration Program Reports (Engineering Science, 1984; AeroVironment, 1987)

2.8.3 WIND

Wind direction, wind speed/velocity, seasonal variability, and evapotranspiration rates are discussed in the following sections.

2.8.3.1 Direction

The prevailing wind direction at Beale AFB is southerly. Winds generated either by approaching fronts or summertime heating in the valley typically enter the Sacramento Valley through the Carquinez Straits. Due to the geography of the valley, the westerly wind is deflected northward where it continues on to Beale AFB. In the summer, this wind brings cooler marine air. In the winter, however, this wind often is associated with a front bringing rain.

A secondary wind direction at Beale AFB is north-northwesterly. This wind is usually produced by a strong ridge of high pressure located off the coast of northern

California. In the summer, this situation usually means very hot temperatures, as the ocean breeze is stifled. In the winter, this wind can become quite strong, and it usually means dry, clear, and cold conditions.

2.8.3.2 Wind Speed/Velocity

Overall, the winds at Beale AFB are generally light and average 4 miles per hour. The winds are strongest in the spring months and gentlest in fall.

2.8.3.3 Seasonal Variability

Table 2-9 contains a monthly listing of predominant wind directions and average wind speeds. The only month with a predominant wind direction other than southerly (or south-southeasterly) is December, with a predominant north-northwesterly wind direction.

Table 2-9
MONTHLY WIND SPEEDS AND DIRECTIONS
12/75-11/85

Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind Speed	4	5	5	5	5	5	4	4	4	3	4	4
Wind Direction	SSE	SSE	SSE	SSE	S	S	S	S	S	S	SSE	NNW

Source: AWS Climatic Brief, USAF Technical Applications Center. February, 1986.

2.8.4 EVAPOTRANSPIRATION

Specific data on evapotranspiration rates in the area are not available at this time. The annual evapotranspiration rate reported for the area is 66.5 inches and the average annual rainfall is 23 inches (Engineering Science, 1984). Ninety-five percent of all rainfall occurs during winter and spring months when evapotranspiration is relatively low.

November, December, January, and February are the only months with a net increase in soil moisture. Only about 11 inches of moisture infiltrate during this period before moisture begins to be removed during the dry season (Taylor, 1986).

III. FIELD INVESTIGATION PROGRAM

3.1 ORGANIZATION AND DEVELOPMENT OF THE FIELD PROGRAM

As discussed in Section 1 of this report, Phase I - Records Search and Phase II, Stage 1 - Confirmation and Quantification Study have previously been completed for Beale AFB. As a result of these studies, it was determined that additional investigations would be required to further define the nature and extent of contaminants at various sites within the base.

Development of this remedial investigation program (Stage 2-1) was initiated in September 1987, when the Air Force issued a delivery order to develop workplans for the remedial investigation (Contract F33615-85-D-4535, Delivery Order No. 0005). Draft workplans, including a Quality Assurance Project Plan (QAPP) and Site Safety Plan (SSP), were developed by CH2M HILL and delivered to USAFOEHL in January 1988.

After review and modifications by the Air Force, draft final versions of the plans were prepared and released in May 1988 to regulatory agencies for review and comment. Final versions of the plans were prepared as the first task of the RI delivery order (Delivery Order 0010 of the same contract) and were distributed in October 1988.

When the first draft versions of the plans were prepared, Stage 2 activities were to include remedial investigation (RI), feasibility study (FS), and risk assessment activities. As initial cost estimates were developed for the Stage 2 effort, the Air Force determined that insufficient funds were available in the current annual budget to accomplish all aspects of the project at once. For that reason, the Air Force modified the plans to include only RI activities and deferred planned activities at three of the 24 IRP sites. This modified program was termed Stage 2-1. Risk assessments, feasibility studies, and additional site investigations will be included in future activities, as necessary.

3.1.1 REMEDIAL INVESTIGATION

The RI program comprising Stage 2-1 includes activities at 19 sites, with sampling and analysis of 16 sites, geophysical investigation of 4 sites, and records search

activities for one site. Background sampling of groundwater, not directly associated with any particular site, was also included in the program.

In addition to the RI objectives of the IRP, several of the sites were also subject to State of California requirements under the Toxic Pits Cleanup Act (TPCA) and the Calderon Bill. Residual materials within the Photo Wastewater Treatment Plant (Site 2), the Fire Protection Training Area (Site 3) overflow basin, and the Sanitary Wastewater Treatment Plant Grease Pit (Site 20) required characterization to determine if they contain hazardous wastes and are, therefore, subject to TPCA.

The Photo Wastewater Emergency Holding Basin (Site 19) had already been declared by the Regional Water Quality Control Board to be subject to TPCA due to hazardous wastes present in the basin. The IRP site investigation included activities to support a hydrogeologic assessment of the site and the generation of a Hydrogeologic Assessment Report, as required by TPCA.

The three known landfills on base (Sites 6, 13, 15) were all subject to the Calderon Bill and, therefore, a Solid Waste Assessment Test (SWAT) was required for each site. Activities needed to meet the SWAT requirements were included in the IRP investigations at each site.

CH2M HILL has prepared the state-mandated reports in support of TPCA and Calderon as separate documents. These reports are not included in this IRP RI report. However, results from investigative activities in compliance with the state requirements also supported the remedial investigations at applicable sites and are therefore discussed as part of this report.

The level of remedial investigation conducted during Stage 2-1 at each site was dependent upon results of previous investigations, California regulatory requirements, and data requirements to support future feasibility studies. In most cases where contaminants were known to exist, additional sampling was conducted to confirm previous results, evaluate changes since the time of the last study, more accurately determine the nature of the contamination, and make a first estimate of the extent of the contamination. It was recognized that Stage 2-1 activities could not fully determine the extent of all contaminants in all media at all sites, primarily because of limited funds and USAF contracting constraints.

Remedial action activities accomplished at each of the IRP sites under Stage 2-1 are detailed in the Stage 2-1 Workplan (CH2M HILL, 1988a), the Stage 2-1 QAPP (CH2M HILL, 1988b), and the USAF Delivery Order No. 0010. The Delivery Order is included in Appendix B. Table 3.1.1-1 is a brief summary of RI activities, by site, completed during Stage 2-1. The number of sampling points and sample analyses, by site, is discussed in subsequent sections.

3.1.2 RISK ASSESSMENT

No risk assessment activities were completed as part of Stage 2-1 activities. Risk assessments will be conducted, as necessary, in future IRP stages.

3.1.3 FEASIBILITY STUDIES

No feasibility study activities were completed as part of Stage 2-1 activities. Feasibility studies will be conducted, as necessary, in future IRP stages.

3.2 DATA QUALITY OBJECTIVES

The EPA, in the March 1987 document Data Quality Objectives for Remedial Response Activities: Volume 1 - Development Process, defines data quality objectives as follows:

> Data quality objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support Agency decisions during remedial response activities. DQOs are determined based on the end uses of the data to be collected.
>
> DQOs are established prior to data collection and are not considered a separate deliverable. Rather, the DQO development process is integrated with the project planning process, and the results are incorporated into the sampling and analysis (S&A) plan, quality assurance project plan (QAPP) and, in general terms, into the work plan for the site. The DQO process results in a well thought out sampling and analysis plan which details the chosen sampling and analysis option and statements of the confidence in decisions made during the remedial process. Confidence statements are possible through the application of statistical techniques to the data (EPA, 1987a).

Table 3.1.1-1
SUMMARY OF ACTIVITIES
FOR STAGE 2-1 REMEDIAL INVESTIGATION

	Site	Activities
1.	West Drainage Ditch	Sample and analyze culvert discharge and surface water in five locations quarterly. Drill five new monitoring wells. Sample and analyze new wells plus one existing well quarterly. Sample and analyze ditch sediments at 12 locations.
2.	Photo Wastewater Treatment Plant, Injection Wells, and Sludge Ponds	Drill one new monitoring well. Sample and analyze new well plus five existing wells quarterly. Drill two 50-foot angled borings at sludge ponds. Sample and analyze five samples from each. Drill two 50-foot borings at injection wells 1 and 3, and one 25-foot boring at injection well 2. Sample and analyze five samples from each. Drill one 50-foot boring at injection well 2. Sample and analyze eight samples from this boring. Drill one background boring. Sample and analyze six samples from this boring. Sample and analyze sludge pond sediment at six locations. Sample and analyze eight surface soil locations.
3.	Fire Protection Training Area	Drill one new monitoring well. Sample and analyze one new well and five existing wells semi-annually. Drill four 50-foot borings, two at the underground tanks and two angle borings under FPTA No. 2. Sample and analyze six samples from each.

Table 3.1.1-1 (Continued)

Site		Activities
		Drill four 20-foot borings at FPTA 1. Sample and analyze five samples from each.
		Drill one 50-foot angled boring at the overflow basin. Sample and analyze five samples from this boring.
		Drill one 50-foot background boring. Sample and analyze six samples from this boring.
		Sample and analyze sediment in overflow pond at three locations.
4.	Battery Shop Dry Well	Sample and analyze existing well semiannually.
		Drill one 50-foot angle boring, then sample and analyze five samples from this boring.
5.	SR-71 Shelter Drainage Area	Sample and analyze runoff from shelter area at two locations.
		Drill one new monitoring well.
		Sample and analyze new well and one existing well semiannually.
		Drill three 50-foot borings. Sample and analyze six samples each.
		Drill one 50-foot background boring. Sample and analyze six samples for this boring.
		Sample and analyze surface soil at five locations.
6.	Landfill No. 2	Sample and analyze one surface water location in Hutchinson Creek quarterly.
		Drill one new monitoring well.
		Sample and analyze the one new well and two existing wells quarterly.

Table 3.1.1-1 (Continued)

Site		Activities
		Drill four 60-foot angled borings. Sample and analyze six samples from each. Drill one 50-foot background boring. Sample and analyze three samples from this boring.
7.	Army Biological Production Area	Prepare a No Further Action Decision Document to reflect determination of no further action.
8.	J-57 Test Cell	No site investigation during Stage 2-1 activities.
9.	Entomology Building 2560	Drill one 20-foot boring. Sample and analyze five samples from this boring.
10.	J-58 Test Cell	No site investigation during Stage 2-1 activities.
11.	Aircraft Ground Equipment Maintenance Area	Sample and analyze one existing well semiannually. Drill three 10-foot borings. Sample and analyze two samples from each.
12.	Entomology Building 440	Prepare a No Further Action Decision Document to reflect determination of no further action.
13.	Landfill No. 1	Sample and analyze surface water in Hutchinson Creek at one location quarterly. Drill six new monitoring wells. Sample and analyze new wells and two existing wells quarterly. One new was sampled only in the third and fourth rounds. Drill four 60-foot angled borings. Sample and analyze six samples from each. Drill one 50-foot background boring. Sample and analyze five samples from this boring.

Table 3.1.1-1 (Continued)

Site		Activities
14.	Transformer Drainage Pit	No site investigation during Stage 2-1 activities.
15.	Landfill No. 3	Sample and analyze four existing monitoring wells. Drill four 60-foot angled borings. Sample and analyze six samples from each. Drill one 50-foot background boring. Sample and analyze five samples from this boring. Conduct emissions screening over middle acre of landfill. Install five landfill vapor monitoring wells. Sample and analyze vapors from one well. Monitor remaining four wells with OVA. Conduct a 24-hour, downwind ambient air test. Collect and analyze air sample.
16.	Explosive Ordnance Disposal Area	Drill one new monitoring well. Sample and analyze new well quarterly. Sample and analyze surface soil at three locations in pit. Conduct geophysical survey to determine whether other trenches exist.
17.	Best Slough	Conduct geophysical survey to determine whether buried drums are present.
18.	Bulk Fuel Storage Facility	Drill two new monitoring wells. Sample and analyze new wells semiannually. Drill three 10-foot borings. Sample and analyze three samples from each. Sample and analyze surface soil at 33 locations.

Table 3.1.1-1 (Continued)

Site	Activities
	Sample and analyze ditch sediment at three locations.
19. Photo Waste Emergency Holding Basin	Sample and analyze surface water at one location quarterly.
	Drill two new monitoring wells west of holding basin and one new background monitoring well east of holding basin.
	Sample and analyze three new wells quarterly.
	Drill one new pumping well and sample it in the second, third, and fourth sampling rounds.
	Drill two 50-foot angled borings. Sample and analyze five samples from each.
	Drill one 50-foot background boring. Sample and analyze five samples from this boring.
	Sample and analyze six surface soil samples from three locations.
	Conduct a 72-hour aquifer test.
20. Grease Pit	Drill one 50-foot angled boring. Sample and analyze five samples from this boring.
	Sample and analyze soil sediment at three locations.
	Conduct geophysical survey to determine whether other pits exist between wastewater treatment plant and Landfill No. 1.
21. JP-7 Aboveground Fuel Storage Tanks (Flightline)	Drill one new monitoring well.
	Sample and analyze new well semi-annually.
	Sample and analyze surface soil at five locations.

Table 3.1.1-1 (Continued)

Site	Activities
22. Abandoned Underground Storage Tanks	Prepare an underground storage tank (UST) base map and review all available drawings of construction to update suspected tank locations. Determine a representative area on base with approximately 10 percent of suspected tank locations for future investigation. Conduct geophysical survey to locate suspected tanks.
23. Ninth Transportation Refueling/Maintenance Shop	Drill one new monitoring well. Sample and analyze new well in the first and fourth sampling rounds. Drill four 20-foot borings. Sample and analyze five samples from each.
24. Landfill No. 4	Determine location, dimensions, and operating history by conducting a records search of documents provided by base officials.
25. Installation Background Sampling	Drill two new monitoring wells. Sample and analyze new wells quarterly. Background soil borings were drilled at Sites 2, 3, 5, 6, 13, and 15 as noted above. Samples were taken and analyzed in each boring.

EPA has described a three-stage process for DQO development. These stages are shown in Figure 3.2-1. All of these components were accomplished during the development of the project work plan (CH2M HILL, 1988a) and QAPP (CH2M HILL, 1988b). Figure 3.2-2 lists these components of the DQO process and corresponding sections in the work plan or QAPP where items are addressed.

3.2.1 IDENTIFICATION OF DATA USERS

The first step in the DQO process is to identify and involve data users. EPA divides data users into primary and secondary categories. Primary data users are defined as "those individuals involved in the ongoing RI/FS activities. These activities include RI/FS planning and implementation, project management and oversight, site-specific decision making, and DQO development" (EPA, 1987a). Primary data users typically include site owners, federal or state lead agencies, and contractor personnel.

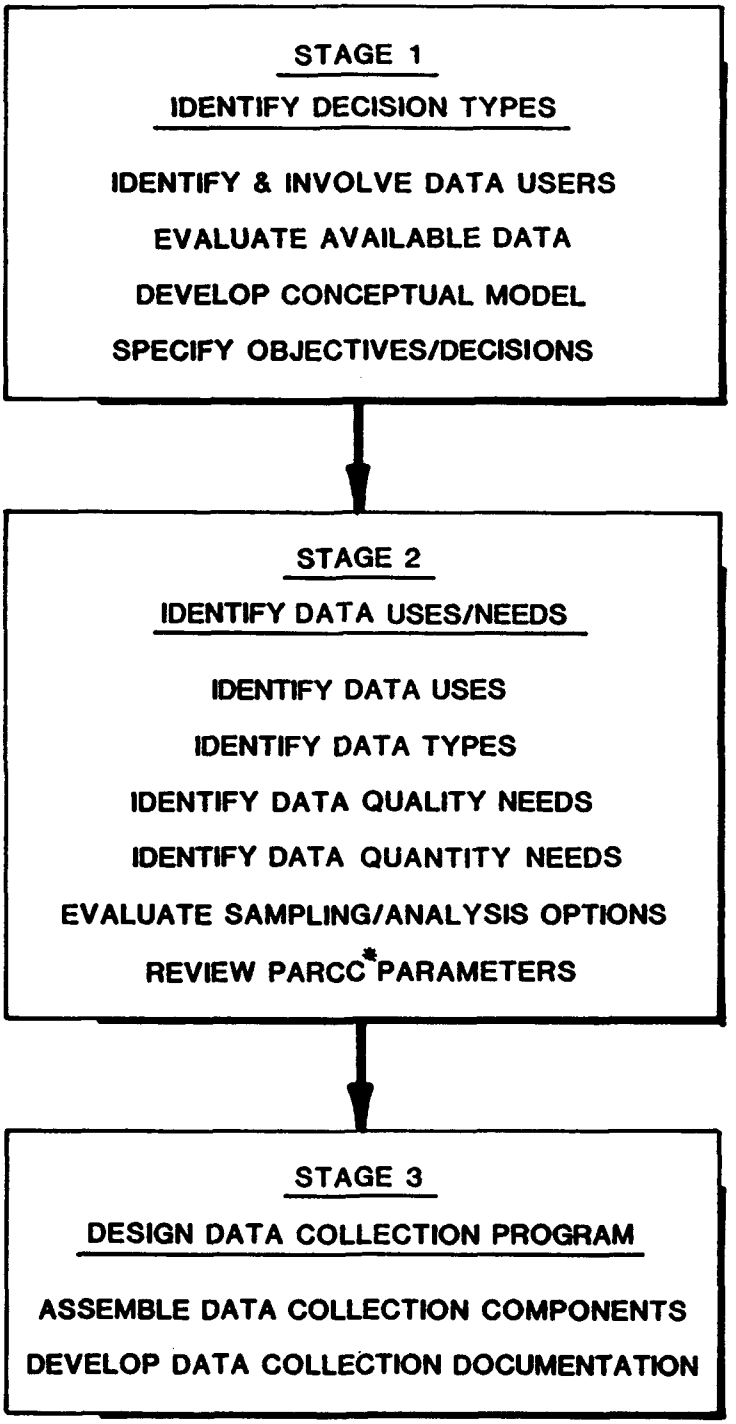
EPA describes secondary data users as those who "rely on RI/FS outputs to support their activities. Secondary data users provide input to the decision maker and primary data users by communicating generic or site specific data needs. Depending on project lead, secondary data users may include the state, enforcement personnel, the Agency for Toxic Substances and Disease Control (ATSDR), U.S. Army Corps of Engineers, and others. The level of involvement of secondary data users will vary according to site-specific requirements, program lead, or Agency policy" (EPA, 1987a).

Primary and secondary data users for this project are listed below. Only one contact at each organization is listed. It is the responsibility of these contacts to distribute data to other personnel within their organization.

PRIMARY USERS

USAFHSD

Sam A. Taffinder
Technical Program Manager
HSD/YAQI
Brooks AFB, TX 78235-5501
512/537-5501



* PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, COMPARABILITY

FIGURE 3.2-1

DQO THREE-STAGE PROCESS

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DQO COMPONENTS	APPLICABLE LOCATIONS
STAGE 1	
IDENTIFY DECISION TYPES	
IDENTIFY & INVOLVE DATA USERS	WORK PLAN – SECTION 1.2.2
EVALUATE AVAILABLE DATA	WORK PLAN SECTIONS 2 & 3
DEVELOP CONCEPTUAL MODEL	WORK PLAN – SECTION 2.2
SPECIFY OBJECTIVES/DECISIONS	WORK PLAN – SECTION 4.4 QAPP – SECTION 1.4
STAGE 2	
IDENTIFY DATA USES/NEEDS	
IDENTIFY DATA USES	WORK PLAN – SECTION 4.4
IDENTIFY DATA TYPES	
IDENTIFY DATA QUALITY NEEDS	
IDENTIFY DATA QUANTITY NEEDS	
EVALUATE SAMPLING/ANALYSIS OPTIONS	
REVIEW PARCC* PARAMETERS	WORK PLAN – SECTION 4.4 QAPP – SECTION 1.4
STAGE 3	
DESIGN DATA COLLECTION PROGRAM	
ASSEMBLE DATA COLLECTION COMPONENTS	WORK PLAN – SECTIONS 5 & 7
DEVELOP DATA COLLECTION DOCUMENTATION	QAPP (VARIOUS SECTIONS)

* PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, COMPARABILITY

FIGURE 3.2-2
LOCATION OF DQO COMPONENTS
WITHIN THE WORK PLAN AND QAPP

USAF Major Command	Bill Buchans/Wanda Schroeder Environmental Engineer HQ SAC/DEVC Offutt AFB, NE 68113-5001 402/294-4061
Beale AFB	Kirk Schmalz Environmental Engineer 9CSG/DEEV Beale AFB, CA 95903 916/634-4485
California Regional Water Quality Control Board	Mike Mosbacher Area Representative Regional Water Quality Control Board 3443 Routier Road Sacramento, CA 95827-3098 916/361-5682
California Department of Health Services	Gordon Stephens Hazardous Materials Specialist Department of Health Services Northern California Section Toxic Substance Control Division 10151 Croydon Way Sacramento, CA 95827 916/855-7871
CH2M HILL (Contractor)	Rob Pexton Hydrogeologist CH2M HILL 3840 Rosin Court, Suite 110 Sacramento, CA 95834 916/920-0300

SECONDARY USERS

U.S. Environmental Protection Agency	Dick Procunier U.S. Environmental Protection Agency 215 Fremont Street, T-4-6 San Francisco, CA 94105

County Health Department	John J. Krug Director Yuba County Health Department 938 14th Street Marysville, CA 95901 916/741-6251
Beale AFB Public Affairs	Capt. Antonio Ronquillo 9SRW/PA Beale AFB, CA 95903 916/634-2137

3.2.2 IDENTIFICATION OF DATA USES AND NEEDS

Data needs for the individual IRP sites at Beale AFB have been detailed in the Work Plan and QAPP. Table 3.1.1-1 (previously given) summarizes the actions which were taken at each site to meet the data needs.

In general, DQOs were developed to include data uses and needs by evaluating the following criteria:

- Data uses--What will the collected data be used for?
- Data types--What sample types, media, chemical analyses, and physical parameters need to be evaluated?
- Data quality--What degree of confidence (quality) must be accomplished?
- Data quantity--How many samples and tests will be required?
- Sampling/analysis options--Which sampling/analysis scheme(s), such as one-time or phased sampling, will be needed?
- PARCC parameters--Definition of precision, accuracy, representativeness, completeness, and comparability parameters for tests and analyses.

Data uses, for the Stage 2-1 RI, are primarily to support site characterization including definition of the nature and extent of contamination and status of sites with respect to meeting ARARs. It is anticipated that, in the future, data

generated in Stage 2-1 will additionally be used to support risk assessment and evaluation of alternatives.

Data types generated in Stage 2-1 included information about contaminant sources, transport routes, receptors, and background conditions. Media sampled included wastes, soils, sediments, surface water, groundwater, and air. Chemical analyses were specific to individual site data needs, but generally included metals, organics, fuel hydrocarbons, water quality parameters, and various site-specific analyses. Physical testing was primarily limited to aquifer tests to determine flow and storage properties and standard penetration testing of soils.

To develop the sampling and analysis approach used in Stage 2-1, a preliminary ARARs evaluation was conducted during the workplan development task. Based upon this evaluation of chemical-specific and location-specific ARARs, analyses were selected that had detection limits suitable for meeting these ARARs. For example, the GC methods 8010 and 8020 for purgeable aromatics and halocarbons were selected for water analyses, in place of the GC/MS method 8240, because the GC methods had lower detection limits capable of meeting State of California Action Levels.

During Stage 2-1 activities, the preliminary ARARs evaluation was expanded into a more detailed evaluation based on contaminant analytes detected. This ARARs evaluation is included as Appendix I.

Data quality for Stage 2-1 involved Level 1 (field screening), Level 2 (field analysis), and Level 3 (standard laboratory analysis). Field screening was primarily limited to visual inspection of sample media and organic vapor analyzer "sniffing". Field analysis included water quality testing for pH, specific conductivity, temperature, and alkalinity. All remaining analyses were conducted by standard laboratory methods.

Data quantity varied from site to site dependent upon results of previous studies (if any), and anticipated data uses.

Sampling and analysis options generally involved either onetime sampling and analysis, as with soils and sediments, or phased sampling, as with surface water or groundwater. Water samples were collected either quarterly or semiannually dependent upon contaminant levels expected and proximity of individual sites to potential receptors.

PARCC parameters have been detailed in the QAPP, especially with respect to acceptable limits for analytical precision (relative percent difference), accuracy (percent recovery), and completeness.

3.3 IMPLEMENTATION OF THE FIELD PROGRAM AND SUMMARY OF FIELD WORK PERFORMED

A field program to accomplish goals outlined in the Stage 2-1 Workplan, QAPP, and SSP was initiated in October 1988. Environmental media at 16 sites were sampled, analyzed, and interpreted. Two of these sites, plus two additional sites, underwent geophysical investigation. A records search was conducted for one site. Four quarterly water sampling rounds were completed in 1989. All field methods were consistent with procedures in USAF-HSD Technical Services Division Handbook to Support the Installation Restoration Program (IRP) Statements of Work for Remedial Investigation/Feasibility Studies Version 2.0 (April 1988) and the Statement of Work. The following describes the time sequence for the field program and the role of the subcontracting firms.

3.3.1 TIME SEQUENCE OF WORK PERFORMED

The time sequence of Stage 2-1 remedial investigation field activities is given in Table 3.3.1-1.

Surface soil sampling began on November 15, 1988, and continued until December 21. Soil borings were drilled from November 30, 1988 until January 18, 1989. Drilling and installation of the wells proceeded from November 29, 1988 through January 11, 1989. Development of the wells followed installation of each well head surface monument (concrete pad) after allowing a minimum of 72 hours to provide adequate curing of the monument and cement-bentonite grout seal. Well development occurred from December 5, 1988, to January 25, 1989. Aquifer tests were conducted starting on January 26 and ending on March 22, 1989. Water level readings taken prior to the first quarter water sampling round were taken February 2 to 7, 1989. On February 13, 1989, the first quarter water sampling round began and lasted through April 4. The subsequent rounds were conducted in May, August, and November 1989.

Resampling of some soil samples occurred on January 6, January 19 through 25, and May 2 and 3, all in 1989. Some water resampling occurred on March 18, 19, and 20, 1989.

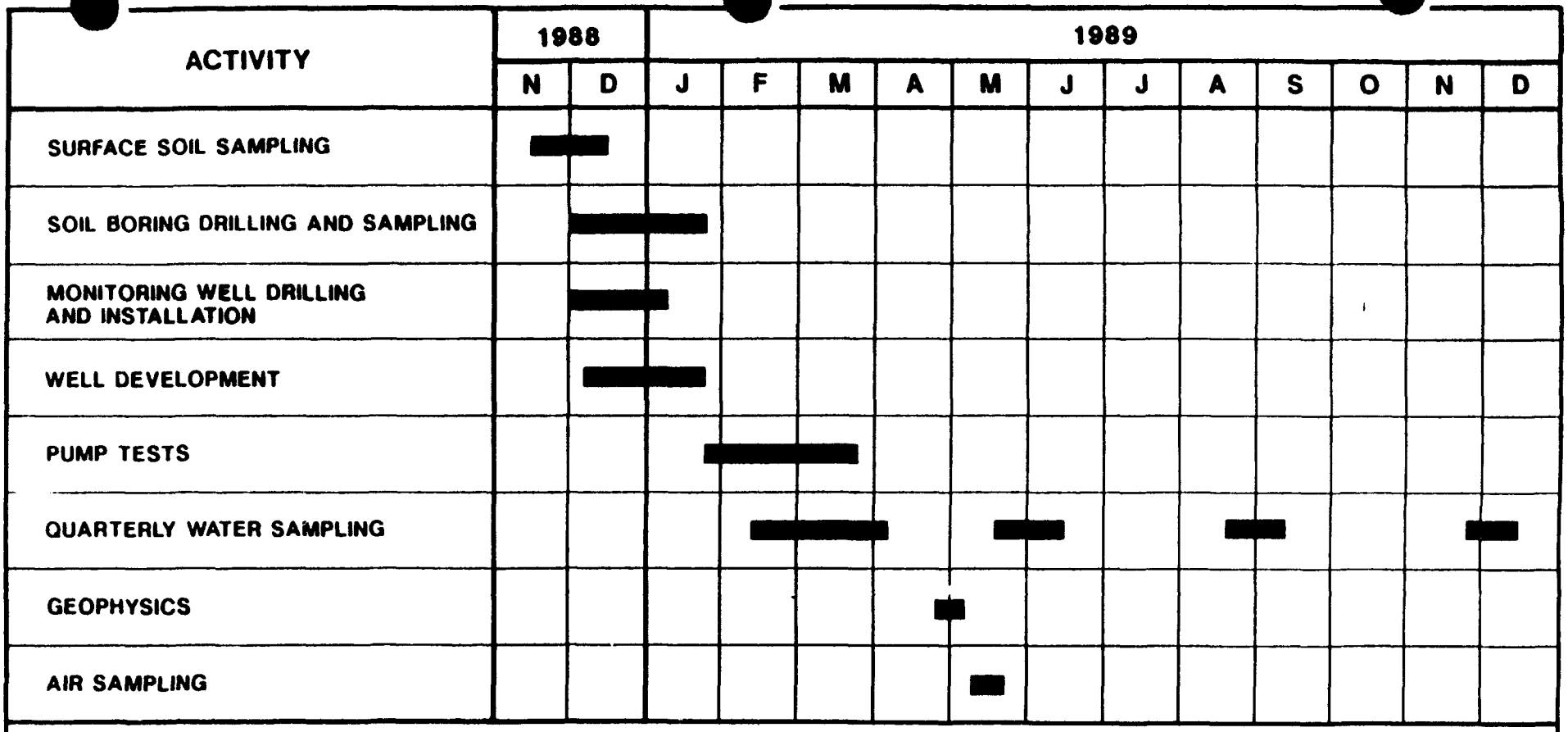


TABLE 3.3.1-1
TIME SEQUENCE OF STAGE 2-1
REMEDIAL INVESTIGATION FIELD ACTIVITIES

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Resampling occurred due to laboratory analysis holding times being exceeded or analysis quality not meeting contract specifications. This is further discussed on a site-by-site basis in Section IV.

Air sampling was conducted at Site 15 from May 11 through May 17, 1989. The geophysical investigations at Sites 16, 17, 20, and 22 were conducted April 24 through May 5, 1989.

3.3.2 IDENTIFICATION AND ROLE OF SUBCONTRACTORS

For field work carried out in Stage 2-1 activities, CH2M HILL employed two California subcontractors: Layne Environmental Services of Fontana and Diamond Core Drilling of Palo Cedro.

Layne Environmental Services drilled, installed, and developed all groundwater monitoring wells and assisted in aquifer testing and groundwater sampling. They also performed some of the cleanup of the work areas after drilling at the sites.

Diamond Core Drilling drilled both vertical and angled soil borings to collect samples and allow development of boring log records. Additionally, Diamond Core constructed the five soil vapor monitoring wells at Landfill No. 3 (Site 15).

3.4 INVESTIGATION METHODS AND SURVEYS CONDUCTED INCLUDING TYPES OF INSTRUMENTATION USED

3.4.1 GEOPHYSICAL INVESTIGATION

The sites that underwent geophysical investigation were Site 16, the Explosive Ordnance Disposal (EOD) area, Site 17, Best Slough; Site 20, the Grease Pit (including Site 13, Landfill No.1); and Site 22, Abandoned Underground Storage Tanks (selected locations).

3.4.1.1 Objectives

Explosive ordnance is disposed in a trench at Site 16. The ground appears disturbed in the vicinity of the trench. The objective of the investigation was to determine if other trenches were used in this area in the past and to identify their locations.

There are four trenches of various dimensions at Site 17, Best Slough. Three of the four contain from 10 to 40 rusted

55-gallon drums. The geophysical investigation at Best Slough was to determine if any metal objects indicative of additional drums could be detected in the vicinity of these trenches.

Behind the Grease Pit at Site 20, there is a long trench, and the soil surface in the area appears very uneven. A magnetometer survey was conducted in this area to help locate metal objects that could be indicative of any buried trenches.

A geophysical investigation was also conducted in areas where underground tanks from Camp Beale had been located. Current estimates place the original number of underground tanks at about 750. The purpose of this investigation was to investigate a "representative" 10 percent of these locations in order to give an indication of the total number of Camp Beale WWII vintage tanks that may still be in the ground. A magnetometer survey was conducted at the locations of 82 tanks of various sizes in the cantonment area, the WWII barracks area between Doolittle Drive and Warren Shingle Boulevard and D and F Streets, and the WWII hospital area.

3.4.1.2 Equipment

Because ground-penetrating radar cannot be used effectively in areas where the soil is moist and contains a high percentage of clay, magnetometry was determined to be the most reliable method to meet the objectives listed above. An EDA Omni Plus gradiometer was used for the survey. This instrument simultaneously measures both the total magnetic field and the vertical gradient.

3.4.1.3 Procedure

The procedure for evaluating the presence of an underground tank consisted of setting up a small grid on a tank-by-tank basis. The grid was comprised of three lines 60 feet long and 10 feet apart, and centered on the tank location as specified by the 1944 Camp Beale maps. When an anomaly was located at the edge of the grid, the grid was extended to include the entire anomaly.

Measurements were made of both the total magnetic field as well as the vertical gradient at all the grid points. In most cases the vertical gradient was used to supplement the total field data, and most of the data presented in Section IV is based upon total field data.

The procedure used for Sites 16, 17, and 20 was quite different from that for the underground tank investigation. Magnetic characterization of these sites involved surveying large areas, whereas the tank investigation required surveying only the small area close to tank locations on the 1944 Camp Beale Maps. For these large areas, a grid was set before taking measurements. At Site 20, and during the first day at Site 17 (east of the fence), the line spacing was 20 feet, with a station spacing of 10 feet, yielding a grid with rectangles 20 feet on one side and 10 on the other. At Sites 16 and 17 during the second day (west of the fence), the line spacing was expanded to 40 feet except near the trenches. The lines ran generally north-south. Individual magnetometer profiles along the grids are provided in Appendix H.

3.4.1.4 Interpretation

Different investigation objectives for Sites 16, 17, and 20, as contrasted with the underground tank sites, led to the application of different interpretation methods in these two cases.

3.4.1.4.1 Sites 16, 17, and 20

Measurements over these sites were made on grids that covered relatively large areas. The objectives were to identify and delineate waste burial sites. The following procedures were performed to evaluate the data.

Contour maps of the total field intensity were generated and are presented with each site discussion in Section IV. The contour maps were used to highlight anomalous features and show their approximate extent and orientation.

Profile plots were generated to show the magnetic intensity along each survey line. These plots are presented in Appendix H. These plots were used to identify anomalies and to interpret the location of the source of each anomaly. Some anomalies identified in the profiles were too small to affect the contour map. The source locations are estimated to extend from the magnetic high on the south side of the source to the low on the north side.

An interpretation map showing the location of buried metal was prepared for each of the locations interpreted from the profiles.

3.4.1.4.2 Site 22 Underground Abandoned Tanks

The purpose of this investigative work was to develop a methodology to locate tanks and to assess a representative subset of the abandoned tanks on base. Small grids, consisting generally of three survey lines, were established over the suspected tank locations. The data were not contoured except as needed to help understand non-characteristic anomalies.

Profile plots of the data were prepared for only one line per grid, and are presented in Appendix H. The line selected generally had the strongest anomaly and was assumed to be the line nearest the source.

If an anomaly indicative of buried metal that was interpreted to be a buried tank was present on the profile plot, the location of the tank was estimated. A tank was interpreted to be present if the anomaly indicated a shallow, isolated metal object of limited extent. This interpretation was based on visual appearance of the anomaly, and not on any quantitative assessment of the data. Magnetometer data cannot be used to distinguish buried tanks from other buried metal. For the purposes of this study, it was assumed that if buried metal was identified where a tank is supposed to be, then it was a tank.

If the presence of a buried tank was uncertain after review of the profile plot, a contour map of the magnetic intensity was made. The contour map was used to determine if the anomaly extent was consistent with a body the size of a tank. The contour maps are not included in this report. Excavations performed at several possible underground tank locations are discussed in Section 4.1.22.3. The results of the Site 22 geophysical investigation are summarized in Table 4.1.22-1.

3.4.2 SOIL GAS INVESTIGATION

The purpose of the soil gas investigation was to determine the extent of landfill gas migration through both soil and air. Four different tests were performed at Site 15 (Landfill No. 3): emissions screening, a downwind ambient air test, a landfill gas test, and a landfill gas migration test. All tests were conducted in compliance with the California Air Resources Board testing guidelines for active solid waste disposal sites (CARB, 1986). The results of all soil gas investigations are discussed in Section 4.1.15.1.3.

3.4.2.1 Emissions Screening

The purpose of the emissions screening was to detect emissions of organic compounds from the landfill surface soil cover.

Emissions screening consisted of two steps. The organic vapor background concentration was first measured upwind from the landfill with an organic vapor analyzer (OVA). The OVA inlet probe was held 10 feet above the ground surface for 1 minute and the OVA reading was recorded. This reading was used as the background value for comparison with the landfill measurements. Second, the approximate center acre of the landfill was screened for organic vapors with an OVA. The OVA was carried across a 25-foot grid pattern. The OVA inlet probe was held 2 to 3 inches above the landfill cap during testing. Points of vapor emissions above 50 ppm were plotted on a map of the site and are presented in Section IV.

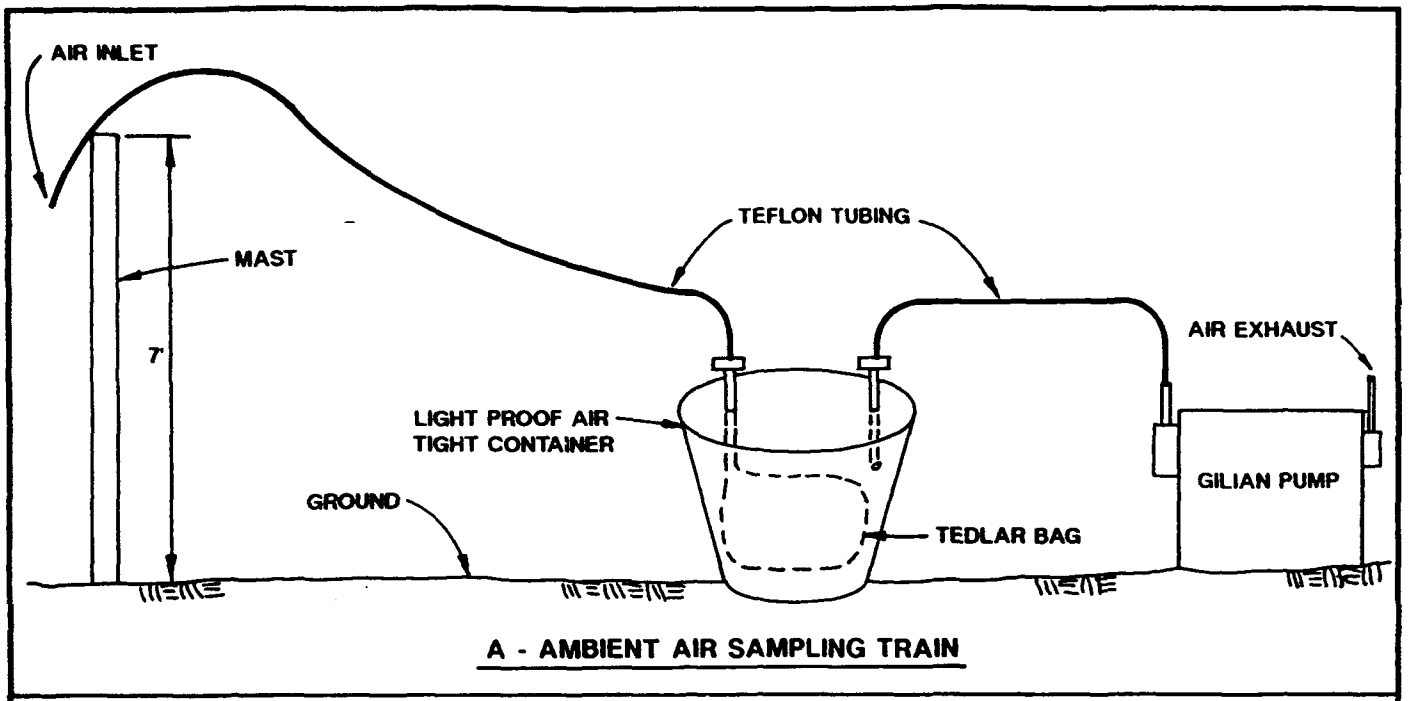
3.4.2.2 Downwind Ambient Air Testing

The downwind ambient air test was conducted to characterize the organic vapors present in the air downwind of the landfill. This phase of air monitoring consisted of collecting a 30-liter air sample downwind of the landfill over a period of 24 hours.

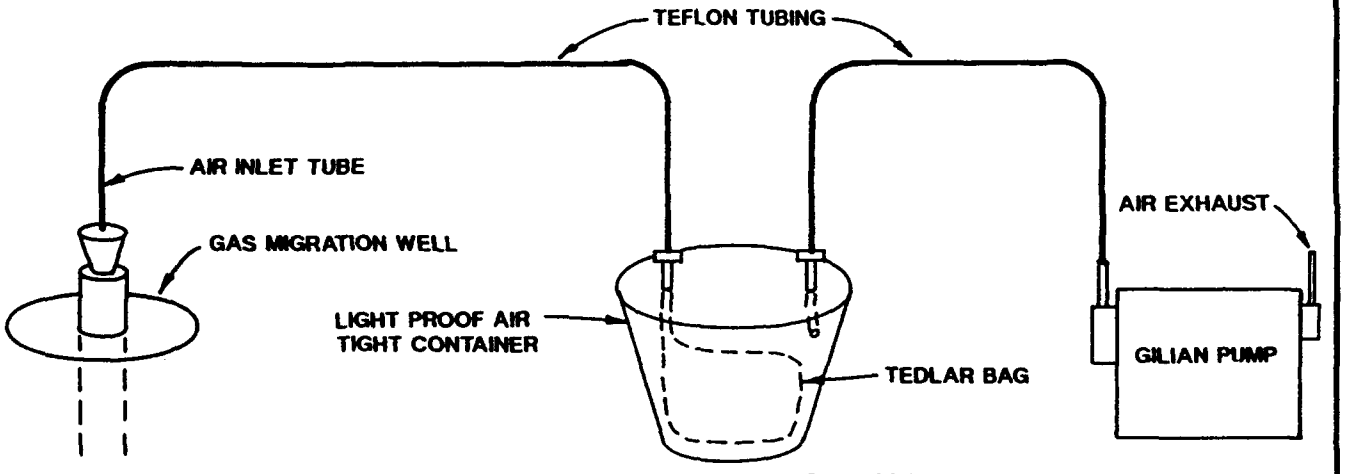
Before sampling, the Beale AFB weather station was contacted to obtain prevailing wind velocity and a 24-hour weather forecast. The ambient air sampling train, illustrated in Figure 3.4.2-1A, was placed approximately 100 feet downwind of the landfill, 7 feet above the ground surface. Three consecutive 8-hour samples were collected. A Gilian personal sampling pump was used to control the air flow into the Tedlar sampling bags. One 10-liter Tedlar bag was collected during each 8-hour sampling period. Each Tedlar bag remained in a light-proof container during and following sample collection. At the conclusion of the 24-hour period, the three 10-liter Tedlar bags were shipped in light-proof boxes to a laboratory for analysis.

3.4.2.3 Landfill Gas Testing

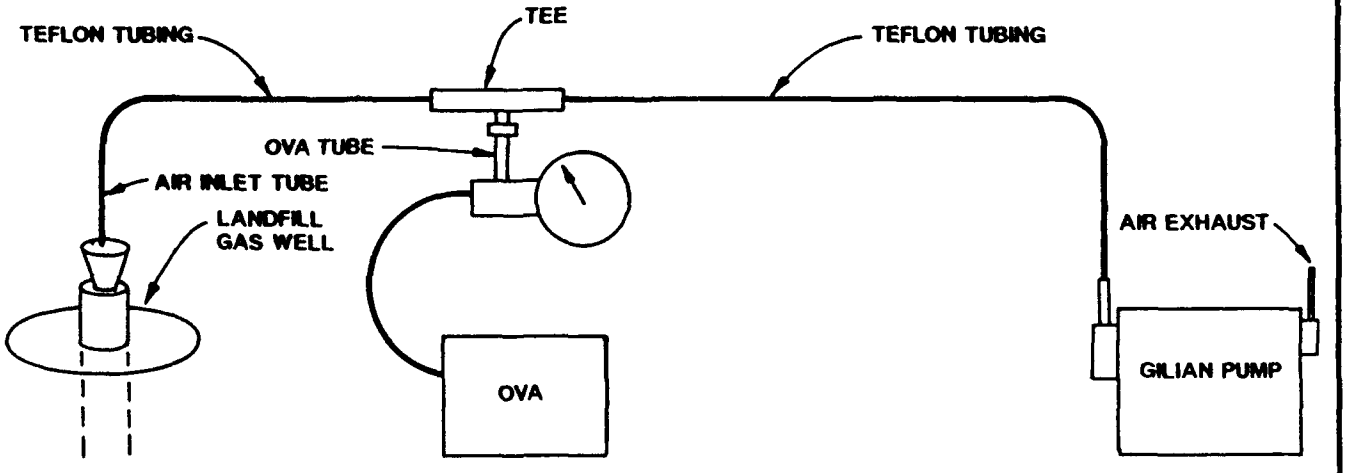
To characterize any landfill gas generated, a soil vapor monitoring well was installed in a soil capped landfill trench. The soil vapor monitoring well was constructed by drilling a 4-inch-diameter hole with a Mobile B-53 truck-mounted drill rig. A 1-inch-diameter galvanized steel pipe



A - AMBIENT AIR SAMPLING TRAIN



B - LANDFILL GAS SAMPLING TRAIN



C - GAS MIGRATION MONITORING TRAIN

FIGURE 3.4.2-1
AIR SAMPLING SCHEMATIC

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was installed in the hole to complete the vapor well. The bottom 18 inches of the pipe were slotted at 1-inch intervals on alternating sides of the pipe. The slots were approximately .25-inch wide. A threaded, galvanized steel cap covered the bottom of the pipe. A sand pack (Monterey No. 3 sand) was placed in the annulus between the borehole and the pipe to fill the space from the bottom of the vapor well to approximately 6 inches above the highest slot. A cement-bentonite grout mixture was placed above the sand to the ground surface. The galvanized steel pipe was steam-cleaned before well construction. Figure 3.4.2-2 schematically illustrates the well completion detail.

The soil vapor monitoring well was installed on May 4, 1989, and sampled 7 days later. Prior to sampling, the well was purged of three to five well volumes of air with a Gilian sampling pump. After purging, a 10-liter air sample was drawn from the well into a Tedlar bag at the rate of 1 liter per minute. Figure 3.4.2-1B shows the sampling train used for landfill gas collection. The Tedlar bag was kept in a light-proof container during sampling and shipping. The sample was shipped to a laboratory for analysis.

3.4.2.4 Gas Migration Testing

The purpose of the gas migration testing phase was to determine the extent of landfill gas migration, if any, through the ground from the landfill. Four soil vapor monitoring wells were constructed, one on each side of the landfill. A Mobile B-53 truck-mounted drill rig was used to construct the vapor wells. Each well was completed through hollow-stem augers to a depth of approximately 8 feet below the ground surface. The four vapor wells were similar to the vapor well used for landfill gas testing. The wells were purged of three to five well volumes of air with a Gilian pump using the sampling train for gas migration monitoring shown in Figure 3.4.2-1C. Air being drawn from the wells was monitored with an OVA via an access point in the tubing between the well head and pump intake. Purging continued until a stable OVA reading was reached. In accordance with CARB guidance (CARB, 1986), air samples from the four perimeter vapor wells were not collected and analyzed.

3.4.3 GEOTECHNICAL AND ENGINEERING INVESTIGATION

No geotechnical or engineering investigations were performed as part of Stage 2-1 activities except for blow counts during soil boring sampling for lithology and chemical analyses. Blow counts are recorded on soil boring logs in

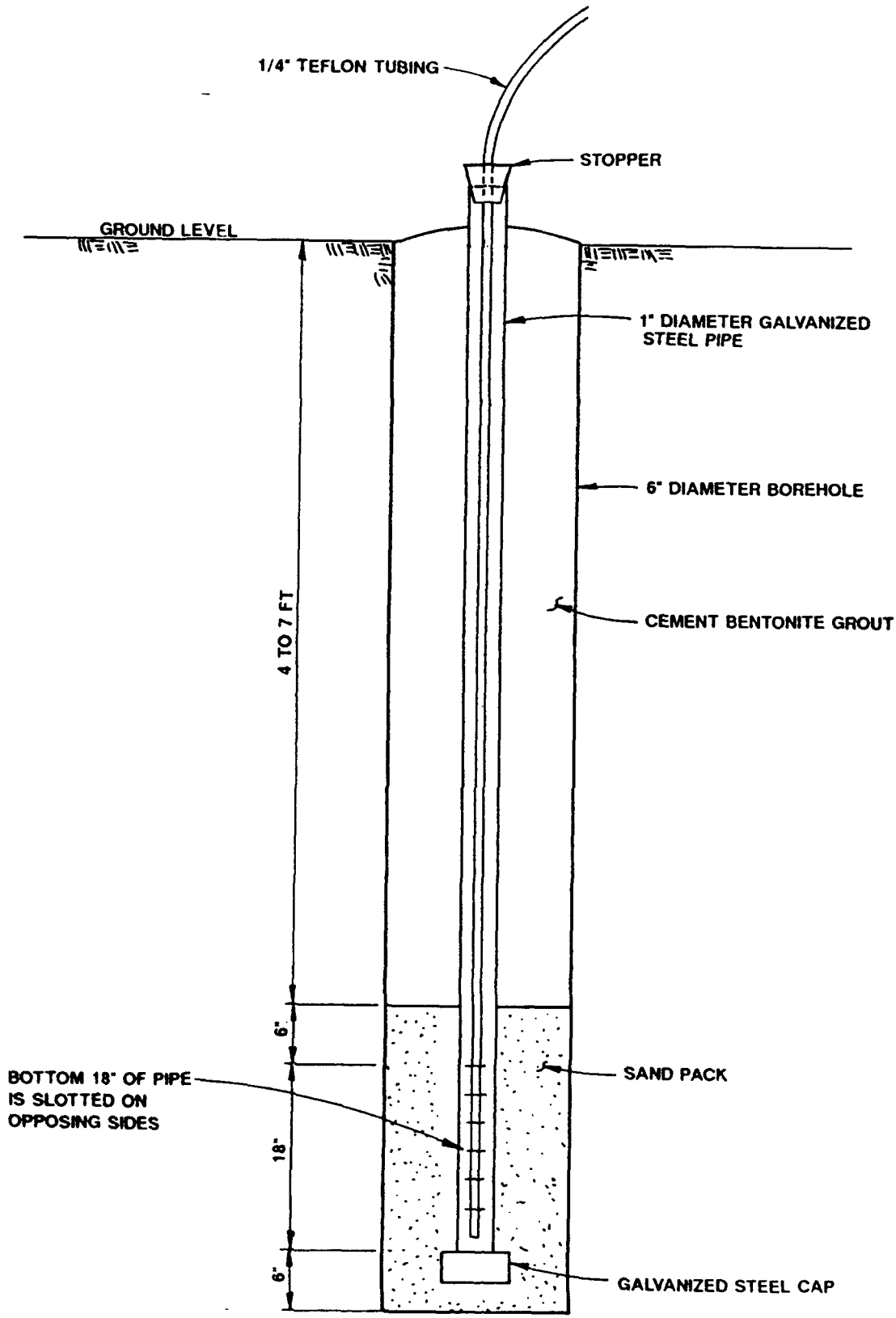


FIGURE 3.4.2-2

SOIL VAPOR WELL SCHEMATIC

Appendix D. Geotechnical and engineering investigations will be conducted, as necessary, in future IRP stages.

3.4.4 SURVEYING AND PERMANENT FIELD IDENTIFICATION OF ALL SAMPLING LOCATIONS

The measuring point elevations of the new monitoring wells and borehole sampling locations were determined by survey and recorded to the nearest 0.01 foot (vertical control). The measuring point on monitoring wells was marked by a notch on the north side of the steel riser casing. Elevations were based on U.S. Corps of Engineers (USCE) Benchmark (BM) 131-318 and BE 131-40. In addition, the horizontal coordinates of these wells were determined relative to the State Plane Coordinate System. Horizontal coordinants were based on Cox and Casey U.S. Coast and Geodetic Survey (USC & GS) control points. The surveys were performed by qualified surveyors (Anthony Cruse, Thomas Dale, and Neal Jones) under the supervision of a licensed land surveyor (Gary Dobson, California Land Surveyor No. 4796). Survey equipment was used, operated, and calibrated in accordance with the manufacturer's recommended procedures. Instrumentation used included a Wild T-1000 Theodolite, Wild DI-5S EDM (Electronic Distance Measuring Device), and Wild NA-2 Level. Table 3.4.4-1 lists well and soil boring locations, and elevations for well casing (steel protective casing), PVC casing, and native ground (ground surface). The "point" column presents the point numbers assigned during electronic data collection.

Wells and boreholes are identified by a code consisting of the site number, followed by a letter designating the firm that installed the borehole or well, followed by the number of the borehole or well by that firm at that site. For example, 2-C-4SB indicates a Site 2 borehole installed for CH2M HILL which is the fourth borehole installed at Site 2 for CH2M HILL. In the survey data, SB indicates a soil boring and GW indicates a monitoring well. In the results section GW is dropped for monitoring wells. Monitoring wells were installed for CH2M HILL (C) in this Stage 2-1 investigation, by AeroVironment (A) in the Phase II, Stage 1 investigation, and by Radian (R) in an earlier investigation at Site 2.

Table 3.4.4-1
WELL AND SOIL BORING LOCATIONS

Location	Point[a]	Northing	Easting	Elevations		
				Casing	TPVC[b]	NG[c]
1-C-1SS THRU 3SS	185 -	537400.07	2157865.55			85.95
1-C-4SS THRU 6SS	184	537551.97	2158080.67			86.41
1-C-7SS THRU 9SS	183	537668.53	2158283.48			87.46
1-A-1GW	178	537688.95	2158368.97	94.18	93.87	92.34
1-C-1GW	177	538108.65	2158387.86	95.46	94.68	93.16
1-C-2GW	182	537618.52	2158281.19	92.40	91.95	89.89
1-C-3GW	181	537612.24	2158288.80	92.27	92.13	90.18
1-C-4GW	180	537704.88	2158273.46	92.74	92.27	89.78
1-C-5GW	179	537710.25	2158283.99	93.09	92.22	89.99
2-C-1SB	147	519745.33	2163416.85			92.41
2-C-2SB	156	518476.70	2161496.59			86.30
2-C-3SB	157	517653.10	2161490.87			83.80
2-C-4SB	158	517677.22	2161465.72			83.61
2-C-5SB	149	519056.87	2163633.32			97.49
2-C-6SB	148	518992.67	2163508.80			95.88
2-C-7SB	154	517453.64	2164043.17			84.74
2-C-7BSB	155	517450.68	2164040.61			88.46
2-A-1GW	79	517647.31	2161486.95	86.16	85.65	83.58
2-C-1GW	159	517647.31	2161486.95	86.31	85.12	83.46
2-R-1GW	61	519033.14	2163438.82	93.41	93.10	92.57
2-R-2GW	62	519096.42	2163465.96	94.05	93.72	93.13
2-R-3GW	80	519091.43	2163877.91	96.84	96.60	95.39
2-R-4GW	60	518857.33	2163521.34	95.59	95.38	94.34
3-C-1SB	127	532748.73	2165045.84			111.43
3-C-2SB	121	532363.28	2164739.47			103.99
3-C-3SB	122	532342.48	2164733.91			103.50
3-C-4SB	126	532515.78	2164849.47			107.83
3-C-5SB	132	532366.57	2164524.46			104.19

Table 3.4.4-1 (Continued)

Location	Point[a]	Northing	Easting	Elevations		
				Casing	TPVC[b]	NG[c]
3-C-6SB	125	532527.26	2164777.57			107.83
3-C-6BSB	124	532528.74	2164778.59			107.89
3-C-7SB	123	532393.96	2164724.60			104.38
3-C-8SB	120	532381.91	2164763.49			104.22
3-C-9SB	134	532587.94	2164513.14			106.54
3-C-10SB	133	532510.91	2164499.02			106.88
3-A-1GW	128	532840.58	2165054.53	114.86	114.50	112.02
3-A-2GW	129	532488.28	2165062.73	108.74	108.45	106.75
3-A-3GW	135	532241.17	2164324.03	103.10	102.47	101.00
3-A-4GW	131	532467.60	2164281.40	107.27	106.73	103.08
3-A-5GW	136	532751.52	2164081.53	105.74	105.55	105.53
3-C-1GW	130	532437.06	2164490.17	108.78	107.51	105.59
4-C-1SB	171	540314.93	2161876.45			119.87
4-A-1GW	170	540292.73	2161867.22	119.30	118.97	119.25
DRY BATTERY WELL	172	540325.45	2161872.51			120.79
5-C-1SB	162	538510.26	2160901.48			113.59
5-C-2SB	161	538758.02	2160818.05			112.11
5-C-3SB	160	538953.83	2160753.57			110.74
5-C-4SB	165	539131.32	2161521.00			115.40
5-A-1GW	163	538958.24	2160656.66	108.71	108.45	108.47
5-C-1GW	164	538627.10	2160760.63	110.42	109.60	110.21
6-C-1SB	81	522866.93	2171669.96			115.32
6-C-2SB	82	522707.87	2172373.72			122.13
6-C-3SB	84	521575.97	2172583.62			113.83
6-C-4SB	83	521494.39	2171786.74			118.01
6-C-5SB	85	520541.96	2171582.69			109.84
6-A-1GW	87	521696.73	2171142.00	101.56	100.97	99.48
6-A-2GW	86	520913.84	2170820.75	100.24	99.64	98.70
6-C-1GW	88	522900.47	2173251.74	110.96	110.78	108.49
8-A-1GW	180	543460.50	2160627.57	156.91	156.65	156.85

Table 3.4.4-1 (Continued)

Location	Point[a]	Northing	Easting	Elevations		
				Casing	TPVC[b]	NG[c]
9-C-1SB	146	530867.20	2174058.49			129.18
10-A-1GW	101	539819.02	2164940.41	140.84	140.56	140.59
11-C-1SB	173	541655.58	2161272.11			124.61
11-C-2SB	175	541675.09	2161317.45			124.51
11-C-3SB	176	541800.56	2161278.47			127.64
11-A-1GW	174	541639.67	2161288.12	126.10	125.58	124.21
13-C-1SB	74	518234.51	2163107.47			89.11
13-C-2SB	65	518725.93	2162800.20			88.52
13-C-2BSB	66	518716.48	2162798.75			88.47
13-C-3SB	63	518705.39	2163123.55			92.25
13-C-3BSB	64	518700..37	2163119.97			92.22
13-C-4SB	75	518522.40	2163115.00			91.12
13-C-4SBA	76	518507.14	2163096.59			89.48
13-C-4SBB	77	518477.69	2163097.60			89.62
13-C-5SB	72	518456.69	2162846.69			89.16
13-A-1GW	68	518695.75	2162557.54	89.35	88.94	86.90
13-A-2GW	71	518447.38	2162729.87	88.58	88.22	86.66
13-C-1GW	67	518776.35	2162738.56	91.73	90.37	88.19
13-C-2GW	70	518533.63	2162680.51	88.53	88.01	85.84
13-C-3GW	69	518541.94	2162692.80	88.22	87.51	85.51
13-C-4GW	73	518368.54	2162827.16	90.92	90.20	87.81
13-C-5GW	78	518413.41	2163224.83	95.57	94.47	92.45
15-C-1SB	196	522234.99	2177789.58			181.01
15-C-2SB	190	522618.55	2176497.39			141.60
15-C-3SB	195	522157.90	2178731.93			165.72
15-C-4SB	197	521828.25	2178323.18			179.81
15-C-5SB	194	522775.76	2177193.62			144.07
15-A-1GW	198	522544.37	2179046.96	171.23	170.75	168.89
15-A-2GW	191	522546.99	2175856.73	136.40	136.00	133.24
15-A-3GW	192	521819.18	2175839.76	137.46	136.71	135.01

Table 3.4.4-1 (Continued)

Location	Point[a]	Northing	Easting		Elevations Casing	TPVC[b]	NG[c]
15-A-4GW	193	521267.44	2176116.71		141.72	141.07	139.63
16-C-3SB	150	538611.87	2174108.48				171.07
16-C-1GW	152	538771.41	2173803.64		162.43	161.03	159.36
ABAND.WL	151	538720.45	2173850.26				161.69
18-C-1SB	110	524540.03	2166801.24				117.15
18-C-2SB	111	524528.96	2166642.64				117.12
18-C-3SB	112	524525.50	2166519.05				117.36
18-C-1GW	114	523306.28	2165435.32		113.89	112.71	110.82
18-C-2GW	113	523803.46	2165977.57		117.33	115.84	114.07
19-C-1SB	105	526112.34	2171066.82				111.25
19-C-2SB	104	526046.98	2171022.17				110.66
19-C-3SB	101	525866.34	2171010.38				109.63
19-C-1GW	106	526056.34	2171208.55		114.87	114.28	114.54
19-C-2GW	103	526016.80	2170889.50		116.13	116.17	112.99
19-C-3GW	102	525886.95	2170888.65		114.83	114.28	112.17
19-C-4GW	100	525767.84	2171098.14		112.73	111.39	109.07
20-C-1SB	51	518746.30	2163253.14				94.99
21-C-1GW	166	538981.89	2160167.50		105.55	103.52	102.20
23-C-1SB	140	529444.47	2173087.36	1			127.46
23-C-2SB	143	529348.89	2173093.90	2			129.58
23-C-2BSB	144	529347.62	2173095.81	3			129.61
23-C-3SB	145	529306.03	2172974.65	4			127.43
23-C-4SB	142	529266.72	2172883.31	5			122.91
23-C-1GW	141	529294.54	2172948.27	6	128.06	126.99	127.76
BG-C-1GW	202	545496.67	2164123.88		171.54	171.11	169.22
BG-C-2GW	201	527526.32	2178530.28		163.54	162.19	159.98

[a]Point is the number electronically assigned during field work.
[b]TPVC is top of polyvinyl chloride casing.
[c]NG is natural ground surface.

3.5 DRILLING AND BOREHOLE PROGRAM

3.5.1 NUMBER OF WELLS AND BOREHOLES INSTALLED

A total of 26 new wells and 52 boreholes were installed during Stage 2-1. They are described and listed by site in Table 3.1.1-1 (given previously) and summarized by site in Table 3.5.1-1.

3.5.2 FOOTAGE SUMMARY

Table 3.5.2-1 summarizes soil boring footages completed at Beale AFB during Stage 2-1. Similarly, Table 3.5.2-2 lists the footages for groundwater monitoring wells installed during Stage 2-1.

3.5.3 DRILL RIGS AND DRILLING TECHNIQUES USED

3.5.3.1 Soil Borings

Boreholes were advanced by continuous flight 3¼-inch-inside-diameter hollow-stem augers. The vertical borings were drilled with a Mobile B-80 truck-mounted drill rig, and the angled borings with a Mobile B-53 truck-mounted drill rig. Angle borings were all drilled at a 30 degree angle from vertical. Boring and sample depths in angle borings in this report are listed as distance along the borehole with the actual vertical depth following in parentheses. For angle borings the vertical depth below ground is approximately 0.87 times the depth down the borehole.

After blocking plug, auger flights, and interior had undergone decontamination procedures outlined in Section 2.4.6 of the QAPP (CH2M HILL, 1988b), the auger and blocking plug were advanced to the depth at which a sample was to be collected. The sample was collected in accordance with ASTM Method D-1586. Between samples, the materials encountered during drilling were recorded on soil boring logs throughout drilling activities. Organic vapors were also monitored and recorded. Cuttings from soil borings and monitoring wells were not drummed unless visual inspection, odor, or organic vapor monitoring indicated contamination. Soil cuttings were stockpiled on plastic sheeting during drilling, and have been disposed of under the direction of the base environmental engineer, Kirk Schmalz, P.E., in accordance with Section 2.0 of the QAPP and applicable regulations (CH2M HILL, 1988b).

Table 3.5.1-1
MONITORING WELLS, SOIL BORINGS, AND HAND AUGERINGS
STAGE 2-1

Site Number	Monitoring Wells	Soil Borings	Hand Augerings
1	5	0	12
2	1	7	14
3	1	10	3
4	0	1	0
5	1	4	5
6	1	5	0
9	0	1	0
11	0	3	0
13	6	5	0
15	0	5	0
16	1	0	3
18	2	3	36
19	4	3	3
20	0	1	3
21	1	0	5
23	1	4	0
Background Wells	2	0	0
—	—	—	—
Total	26	52	84

Table 3.5.2-1
FOOTAGE SUMMARY FOR SOIL BORINGS AT BEALE AFB
STAGE 2-1

Site	Boring	Date	Depth (ft.)	No. of Samples
2	2-C-1SB	12/05/88	51.5	5
2	2-C-2SB	12/05/88	51.5	5
2	2-C-3SB	12/07/88	51.5	8
2	2-C-4SB	12/08/88	28.0	5
2	2-C-5SB	12/20/88	49.0	5
2	2-C-6SB	12/21/88	50.0	5
2	2-C-7SB	12/02/88	51.5	6
3	3-C-1SB	12/12/88	51.5	6
3	3-C-2SB	12/12/88	21.5	5
3	3-C-3SB	12/13/88	21.5	5
3	3-C-4SB	12/13/88	51.5	6
3	3-C-5SB	12/14/88	48.5	5
3	3-C-6SB	12/14/88	51.5	6
3	3-C-7SB	01/04/89	21.5	5
3	3-C-8SB	01/05/89	21.5	5
3	3-C-9SB	01/11/89	49.0	6
3	3-C-10SB	01/12/89	49.0	6
4	4-C-1SB	01/17/89	49.0	5
5	5-C-1SB	01/09/89	51.5	6
5	5-C-2SB	01/10/89	51.5	6
5	5-C-3SB	01/11/89	51.5	6
5	5-C-4SB	01/12/89	52.0	6
6	6-C-1SB	12/01/88	51.5	3
6	6-C-2SB	12/12/88	59.0	6
6	6-C-3SB	12/08/88	59.0	6
6	6-C-4SB	12/12/88	58.0	6
6	6-C-5SB	12/09/88	59.0	6
9	9-C-1SB	12/09/88	21.5	5
11	11-C-1SB	12/09/88	10.1	2
11	11-C-2SB	12/16/88	7.8	2
11	11-C-3SB	01/13/89	12.3	2
13	13-C-1SB	12/06/88	51.5	5
13	13-C-2SB	12/15/88	59.0	6
13	13-C-3SB	12/14/88	59.0	6
13	13-C-4SB	01/04/89	59.0	6
13	13-C-5SB	12/16/88	59.0	6

Table 3.5.2-1 (Continued)

Site	Boring	Date	Depth (ft.)	No. of Samples
15	15-C-1SB	12/01/88	63.5	6
15	15-C-2SB	12/06/88	59.0	6
15	15-C-3SB	12/05/88	59.0	6
15	15-C-4SB	12/07/88	59.0	6
15	15-C-5SB	11/30/88	51.5	5
18	18-C-1SB	01/03/89	13.0	3
18	18-C-2SB	01/03/89	11.5	3
18	18-C-3SB	01/03/89	11.5	3
19	19-C-1SB	12/08/88	51.5	5
19	19-C-2SB	12/13/88	48.5	5
19	19-C-3SB	01/05/89	50.0	5
20	20-C-1SB	01/10/89	49.0	5
23	23-C-1SB	12/20/88	21.5	5
23	23-C-2SB	12/20/88	21.5	5
23	23-C-3SB	12/19/88	21.5	5
23	23-C-4SB	12/21/88	21.5	5
Totals	52		2214.2[a]	268[b]

[a]Total footage
[b]Total samples

Table 3.5.2-2
FOOTAGE SUMMARY FOR GROUNDWATER MONITORING WELLS
AT BEALE AFB, STAGE 2-1

Site	Well Number	Date Drilled	Total Depth	Screened Interval
1	1-C-1	12/02/88	111	86-106
1	1-C-2	11/29/88	146	120-140
1	1-C-3	12/01/88	110	85-105
1	1-C-4	12/01/88	140	115-135
1	1-C-5	12/02/88	110	85-105
2	2-C-1	12/05/88	170	145-165
3	3-C-1	12/13/88	138	113-133
5	5-C-1	12/15/88	129	104-124
6	6-C-1	12/05/88	90	65-85
13	13-C-1	12/09/88	120	95-115
13	13-C-2	12/07/88	150	125-145
13	13-C-3	12/08/88	110	85-105
13	13-C-4	12/06/88	105	80-100
13	13-C-5	12/07/88	117	92-112
13	13-C-6	08/07/89	108	83-103
16	16-C-1	01/11/89	39	14-34
18	18-C-1	12/09/88	134	109-129
18	18-C-2	12/12/88	130	105-125
19	19-C-1	12/14/88	104.5	79.5-99.5
19	19-C-2	12/12/88	101	65-85
19	19-C-3	12/08/88	110	75-95
19	19-C-4	01/04/89	148	83-143
21	21-C-1	12/15/88	139	104-124
23	23-C-1	12/14/88	79	45-65
Background Wells	BG-C-1	12/08/88	99	74-94
	BG-C-2	12/14/88	109	84-104
Totals	26		3046.5[a]	560[b]

[a]Total footage
[b]Total screen length

Cuttings suspected of being hazardous based on field screening during drilling were drummed on site. Drummed cuttings were disposed of under the direction of the Environmental Branch at Beale AFB. Thirty-six barrels of drummed drill cuttings were delivered to the Base Hazardous Waste Storage Facility; 25 of these barrels were disposed of as hazardous waste solid, N.O.S. Disposal was done through the Defence Reutilization and Marketing Office (DRMO), McClellan AFB, Ca. Barrels disposed of through DRMO consisted of soil from borings 3-C-2SB, 3-C-3SB, 3-C-4SB, 3-C-6SB, 3-C-6BSB, 3-C-8SB, 3-C-10SB, 18-C-18SB, and 18-C-3SB. The remaining 11 barrels were disposed of at the Beale AFB landfill (Site 15). On November 15, 1989, an agreement was reached between Thomas Hultin, Beale AFB, and Sue Yea, California Regional Water Quality Control Board (CRWQCB), to use the Base landfills for disposal of those barrels with a total fuel hydrocarbon value of less than 400 ppm. The barrels disposed of in the landfill consisted of soil from borings 3-C-5SB, 3-C-10SB, and 23-C-2SB. Cuttings that showed no indication of being hazardous at the time of drilling using field screening techniques were stored on plastic at the drill sites until analytical results confirmed they were not hazardous. These cuttings were then spread out at the drill site.

At the sampling depth, the blocking plug was removed and replaced with a 2.5-inch I.D. California modified split-spoon sampler. The sample was taken by driving the sampler using a standard 140-pound slide hammer operated on a wire line. Blow counts were recorded for each 6 inches of sampler penetration. The sampler was then removed and drilling continued to the next sampling depth. The split spoon sampler was opened and the three 2.5-inch-diameter by 6-inch-long brass sampled sleeves were removed by CH2M HILL personnel. The ends of the sleeve were immediately covered with Teflon sheets and capped with tight fitting plastic caps, and sealed with electrical tape. The sleeves were placed in zip-lock plastic bags and immediately stored in an ice chest at approximately 4°C. Sample preservation is discussed in Section 3.6.3. When the maximum depth of the borehole was reached, the auger was removed and the borehole was grouted to the surface with a bentonite-cement slurry. All augers and equipment used below the ground surface were then decontaminated. Typically the top of the grout settled several feet within a day of grouting. Where this occurred, the boreholes were topped off to the ground surface with additional grout.

3.5.3.2 Monitoring Wells

Monitoring wells were installed by Layne Environmental Services using the reverse circulation dual-tube percussion hammer technique with a Drilling Systems AP-1000 drill rig. This drilling method was selected because wells drilled using air develop more quickly than wells drilled using mud, particularly in low permeability formations such as those often encountered in the uppermost aquifer at Beale AFB. This method returns cuttings up to 6 inches in diameter to the ground surface through a discharge hose and cyclone separator. Cuttings drop continuously from the cyclone separator onto plastic sheeting, allowing continuous sampling and permitting logging of the depth to soil contacts, perched groundwater zones, and the groundwater table, or the uppermost groundwater-producing zone when this zone occurs under confined conditions. This method also allows a rough estimate of the ultimate yield of the monitoring well and of the aquifer properties, based upon the sediments collected and the amount of water produced during drilling.

The wells were drilled to a depth of about 20 feet below the dry season water table. Wells were screened with the screen covering the uppermost saturated permeable zone. All equipment used down hole was decontaminated by steam cleaning between uses (as described in Section 2.4.6 of the QAPP: Equipment Decontamination) to prevent cross contamination between boreholes. Organic vapors were monitored as described in Section 2.4.3 of the QAPP. For well drilling activities, drill cuttings were not drummed because visual inspection, odor, and organic vapor meter readings did not indicate contamination. All monitoring well cuttings not drummed have been disposed of under the direction of the base environmental engineer in accordance with Section 2 of the QAPP (CH2M HILL, 1988b).

3.5.4 WELL DESIGN AND WELL CONSTRUCTION DETAILS

The groundwater monitoring wells were completed with 4-inch-inside-diameter Schedule 40 PVC casing installed in a borehole approximately 10 inches in diameter. The screened interval consists of 20 feet of Johnson wire-wrap type 304 stainless steel screen in either 0.020-inch or 0.010-inch slot size (see well logs in Appendix D). A 5-foot type 304 stainless steel blank was installed below the screen to serve as a sediment trap. Monterey No. 3 sand was used for the gravel pack, and a bentonite seal was placed approximately 5 feet above the screened interval. A No. 30 silica

sand seal above the bentonite separated the cement-bentonite grout from the bentonite seal. Cement-bentonite grout was placed from the top of the silica sand to ground surface. The surface completion was either a steel protective casing set in a 2 x 2-foot x 4-inch concrete pad with approximately 3 feet of stick-up or a ground surface completion using a concrete vault set in a cement pad, as specified in the QAPP (CH2M HILL, 1988b). Figure 3.5.4-1 presents a schematic of well construction details.

Construction details for each well are shown in the monitoring well logs in Appendix D.

Following construction, the wells were developed for a minimum of 2 hours each by bailing, surging with a surge block, or pumping until the water flowed free of visible turbidity and suspended sediments. In this way, the natural hydraulic properties of the aquifer were restored. Water levels in the wells were measured during development to gain a preliminary understanding of the yield of the well.

3.5.5 FIELD MEASUREMENTS AND DATA ACQUISITION

Field measurements were obtained based on media considerations as well as appropriateness to specific field work being conducted. All field activities were first noted in the sampler's assigned bound and numbered field notebook. Specific data and descriptions were then recorded on appropriate preprinted bound forms particular to activity and media.

3.5.5.1 Field Measurements and Data Acquisition During Well Construction and Testing

During all well drilling, soil data were entered on soil boring logs using the Unified Soil Classification System (USCS) (ASTM D2487-84 and 85) in accordance with Section 2 and Appendix D of the QAPP (CH2M HILL, 1988b). Water levels were measured with a water level sounder and recorded in the field notebooks.

Three safety devices were used during drilling: an HNU PI 101 Organic Vapor Meter (OVM), an S.E. Radiation Alert Monitor 4, and an MX 241 Explosimeter. Readings from this equipment were entered in bound field notebooks. HNU readings were also included on the boring logs. The radiation monitor was checked at least once per drilling, and the explosimeter and HNU were checked approximately

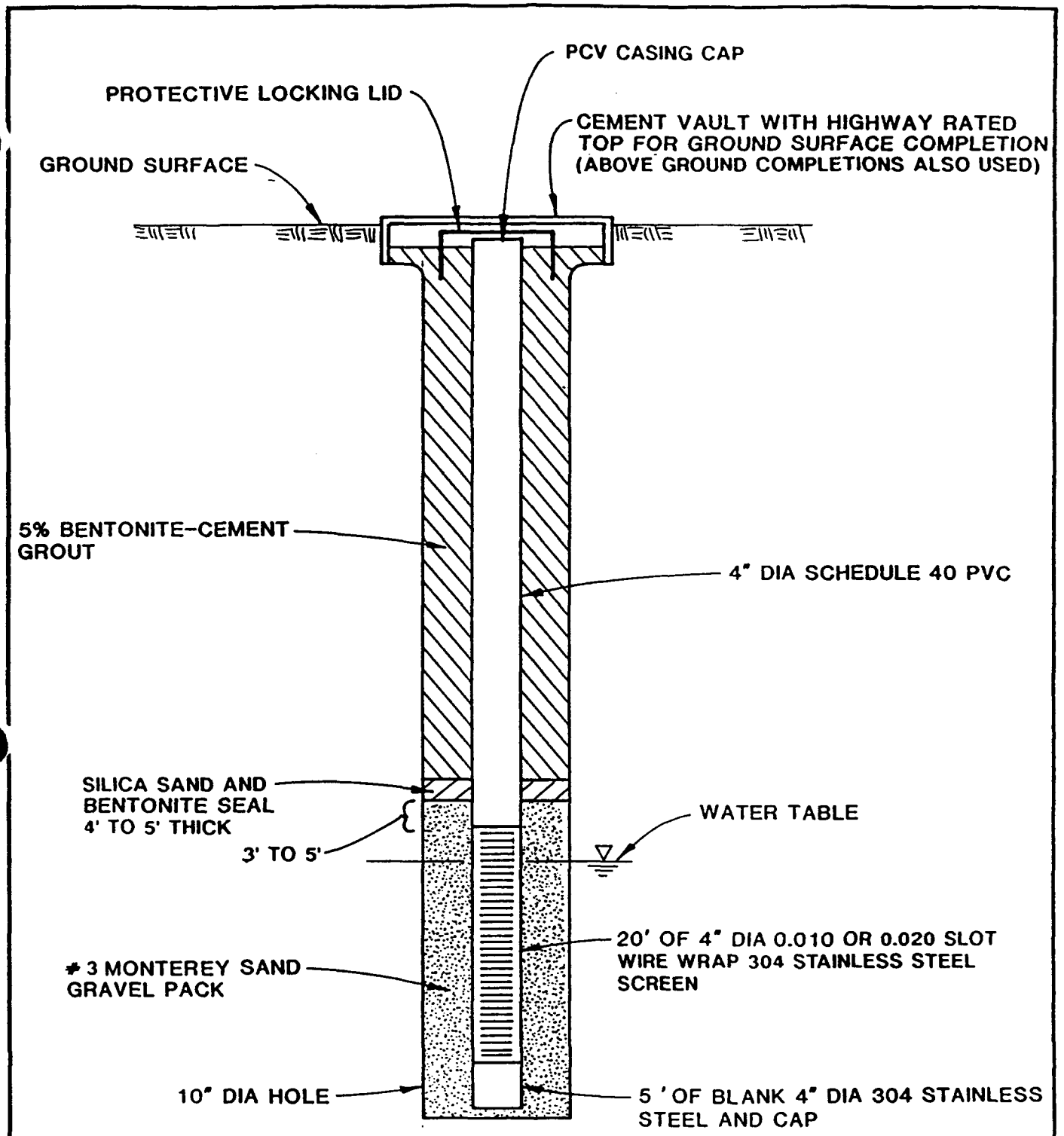


FIGURE 3.5.4-1
SCHEMATIC DIAGRAM OF MONITORING WELL

CH2M HILL

every 30 minutes (depending on the site) at the open end of the dual tube drill pipe, the drill cuttings, and the breathing zone.

Aquifer pump tests were performed at all new monitoring wells using nearby monitoring wells as observation wells when possible. Pump test analysis is discussed in detail in Appendix E which includes data plots for all tests. A pump test generally consisted of 4 hours of pumping and 4 hours of recovery time. In order to induce adequate water level drawdown in the pumping and observation wells, pumping rates were monitoring well specific. Pump rates ranged from 1 to 50 gallons per minute (gpm) using Grundfos 1/3- to 3-horsepower stainless steel submersible pumps. Groundwater level drawdowns and recoveries were measured with an In-Situ Hermit Environmental Data Logger (Model SE 1000B), which automatically collected the drawdown recovery data. Data were then transferred to a portable computer in the field office to facilitate plotting and calculations.

At Site 19, a 72-hour pump test was performed on the dedicated pumping well (6-inch-diameter casing and screen). One Hermit data logger was used on the pump well, and the other logger was used on two nearby wells. A water level sounder was used manually at the third observation well, and its data were recorded in the field notebooks. To account for changes in the aquifer level due to changing air pressure, barometric pressure was obtained from the Beale AFB weather station and recorded in the field notebooks. Water levels were also related to barometric pressure readings in the pump test wells for a period of 72 hours prior to the test, and during the test in nearby well 6-C-1. An HNU PI 101 OVA was used to monitor organic vapor concentrations at the top of the wells; data were recorded in the field notebooks.

To calculate groundwater level contours, water levels in all monitoring wells at Beale AFB were measured relative to the surveyed measuring points with a calibrated Solonist electric sounder. The same operator and the same instrument conducted all measurements in each round to maintain consistency.

3.5.5.2 Field Measurements and Data Acquisition during Soil Sampling

During all soil sampling, soil data were entered on soil boring logs using the Unified Soil Classification System (ASTM D2487-84 and 85). Three safety devices were used during drilling: an HNU PI 101 Organic Vapor Meter, and S.E.

Radiation Alert Monitor 4, and an MX 241 Explosimeter. Readings from this equipment were entered in bound field notebooks. HNU readings were also included in the boring logs (Appendix D). The radiation monitor was checked at least once per drilling, and the explosimeter and HNU were checked approximately every 30 minutes (depending on the site) at the auger hollow stem, the drill cuttings, and the breathing zone.

3.5.5.3 Field Measurements and Data Acquisition During Water Sampling

For all water samples, the following parameters were measured during sampling and well purging: pH was measured by either an Orion 230 or Orion 250 pH meter; temperature was measured by a Fisher mercury thermometer; electrical conductivity was measured by a YSI 33 SCT meter; and photoion potential of the vapors coming off of the purged water was measured by an HNU PI 101. Samples to be analyzed for total dissolved metals were filtered through a 0.45 micron filter with a Geofilter peristaltic pump before being preserved with nitric acid. A portion of the unpreserved sample was titrated using a field Hach titration kit to determine the alkalinity of the water sample prior to shipment to the laboratory.

In addition, weather conditions (i.e., cloud cover, precipitation, air temperature, and wind speed and direction), water clarity, and pump discharge rate (for groundwater) were noted in the bound well diaries.

3.6 SAMPLING PROGRAM FOR AIR, WATER, SOIL, SEDIMENT, AND BIOLOGICAL DATA

3.6.1 TYPES AND NUMBERS OF SAMPLES TAKEN

The number of analyses conducted, by site, is given in Table 3.6.1-1 (soil) and Table 3.6.1-2 (water). A summary of the total number of environmental samples and field QC samples collected per sampling round is given in Table 3.6.1-3.

3.6.2 SAMPLING METHODOLOGY AND PROTOCOLS

Sampling was conducted in accordance with the QAPP (CH2M HILL, 1988b) and the USAFOEHL Technical Services Division Handbook (USAF, 1988).

Table 3.6.1-1
SUMMARY OF SOIL, SEDIMENT, AND AIR SAMPLE ANALYSES BY SITE
FOR STAGE 2-1 REMEDIAL INVESTIGATION

PARAMETER	ANALYTICAL METHOD	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 9	Site 11	Site 13
Oil & Grease	SW9071									
Petroleum Hydrocarbons (Gasoline/Diesel)	CALIF	24	53	58	5	29	27	5	6	29
ICP Screen (23 metals, exclude Boron and Silica)	SW3050/SW6010	24	53	58	5		27	5	6	29
Mercury	SW7471		53	58			27	5		24
Organochlorine Pesticides and PCBs	SW3550/SW8080							5		
Chlorinated Phenoxy Acid Herbicides	SW8150							5		
Volatile Organic Compounds	SW8240	24	53	58			27	5	6	28
Semivolatile Organic Compounds	SW3550/SW8270	24	53	58			27		6	29
Soil Moisture Content	ASTM D2216	24	53	58	5	29	27	5	6	29
Soil pH	SW9045				5					
Polychlorinated Dibenzo-p-dioxins (PCDDs) and polychlorinated Dibenzofurans (PCDFs)	SW8280		1							
Explosives	USATHAMA Method 48									
Ignitability	SW1010			58						
Cyanide, Total	SW9010		53							
Air Samples Analyses	Calif ADDL002									

TBL3AJL.WK1

Table 3.6.1-1
(Continued)

PARAMETER	ANALYTICAL METHOD	Site 15	Site 16	Site 18	Site 19	Site 20	Site 21	Site 23
Oil & Grease	SW9071					8		
Petroleum Hydrocarbons (Gasoline/Diesel)	CALIF	29	3	45	21		5	20
ICP Screen (23 metals, exclude Boron and Silica)	SW3050/SW6010	29	3	45	21	8		20
Mercury	SW7471	29	3		21	8		
Organochlorine Pesticides and PCBs	SW3550/SW8080							
Chlorinated Phenoxy Acid Herbicides	SW8150							
Volatile Organic Compounds	SW8240	29	3	45	21	8		20
Semivolatile Organic Compounds	SW3550/SW8270	29	3		21	8		
Soil Moisture Content	ASTM D2216	29	3	45	21	8	5	20
Soil pH	SW9045							
Polychlorinated Dibenzo-p-dioxins (PCDDs) and polychlorinated Dibenzofurans (PCDFs)	SW8280				1			
Explosives	USATHAMA Method 48		3					
Ignitability	SW1010					8		
Cyanide, Total	SW9010							
Air Samples Analyses	Calif ADDL002	2						

TBL38JL.WK1

Table 3.6.1-2
SUMMARY OF GROUNDWATER AND SURFACE WATER (GW/SW) ANALYSES BY SITE
FOR STAGE 2-1 REMEDIAL INVESTIGATION

PARAMETER	ANALYTICAL METHOD	Site 1 GW/SW	Site 2 GW/SW	Site 3 GW/SW	Site 4 GW/SW	Site 5 GW/SW	Site 6 GW/SW	Site 11 GW/SW	Site 13 GW/SW
Alkalinity-Carbonate, Bicarbonate & Hydroxide (Field Test)	A403	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Specific Conductance (Field Test)	E120.1	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
pH (Field Test)	E150.1	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Total Dissolved Solids	E160.1	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Temperature (Field Test)	E170.1	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Common Anions (Chloride, Fluoride, Sulfate)	E325.3 E340.2 E375.2	24/20 24/20 24/20	24/0 24/0 24/0	12/0 12/0 12/0	2/0 2/0 2/0	4/4 4/4 4/4	12/4 12/4 12/4	2/0 2/0 2/0	30/4 30/4 30/4
Nitrogen, Nitrate-Nitrite	E353.2	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Petroleum Hydrocarbons (Gasoline/Diesel)	CALIF	24/20		12/0	2/0	4/4	12/4	2/0	30/4
ICP Screen (23 metals, exclude Boron and Silica)	SW3005/SW6010	24/20	24/0	12/0	2/0	4/4	12/4	2/0	30/4
Arsenic	SW7060	24/20	24/0	12/0			12/4		30/4
Lead	SW3005/SW7421	24/20	24/0	12/0	2/0		12/4	2/0	30/4
Mercury	SW7470		24/0	12/0			12/4		30/4

GW = GROUNDWATER
SW = SURFACE WATER

TBL3CJL.WK1

Table 3.6.1-2
(Continued)

PARAMETER	ANALYTICAL METHOD	Site 1 GW/SW	Site 2 GW/SW	Site 3 GW/SW	Site 4 GW/SW	Site 5 GW/SW	Site 6 GW/SW	Site 11 GW/SW	Site 13 GW/SW
Selenium	SW7740		24/0	18/0			12/4		30/4
Purgeable Halocarbons	SW5030/SW8010	28a/20	18/0	18/0		4/4	12/4	2/0	35a/4
Purgeable Aromatics	SW5030/SW8020	24/20	18/0	18/0			12/4	2/0	30/4
Semivolatile Organic Compounds	SW3510/SW8270	24/20	18/0	18/0			11/3	2/0	29/4
Chemical Oxygen Demand (COD)	A508A						12/4		30/4
TNT, RDX, Picric Acid	USGS01								
Cyanide, Total	SW9010		18/0						

GW = GROUNDWATER
SW = SURFACE WATER
a: Includes off-base well samples for third and fourth sampling rounds.

TBL3DJL.WK1

Table 3.6.1-2
(Continued)

PARAMETER	ANALYTICAL METHOD	Site 15 GW/SW	Site 16 GW/SW	Site 18 GW/SW	Site 19 GW/SW	Site 21 GW/SW	Site 23 GW/SW	BACK-GROUND GW/SW
Alkalinity-Carbonate, Bicarbonate & Hydroxide (Field Test)	A403	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Specific Conductance (Field Test)	E120.1	16/0	4/0	4/0	15/4	2/0	2/0	7/0
pH (Field Test)	E150.1	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Total Dissolved Solids	E160.1	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Temperature (Field Test)	E170.1	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Common Anions (Chloride, Fluoride, Sulfate)	E325.3 E340.2 E375.2	16/0 16/0 16/0	4/0 4/0 4/0	4/0 4/0 4/0	15/4 15/4 15/4	2/0 2/0 2/0	2/0 2/0 2/0	7/0 7/0 7/0
Nitrogen, Nitrate-Nitrite	E353.2	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Petroleum Hydrocarbons (Gasoline/Diesel)	CALIF	16/0	4/0	4/0	15/4	2/0	2/0	7/0
ICP Screen (23 metals, exclude Boron and Silica)	SW3005/SW6010	16/0	4/0	4/0	15/4	2/0	2/0	7/0
Arsenic	SW7060	16/0	4/0		15/4			7/0
Lead	SW3005/SW7421	16/0	4/0	4/0	15/4		2/0	7/0
Mercury	SW7470	16/0	4/0		15/4			7/0

GW = GROUNDWATER
SW = SURFACE WATER

TBL3EJL.WK1

Table 3.6.1-2
(Continued)

PARAMETER	ANALYTICAL METHOD	Site 15 GW/SW	Site 16 GW/SW	Site 18 GW/SW	Site 19 GW/SW	Site 21 GW/SW	Site 23 GW/SW	Back-Ground GW/SW
Selenium	SW7740	16/0	4/0		15/4			7/0
Purgeable Halocarbons	SW5030/SW8010	16/0	4/0	4/0	15/4	2/0		7/0
Purgeable Aromatics	SW5030/SW8020	16/0	4/0	4/0	15/4		2/0	7/0
Semivolatile Organic Compounds	SW3510/SW8270	16/0	4/0		15/4			7/0
Chemical Oxygen Demand (COD)	A508A	16/0			15/4			7/0
TNT, RDX, Picric Acid	USGS01		4/0					

GW = GROUNDWATER
SW = SURFACE WATER

TBL3FJL.WK1

Table 3.6.1-3
SUMMARY OF SAMPLE TYPES AND MEDIA

Sample Type	Groundwater					Surface Water					Soil Boring	Surface Soil	Sediment	Air
	1st	2nd	3rd	4th	Total	1st	2nd	3rd	4th	Total				
Environmental	46	31	51	34	167	10	8	10	8	36	268	60	39	2
Replicate	5	5	4	4	18	3	2	0	1	6	25	6	3	
Equipment Blank	5	3	4	4	16	3	2	0	1	6				
Ambient Condition Blank	5	3	5	4	17	3	2	0	1	6				
Travel Blank	3	5	5	3	16	2	0	1	1	4	18	5	3	

Notes: Includes all off-base groundwater samples.

3.6.2.1 Groundwater Sampling

After development, the groundwater wells were allowed to stabilize for a minimum of 3 days before sampling. When possible, wells judged to potentially yield samples containing low levels of contamination were sampled prior to those judged to have higher levels. Weather conditions were recorded at the time of sampling (e.g., wind direction and speed, ambient temperature, precipitation).

Prior to purging each well, the initial water level was measured with a Solonist electric sounder to the nearest 0.01 foot with respect to the established survey point on top of the well casing. Based on the static water level, the volume of water in the well casing and gravel pack was calculated.

Each well was then purged a minimum of three effective well volumes (volume of water in the well casing plus volume of water in the sand pack) and until the pH, temperature, and electrical conductivity of the discharge water stabilized in repeated measurements during purging within $\pm$0.1 pH units, $\pm$0.5 degrees C, and $\pm$10 umhos conductivity. Once stabilized, the well was sampled. However, if stabilization was not reached within 30 minutes and after ten well volumes were removed, the well was sampled at that time. Wells were purged either by bailing, with a stainless steel decontaminated bailer, or if more cost-effective, by pumping using a stainless steel submersible pump decontaminated before and after use. Some of the monitoring wells had low yields and thus were pumped dry three times in order to take a representative formation water sample. Well discharge was also measured intermittently during purging using a stopwatch and calibrated 5-gallon container.

Well development, aquifer testing, and groundwater sampling purge water was placed in portable tanks which were taken to the sewage treatment plant and discharged in accordance with instructions from the California Department of Health Services and Regional Water Quality Control Board. If a monitoring well had no detected contamination based on previous results, water was discharged to the ground.

Samples were collected in the appropriate laboratory-supplied containers. Samples were collected with a decontaminated Teflon hand bailer with a dedicated line used for only one well. Sample bottles were prepared by adding required sample preservatives at the field office prior to

daily sampling activities. Two-person sampling teams were used (one sampler, one recordkeeper).

Relevant information was recorded in the field notebook and on the sample collection log. Immediately following sample collection, field water quality parameters (temperature, pH, electrical conductivity, and visual clarity) were analyzed again and recorded.

Sample bottles were kept out of the sun to keep them cool prior to sampling. The filled sample bottles were immediately placed in an iced cooler.

When sampling for VOCs, each 40-ml vial was filled until the sample formed an inverted meniscus that eliminated air bubbles and allowed no head space. After filling, each vial was turned upside-down and tapped to check for air bubbles. If there were any bubbles, a new vial was filled and checked. This procedure was repeated until an acceptable sample was obtained.

3.6.2.2 Surface Water Sampling

Surface water samples were collected in midflow of moving water or in the middle of a pool of standing water. The sample container was inverted before being submerged. To collect the sample, the mouth of the container was positioned facing upstream at a 45-degree angle above horizontal, from ½ inch to 2 inches below the surface of the water. When the depth of the water being sampled prevented submersion of the sampling container, smaller sample collection containers were used to obtain the sample. These were immediately transferred to the appropriate container.

Sampling personnel stood downstream with respect to the sampling container at all times. Multiple samples at a given site were obtained with downstream samples taken first and subsequent samples collected progressively upstream.

Samples to be preserved were collected in new collection containers, then immediately transferred to the appropriate container containing preservative.

Sample collection data were recorded in the samplers' bound field notebooks and in the bound water sample collection logs. The electrical conductivity, pH, temperature, and visual clarity of the surface water samples were determined immediately after sampling. Samples were sealed, labeled, and immediately placed in a cooler at approximately 4°C.

3.6.2.3 Soil and Sediment Sampling

Subsurface soil sampling was done using ASTM Method D-1586 with a modified California split-spoon drive sampler with three 6-inch-long brass liners.

Prior to each sampling, the modified California drive sampler was decontaminated. As each sample was recovered, the exposed ends of each sleeve were examined and logged. The sample ends were then wrapped with a Teflon sheet, capped with plastic caps, and sealed with electrical tape. The sample container was marked with the sample number, location, date, and time, as described in the QAPP (CH2M HILL, 1988b). The outsides of the sample containers were wiped with deionized water, and the sample was placed in clean plastic bags. Samples were immediately placed in coolers at approximately 4°C. All samples were logged on chain-of-custody sampling forms, a sampling log, and recorded in a field notebook maintained by the on site supervisor.

Surface soil samples were collected after establishing the surface sampling points by measurements from known locations. The surface vegetation, if present, was removed. The soil was sampled with a stainless-steel trowel or hand auger. An established volume of soil was collected. Any obviously discolored areas observed near the sampling location were sampled. Once the jars were filled, the sampling equipment was decontaminated. All surface samples were marked with the sample number, date, time, and other appropriate information, and immediately stored in coolers at approximately 4°C. All sampling information was recorded in sample log books, chain-of-custody forms, and the field notebook maintained by the onsite supervisor.

During all soil sampling activities, an HNU PI 101 OVM was used to measure headspace concentrations of organic vapors from soil samples and to measure work place concentrations. Work place concentrations were monitored approximately every 30 minutes during drilling/sampling activities. Monitoring was conducted especially during activities with highest potential for vapor emissions. Monitoring was accomplished by holding the analyzer inlet probe at breathing level (4 to 5 feet above ground), in the vicinity of the highest emission source (usually near the well or borehole opening), and monitoring concentration of organic vapors for a minimum period of 10 seconds. Results were compared to background concentrations measured upwind from the work area. The HNU was calibrated at the beginning of each day using ultra-pure

air, and low- and high-level standards. The analyzer(s) was also checked for performance at the end of each working day and any significant drift in the precision or accuracy of the instrument was recorded.

3.6.2.4 Biological Sampling

No biological sampling was conducted as part of Stage 2-1 activities. Biological sampling will be conducted, if necessary, in future IRP stages.

3.6.2.5 Air

The air sampling at Site 15 (Landfill No. 3) was conducted according to the Calderon testing protocol for Category 2 landfills. The four tests described in Section 3.4 were each conducted once.

3.6.2.1 Emissions Screening

The area selected for emissions screening was approximately 100 feet wide by 500 feet long, and extended over a backfilled landfill trench. The trench had been capped for approximately 1½ years. A Foxboro Century Organic Vapor Analyzer (OVA) was carried over a 25-foot grid in this area.

The weather at the time of emissions screening was mostly sunny with high clouds. The wind was 3 to 5 knots (4 to 6 mph) out of the northwest. The temperature was approximately 90 degrees F.

3.6.2.2 Downwind Ambient Air Testing

The ambient air testing was performed on the downwind side of Site 15 (Landfill No. 3). Before sampling began, the Beale AFB weather station was contacted to ascertain the wind velocity. During sample collection, the weather station was contacted periodically for updates on current wind speed and direction. When the wind direction changed, the sampling was halted briefly while the sampling train location was moved to the new downwind location. At the conclusion of the 24-hour period, the three 10-liter Tedlar bags were shipped in light-proof boxes to a laboratory for analysis.

3.6.2.3 Landfill Gas Testing

A soil vapor well was constructed above a backfilled landfill trench at Site 15 (Landfill No. 3). The landfill

operator was consulted for locations of backfilled landfill trenches. A trench was selected that extended east-west across the length of the landfill. During operation this trench had accepted domestic refuse. The trench has been capped for approximately 1½ years, and has additional capped trenches located to the north and south. A hole was drilled through the clay cap to a total depth of 9 feet. The boring extended approximately 6 feet into the refuse. Sampling was done at least 24 hours after construction of the well. A 10-minute, 10-liter sample was taken and shipped in a light-proof box to the laboratory for analysis.

3.6.2.4 Gas Migration Testing

Soil vapor wells were constructed on the north, east, south, and west sides of Site 15. Each well was positioned outside the landfill boundary. The four vapor wells were similar to the vapor well used for landfill gas testing. At least 24 hours after well construction, the soil vapor wells were purged and the pump effluent monitored with an OVA. Purging continued until a stable OVA reading was reached.

All Tedlar bag samples were shipped immediately after sample collection to the laboratory for analysis. The Tedlar bags were shipped in light-proof containers with custody seals. All samples were analyzed before the 72-hour holding time expired. No field blanks or duplicates were taken.

3.6.3 SAMPLE PRESERVATION METHODS, REQUIRED CONTAINERS, AND HOLDING TIMES

Table 3.6.3-1 presents the methods of sample preservation for analyses employed in Stage 2-1. The table also shows the methods of sample packaging and shipping criteria.

Table 3.6.3-2 gives the allowable holding times for samples collected during Stage 2-1.

Samples obtained during the field investigations were packed for shipment in the following manner:

- Each container was packaged and sealed in a separate sealable plastic bag. Figure 3.6.3-1 shows the process for packaging soil and sediment samples and Figure 3.6.3-2 illustrates packaging for groundwater and surface-water samples.

- Both the inside and outside of cooler drains were taped.

Table 3.6.3-1
SAMPLE QUANTITIES, BOTTLES, PRESERVATIVES, AND PACKING FOR SAMPLES FROM BEALE AFB, CALIFORNIA

Analysis	Containers	Sample Volume	Preservation	Shipping*	Packaging
Water Pollutant Analyses					
Volatiles	3 VOA vials	3 x 40 ml, no headspace	2 drops 1:1 HCL, iced to 4°C, away from sunlight	Priority 1	No. 1 foam liner
Semivolatiles and Pesticides	3 - 2½-liter amber bottles with Teflon-lined cap	Fill bottle to neck	Iced to 4°C, away from sunlight	Priority 1	No. 1 foam liner or bubble wrap
Metals - Dissolved	1-liter high-density polyethylene bottle	Fill bottle to neck	Filter through 0.45 mm filter (groundwater only) nitric acid to pH ≤2, iced to 4°C	Priority 1	No. 1 foam liner or bubble wrap
Metals - Total	1-liter high-density polyethylene bottle	Fill bottle to neck	Nitric acid to pH ≤2, iced to 4°C	Priority 1	No. 1 foam liner or bubble wrap
Cyanide	1-liter high-density polyethylene bottle	Fill bottle to neck	NaOH to pH ≥12 0.06 g ascorbic acid, cool to 4°C	Priority 1	No. 1 foam liner or bubble wrap
Nitrate + Nitrite	1 - 125-ml high-density polyethylene bottle	Fill bottle to neck	H_2SO_4 to pH <2 Iced to 4°C	Priority 1	No. 1 foam liner or bubble wrap
Total Fuel Hydrocarbons	2 VOA vials 3 - 1 liter amber glass bottles	2 X 40 ml, no headspace Fill to bottleneck	Iced to 4°C	Priority 1	No. 1 foam liner or bubble wrap
Carbonate, Bicarbonate, Chloride, Sulfate, Total Dissolved Solids	1-liter high-density polyethylene bottle	Fill bottle to neck	Iced to 4°C	Priority 1	No. 1 foam liner or bubble wrap
Subsurface Soil					
Pollutant Analysis (all analytes)	Modified California split-spoon with brass sleeve capped with Teflon	3 sleeves 2-inch diameter 6 inches long	Iced to 4°C	Priority 1 (if medium or high hazard, include certificate for restricted articles)	In cans packed in bubble wrap

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Table 3.6.3-1 (Continued)

Analysis	Containers	Sample Volume	Preservation	Shipping*	Packaging
Surface Soil and Wastes					
Pollutant Analysis Hazard Classification (all analytes)	1 - 125-ml, 4 - 500-ml wide-mouth glass jars	Fill full	Iced to 4°C, away from sunlight	Priority 1 (if medium or high hazard, include certificate for restricted articles)	Foam Liner No. 3
Dioxin, Furans	1 - 500-ml wide-mouth glass jar	Fill full	Iced to 4°C, away from sunlight	Priority 1 (if medium or high hazard, include certificate for restricted articles)	Foam Liner No. 3
Total Fuel Hydrocarbons	1 - 500-ml wide-mouth glass jar	Fill full (no headspace)	Iced to 4°C, away from sunlight	Priority 1 (if medium or high hazard, include certificate for restricted articles)	
Air Contaminants					
Landfill Gas	10-liter Tedlar bag	10 liter	Keep away from sunlight	Priority 1	Protective container
Ambient Air	30-liter Tedlar bag	30 liter	Keep away from sunlight	Priority 1	Protective container

*Priority 1 = Next day delivery

Table 3.6.3-2
HOLDING TIMES FOR SAMPLES, BY ANALYSIS

Analysis	Holding Time (Days) Air	Water	Soil
8010, 8020, 8240	--	14	14
8270			
Extraction	--	7	14
Analysis after extraction	--	40	40
8280			
Extraction	--	7	14
Analysis after extraction	--	40	40
8080			
Extraction	--	7	14
Analysis after extraction	--	40	40
8150			
Extraction	--	7	14
Analysis after extraction	--	40	40
Total Fuel Hydrocarbons			
Extraction	--	14	14
Analysis after extraction	--	40	40
Metals	--	6 mo.	6 mo.
Mercury	--	28	28
Cyanide	--	14	14
Ammonia	--	28	7
TKN	--	28	7
Nitrate + Nitrite			
Extraction	--	-	7
Analysis after extraction	--	28	28[a]
Carbonate, Bicarbonate	--	14	N/A
Chloride	--	28	N/A
Sulfate	--	28	N/A
Total Dissolved Solids	--	7	N/A
Ambient Air	3	--	--
Fixed Gas	3	--	--

[a]Extract preserved with H_2SO_4

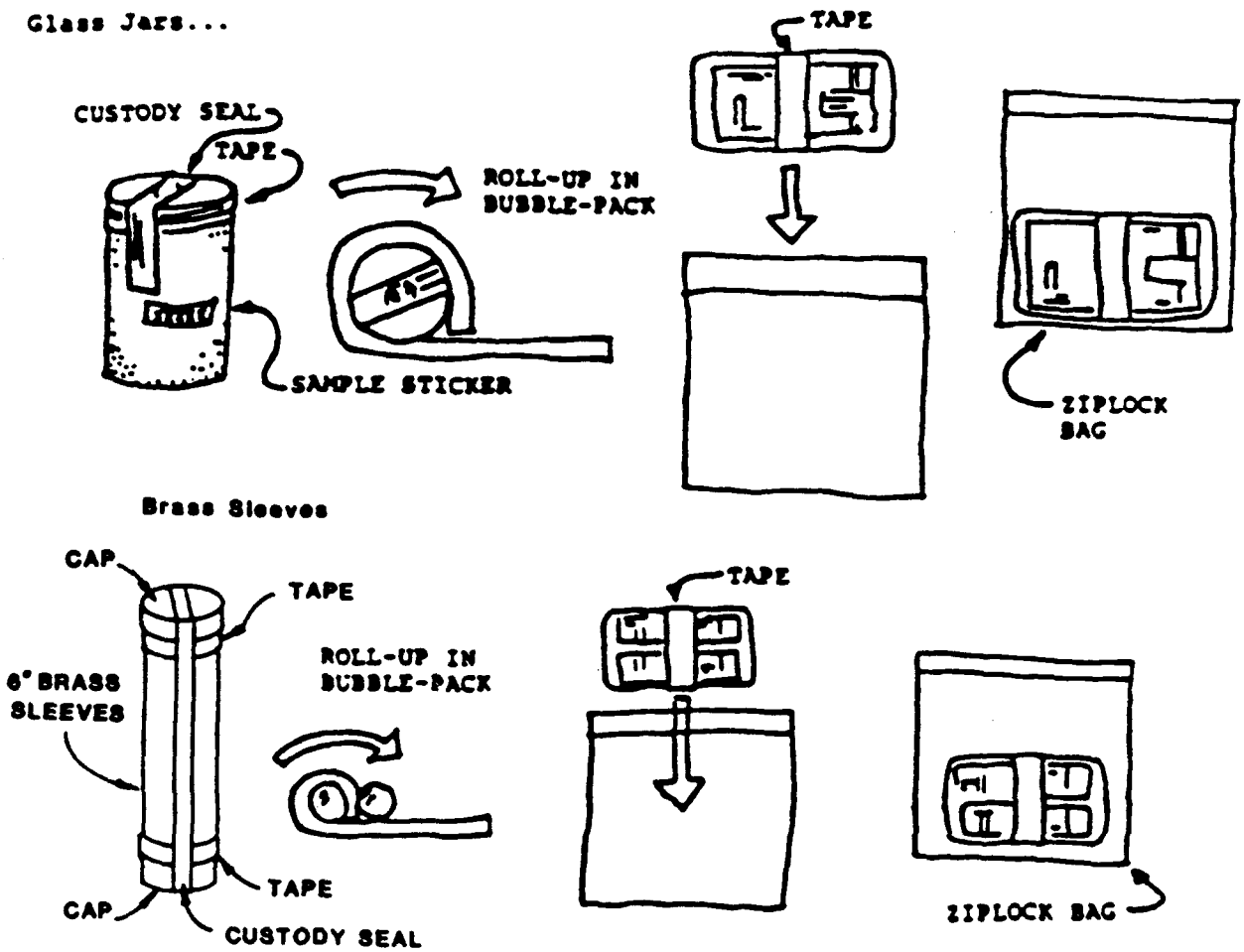


FIGURE 3.6.3-1

SOIL AND SEDIMENT SAMPLE PACKAGING

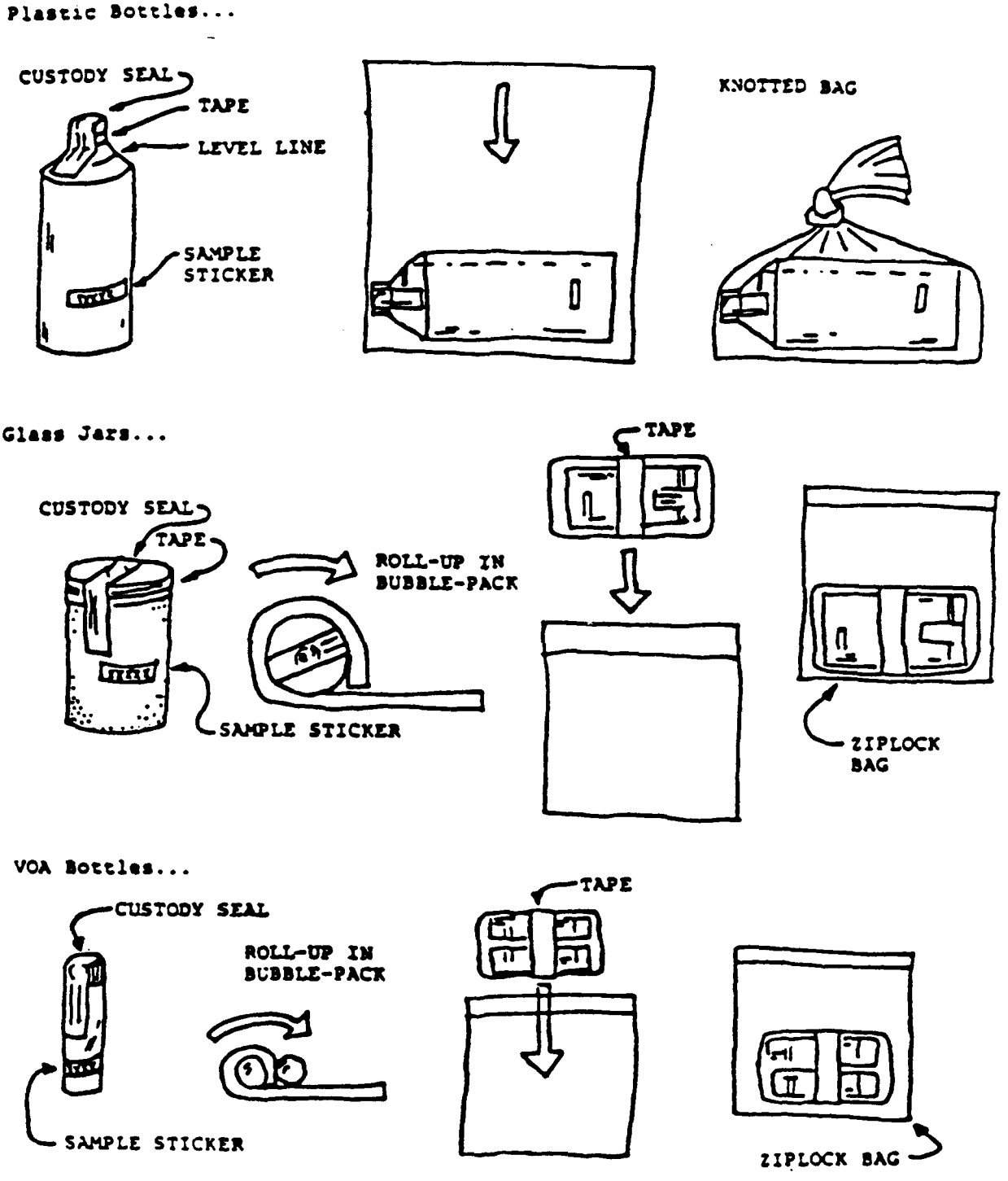
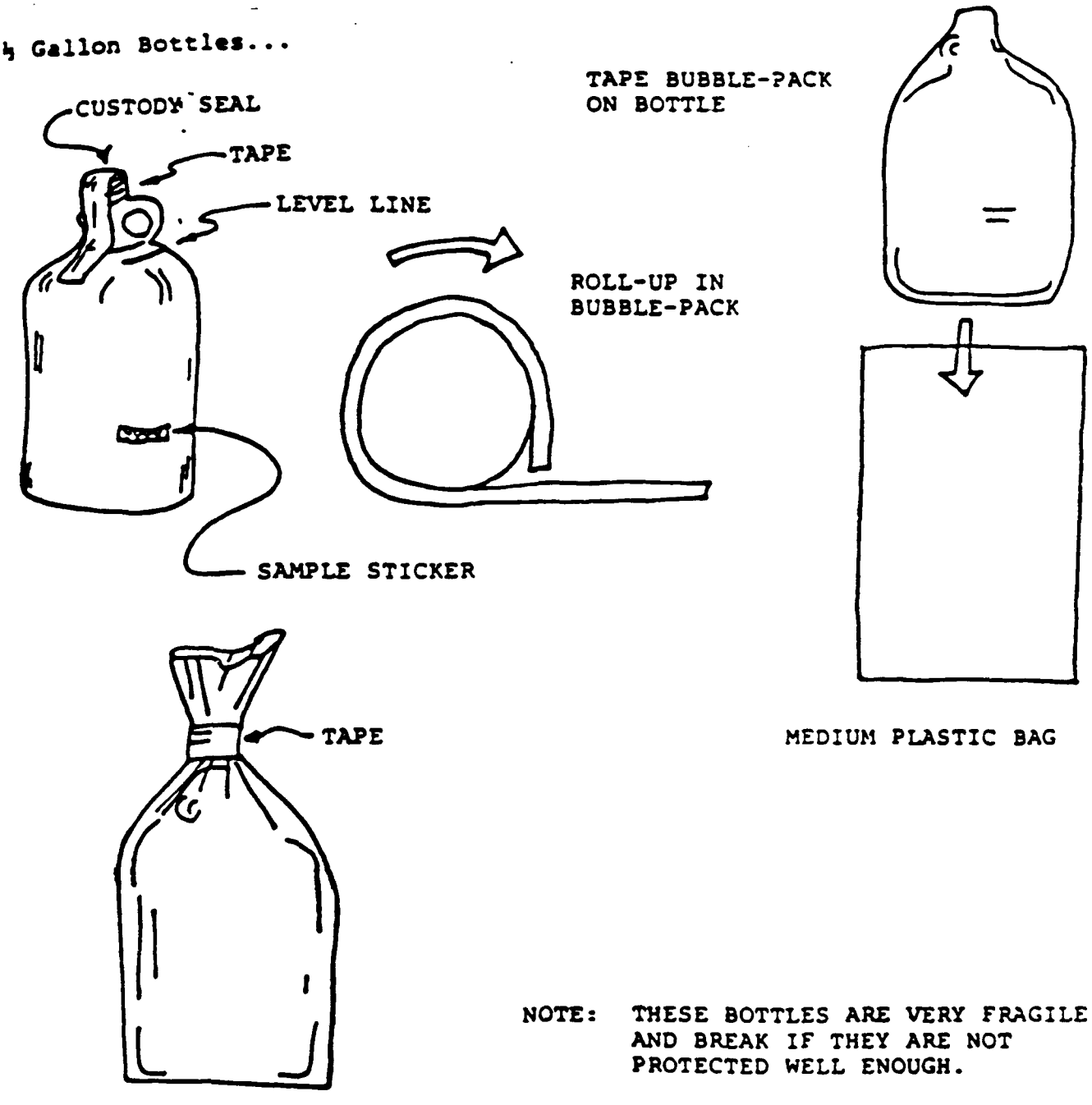


FIGURE 3.6.3-2
WATER SAMPLE PACKAGING

CH2MHILL



NOTE: THESE BOTTLES ARE VERY FRAGILE AND BREAK IF THEY ARE NOT PROTECTED WELL ENOUGH.

FIGURE 3.6.3-2 (CONT)

WATER SAMPLE PACKAGING

CH2M HILL

- Coolers were lined with large plastic bags, and approximately 3 inches of vermiculite was placed in the bottom of the bags.

- The sample containers and ice packages in sealable plastic bags were placed on end in the cooler and arranged so they did not touch, and the voids were filled with vermiculite.

- The large plastic bags were taped closed and custody sealed.

- A custody seal was placed on each sample container.

- A mailing label with the laboratory address was placed on top of each cooler.

- "THIS SIDE UP" labels were attached on all four sides of each cooler. "FRAGILE" labels were attached on at least two sides of each cooler.

- Shipper's address was written on outside of cooler.

- Each cooler weighed less than 70 pounds.

Shipping containers were plastic or metal-clad ice chests, in good condition, capable of retaining fluids should a sample loss occur.

3.6.4 FIELD QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROGRAM

A variety of QC procedures have been implemented in the Stage 2-1 field sampling activities at Beale AFB in accordance with the USAF Statement of Work and the USAF Technical Services Division Handbook (USAF, 1988). A summary of field and laboratory quality control procedures is given in Table 3.6.4-1. Descriptions of these procedures are listed below and are given in the QAPP (CH2M HILL, 1988b).

3.6.4.1 Background Samples

In addition to background soils and groundwater samples collected at selected individual sites, background groundwater samples were collected from two wells installed on the base upgradient of all sites. Quarterly sampling was conducted for 1 year at these wells.

Table 3.6.4-1
SUMMARY OF QUALITY CONTROL PROCEDURES
STAGE 2-1

FIELD QC

Sample Type	Target Frequency	Daily Minimum[a]	Comment
Replicate (water)	10%	None	
Replicate (soil)	10%	None	If sufficient volume
Equipment (Field) Blank (water)	10%	None	Water only
Ambient Condition Blank (water)	10%	None	Water only - 8010/8020 only
Trip blank (water and soil)	10%	None	Water - 8010/8020 only Soil - 8240 only

LABORATORY QC

Sample Type	Target Frequency	Daily Minimum[b]
Duplicate	5%	1/analysis method
Blank	5%	1/analysis method
Matrix spike	5%	1/analysis method
Surrogate spike	(method specific)	(method specific)
Control	5%	1/analysis method

[a]During sampling activities for specific media

[b]During analysis activities for specific methods

3.6.4.2 Field Replicate Samples

Field replicate samples were collected at a rate of approximately 10 percent per media sampled. For surface soils or waste samples (solids), replicate samples were collected by splitting samples, provided that sufficient sample volume could be collected. If sufficient sample volume could not be obtained in a single split-spoon sample, the sampler was driven in a second time to obtain the replicate sample.

Field replicate samples collected from soil borings consisted of sequential modified California Split Spoon intervals.

For all water samples, replicate samples were collected by retaining consecutive samples from the sampling device (bailer, pump discharge, or grab container).

3.6.4.3 Field Blanks

Field blank samples, also called equipment blanks, were collected at the rate of approximately 10 percent of project samples (no daily requirement) for water samples only. Field blanks for water samples were collected utilizing field sampling techniques, but substituting deionized (DI) water instead of actual samples. For well samples collected with bailers, deionized water (Type II, Reagent Grade) was placed in the sampling bailer, after decontamination, then placed in sample containers. Grab water sample field blanks were collected in a similar fashion, by adding DI water to the sample collection container, after decontamination, then retained in sampling containers. For all water samples, field blank collection followed actual sampling methods as closely as possible.

No field blank samples were collected for solid (soil and waste) media.

3.6.4.4 Ambient Condition Blanks

Ambient condition blanks were collected at a rate of approximately 10 percent of water samples collected for purgeable organic analyses (8010/8020). Ambient condition blanks were collected by placing deionized water (Type II, Reagent Grade) in sampling bottles, at the sampling site. These differ from field blanks in that the water is not passed through the sampling equipment.

3.6.4.5 Trip Blanks

Trip blank samples were collected at a rate of approximately 10 percent of liquid samples for purgeable organic analyses (8010/8020). Trip blanks are similar to other blanks in that they are prepared with Type II Reagent Grade water. They differ from other blanks in that the water is not exposed to field conditions. Trip blanks were prepared at the laboratory, shipped to the field office, and shipped with field samples back to the laboratory.

3.6.4.6 Sample Labels

All samples were labeled with information identifying the sample location, date and time of sample collection, sampler, and other relevant data, as appropriate. All samples were assigned a unique identifying number which was written on the sample label, and affixed as a separate printed label.

All labels were filled out using indelible ink and affixed to the sample containers via the adhesive backing. An example of the sample label to be used is given in Figure 3.6.4-1.

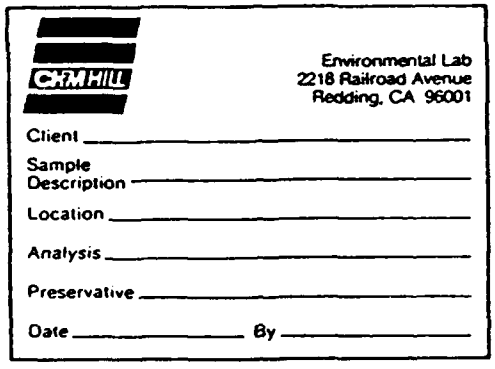
3.6.4.7 Chain-of-Custody Record

A Chain-of-Custody Record was filled out for each sample shipment container. All samples within a container had to be accounted for on the Chain-of-Custody Record. An example of the Chain-of-Custody Record is given in Figure 3.6.4-2.

3.6.4.8 Transfer of Custody and Shipment

Samples were accompanied at all times by a Chain-of-Custody Record. When transferring samples, the individuals relinquishing and receiving the samples signed, dated, and noted the time on the record. This record was used to fully document sample custody transfer from the sampler, often through another person, to the analyst at the laboratory.

Samples were packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate Chain-of-Custody Record accompanying each shipping container. Shipping containers were sealed with custody seals for shipment to the laboratory. The method of shipment, courier name(s), and other pertinent information were



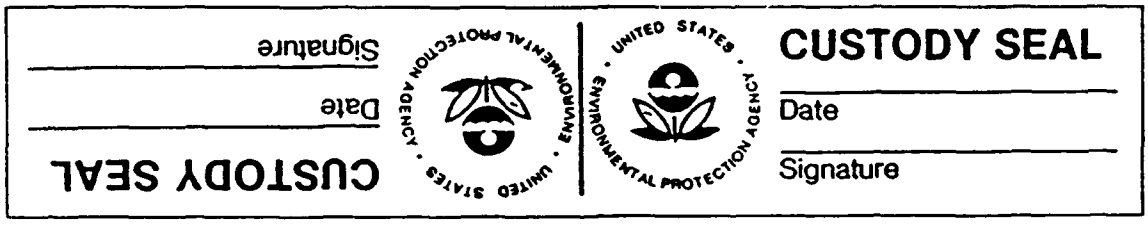
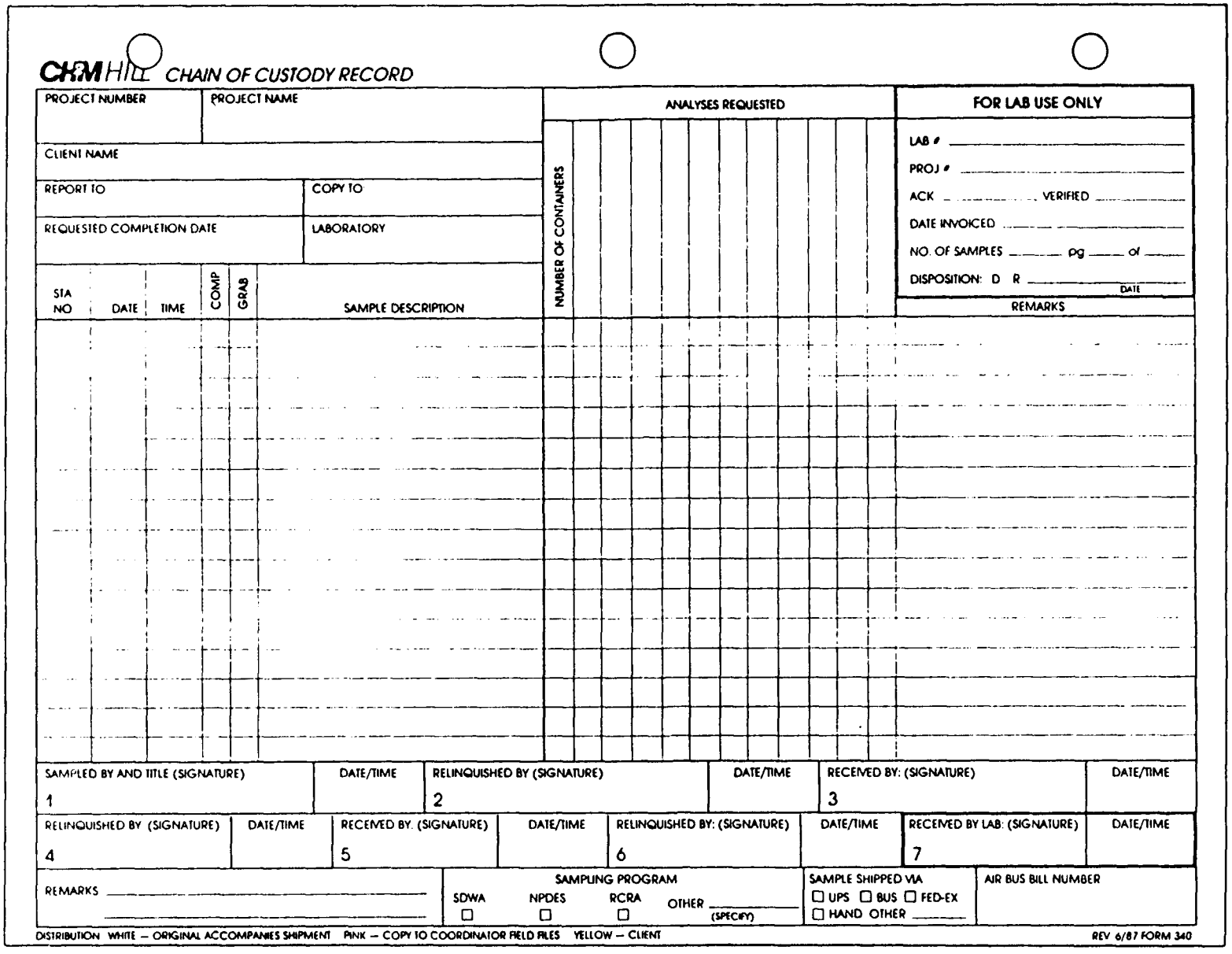


FIGURE 3.6.4-1

EXAMPLE LABEL & CUSTODY SEAL



CH2M HILL CHAIN OF CUSTODY RECORD

PROJECT NUMBER | PROJECT NAME

CLIENT NAME

REPORT TO | COPY TO

REQUESTED COMPLETION DATE | LABORATORY

STA NO	DATE	TIME	COMP	GRAB	SAMPLE DESCRIPTION	NUMBER OF CONTAINERS

ANALYSES REQUESTED

FOR LAB USE ONLY

LAB # _____

PROJ # _____

ACK _____ VERIFIED _____

DATE INVOICED _____

NO. OF SAMPLES _____ pg _____ of _____

DISPOSITION: D R _____ DATE

REMARKS

SAMPLED BY AND TITLE (SIGNATURE)	DATE/TIME	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME
1		2		3	

RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY LAB: (SIGNATURE)	DATE/TIME
4		5		6		7	

REMARKS _____

SAMPLING PROGRAM: SDWA ☐ NPDES ☐ RCRA ☐ OTHER _____ (SPECIFY)

SAMPLE SHIPPED VIA: ☐ UPS ☐ BUS ☐ FED-EX ☐ HAND OTHER _____

AIR BUS BILL NUMBER

DISTRIBUTION WHITE — ORIGINAL ACCOMPANIES SHIPMENT PINK — COPY TO COORDINATOR FIELD FILES YELLOW — CLIENT

REV 6/87 FORM 340

FIGURE 3.6.4-2

CHAIN OF CUSTODY RECORD

CH2M HILL

entered in the Remarks section of the Chain-of-Custody Record. An example of the custody seal is also given in Figure 3.6.4-1.

If sent by mail, the package was registered with return receipt requested. If sent by common carrier, a bill of lading was used. Air freight shipments were sent collect. Freight bills, postal service receipts, and bills of lading were retained as part of the permanent documentation.

Documents were distributed as follows:

- Shipped with samples:
  - Chain-of-Custody Record (original)
- Returned to CH2M HILL files:
  - Chain-of-Custody Record (pink copy)
  - Shipping records

3.6.4.9 Sample Identification

Samples were assigned alpha-numeric numbers unique to each sample. The sample numbers began with BAFB-0001 and progressed sequentially (BAFB-0002, BAFB-0003, etc.). This simplified numbering system was easy to use and resulted in few errors.

A Master Field Logbook was used to describe each sample collected in terms of appropriate identifying information.

3.6.4.10 Field Record Keeping

In addition to completion of the Chain-of-Custody Record, soil boring logs, well completion logs, and other preprinted data forms, all team members were assigned bound field notebooks, in which significant events, observations, and measurements were recorded. These notebooks were kept as permanent records. During field work, notebook pages were copied weekly to serve as a backup in case the original notebook was lost or destroyed. Notebook copies were maintained in CH2M HILL Sacramento office files.

In addition to the field notebooks, a field Master Sample Log was maintained in a bound notebook kept at the field headquarters. All samples collected at the base were logged in the Master Sample Log on a daily basis. The Master Sample Log utilized sample numbers printed on adhesive labels.

Each number was printed on three labels. At the beginning of each sampling episode, field team members took an appropriate number of labels to the sampling locations. This prevented duplication of numbers if multiple sampling was in progress. After each sample was collected, the sampler placed one of the three labels on the sample, and placed a second label in his/her field notebook, along with a sample description. At the end of a sampling episode, the third label was placed in the Master Sample Log, with appropriate data. This three-sticker system prevented number transposition and disagreements between field logs, Master Sample Log, and samples.

If for any reason a sample number was not used (accidentally skipped), all three labels were placed in the Master Sample Log to indicate that number was not used.

The Master Sample Log was copied regularly. An updated copy is kept on file in the CH2M HILL office in Sacramento.

3.6.4.11 Corrections to Documentation

Unless prohibited by weather conditions, all original data recorded in field notebooks, the Master Sample Log, sample identification tags, and Chain-of-Custody Records were written in waterproof ink.

If an error was made on an accountable document assigned to one individual, that individual made corrections by crossing a line through the error and entering the correct information. The erroneous information was not obliterated. Any subsequent error discovered on an accountable document was corrected by the person who made the entry. All subsequent corrections were initialed and dated.

3.6.4.12 Field Calibration Procedures

Field equipment requiring calibration includes the electrical conductivity and pH meters and water-level measurement meters. The conductivity and pH meters were calibrated prior to and at the completion of each day's use to standards in accordance with procedures and schedules outlined in the particular model's handbook. The calibration standards for these instruments and the suppliers from which standards are obtained are:

EC 223, 1,000 umhos/cm Fisher Scientific, Tustin, California

pH 4, 6.8, 10 buffers Fisher Scientific, Tustin, California

The well discharge and water level measurement meters were calibrated according to manufacturer's instructions.

Calibrated equipment was uniquely identified by using either the manufacturer's serial number or other means. The results of calibrations and records of repairs were entered in a logbook.

Equipment that failed calibration or became inoperable during use was removed from service and either segregated to prevent inadvertent use or tagged to indicate it was out of calibration.

3.7 LABORATORY PROGRAM

The following sections describe the CH2M HILL laboratory and other laboratories used in the Stage 2-1 Remedial Investigation. Descriptions of analytical methods (including instrumentation used, calibration procedures, analytical interferences, etc.) and the laboratory QA/QC program are provided. Further detail is available in the QAPP.

3.7.1 IDENTIFICATION OF LABORATORIES

The CH2M HILL Redding Environmental Lab is the main contracted lab for analysis of samples from Beale Air Force Base for Stage 2-1 activities. The names, addresses, and telephone numbers of that lab and all labs subcontracted for Beale Stage 2-1 are listed below. All laboratories used are accredited by California Department of Health Services for hazardous waste testing.

CH2M HILL Redding Environmental Laboratory
5090 Caterpillar Road
Redding, California 96003
916/244-5227

CH2M HILL Montgomery Environmental Laboratory
2567 Fairlane Drive
Montgomery, Alabama 36116
205/271-1444

CH2M HILL Corvallis Office
2300 W. Walnut Boulevard
Corvallis, Oregon 97330
503/752-4271

California Analytical Labs
2544 Industrial Boulevard
West Sacramento, California 95691
216/372-I393

Enseco
Rocky Mountain Analytical Labs
4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611

Roy F. Weston
7720 Lorraine Avenue, #105
Stockton, California 95210
209/957-3405

E.A.S. Lab
3576 Empleo, Suite 5
San Luis Obispo, California 93401
805/541-3666

3.7.2 DESCRIPTION OF ANALYTICAL PARAMETERS

3.7.2.1 Analyses Conducted

Analyses conducted for each IRP site varied according to known contaminants at each site, conclusions from previous studies, and identified data needs. Table 3.7.2-1 lists the tests and individual analytes for soils and sediment samples. Table 3.7.2-2 gives similar information for water samples. Not every sample was analyzed for all tests listed in these tables.

3.7.2.2 Instrumentation Used

The following is a list of equipment used by the CH2M HILL Redding Environmental Laboratory during this investigation.

Atomic Absorption Spectrophotometer:
Perkin Elmer 305B flame AA with background correction
Perkin Elmer 5100 Zeeman AA with background correction

Inductively Coupled Plasma Spectrometer
Thermo Jerrall Ash ICP61

Table 3.7.2-1
SUMMARY OF QUALITY ASSURANCE FOR SOILS AND SEDIMENT ANALYSES

Parameter	Method[a] Extraction	Method[a] Analysis	Detection Limit (mg/kg)	Accuracy (% Recovery)	Precision (Relative % Difference)	Completeness
Volatile Organics	5030	8240		See Table 3.7.3-1		90%
Chloromethane			0.1			
Bromomethane			0.1			
Vinyl chloride			0.1			
Chloroethane			0.1			
Methylene chloride			0.1			
Acetone			0.1			
Carbon disulfide			0.1			
1,1-Dichloroethene			0.1			
1,1-Dichloroethane			0.1			
trans-1,2-Dichloroethene			0.1			
Chloroform			0.1			
1,2-Dichloroethane			0.1			
2-Butanone			0.1			
1,1,1-Trichloroethane			0.1			
Carbon tetrachloride			0.1			
Vinyl acetate			0.1			
Bromodichloromethane			0.1			
1,1,2,2-Tetrachloroethane			0.1			
1,2-Dichloropropane			0.1			
trans-1,3-Dichloropropene			0.1			
Trichloroethene			0.1			
Dibromochloromethane			0.1			
1,1,2-Trichloroethane			0.1			
Benzene			0.1			
cis-1,3-Dichloropropene			0.1			
Bromoform			0.1			
2-Hexanone			0.1			
4-Methyl-2-pentanone			0.1			
Tetrachloroethene			0.1			
Toluene			0.1			
Chlorobenzene			0.1			
Ethyl benzene			0.1			
Styrene			0.1			
Total xylenes			0.1			
2-Chloroethylvinyl ether			0.1			
Extractable Organics	3550	8270		See Table 3.7.3-1		90%
2,4-Dinitrophenol			1.60			
4-Nitrophenol			1.60			
Dibenzofuran			0.33			
2,4-Dinitrotoluene			0.33			
2,6-Dinitrotoluene			0.33			
Diethyl phthalate			0.33			
4-Chlorophenyl phenyl ether			0.33			
Fluorene			0.33			
4-Nitroaniline			1.60			
4,6-Dinitro-2-methylphenol			1.60			
4-Bromophenyl phenyl ether			0.33			
Hexachlorobenzene			0.33			
Pentachlorophenol			1.60			
Phenanthrene			0.33			
Anthracene			0.33			
Di-n-butyl phthalate			0.33			
Fluoranthene			0.33			
Pyrene			0.33			
Butyl benzyl phthalate			0.33			
3,3'-Dichlorobenzidene			0.66			
Benzo(a)anthracene			0.33			
bis(2-ethylhexyl)phthalate			0.33			
Chrysene			0.33			
Di-n-octyl phthalate			0.33			
Benzo(b)fluoranthene			0.33			
Benzo(k)fluoranthene			0.33			
Benzo(a)pyrene			0.33			
Indeno((1,2,3-cd)pyrene			0.33			

Table 3.7.2-1 (Continued)

Parameter	Method[a] Extraction	Method[a] Analysis	Detection Limit (mg/kg)	Accuracy (% Recovery)	Precision (Relative % Difference)	Completeness
Extractable Organics (continued)	3550	8270		See Table 3.7.3-1		90%
Dibenzo(a,h)anthracene			0.33			
Benzo(g,h,i)perylene			0.33			
N-Nitrosodimethylamine			0.33			
Phenol			0.33			
bis(2-Chloroethyl) ether			0.33			
2-Chlorophenol			0.33			
1,3-Dichlorobenzene			0.33			
1,4-Dichlorobenzene			0.33			
Benzyl alcohol			0.33			
1,2-Dichlorobenzene			0.33			
2-Methylphenol			0.33			
bis(2-Chloroisopropyl) ether			0.33			
4-Methylphenol			0.33			
N-Nitrosodipropylamine			0.33			
Hexachloroethane			0.33			
Nitrobenzene			0.33			
Isophorone			0.33			
2-Nitrophenol			0.33			
2,4-Dimethylphenol			0.33			
Benzoic acid			1.60			
bis(2-Chloroethoxy) methane			0.33			
2,4-Dichlorophenol			0.33			
1,2,4-Trichlorobenzene			0.33			
Naphthalene			0.33			
4-Chloroaniline			0.33			
Hexachlorobutadiene			0.33			
4-Chloro-3-methylphenol (para-chloro-meta-cresol)			0.33			
2-Methylnaphthalene			0.33			
Hexachlorocyclopentadiene			0.33			
2,4,6-Trichlorophenol			0.33			
2,4,5-Trichlorophenol			1.60			
2-Chloronaphthalene			0.33			
2-Nitroaniline			1.60			
Dimethyl phthalate			0.33			
Acenaphthylene			0.33			
3-Nitroaniline			1.60			
Acenaphthene			0.33			
N-nitrosodiphenylamine			0.33			
Metals						
Aluminum	3050	6010	20	75-125 post spike	±20	90%
Antimony	3050	6010	30	"	"	"
Arsenic	3050	6010	30	"	"	"
Barium	3050	6010	10	"	"	"
Beryllium	3050	6010	0.5	"	"	"
Cadmium	3050	6010	1	"	"	"
Calcium	3050	6010	100	"	"	"
Chromium	3050	6010	3	"	"	"
Cobalt	3050	6010	4	"	"	"
Copper	3050	6010	3	"	"	"
Iron	3050	6010	10	"	"	"
Lead	3050	6010	20	"	"	"
Magnesium	3050	6010	100	"	"	"
Manganese	3050	6010	1.5	"	"	"
Mercury	(method)	7471	0.06	"	"	"
Molybdenum	3050	6010	4	"	"	"
Nickel	3050	6010	4	"	"	"
Potassium	3050	6010	as det.	"	"	"
Selenium	3050	6010	40	"	"	"
Silver	3050	6010	3	"	"	"
Sodium	3050	6010	100	"	"	"
Thallium	3050	6010	50	"	"	"
Vanadium	3050	6010	4	"	"	"
Zinc	3050	6010	2	"	"	"

Table 3.7.2-1 (Continued)

Parameter	Method[a] Extraction	Method[a] Analysis	Detection Limit (mg/kg)	Accuracy (% Recovery)	Precision (Relative % Difference)	Completeness
Pesticides & PCBs	3550	8080		See Table 3.7.3-1		90%
alpha-BHC			0.01			
beta-BHC			0.01			
delta-BHC			0.01			
gamma-BHC (Lindane)			0.01			
Heptachlor			0.01			
Aldrin			0.01			
Heptachlor epoxide			0.01			
Endosulfan I			0.01			
Dieldrin			0.02			
4,4'-DDE			0.02			
Endrin			0.02			
Endosulfan II			0.02			
4,4'-DDD			0.02			
Endosulfan sulfate			0.02			
4,4'-DDT			0.02			
Endrin ketone			0.02			
Methoxychlor			0.08			
Chlordane			0.1			
Toxaphene			0.2			
AROCLOR-1016			0.1			
AROCLOR-1221			0.1			
AROCLOR-1232			0.1			
AROCLOR-1242			0.1			
AROCLOR-1248			0.1			
AROCLOR-1254			0.2			
AROCLOR-1260			0.2			
Cyanide	SM412[b]	9010	20	75-125	±20	90%
Waste Analyses						
STLC	California method[c]		N/A	N/A	N/A	90%
Ignitability		1010	N/A	N/A	N/A	N/A
Percent Moisture	ASA#9, Part 1, Method 7-2.2[d]		N/A	N/A	N/A	N/A
Soil pH		9045	N/A	N/A	N/A	N/A
Petroleum Hydrocarbons[e]						
Gasoline Components	California Method[c]		1 ppm	50-170	50	90%
Diesel Components	California Method[c]		1 ppm	50-170	50	90%
Oil and Grease		9071	50	N/A	N/A	N/A

Table 3.7.2-1 (Continued)

Parameter	Method[a] Extraction	Method[a] Analysis	Detection Limit (mg/kg)	Accuracy (% Recovery)	Precision (Relative % Difference)	Completeness
Site-Specific Analyses						
Dioxins, Furans (all isomers)		8280[f]	(low level)[f]	f	f	f
Chlorophenoxy Herbicides						
2,4-D	(method)	8150	0.8	20-150	50	90%
2,4,5-T	(method)	8150	0.1	20-150	50	90%
Silvex	(method)	8150	0.1	20-150	50	90%
Explosives	USATHAMA	4B	g	g	g	g
Nitrobenzene	USATHAMA	4B	7.0	g	g	g
2, 4-Dinitrotoluene	USATHAMA	4B	7.0	g	g	g
2, 6-Dinitrotoluene	USATHAMA	4B	10.0	g	g	g
Sym-Trinitrobenzene	USATHAMA	4B	10.0	g	g	g
TNT	USATHAMA	4B	10.0	g	g	g
RDX	USATHAMA	4B	5.0	g	g	g
HMX	USATHAMA	4B	10.0	g	g	g

[a]Methods given are EPA SW-846 methods, unless otherwise noted.
U.S. Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste - Physical/Chemical Methods. Office of Solid Waste, U.S. EPA, Washington, D.C. SW-846, Third Edition, 1986.

[b]American Public Health Association. Standard Methods for the Examination of Water and Wastewater 16th Edition (1985).

[c]California Administrative Code, Title 22, Division 4, Chapter 30, Article 11 Criteria for Identification of Hazardous and Extremely Hazardous Wastes.

[d]American Society of Agronomy, Inc. Methods of Soil Analysis Part 2 Chemical and Microbiological Properties. 2nd Ed., 1982.

[e]California Regional Water Quality Control Board, Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure. Dec. 1987. Suggested criteria.

[f]Dioxins, furans analysis by modified Method 8280 (SW-846). Analyses were subcontracted and modified method is laboratory specific.

[g]Explosives analysis were subcontracted and method is laboratory specific.

Table 3.7.2-2
SUMMARY OF QUALITY ASSURANCE OBJECTIVES FOR WATER ANALYSES

Parameter	Method[a] Extraction	Method[a] Analysis	Detection Limit (ug/l unless given)	Accuracy (% Recovery)	Precision (Relative % Difference)	Completeness
Purgeable Halocarbons	5030	8010	[f]	See Table 3.7.3-1		90%
Bromodichloromethane			1.0	42-172	20	
Bromoform			1.0	13-159	33	
Bromomethane			1.0	D-144	12	
Carbon tetrachloride			1.0	43-143	22	
Chlorobenzene			1.0	38-150	24	
Chloroethane			1.0	46-137	20	
2-Chloroethyl vinyl ether			1.0	14-186	35	
Chloroform			1.0	49-133	19	
Chloromethane			1.0	D-193	59	
Dibromochloromethane			1.0	24-191	32	
1,2-Dichlorobenzene			1.0	D-208	44	
1,3-Dichlorobenzene			1.0	7-187	38	
1,4-Dichlorobenzene			1.0	42-143	22	
1,1-Dichloroethane			1.0	47-132	19	
1,2-Dichloroethane			1.0	51-147	20	
1,1-Dichloroethene			1.0	28-167	29	
trans-1,2,-Dichloroethene			1.0	38-155	24	
1,2-Dichloropropane			1.0	44-156	23	
cis-1,3-Dichloropropene			1.0	22-178	32	
trans-1,3-Dichloropropene			1.0	22-178	32	
Methylene chloride			5	25-162	28	
1,1,2,2-Tetrachloroethane			1.0	8-184	37	
Tetrachloroethene			1.0	26-162	29	
1,1,1-Trichloroethane			1.0	41-138	22	
1,1,2-Trichloroethane			1.0	39-136	22	
Trichloroethene			1.0	35-146	25	
Vinyl Chloride			1.0	28-163	29	
Purgeable Aromatics[f]	5030	8020				
Benzene			1.0	39-150	24	
Chlorobenzene			1.0	55-135	18	
1,2-Dichlorobenzene			1.0	37-154	25	
1,3-Dichlorobenzene			1.0	50-141	19	
1,4-Dichlorobenzene			1.0	42-143	22	
Ethylbenzene			1.0	32-160	27	
Toluene			1.0	46-148	14	
Xylenes			1.0	N/A	N/A	
Extractable Organics	3510/3520	8270		See Table 3.7.3-1		90%
2,4-Dinitrophenol			50			
4-Nitrophenol			50			
Dibenzofuran			10			
2,4-Dinitrotoluene			10			
2,6-Dinitrotoluene			10			
Diethyl phthalate			10			
4-Chlorophenyl phenyl ether			10			
Fluorene			50			
4-Nitroaniline			50			
4,6-Dinitro-2-methylphenol			10			
4-Bromophenyl phenyl ether			10			
Hexachlorobenzene			50			
Pentachlorophenol			10			
Phenanthrene			10			
Anthracene			10			
Di-n-butyl phthalate			10			
Fluoranthene			10			
Pyrene			10			
Butyl benzyl phthalate			20			
3,3'-Dichlorobenzidene			10			
Benzo(a)anthracene			10			
bis(2-ethylhexyl)phthalate			10			
Chrysene			10			
Di-n-octyl phthalate			10			
Benzo(b)fluoranthene			10			

Table 3.7.2-2 (Continued)

Parameter	Method[a] Extraction	Method[a] Analysis	Detection Limit (ug/l unless given)	Accuracy (% Recovery)	Precision (Relative % Difference)	Completeness
Extractable Organics (Continued)	3510/3520	8270		See Table 3.7.3-1		90%
Benzo(b)fluoranthene			10			
Benzo(k)fluoranthene			10			
Benzo(a)pyrene			10			
Indeno((1,2,3-cd)pyrene			10			
Dibenzo(a,h)anthracene			10			
Benzo(g,h,i)perylene			10			
N-Nitrosodimethylamine			10			
Phenol			10			
bis(2-Chloroethyl) ether			10			
2-Chlorophenol			10			
1,3-Dichlorobenzene			10			
1,4-Dichlorobenzene			10			
Benzyl alcohol			10			
1,2-Dichlorobenzene			10			
2-Methylphenol			10			
bis(2-Chloroisopropyl) ether			10			
4-Methylphenol			10			
N-Nitrosodipropylamine			10			
Hexachloroethane			10			
Nitrobenzene			10			
Isophorone			10			
2-Nitrophenol			10			
2,4-Dimethylphenol			10			
Benzoic acid			50			
bis(2-Chloroethoxy) methane			10			
2,4-Dichlorophenol			10			
1,2,4-Trichlorobenzene			10			
Naphthalene			10			
4-Chloroaniline			10			
Hexachlorobutadiene			10			
4-Chloro-3-methylphenol (para-chloro-meta-cresol)			10			
2-Methylnaphthalene			10			
Hexachlorocyclopentadiene			10			
2,4,6-Trichlorophenol			10			
2,4,5-Trichlorophenol			50			
2-Chloronaphthalene			10			
2-Nitroaniline			50			
Dimethyl phthalate			10			
Acenaphthylene			10			
3-Nitroaniline			50			
Acenaphthene			10			
N-nitrosodiphenylamine			10			
Metals						
Aluminum	3005	6010	0.2 mg/l	75-125	±20	90%
Antimony	3005	6010	0.3 mg/l	75-125	±20	90%
Arsenic (AA)	3020	7060/7061	0.005 mg/l	75-125	±20	90%
Arsenic (ICP)	3005	6010	0.3 mg/l	75-125	±20	90%
Barium	3005	6010	0.1 mg/l	75-125	±20	90%
Beryllium	3005	6010	0.005 mg/l	75-125	±20	90%
Cadmium	3005	6010	0.01 mg/l	75-125	±20	90%
Calcium	3005	6010	1.0 mg/l	75-125	±20	90%
Chromium	3005	6010	0.03 mg/l	75-125	±20	90%
Cobalt	3005	6010	0.04 mg/l	75-125	±20	90%
Copper	3005	6010	0.03 mg/l	75-125	±20	90%
Iron	3005	6010	0.1 mg/l	75-125	±20	90%
Lead (AA)	3020	7420/7421	0.005 mg/l	75-125	±20	90%
Lead (ICP)	3005	6010	0.2 mg/l	75-125	±20	90%
Magnesium	3005	6010	1.0 mg/l	75-125	±20	90%
Manganese	3005	6010	0.015 mg/l	75-125	±20	90%
Mercury	(method)	7471	0.0005 mg/l	75-125	±20	90%
Molybdenum	3005	6010	0.04 mg/l	75-125	±20	90%
Nickel	3005	6010	0.04 mg/l	75-125	±20	90%
Potassium	3005	6010	determined	75-125	±20	90%
Selenium (AA)	3020	7740/7741	0.005 mg/l	75-125	±20	90%

Table 3.7.2-2 (Continued)

Parameter	Method[a] Extraction	Method[a] Analysis	Detection Limit (ug/l unless given)	Accuracy (% Recovery)	Precision (Relative % Difference)	Completeness
Metals (Continued)						
Selenium (ICP)	3005	6010	0.4 mg/l	75-125	±20	90%
Silver	3005	6010	0.03 mg/l	75-125	±20	90%
Sodium	3005	6010	1.0 mg/l	75-125	±20	90%
Thallium	3005	6010	0.5 mg/l	75-125	±20	90%
Vanadium	3005	6010	0.04 mg/l	75-125	±20	90%
Zinc	3005	6010	0.02 mg/l	75-125	±20	90%
Cyanide	N/A	9010	0.01 mg/l	75-125	±20	90%
Water Analyses						
Temperature	N/A	E170.1[b]	N/A	N/A	±20	90%
pH	N/A	E150.1[b]	N/A	N/A	±20	90%
Specific Conductivity	N/A	E120.1[b]	N/A	N/A	±20	90%
Total Dissolved Solids	N/A	E160.1[b]	3 mg/l	N/A	±20	90%
Anions						
Alkalinity, Carbonate Bicarbonate	N/A	SM403[c]	10 mg/l	75-125	±20	90%
Chloride	N/A	E325.3[b]	1 mg/l	75-125	±20	90%
Fluoride	N/A	E340.2[b]	0.05 mg/l	75-125	±20	90%
Sulfate	N/A	E375.4[b]	1 mg/l	75-125	±20	90%
Nitrate + Nitrite	N/A	E353.3[b]	0.05 mg/l	75-125	±20	90%
Petroleum Hydrocarbons[e]						
Gasoline Components	California Method[d]		0.5 mg/l	50-150	±50	90%
Diesel Components	California Method[d]		0.5 mg/l	50-150	±50	90%
Site-Specific Analyses						
COD	N/A	E410.4[b]	7 mg/l	75-125	±20	90%
Dioxins, Furans (all isomers)	8280[g]	[g]	[g]	[g]	[g]	[g]
TNT,		USGS	0.8	[h]	[h]	[h]
RDX		USGS	0.6	[h]	[h]	[h]
Picric Acid		USGS	0.2	[h]	[h]	[h]

[a]Methods given are EPA SW-846 methods, unless otherwise noted.
U.S. Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste - Physical/Chemical Methods. Office of Solid Waste, U.S. EPA, Washington, D.C. SW-846, Third Edition, 1986.

[b]U.S. Environmental Protection Agency. Methods for Chemical Analysis of Water and Wastes, EPA Manual 600/4-79-020 (USEPA, 1983).

[c]American Public Health Association. Standard Methods for the Examination of Water and Wastewater 16th Edition (1985).

[d]California Regional Water Quality Control Board, Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure. Dec. 1987. Suggested criteria.

[e]These limits are for advisory purposes only. They are not to be used to determine if a sample should be reanlyzed. When sufficient multilaboratory data are available, standard limits will be calculated.

[f]These limits are for a 20 mg/l concentration.

[g]Dioxins, furans analysis by modified Method 8280 (SW-846). Analyses were subcontracted and modified method is laboratory specific.

[h]TNT, RDX, Picric Acid analysis were subcontracted and method is laboratory specific.

Gas Chromatography/Mass Spectrometers
- Finnigan 5100
- Finnigan 4600: EI/CI/PPINICI sources
- Super Incos data station
- Tekmar ALS, LS II purge and trap concentrator and autosampler

Gas Chromatography
- Varian 3700: Hall/PID
- Tekmar ALS, LS II purge and trap concentrator and autosampler
- Vista 402 data station
- Varian 3700: capillary FID, TSD
- Varian 8000 autosampler
- Varian 3700: dual ECD
- Varian 8000 autosampler
- Varian 600 data station
- Varian 9000 autosampler
- Dynamic Solutions data system

Ancillary Instrumentation and Equipment:
- Bausch & Lomb spectronic 710 UV/Vis spectrophotometer
- Beckman specific ion/pH meter
- Hach nephelometer
- Heat Systems sonicator
- Millipore E.P. pressure filter
- Mettler analytical balance

- O'Haus top-loading balance
- Sartorius top-loading balance
- Evaporators
- Pensky Martens flash point apparatus
- Continuous extractors
- K-D apparatus

3.7.2.3 Analytical Interferences

Three laboratory interferences were identified during the Stage 2-1 study. First, methylene chloride and acetone were detected in many of the samples, and also in many of the method blanks. These are common laboratory contaminants and are considered false positive results.

Second, a bottle of acetone used in soil extraction was found to be contaminated with phenol. The contamination was discovered in method blanks developed from extraction of kiln-dried pure silica sand (soil blank matrix) and was estimated to be 1.7 mg/kg phenol. Approximately 57 surface soil and soil boring samples that came from sites 2, 3, 6,

9, 13, 16, 18, 19, and 20 were affected by this false positive result.

Third, thallium was detected in some soil samples. The thallium results are false positive results due to an interference problem (primarily with titanium) in the ICP metals analysis. Analysis of thallium by ICP suffers from spectral interferences from titanium which is not a reported analyte for ICP metals analysis. The interferences occur on both sides of the spectral bandwidth, and are difficult if not impossible to correct when the concentration of thallium is low compared to the concentrations of the interferents.

Fourth, toluene was detected in a majority of soil samples and many of the water samples throughout the base. This is probably a false positive result that may be related to the electrical tape used to seal the caps on the brass soil sample tubes. AeroVironment, the previous IRP contractor at Beale AFB, also has false positive results for toluene (AeroVironment, 1987, page III-48). They performed an experiment putting a 2-inch piece of electrical tape in a vial of organic-free water and analyzing the water for volatile organic compounds by EPA Method 601/602. The analysis showed high levels of toluene, but no other volatile organic compounds were detected.

Additional analytical interferences are discussed in Section 4, within individual site discussions.

3.7.3 LABORATORY QA/QC PROGRAM

This section summarizes the QA/QC procedures used by CH2M HILL during this investigation.

3.7.3.1 Establishment of Detection Limits

Maximum required detection limits are established by the USAF for the IRP program in the IRP Analytical Protocols Handbook (USAF, 1988b). Tables 3.7.2-1 and 3.7.2-2, given in the previous section, list the standard detection limits for all analytes.

In some cases, actual detection limits varied from those listed in the tables. Lower detection limits were achieved for some tests, but matrix interferences and required dilutions often resulted in higher detection limits for organic analyses. The analytical results given in Appendix A list the detection limits achieved for each sample and detected analyte, as well as dilution factors.

The limits of quantification (LOQ) are the detection limits given in Appendix A. Some analytes were tentatively identified below the LOQ and are flagged with a "J". This indicates that the analyte is believed to be present at low concentrations, but the concentration cannot be accurately determined with confidence.

3.7.3.2 Frequency and Type of Laboratory QA/QC Data

The following section describes the laboratory QA/QC sample program, sample frequency, and corrective actions. QA/QC data for surrogate spike receivers are presented with the sample analysis results and field QC results in Appendix A. Other supporting QA/QC data, including method blanks, matrix spikes, matrix spike duplicates, and trip blanks, are given in Appendix F.

3.7.3.2.1 Method Blank Analyses

A method blank is a "clean" sample (i.e., containing no analyte of concern), most often distilled water, to which all reagents and analytical procedures are performed. Method blanks are analyzed at a rate of one per sample lot or at least every 20 samples or batch if less than 20. The blank is analyzed in order to assess possible contamination from the laboratory so that corrective actions may be taken, if necessary.

Corrective Actions--the method blank results should contain no greater than method detection limits. If high blank values are observed, laboratory glassware and reagents should be checked for contamination and the analysis halted until the system can be brought under control.

3.7.3.2.2 Surrogate Spike Analyses

For certain analyses, such as GC/MS, each sample and blank is spiked with one or more "surrogate" compounds prior to preparatory operations such as purging or extraction. These surrogate standards are chosen so as to have properties similar to sample analytes of interest, but are most likely absent from the natural sample. This procedure is used to evaluate the efficiency of the analytical procedure to recover the true amount of a known compound.

Corrective Actions--the results of surrogate standard determinations are compared with the true values spiked into the sample matrix prior to extraction and analysis, and the percent recoveries of the surrogate standards are determined.

Recoveries should meet the upper and lower control limits as specified for each compound. If control limits are exceeded for surrogate standards, the following sequence of actions are taken:

- Calculations are checked to be sure that there are no errors.
- Internal standards and surrogate spiking solutions are checked for degradation, contamination, or solvent evaporation.
- Instrument performance is checked.
- If the above measures fail to reveal the cause of the non-compliant surrogate recoveries, the sample is repurged or re-extracted.
- If all the measures listed above fail to correct the problem for laboratory blank surrogate analyses, the analytical system is considered out of control, and must be recalibrated and examined for mechanical faults.
- If all the measures listed above fail to correct the problem for field sample surrogate analyses, the deficiency is probably due to sample interferences, and not due to any procedural or mechanical problems in the laboratory. The surrogate spike recovery data and the sample data from both extractions are reported.

3.7.3.2.3 Matrix Spike/Matrix Spike Duplicate Analyses

To evaluate the effect of the sample matrix upon analytical methodology, two separate aliquot samples are spiked with a standard mix of compounds appropriate to a given analysis. The matrix spike/matrix spike duplicate (MS/MSD) are analyzed at a frequency of one per lot or one per 20 samples, whichever is more frequent. The percent recovery for the spiking compounds is calculated. The relative percent difference (% RPD) between the MS/MSD is also calculated.

Corrective Actions--the observed percent recoveries and % RPD between the MS/MSD are used to determine the accuracy and the precision of the analytical method for the sample matrix. If the percent recovery and % RPD results exceed the control limits as specified for each spiking compound, the sample will not be re-analyzed. The reason is that poor

recovery in matrix spiked samples does not necessarily represent an analytical system out of control. It is possible that unavoidable interferences from the sample itself preclude efficient recoveries.

3.7.3.2.4 Internal Standards Analyses

Once an instrument has been calibrated, it is necessary to confirm periodically that the system remains in calibration. This is done each time analyses are performed by the use of appropriate internal standards added at a frequency consistent with the method being used. When internal standard addition is not appropriate to a particular method, other means of accuracy checks, such as standard addition are used. Results from internal standard analyses are entered on an accuracy control chart and compared to the mean calibrated value.

Corrective Actions--deviation from this mean beyond a predetermined magnitude, depending on the type of analysis, defines an out-of-control condition. The system must then be brought back into control by:

- Checking the quality of the internal standards and reanalyzing the sample
- Recalibrating the system
- Correcting the malfunctions causing the instrument to fall out of calibration

3.7.3.2.5 Duplicate Sample Analyses

Duplicate analyses are performed to evaluate the reproducibility of the method. Results of the duplicate analyses are used to determine the relative percent difference (% RPD) between replicate samples. For each parameter analyzed, at least one duplicate sample is tested per group of 20 samples or batch if less than 20.

Corrective Actions--the precision value, % RPD, should be reviewed by the QA Coordinator and department manager. If the precision value exceeds the control limit for the given parameter, the sample set should be reanalyzed for the parameter in question.

3.7.3.2.6 Check Standard Analyses

Analysis of check standards is used to verify the standard curve and shall be performed with each group of samples. Results of these data shall be summarized, evaluated and presented to the Laboratory Manager and QA Coordinator for review.

Corrective Actions--the results of check standard analysis are compared with the true values and the percent recovery of the check standard is calculated. If correction is required, the check standard shall be reanalyzed to demonstrate that the corrective action has been successful.

3.7.3.2.7 Performance Evaluation Standards Analyses

Performance standards serve as an accuracy check of laboratory operations and measurement systems by comparing CH2M HILL results with those of other laboratories. CH2M HILL routinely receives performance evaluation samples and standards from numerous performance audit programs such as EPA's Contract Laboratory Program (CLP); EPA's NPDES program; Florida's DER Round Robin program; etc. The results from these samples are reviewed by the Laboratory Manager, department managers, and the Quality Assurance Coordinator.

Corrective Actions--the results from the performance standards and the blind QC samples are reviewed by the Laboratory Manager, department manager, and QA coordinator. If the laboratory fails in its ability to perform acceptably on these samples, the entire analytical measurements process should be examined to ascertain why the errors were obtained. The corrective actions identified should be taken by the laboratory immediately.

3.7.3.3 Establishment of QA/QC Sample Control Limits

Control limits for precision, accuracy, and completeness are given in Tables 3.7.2-1 and 3.7.2-2 (previously given), and in Table 3.7.3-1.

For the Stage 2-1 activities at Beale AFB, the laboratory had responsibility to notify the Project Manager, in writing, should out-of-control conditions occur. The actions taken to correct the situation were also to be reported. Individual out-of-control conditions are discussed in Section 4 of this report, on a site-specific basis.

Table 3.7.3-1
RECOVERY LIMITS

SURROGATE SPIKE RECOVERY LIMITS

Fraction	Surrogate Compound	Low/Medium Water % Recovery	Low/Medium Soil/Sediment % Recovery
Volatiles	Toluene-d_8	88-110	81-117
	4-bromofluorobenzene	86-115	74-121
	1,2-dichloroethane-d_4	76-114	70-121
Semivolatiles	Nitrobenzene-d_5	35-114	23-120
	2-fluorobiphenyl	43-116	30-115
	p-terphenyl-d_{14}	33-141	18-137
	Phenol-d_5	10-94	24-113
	2-fluorophenol	21-100	25-121
	2,4,6-tribromophenol	10-123	19-122
Pesticides	(Dibutylchlorendate)[d]	(24-154)[a]	(20-150)[a]
Purgeable Halocarbons	Bromochloromethane	70-130	N/A
Purgeable Aromatics	α α α-trifluorotoluene	70-130	N/A

MATRIX SPIKE RECOVERY AND PRECISION LIMITS

Fraction	Matrix Spike Compound	Water[b] Recovery	Water[b] RPD[c]	Soil/Sediment[b] Recovery	Soil/Sediment[b] RPD[c]
Volatiles	1,1-dichloroethene	61-145	14	59-172	22
	Trichloroethene	71-120	14	62-137	24
	Chlorobenzene	75-130	13	60-133	21
	Toluene	76-125	13	59-139	21
	Benzene	76-127	11	66-142	21
Semivolatiles	1,2,4-trichlorobenzene	39-98	28	38-107	23
	Acenaphthene	46-118	31	31-137	19
	2,4-dinitrotoluene	24-96	38	28-89	47
	Pyrene	26-127	31	35-142	36
	N-nitroso-di-n-propylamine	41-116	38	41-126	38
	1,4-dichlorobenzene	36-97	28	28-104	27
	Pentachlorophenol	9-103	50	17-109	47
	Phenol	12-89	42	26-90	35
	2-chlorophenol	27-123	40	25-102	50
	4-chloro-3-methylphenol	23-97	42	26-103	33
	4-nitrophenol	10-80	50	11-114	50
Pesticides	Lindane	56-123	15	46-127	50
	Heptachlor	40-131	20	35-130	31
	Aldrin	40-120	22	34-132	43
	Dieldrin	52-126	18	31-134	38
	Endrin	56-121	21	42-139	45
	4,4'-DDT	38-127	27	23-134	50

[a]These limits are for advisory purposes only. They are not used to determine if a sample should be reanalyzed. When sufficient data become available, the USEPA may set performance-based contract-required windows.

[b]These limits are for advisory purposes only. They are not to be used to determine if a sample should be reanalyzed. When sufficient multi-laboratory data are available, standard limits will be calculated.

[c]RPD = Relative percent difference.

[d]Dibutylchlorendate is not commercially available; another substitute will have to be used if necessary.

3.7.3.4 Reference to Appendixes

As stated previously, chemical analysis data are reported in Appendix A. Also included in that appendix are results for field replicate samples, field blanks, ambient condition blanks, and equipment use blanks. Surrogate spike recoveries are reported in association with each organic analysis within Appendix A.

Appendix F contains supporting QA/QC data including method blank results, trip blank results, and matrix spike/matrix spike duplicate results.

IV. RESULTS AND SIGNIFICANCE OF FINDINGS

4.1 Discussion of Results

This section presents the results and findings for IRP Stage 2-1 activities at Beale AFB. The results include discussions of site geology and hydrogeology, analytical results, sample and analytical problems, and significance of findings. These items are discussed individually for each of the IRP sites. Even though several of the sites did not receive actions under Stage 2-1, subsections are included within this section in order to explain the current status of these sites in the IRP and to preserve the section numbering system.

Within this section, site discussions begin with three-digit headings (e.g., 4.1.1) where the third digit corresponds to the IRP site number. Each site discussion begins on a new page so that the results section may be separated into individual sites for evaluation, if desired.

Several important points should be noted regarding Section IV. These are:

1. Included in Section 4.1 are both statements of factual results, interpretations of these results, and development of conclusions regarding the physical and chemical status of each IRP site. These results are based primarily on information collected by CH2M HILL during IRP Stage 2-1 activities, but also include information collected during previous IRP work and related information provided by Beale AFB personnel. As the IRP progresses at Beale AFB, additional data will become available that may modify the conclusions in this report.

2. To determine the "significance of findings," it is necessary to interpret results and discuss those results that are most meaningful, according to best professional judgement. One example of this is the discussion of chemical analytes detected. For each site where samples were taken, all analytes detected are reported in the Analytical Results Table within each site discussion and in Appendix A. The text sections, figures, and other tables, however, discuss or present analytes that are interpreted to be indicators of site-specific contaminants. Omission of certain contaminants from text discussions or figures and tables does not imply that these compounds are unimportant. Until the time that risk assessments are completed for each site, all

analytes detected, except for those shown to be false positive results, or metals detected at or below background levels, must be considered significant.

3. Discussions about the concentrations of metals detected in soil samples have been compared to the natural background concentrations of these metals. To make this comparison, the concentrations of 17 metals in 31 samples collected from 6 background soil borings (Sites 2, 3, 6, 13, 15, and 19) were averaged. A distribution of two standard deviations about the mean was calculated for each metal. Table 4.1-1 presents the results for this assessment of background metals. Discussions within the following sections compare soil metal concentrations in site samples to the background range, which has arbitrarily been set as the two standard deviation range. Natural variability of metals in soils at Beale AFB will probably cause some sample results to exceed this background range. The presence of one or more metals at levels exceeding the background range should not automatically be interpreted as a contamination impact. Soil and groundwater background results are discussed further in Section 4.1.25.

4. This report contains data for all soil, groundwater, and surface water samples collected in Stage 2-1.

5. Stage 2-1 investigations included subsurface soil sampling using both vertical and angled borings. The text and site maps in the following sections discuss which borings were angled and which were vertical. Field notes and the depths at which samples were collected were recorded in terms of footage drilled, not corrected vertical footage. Because all of the field notes and analytical data are given as footage drilled, that is the format followed in this report. The text refers to the drilled depth and gives the true vertical depth in parentheses. Because all angled borings were drilled at 30 degrees from vertical, drilled depths can be converted to true depths by multiplying times 0.87.

6. California total fuel hydrocarbon (TFH)-diesel and -gas analyses have been performed for selected soil and water samples. The TFH analyses detect aliphatic (straight-chain hydrocarbons) and aromatic constituents (hydrocarbons made up of one or more benzene rings) contained in fuel. Detection is reported as the sum total of all hydrocarbons in the sample, rather than as individual chemicals. The TFH-diesel analysis focuses on aliphatic hydrocarbons ranging in length from C10 to C23, the TFH-gas analysis on hydrocarbon lengths ranging from C4 to C12 (State Water Resources Control Board,

Table 4.1-1
ICP METAL CONCENTRATIONS
BASEWIDE BACKGROUND AVERAGES

ICP Metal[a]	Mean Average (mg/kg)	Standard Deviation (mg/kg)	Range of 2 Standard Deviations About the Mean (mg/kg)	No. Detected/ No. of Samples
Aluminum	14,186	1,720	10,746-17,626	31/31
Barium	149	48	53-245	31/31
Beryllium	--[b]	--	--	1/31
Calcium	5,003	562	3,879-6,127	31/31
Cobalt	25	15	0-55	31/31
Chromium	31	8	15-46	31/31
Copper	44	12	21-67	31/31
Iron	25,843	3,925	17,993-33,692	31/31
Magnesium	5,480	674	4,133-6,827	31/31
Manganese	815	214	387-1,243	31/31
Nickel	23	4	15-31	31/31
Lead	--[b]	--	--	1/31
Potassium	551	210	131-970	28/31
Sodium	234	96	42-426	31/31
Vanadium	70	18	33-107	31/31
Zinc	57	7	43-70	31/31

[a]Only ICP metals detected at least once in background borings are presented in this table.
[b]Beryllium was detected in only one sample at 0.62 mg/kg and lead was detected in only one sample at 24.2 mg/kg. Because these elements were detected in only 1 of 31 samples, calculation of a mean is not valid.

1989). The Leaking Underground Fuel Tanks (LUFT) Field Manual presents a method for developing sample-specific cleanup standards which it refers to as a Leaching Potential Analysis. This analysis considers the depth to groundwater, rainfall, local geology, and site-specific features to derive standards for TFH-gas, TFH-diesel, benzene, toluene, total xylenes and ethyl benzene (State Water Resources Control Board, 1989).

The intent of the LUFT field manual is that these standards be used as guidelines to assess the need for or scope of additional investigations or remediation at leaking underground fuel tank sites. Only one IRP site for which TFH analyses were conducted contains underground fuel tanks (Site 3). However, because TTLC values have not been established for TFH-gas, TFH-diesel, benzene, toluene, xylenes or ethyl benzene, sample results are compared to standards derived from a Leaching Potential Analysis for purposes of discussion. Where sample concentrations exceed derived standards, it should not automatically be assumed that additional investigation or remediation is required. TTLC and STLC values are not considered cleanup levels. Cleanup levels will eventually be determined by a risk assessment process which incorporates site specific public health and ecological based exposure data.

7. A number of compounds were detected at low levels in many soil and water samples which are either common laboratory-induced contaminants, false positives due to laboratory- or field-induced contamination, or false positive results due to interference problems in the analytical method used.

Methylene chloride, acetone, and phthalate compounds are common laboratory contaminants, and they are considered to be false positive results where they were detected. Phenol contamination occurred in a total of 57 surface soil and soil boring samples that came from Sites 1, 2, 3, 6, 9, 13, 16, 18, 19, and 20. This phenol has been traced to a factory-contaminated bottle of reagent grade acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks affected by this contamination that the average induced contamination was 1.7 mg/kg.

Thallium was detected in some soil samples. The thallium results are false positive results due to an interference problem (primarily with titanium) in the ICP metals analysis. Analysis of thallium by ICP suffers from spectral interferences from titanium which is not a reported analyte for ICP metals analysis. The interferences occur on both

sides of the spectral bandwidth, and are difficult if not impossible to correct for when the concentration of thallium is low compared to the concentrations of the interferents.

Toluene was detected at low levels in many samples. While toluene is not a common laboratory contaminant, its ubiquitous extent and the poor reproducibility of the toluene results suggest that it is a false positive result. Toluene detections may be related to the electrical tape used to wrap soil and water samples as specified in the work plan. Where true environmental contamination with toluene is believed to be present, it is discussed on a site-by-site basis.

8. Newly installed monitoring wells at Beale AFB were given short-term pump tests to provide an estimate of yield and furnish a picture of geologic conditions in the immediate vicinity of the well. In addition, well 19-C-4 was given a 72-hour drawdown test and a 72-hour recovery test to supply an estimate of aquifer parameters that affect groundwater flow velocity. Plots of the pump tests are provided in Appendix E, along with a discussion of methodology. A discussion of hydrogeology at Beale AFB is presented in Section 2.

The groundwater system at Beale AFB is characterized by its alluvial geologic setting, in which isolated coarse-grained stream channel deposits are contained within a matrix of fine-grained overbank deposits. There is no "aquifer" in a textbook sense. Groundwater tends to flow in relatively more permeable lenticular clayey and silty sands contained within a complex assemblage of sandy clays and sandy silts. Thus, rather than identifiable aquifers that may be correlated from place to place, the groundwater may be considered to flow in a single, large-scale heterogeneous system.

In such a setting, pump tests must be regarded as indicators of the yield of the well, as estimates of hydrologic conditions, and as a descriptive tool to help define the subsurface geology. Historically, groundwater analytical techniques have been developed using simplifying assumptions. These include such assumptions as that aquifers and groundwater flow paths are horizontal, are bounded by units capable of being described mathematically, are infinite in areal extent, are of constant thickness, and are homogeneous and isotropic.

Although techniques have been developed that deal with some departure from the simplified assumptions described above, no analytical technique fully addresses a system as complex

as that at Beale AFB. In this situation, it was decided to employ standard methods of pump test analysis, while recognizing that results are only estimates. The test that most accurately portrays subsurface groundwater conditions at Beale AFB was the 72-hour test performed at well 19-C-4, which tended to average out local heterogeneities. Estimates of groundwater flow velocity presented in this report were made using the value of hydraulic conductivity derived from this test. Short-term pump test results are indicative of hydrogeologic conditions in the immediate vicinity of the well screen, and are useful as estimates of yield for sampling purposes and to show hydraulic communication among nearby wells.

9. The discussion for each site in Section 4 contains subsections that address the rate and direction of migration based on hydrogeological properties and the time of travel to receptors. As described above, velocity calculations were made using the value of hydraulic conductivity obtained from the 72-hour drawdown and recovery test performed in well 19-C-4. It should be remembered that the hydrogeological regime at Beale AFB is extremely variable, and that hydraulic conductivity may also vary from the value obtained at well 19-C-4. For example, there are some indications that subsurface materials in the northern part of Beale AFB may be relatively more permeable than in the southern part, where well 19-C-4 is located.

Groundwater velocity is also directly variable with the hydraulic gradient. Calculations presented in this section use local gradients wherever possible. However, this gradient also varies from place to place.

Groundwater velocity finally varies inversely with the effective porosity of the materials through which it is flowing. Because of the extreme variability of the geology, the effective porosity will also change dramatically from place to place. On the assumption that contaminants will migrate preferentially through relatively more permeable materials, an effective porosity of 0.20 was assumed in the calculations.

Many other factors affect the rate at which contaminants migrate with groundwater. Physical factors include such phenomena as dispersion and diffusion along the flow path. Chemical factors include phenomena as adsorption of contaminants on geologic materials, precipitation, reactions with other chemicals and soil minerals, and the oxidation or reduction of the contaminants themselves. Microbiological degradation may attenuate the levels of contamination.

Calculations presented here assumed that contaminants exhibited advective flow; e.g., that they flowed at the same rate as the groundwater.

However, the mobility of contaminants is extremely complex, and depends on a wide variety of hydrological and biochemical conditions. Precise calculation of all the variables influencing flow at Beale AFB is nearly impossible, and certainly beyond the scope of this investigation. Statements in Section 4 describing groundwater flow velocities and potential time of travel to receptors should be regarded as estimates only.

4.1.1 DISCUSSION OF RESULTS FOR SITE 1: WEST DRAINAGE DITCH

Site 1 drains runoff originating from the flightline area about 2,000 feet east of Site 1. The runoff passes through a series of 66-inch culverts which discharge through a headwall about 800 feet west of the main runway into the West Drainage Ditch. Since 1984, oil absorbent booms have been placed immediately downstream from the headwall. The booms are periodically replaced.

Runoff from the West Drainage Ditch originates at a drainage channel at Site 10, the J-58 Test Cell at the east end of Grumman Avenue, east of Doolittle Drive (Plate 1). The channel runs west underneath Doolittle Drive into two 60-inch-diameter storm drains. Fuel has been observed by Beale AFB personnel in the drains east of Arnold Avenue. Runoff from maintenance buildings near Sites 4 and 11 and hangars joins the double drains at Arnold Avenue. Runoff from the taxiways and SR-71 shelters (Site 5) enters the double drain west of the shelters. Runoff from the runway and grassy areas east of the runway, including Site 21, enters the drain east of the runway. Here the drain transitions to three 66-inch CMP culverts which flow west and discharge to the West Drainage Ditch.

During the Stage 2-1 study, water discharging to the ditch was sampled quarterly for 1 year. Surface water within the ditch was also sampled quarterly at four locations along the ditch (Figure 4.1.1-1).

Surface sediment samples were collected from four cross sections of the ditch downstream from the headwall. At each cross section, two different depth interval samples were obtained from three hand-augered holes. A total of 24 samples were collected. Section points were one on each bank and one at near the center line of the ditch. Sample depths were zero to 0.5 feet and 1.5 to 2.0 feet.

Five new wells were constructed at Site 1 as part of Stage 2-1 activities. These wells, plus one existing well, were sampled quarterly for a period of 1 year. Two existing off-base domestic wells were sampled during the third and fourth sampling rounds.

During sediment and surface water sampling in the west drainage ditch, it was noted that the ditch had recently been dredged from immediately west of the headwall to beyond the most western surface sample locations. Evidence of a backhoe or track-mounted scoop was observed. The bottom of

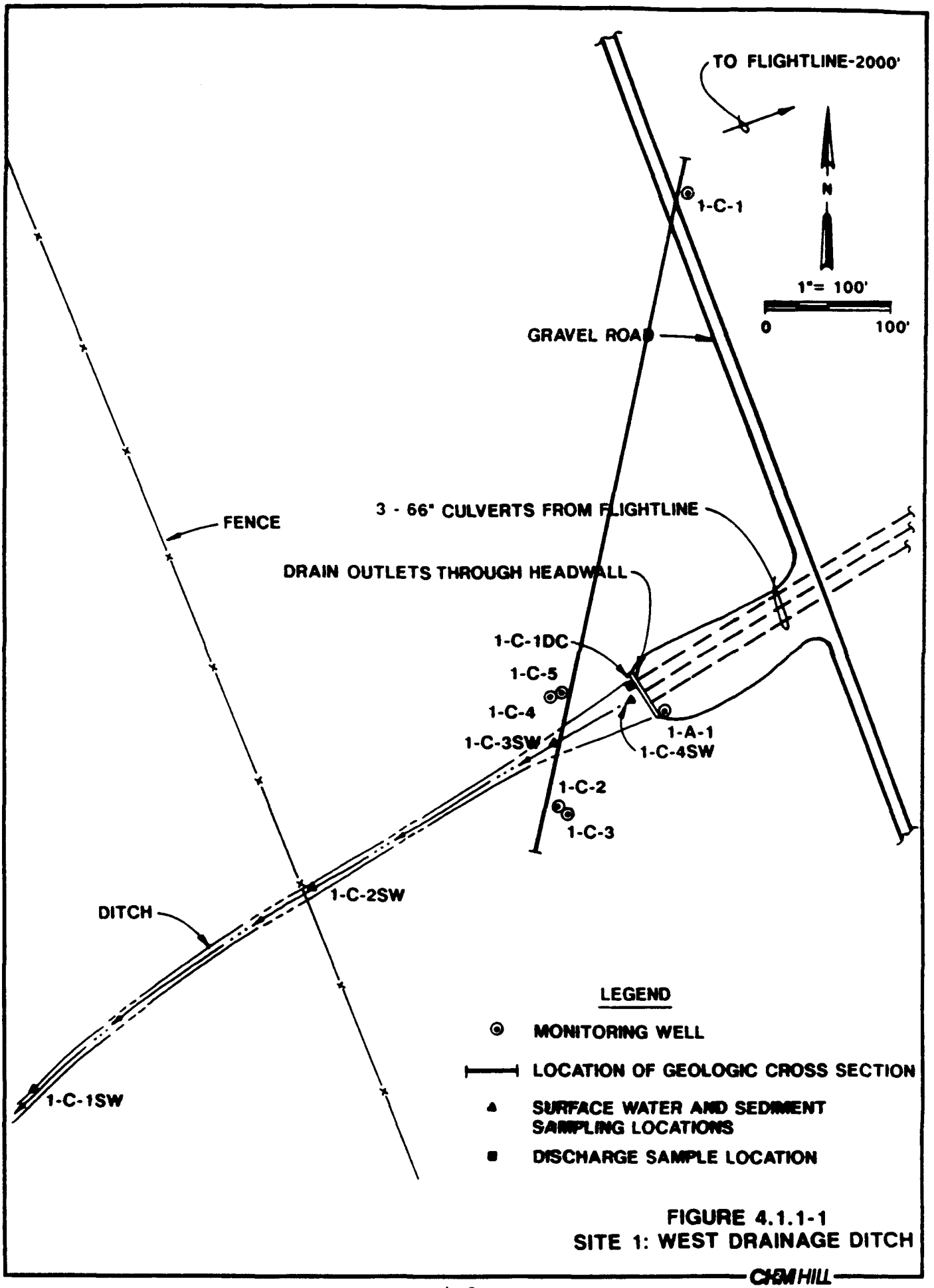


FIGURE 4.1.1-1
SITE 1: WEST DRAINAGE DITCH

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the ditch, in a hard pan clay, had scrape marks from the bucket; track marks were visible on the ground surface north of the ditch, and sediment was piled on plastic sheeting about 50 feet north of the ditch. The sediment contained reeds and roots. Samples from this material were not collected.

4.1.1.1 Presentation of Results

4.1.1.1.1 Site Geology

Evaluation of local geology at Site 1 is based on drilling activities completed during the Stage 2-1 Remedial Investigation and previous IRP studies. There are now six monitoring wells:

- Background well 1-C-1 northeast of the ditch is a shallow well screened across the water table from about 86 to 106 feet BGS (7 to -13 feet NGVD).

- Shallow well 1-A-1 at the headwall installed during previous studies and screened across the water table from about 98 to 118 feet BGS (-6 to -26 feet NGVD).

- One pair south of the ditch consisting of shallow well 1-C-3 screened across the water table from 85 to 105 feet BGS (5 to -15 feet NGVD), and deep well 1-C-2 screened from 120 feet to 140 feet BGS (-31 to -51 feet NGVD).

- One pair north of the ditch consisting of shallow well 1-C-5 screened across the water table from 85 to 105 feet BGS (5 to -15 feet NGVD) and deep well 1-C-4 screened from 115 to 135 feet BGS (-25 to -45 feet NGVD) (see Figure 4.1.1-1).

Well logs are in Appendix D.

A geologic cross section was prepared from the soil boring logs of monitoring wells 1-C-1, 1-C-2, and 1-C-4. The location of this cross section is shown on Figure 4.1.1-1. The cross section, Figure 4.1.1-2, shows that geologic materials at Site 1 are an alluvial sequence consisting primarily of silty sands, sands, and gravels. Although it is difficult to make correlations in materials in the upper levels of the boreholes, a reasonably good correlation may be made among coarse-grained deposits that occur at depth. A thick sequence of sands and gravels occurs in each of the boreholes, beginning at 70 to 85 feet below grade (5 to 20 feet NVGD),

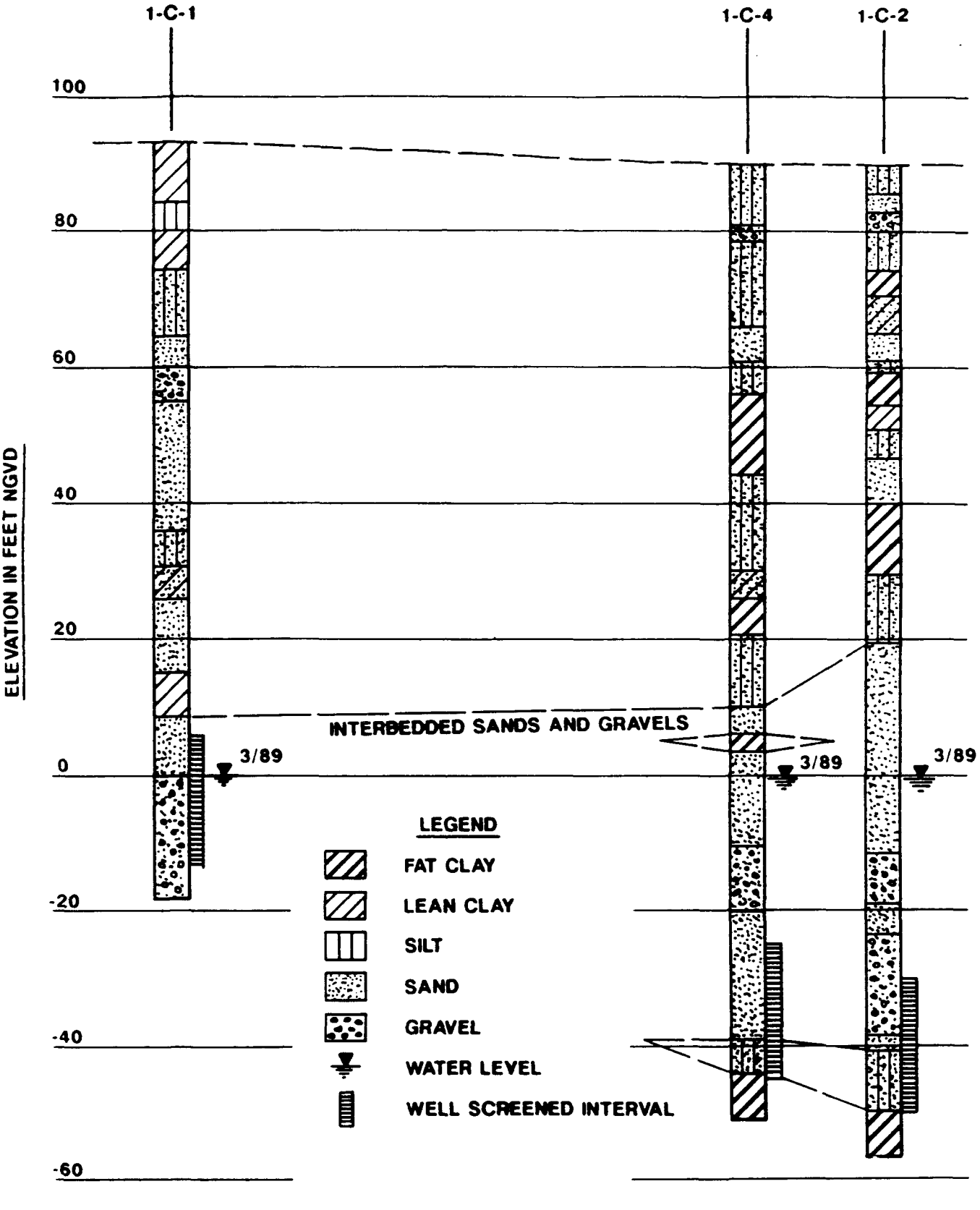


FIGURE 4.1.1-2
GEOLOGIC CROSS SECTION
SITE 1: WEST DRAINAGE DITCH

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and extending down to 135 to 140 feet (-45 to -50 feet NVGD). A stiff clay underlies the sand and gravel in deep wells 1-C-2 and 1-C-4.

Subsurface materials at Site 1 have been assigned to the Victor Formation by Page (1980). This formation comprises continental deposits of silt, sand and gravel, with minor amounts of clay and layers of cemented sediments. Volcanic sediments were not found at Site 1. Rather, cobbles and gravel were composed of clasts of granodiorite. Soils were mapped as Perkins loam along the drainage and San Joaquin loam across the remainder of Site 1 (SCS, 1985).

4.1.1.1.2 Site Hydrogeology

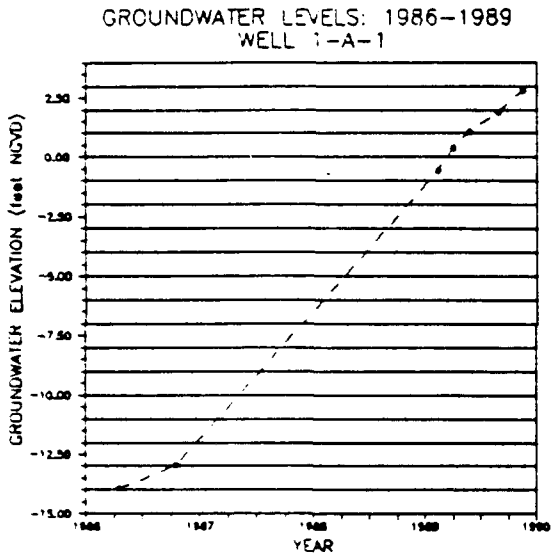
Near-surface groundwater at Site 1 appears to flow under unconfined conditions. During drilling, the first contact with groundwater was immediately observable because the near-surface groundwater at Site 1 flows through highly permeable, coarse-grained materials. The clay unit observed in the bottom of wells 1-C-2 and 1-C-4 appears to form a basal boundary of relatively lower permeability. The unconfined aquifer above the clay has a saturated thickness of about 45-50 feet beneath Site 1. The areal extent of the aquifer and the clay base is unknown.

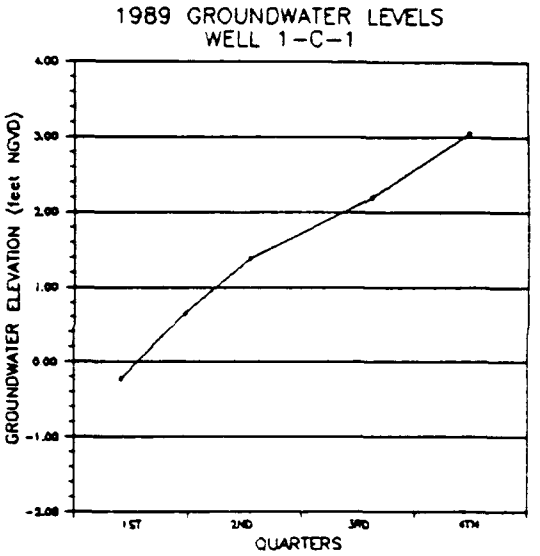
Table 4.1.1-1 and Figures 4.1.1-3 and 4.1.1-4 present groundwater level data collected during Stage 2-1. These data show that the water table rose about 3 feet between February and November 1989. Comparison to measurements made by AeroVironment (1987) shows that water levels in well 1-A-1 have risen about 17 feet between April 1986 and November 1989. A similar rise in groundwater was observed in other monitoring wells on the western edge of the base and in wells monitored by DWR west of Beale AFB.

Figure 4.1.1-5 presents groundwater contours plotted at Site 1 from elevations measured in May 1989. Figure 4.1.1-6 presents groundwater contours for the north side of Beale AFB, also based on the May 1989 elevations. Plates 3 and 4 present groundwater contours for all of Beale AFB based on March and November 1989 measurements. Groundwater elevations from wells screened across the uppermost permeable zone are illustrated in these figures. Figure 4.1.1-5 shows that groundwater is flowing to the southwest at an average gradient of about 0.0016. This flow direction is apparently influenced by the groundwater depression west of Beale AFB. Groundwater elevations from paired wells 1-C-2 and 1-C-3, and 1-C-4 and 1-C-5 demonstrate that there is no detectable vertical gradient beneath Site 1, supporting the

Table 4.1.1-1
GROUNDWATER ELEVATIONS: SITE 1
(FEET NGVD)

Well	Screened Interval	Apr. 1986	Oct. 1986	Feb. 1989	March 1989	May 1989	Aug. 1989	Nov. 1989
1-A-1	-6 to -26	-13.95	-12.95	-0.75	0.38	1.08	1.88	2.80
1-C-1	7 to -13	--	--	-0.47	0.65	1.38	2.19	3.05
1-C-2	-31 to -51	--	--	-0.94	0.21	0.87	1.67	2.62
1-C-3	5 to -15	--	--	-0.97	0.19	0.87	1.66	2.62
1-C-4	-25 to -45	--	--	-0.93	0.23	0.89	1.70	2.64
1-C-5	5 to -15	--	--	-0.86	0.29	0.97	1.76	2.70



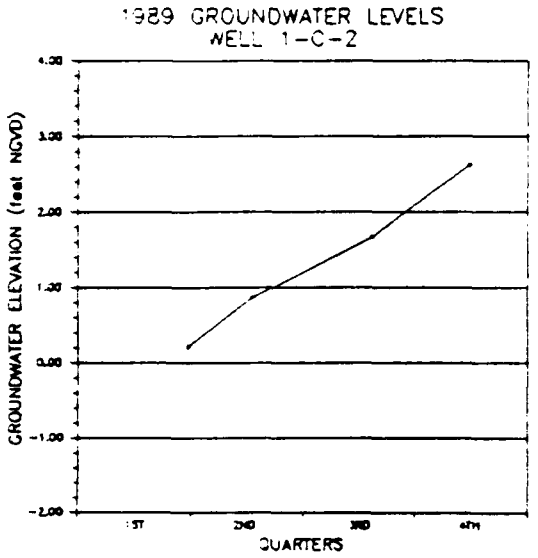


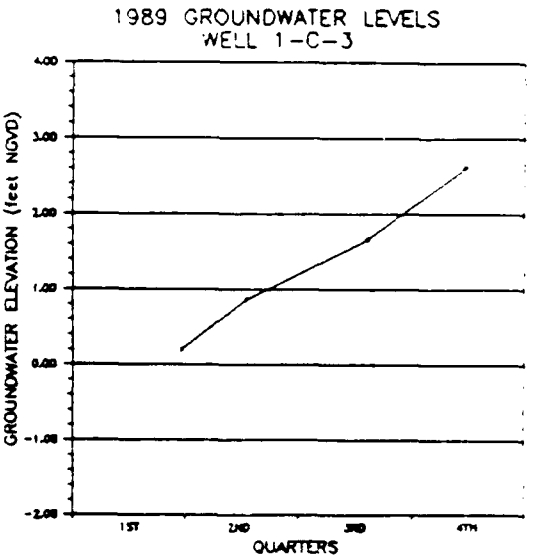
NOTE: VARYING TIME SCALES

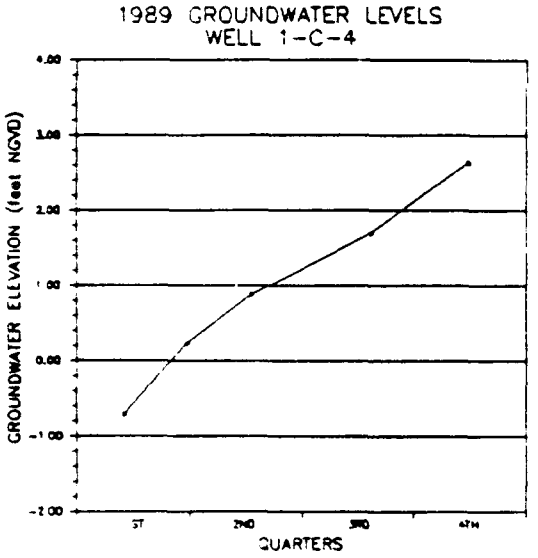
FIGURE 4.1.1-3

MONITORING WELL HYDROGRAPH
SITE 1: WEST DRAINAGE DITCH

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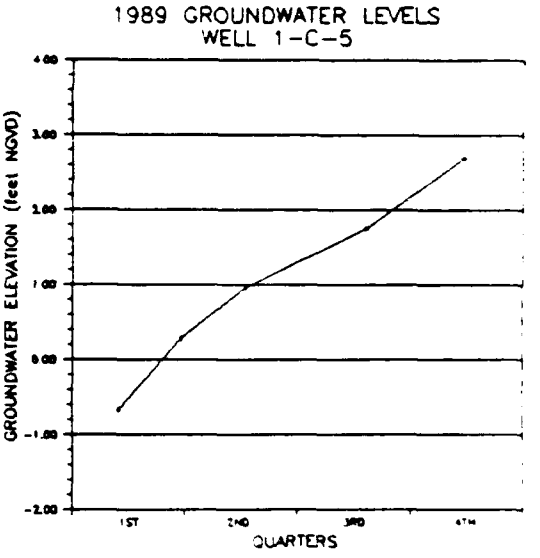


FIGURE 4.1.1-4

MONITORING WELL HYDROGRAPH
SITE 1: WEST DRAINAGE DITCH

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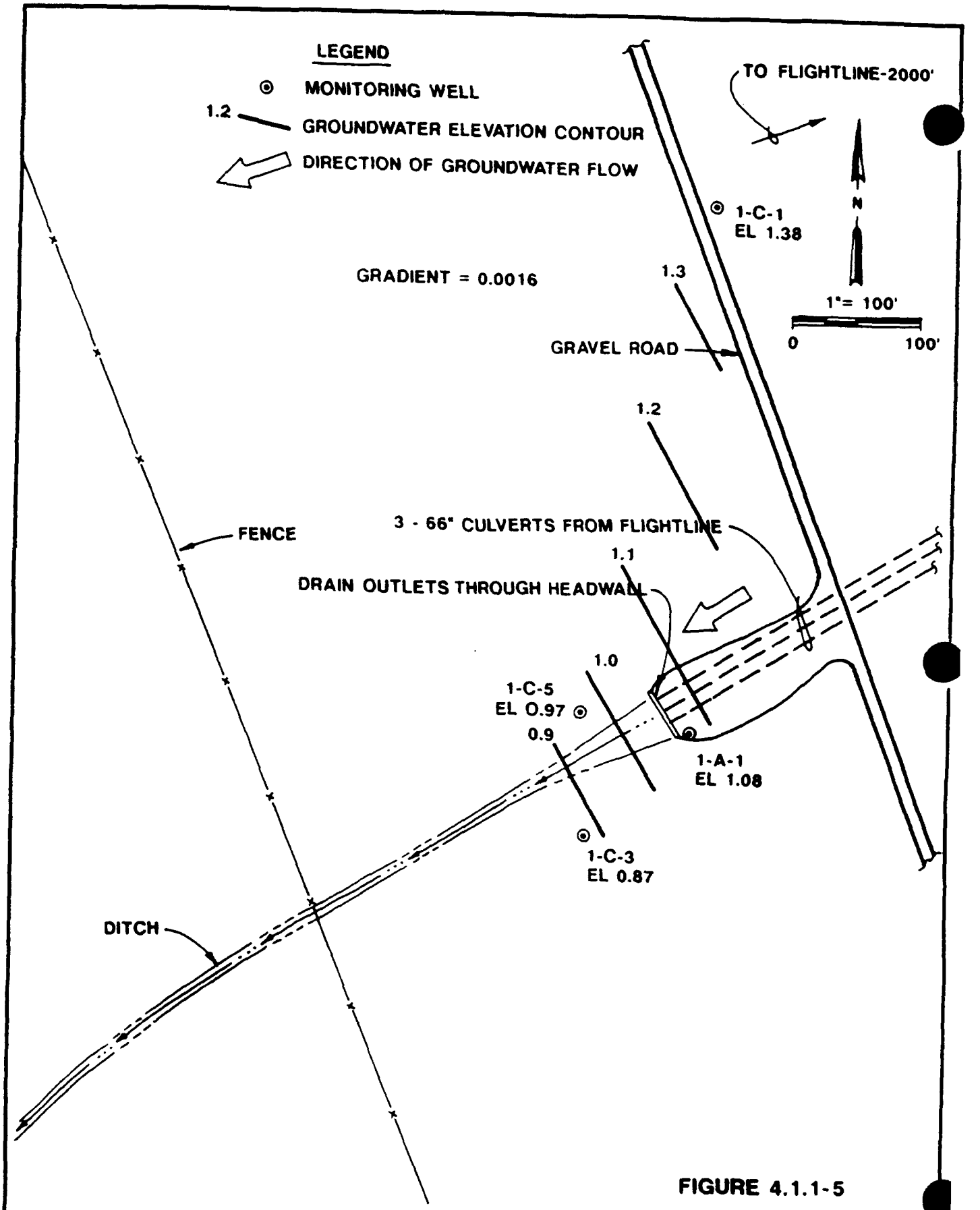


FIGURE 4.1.1-5

GROUNDWATER ELEVATION CONTOURS: MAY 1989
SITE 1: WEST DRAINAGE DITCH

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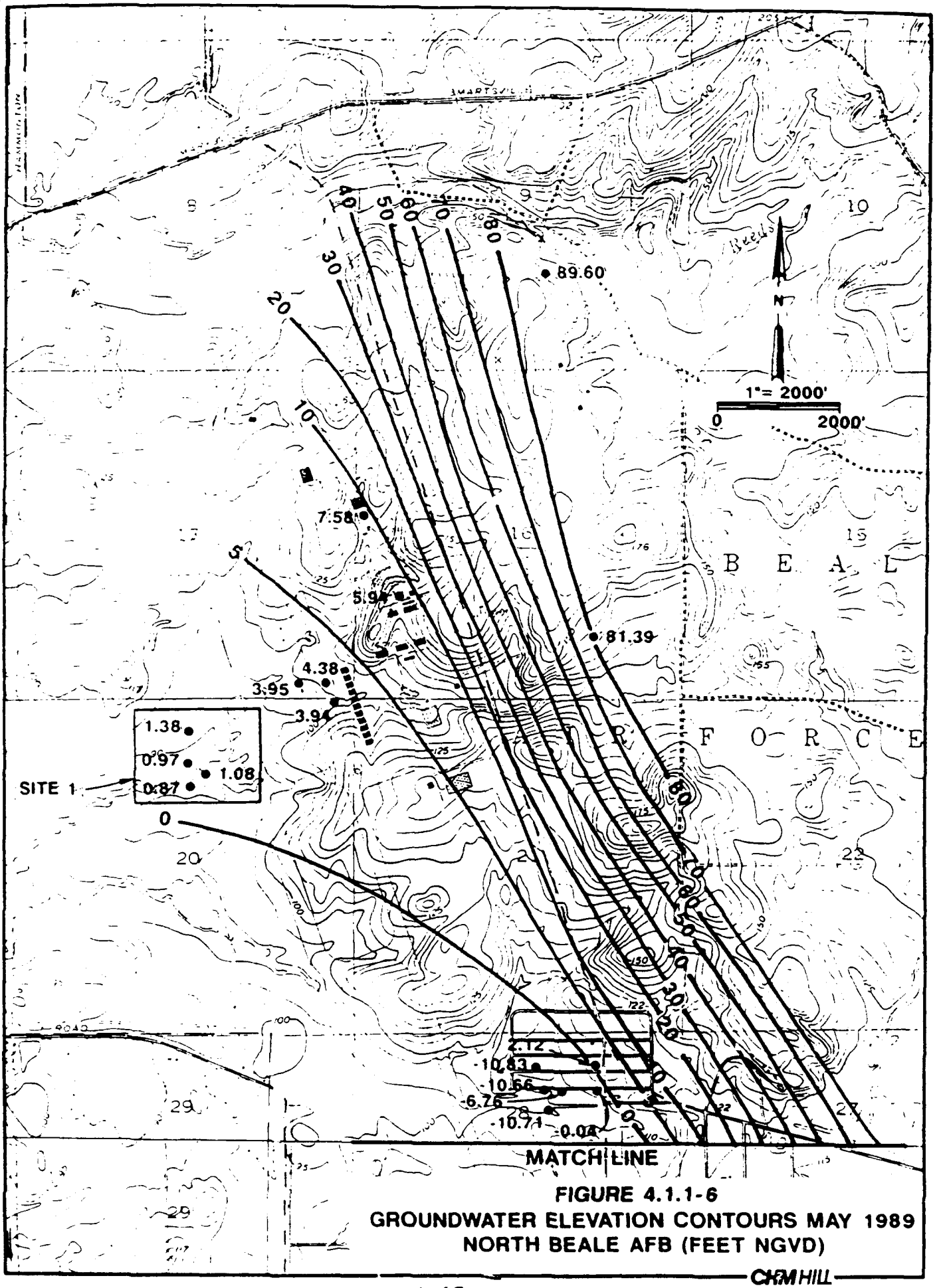


FIGURE 4.1.1-6
GROUNDWATER ELEVATION CONTOURS MAY 1989
NORTH BEALE AFB (FEET NGVD)

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interpretation of a highly permeable unconfined near-surface aquifer system in the vicinity of Site 1. However, plots of pump tests performed on Site 1 wells showed indications of nearby geologic units of relatively lower permeability. These plots are contained in Appendix E.

Table 4.1.1-2 summarizes results of aquifer tests performed on Site 1 wells. This table shows that the average value of transmissivity obtained from the tests was about 110,000 gallons per day per foot, or about 14,000 square feet per day. The average value obtained for hydraulic conductivity was about 340 feet per day (0.12 cm/sec). These relatively high values are representative for coarse sands and gravels. The mean specific yield derived from the tests was 0.023, a value in the expected range for an unconfined aquifer (Freeze and Cherry, 1979). Plots of the aquifer test data and a discussion of testing methodology are provided in Appendix E.

The average linear velocity of groundwater flow may be estimated by the following form of Darcy's Law:

$$V = Ki/n$$

where:

V = Average linear velocity of groundwater flow (L/T)
K = Hydraulic conductivity (L/T)
i = Hydraulic gradient (L/L)
n = Effective transport porosity (dimensionless)

The value of hydraulic conductivity derived during the 72-hour pump test at well 19-C-1 is used for estimates of groundwater velocity. Using the hydraulic conductivity value derived from this test of 28 feet per day, the measured hydraulic gradient of 0.0016, and an estimated effective transport porosity of 0.20, the approximate velocity of groundwater movement near Site 1 is about 0.22 feet per day or about 82 feet per year. This low velocity reflects the low groundwater gradient near Site 1.

If the higher value of hydraulic conductivity obtained in Site 1 pump tests had been used in the calculations, the resulting groundwater velocity would be higher (nearly 1,000 feet per year). However, pump test plots collected in Appendix E reveal the presence of geologic materials of lower permeability in the vicinity of Site 1. As mentioned previously, velocity calculations are only estimates.

4.1.1.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality

Table 4.1.1-2
SUMMARY OF SITE 1 PUMP TEST RESULTS
(Cooper-Jacob Method)

Well	Date	Pumping or Observation Well	DD[a] or R	T[b] (gpd/ft)	T (ft^2/d)	B[c] (ft)	K[d] (ft/d)	S[e]
1-C-1	1/26	P	DD	33,000	4,400	12.4	350	--
	1/26	P	R	31,000	4,200	12.4	340	--
1-C-3	2/7	P	DD	69,000	9,200	46	200	--
	2/7	P	R	73,000	9,800	46	210	--
1-C-4	2/9	P	DD	96,000	13,000	46	280	--
	2/9	P	R	130,000	18,000	46	380	--
1-C-2	2/9	O	DD	170,000	22,000	46	480	0.0092
	2/9	O	R	170,000	22,000	46	480	--
1-C-3	2/9	O	DD	190,000	26,000	46	560	0.018
	2/9	O	R	170,000	23,000	46	500	--
1-A-1	2/9	O	DD	47,000	6,200	46	140	0.068
1-C-1	2/9	O	DD	43,000	6,000	46	130	0.018
1-C-5	3/6	P	R	84,000	11,000	47	240	--
1-C-2	3/7	P	DD	130,000	17,000	47	370	--
	3/7	P	R	120,000	15,000	47	350	--
1-C-4	3/7	O	DD	120,000	16,000	47	330	0.008
	3/7	O	R	110,000	14,000	47	300	--
1-C-5	3/7	O	DD	140,000	18,000	47	390	0.017
	3/7	O	R	140,000	18,000	47	390	--
		Mean		110,000	14,000		340	0.023

[a] DD = Drawdown test; R = Recovery test
[b] T = Transmissivity
[c] B = Saturated aquifer thickness (saturated thickness of screen in single-well test of Well 1-C-1
[d] K = Hydraulic conductivity
[e] S = Storage coefficient (dimensionless)

control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.1.1.4 and in Appendix A.

Surface Water

During the Phase II, Stage 1 study (AeroVironment, 1987), TCE was detected in one surface water sample. Oil and grease were detected in all surface water samples collected.

In the Stage 2-1 water sampling at Site 1, four surface water samples (1-C-1SW to -4SW) and one pipe discharge sample (1-C-1DC) have been collected in each round. Analyses performed for water samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), lead (7421), water quality parameters (various methods), and total fuel hydrocarbons (TFH)-diesel and -gas (California method). A complete list of analytes for each analysis is given in Appendix A.

During the first round, water discharging to the West Drainage Ditch from the northernmost of three culverts did not contain trichloroethene (TCE) in the single discharge sample, but all surface water sampled within the ditch did contain TCE at concentrations ranging from 2 to 4 ug/l. TFH-diesel and TFH-gas were detected in the discharge sample (9.0 mg/l and 0.4 mg/l, respectively) and in surface water sample 1-C-4SW (200 mg/l and 2 mg/l, respectively). Samples taken downstream of 1-C-4SW had no detected TFH-diesel or -gas. Toluene was not detected in first round surface water samples. Figure 4.1.1-7 shows the concentrations of TCE and TFH in each round of surface water samples.

Surface water sampled during the first round, including discharge to the ditch, had general water quality parameters of specific conductivity, alkalinity, major anions and cations, and total dissolved solids, all at lower values than the groundwater samples. All surface water and groundwater samples were filtered in the field through 0.45-micron filters prior to being preserved and sent to the lab for analysis for dissolved constituents. Sample results have been compared to the applicable standard. Iron and manganese were detected in surface water but not in groundwater samples. Iron was detected in the two farthest downstream surface water samples (1-C-1SW and -2SW) at 0.109 and 0.107 mg/l, just above the 0.100 LOQ and below the 0.3 mg/l national

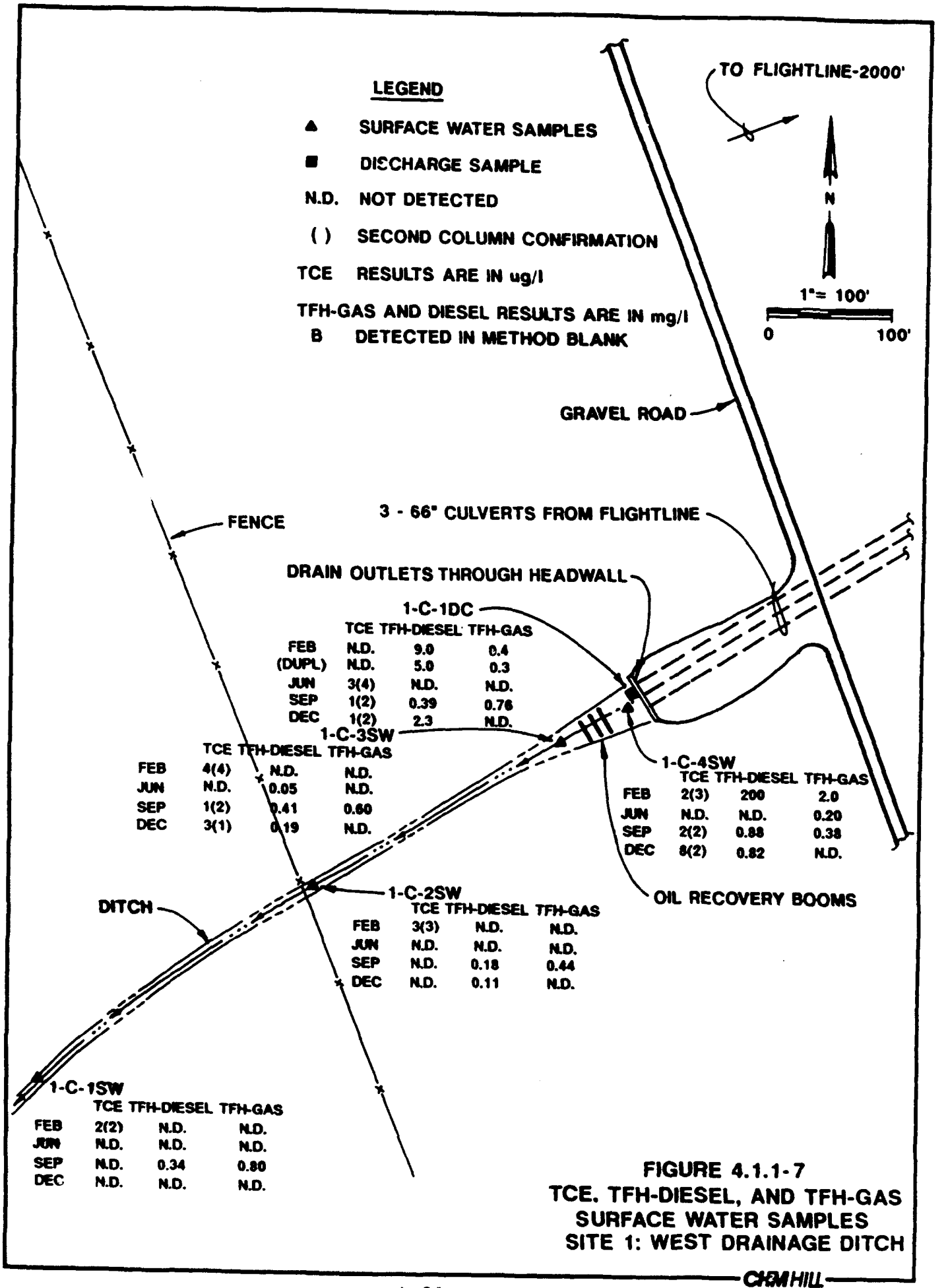


FIGURE 4.1.1-7
TCE, TFH-DIESEL, AND TFH-GAS SURFACE WATER SAMPLES SITE 1: WEST DRAINAGE DITCH

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secondary drinking water standard. Manganese was detected in all samples ranging from 0.034 to 0.063 mg/l, compared to the national secondary drinking water standard of 0.050 mg/l.

In the second round surface water samples, TCE was detected at 3 ug/l (4 ug/l in the second column) in the discharge sample but was not detected in downstream surface water samples (Figure 4.1.1-7). Toluene was not detected in surface water samples. TFH-diesel was not detected in the discharge sample and was only detected downstream in 1-C-3SW at 0.050 mg/l. TFH-gas was not detected in the discharge sample and was only detected downstream in 1-C-4SW at 0.20 mg/l. In addition to iron, which ranged from not detected to 0.188m g/l, and manganese, which increased, ranging from 0.034 to 0.227 mg/l, barium was detected in the second round surface water samples at from 0.129 to 0.163 mg/l below the national primary drinking water standard of 1.0 mg/l. Zinc ranged from not detected to 0.042 mg/l, below the secondary drinking water standard at 5.0 mg/l.

In the third round samples, TCE was detected at 1 ug/l (2 ug/l in second column) in the discharge sample 1-C-1DC (collected from the northernmost culvert), 2 ug/l (2 ug/l in second column) in 1-C-4SW, the nearest downstream sample, 1 ug/l (2 ug/l in second column) in 1-C-3SW, the next downstream sample, and TCE was not detected in other downstream samples (Figure 4.1.1-7). Toluene was 1 ug/l in 1-C-1DC, but not detected in the second column. TFH-diesel was detected at 0.39 mg/l in the discharge sample, 0.88 mg/l in downstream sample 1-C-4SW, 0.41 mg/l in 1-C-3SW, 0.18 mg/l in 1-C-2SW, and 0.34 mg/l in 1-C-1SW. TFH-gas was detected at 0.76 mg/l in the discharge sample, 0.38 mg/l in 1-C-4SW, 0.60 mg/l in 1-C-3SW, 0.44 mg/l in 1-C-2SW, and 0.80 mg/l in 1-C-1SW. Iron was detected only in 1-C-2SW at the 0.100 mg/l LOQ. Manganese ranged from 0.198 in the discharge sample rising downstream to 0.741 mg/l in 1-C-1SW. Barium was not detected in the discharge sample but ranged from 0.144 to 0.146 mg/l in the downstream samples. Zinc ranged from 0.031 to 0.059 mg/l.

In the fourth round surface water samples, TCE was detected at 1 ug/l (2 ug/l in the second column) in the discharge sample 1-C-1DC, 8 ug/l (2 ug/l in the second column) in 1-C-4SW, the nearest downstream sample, and 3 ug/l (1 ug/l in the second column) in 1-C-3SW, the next downstream sample. TCE was not detected in other downstream samples (Figure 4.1.1-7). Toluene was 1 ug/l (9 ug/l in the second column) in 1-C-1DC, 1 ug/l (8 ug/l in the second column) in 1-C-4SW, not detected in 1-C-3SW, 1 ug/l (1 ug/l in the second column) in 1-C-2SW and not detected in 1-C-1SW.

TFH-gas was not detected in any surface water samples. TFH-diesel was detected at 2.3 mg/l in discharge sample 1-C-1DC, 0.82 mg/l in 1-C-4SW, 0.19 mg/l in 1-C-3SW, 0.11 in 1-C-2SW and not detected in 1-C-1SW, the farthest downstream sample. Manganese was detected at 0.0468 mg/l in 1-C-1DC and 0.0472 mg/l in 1-C-4SW, 0.0394 mg/l in 1-C-3SW, 0.132 mg/l in 1-C-2SW, and 0.106 mg/l in 1-C-1SW. Iron was only detected in the two downstream samples at 0.159 mg/l in 1-C-2SW and 0.105 mg/l in 1-C-1SW. Barium ranged from 0.102 to 0.105 mg/l in all five surface water samples. Zinc ranged from 0.0227 to 0.0481 mg/l in all five samples.

Sediment

A total of 24 stream sediment samples were collected at Site 1. These samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), soil moisture (ASTM D2216), and TFH-gas and diesel (California method).

All but 2 of the 24 stream sediment samples from the West Drainage Ditch had detected TFH-diesel as illustrated in Figure 4.1.1-8. Concentrations ranged from 9 to 15,000 mg/kg. In all cases the diesel fuel components were detected in the upper and the lower samples at each location. Thirteen of the 24 samples had detected TFH-gas. Concentrations ranged from 75 to 430 mg/kg. Five locations had TFH-gas in both the upper and lower sample, while three of the samples with detected TFH-gas were from an upper sample, with no TFH-gas detection in the lower sample. Toluene was detected in six sediment samples at concentrations above the LOQ and four samples at estimated values below the LOQ, but are not shown on Figure 4.1.1-8.

Semivolatile compounds were also detected in stream sediment samples. Bis(2-ethylhexyl) phthalate was detected in six samples at concentrations of 1.2 to 14 mg/kg. This compound was detected in both upper and lower samples. The origin of the phthalate is uncertain; it may represent a false positive. Seven compounds (phenanthrene, fluoranthene, pyrene, benzo(a) anthracene, chrysene, benzo(b) fluoranthene, and benzo(a) pyrene) were detected in the zero to 0.5-foot sample at 1-C-8SS at concentrations less than 12 mg/kg but above the LOQ of 2.3 mg/kg.

Metals were detected in surface sediment samples at levels similar to soil samples collected at other sites on base. Lead, only found in one background soil sample on base, was detected in 18 of the surface sediment samples at concentrations from 29.3 to 269 mg/kg. Cadmium, chromium, and zinc were also detected at levels greater than two standard deviations above the averaged mean values from background

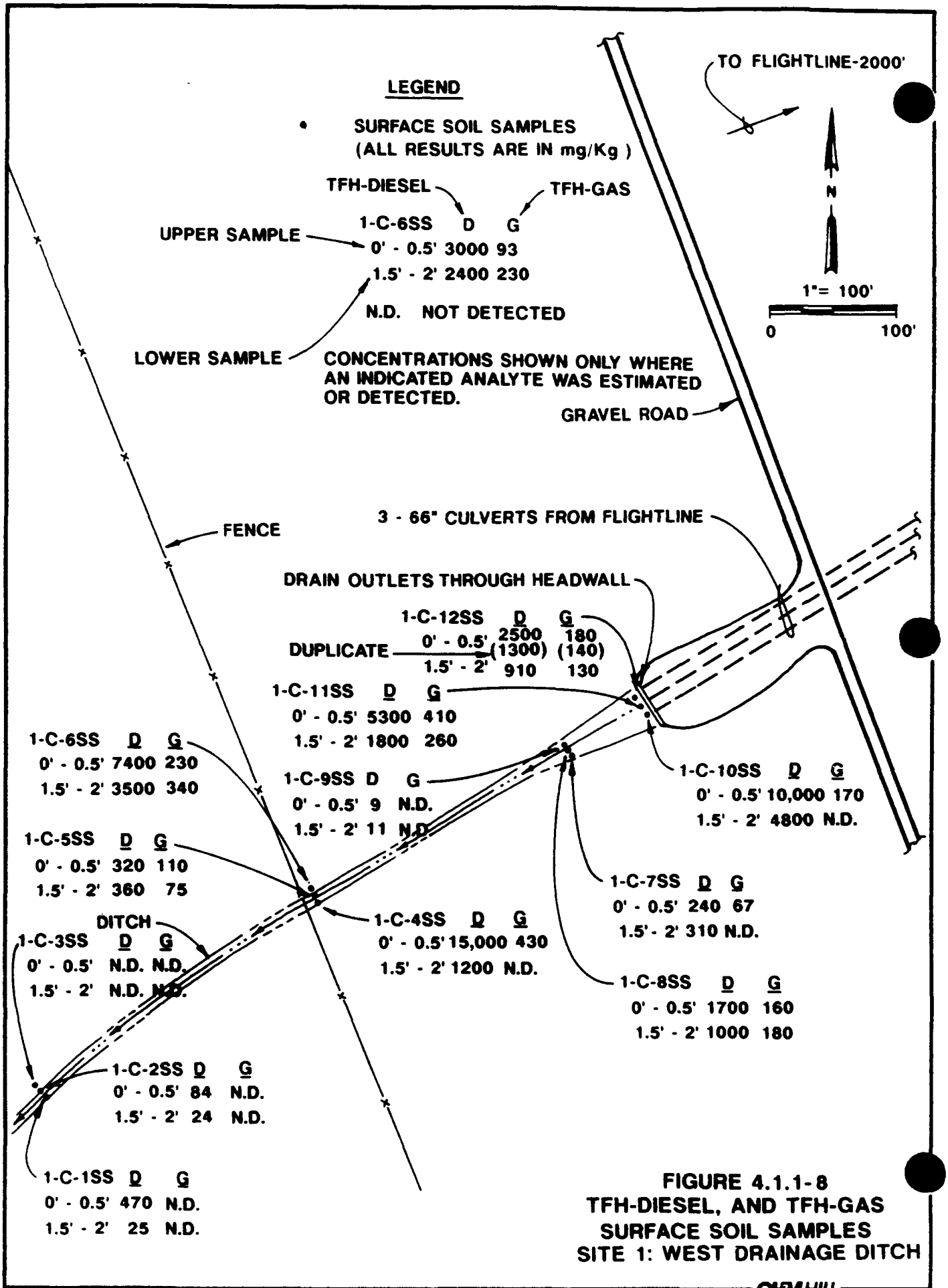


FIGURE 4.1.1-8
TFH-DIESEL, AND TFH-GAS
SURFACE SOIL SAMPLES
SITE 1: WEST DRAINAGE DITCH

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soil borings at other IRP sites on base. Cadmium was not detected in background soil borings. Background values for stream sediments were not taken. There may be a difference in the background values of stream sediment versus material found in background borings. However, the background soil boring values were only a basis of comparison.

Groundwater

Volatile organic compounds were detected in well 1-A-1 during Phase II, Stage 1 studies. TCE was detected at 100 ug/l and 58 ug/l in two sampling rounds.

Analyses performed for groundwater samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), lead (7421), water quality parameters (various methods), and TFH-gas and -diesel (California method).

Groundwater at Site 1 contained TCE in first round samples from 1-C-3, 1-C-5, and 1-A-1 at concentrations ranging from 2 to 8 ug/l, and in a field replicate sample from 1-C-3 at 7 ug/l (see Figure 4.1.1-9). Second column confirmation data for 8010 and 8020 analyses are consistent with first column results. These wells are all screened across the water table (shallow wells), relative to wells 1-C-2 and 1-C-4, which are screened below the water table (deep wells). TCE was not detected in the deep wells or the background well at Site 1.

For all the wells at Site 1, general water quality parameters such as specific conductivity, total dissolved solids, alkalinity, and pH were similar and did not indicate the presence of contamination. Common cations and anions occurred in similar amounts to those in analyses from base water supply wells in the 1960s and 1970s (Page, 1980) except for the 23.4 mg/l of sulfate in 1-C-3, higher than the maximum of 8.1 mg/l in base water supply wells or 10.2 mg/l in well 1-A-1. However, sulfate dropped to 14.7 mg/l in the second, 8.0 mg/l in the third, and 7.3 in the fourth sampling rounds as noted below. TDS ranged from 185 to 250 mg/l in the first round and from 232 to 324 mg/l in later rounds. Water type varies from sodium bicarbonate to sodium-calcium bicarbonate. Silica was not analyzed for in this investigation but ranged from 40 to 66 mg/l in base water supply wells located about 8,000 feet west of Site 1 (Page, 1980). TDS values typically exceed the sum of the measured anions and cations. The lack of a silica analysis may account for most of this difference at Site 1 and throughout the base.

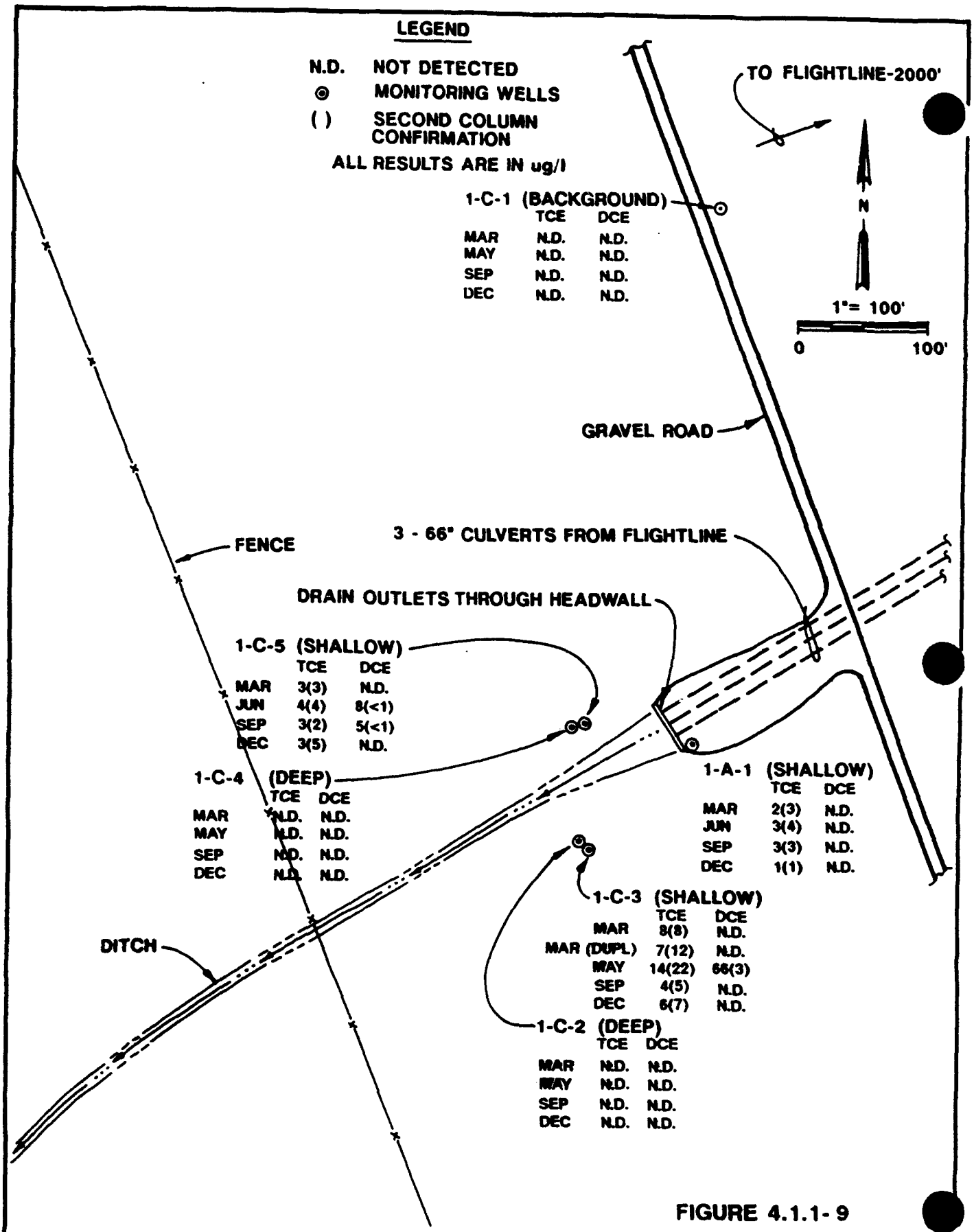


FIGURE 4.1.1- 9
TCE, AND DCE
GROUNDWATER SAMPLES
SITE 1: WEST DRAINAGE DITCH

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Other than the common water quality parameter cations (calcium, potassium, magnesium, and sodium), the only metal detected in the groundwater was zinc at wells 1-C-2, -3, and -4 which ranged from 0.047 to 0.285 mg/l compared to the national secondary drinking water standard of 5.0 mg/l.

Second round groundwater samples (Figure 4.1.1-9) had TCE at 3 ug/l in 1-A-1 (4 ug/l in the second column), 4 ug/l in 1-C-5 (4 ug/l in the second column) and 14 ug/l in 1-C-3 (22 ug/l in the second column). Trans-1,2-DCE was detected in 1-C-3 at 66 ug/l but only 3 ug/l in the second column confirmation. Laboratory review of the 8010 analysis for 1-C-3 indicated that the reported trans-1,2-DCE was probably cis-1,2-DCE, which is not on the 8010 analyte list. Trans-1,2-DCE was detected in 1-C-5 at 8 ug/l but was not detected in the second column confirmation. Toluene was either not detected or detected at 1 or 2 ug/l and not confirmed in the second column confirmation. No organic chemicals were detected in background well 1-C-1 or deep wells 1-C-2 and 1-C-4. Water quality parameters did not change significantly apart from sulfate in well 1-C-3 dropping to 14.7 mg/l. Zinc was detected only in well 1-C-3 at 0.033 mg/l and in 1-A-1 at 0.028 mg/l.

Third round groundwater samples (Figure 4.1.1-9) had TCE at 3 ug/l in well 1-A-1 (3 ug/l in second column), 3 ug/l in 1-C-5 (2 ug/l in second column) and 4 ug/l in 1-C-3 (5 ug/l in second column). Trans-1,2-DCE was detected in 1-C-5 at 5 ug/l but was not detected in the second column confirmation. Toluene was either not detected or detected at 2 to 3 ug/l and not confirmed in the second column confirmation. No organic chemicals other than toluene were detected in background well 1-C-1 or deep wells 1-C-2 and 1-C-4.

Two off-base private water supply wells were sampled for 8010 analyses during the third quarterly sampling round (Figure 4.1.1-10). The first well (OB-C-1) is located by a house on the south side of North Beale Road about 1 mile west of the main gate for Beale AFB. It was sampled from a tap outside the house. No organic chemicals were detected. The second well (OB-C-2) is located by a house on the north side of North Beale Road about 100 yards west of the main gate. It was sampled from a faucet east of the garage, and no organic chemicals were detected.

Water quality parameters did not change significantly apart from sulfate, which dropped again in 1-C-3 to 8.0 mg/l as in other wells at Site 1. Zinc was not detected in any

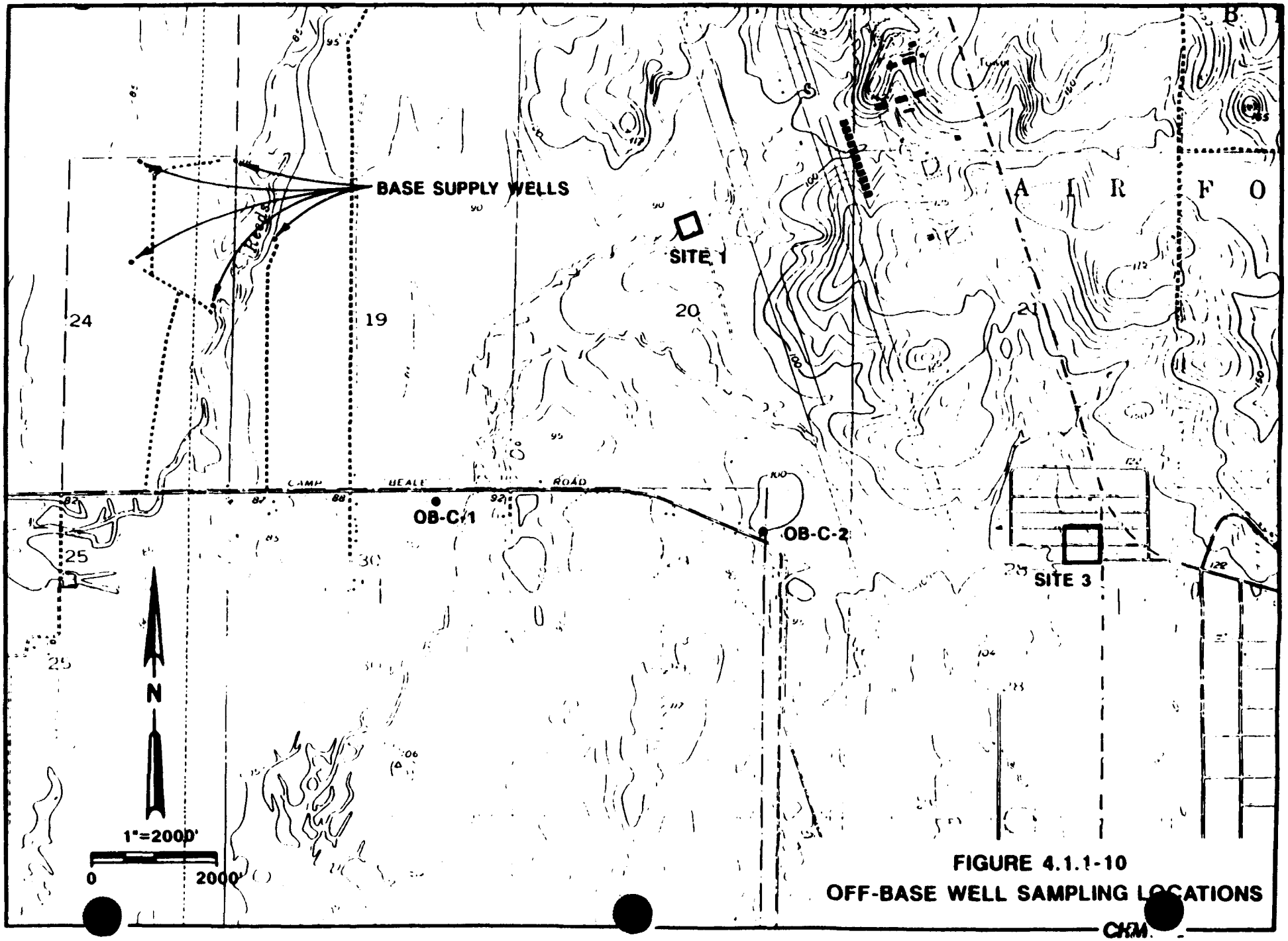


FIGURE 4.1.1-10
OFF-BASE WELL SAMPLING LOCATIONS

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monitoring well. Manganese was detected again in 1-C-3 at 0.018 mg/l. Nickel, which had not been detected previously, was detected at 0.060 mg/l. Iron was detected in 1-A-1 at 0.392 mg/l.

Fourth-quarter groundwater samples (Figure 4.1.1-9) had TCE at 1 ug/l in well 1-A-1 (1 ug/l in the second column), 3 ug/l in 1-C-5 (5 ug/l in the second column), and 6 ug/l in 1-C-3 (7 ug/l in the second column). Toluene was only detected in deep well 1-C-4 at 3 ug/l (4 ug/l in the second column). TFH-diesel was detected in well 1-A-1 at 0.10 mg/l and in well 1-C-2 at 0.06 mg/l.

The two off-base private water supply wells were sampled again for 8010 analysis during the 4th quarter. TCE was detected in the first column at 1 ug/l but was not confirmed in the second column for OB-C-1. No analytes were detected at OB-C-2.

Water quality parameters did not change significantly in the fourth quarter. Sulfate at 1-C-3 was 7.3 mg/l, similar to the 8.0 mg/l detected in the third round sample. Nickel was detected at 0.0575 mg/l in 1-C-3. Zinc and manganese were only detected at 1-A-1 at 0.0291 mg/l and 0.142 mg/l, respectively. Chromium was detected at 0.0311 mg/l, lead at 0.0089 mg/l, and iron at 6.88 mg/l in 1-A-1.

4.1.1.1.4 Analytical Results Table

Table 4.1.1-3 presents a summary of all detected analytes for Site 1 and the two nearby off base domestic wells sampled in September and December 1989. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.1-3 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of Applicable or Relevant and Appropriate Requirements (ARARs) is given in Appendix I.

4.1.1.1.5 Discussion of Analytical Data

Contaminants were detected at Site 1 in all media sampled. Table 4.1.1-4 summarizes the range of contaminants encountered for each media sampled (surface water, sediments, and groundwater), as well as the number of positive detections compared to the number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections or surrogate spike recoveries.

TABLE 4.1.1-3

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 1

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-1SS BAFB-0127 0.0-0.5' 11/30/88	1-C-1SS BAFB-0128 1.5-2.0' 11/30/88	1-C-2SS BAFB-0129 0.0-0.5' 11/30/88	1-C-2SS BAFB-0130 1.5-2.0' 11/30/88	1-C-3SS BAFB-0131 0.0-0.5' 11/30/88	1-C-3SS BAFB-0132 1.5-2.0' 11/30/88
Percent Moisture	ASA#9	N/A	%	NS	NS	21.3	16.1	18.7	17.2	15.1	13.1
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	470	25	84	24	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	7000	5110	5360	8450	10900	7180
Barium	SW6010	10.0	mg/kg	NS	10,000	121	190	209	116	151	193
Cadmium	SW6010	1.0	mg/kg	NS	100	1.3	ND	ND	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	1650	1530	1720	2910	2400	1930
Chromium	SW6010	3.0	mg/kg	NS	500	46.5	22.6	29.0	32.2	31.3	28.7
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.6	19.1	12.3	12.1	10.0	11.5
Copper	SW6010	3.0	mg/kg	NS	2,500	20.3	11.4	110	13.3	14.1	12.7
Iron	SW6010	10.0	mg/kg	NS	NS	14500	10900	13400	16500	17100	15500
Lead	SW6010	20.0	mg/kg	NS	1,000	59.1	ND	ND	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	1310	1300	1550	2080	2200	1960
Manganese	SW6010	1.5	mg/kg	NS	NS	550	862	713	401	549	571
Nickel	SW6010	4.0	mg/kg	NS	2,000	10.0	10.5	10.6	14.5	14.1	10.6
Potassium	SW6010	200	mg/kg	NS	NS	280	ND	246	ND	283	322
Sodium	SW6010	100	mg/kg	NS	NS	151	195	204	274	259	231
Vanadium	SW6010	4.0	mg/kg	NS	2,400	52.4	42.3	43.2	44.0	41.7	45.3
Zinc	SW6010	2.0	mg/kg	NS	5,000	58.8 B	16.7 B	109 B	22.9 B	25.0 B	18.4 B
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	1.4 B	1.3 B	0.96 B	0.92 B	0.82 B	0.76 B
Carbon Disulfide	SW8240	0.005	mg/kg	NS	NS	0.74 BJ	0.55 BJ	0.52 BJ	0.53 BJ	0.48 BJ	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.45 J	ND	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	NT	2.1 B	2.7 B	2.4 B	1.6 B	1.8 B

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-4SS BAFB-0133 0.0-0.5' 12/01/88	1-C-4SS BAFB-0134 1.5-2.0' 12/01/88	1-C-5SS BAFB-0135 0.0-0.5' 12/01/88	1-C-5SS BAFB-0136 1.5-2.0' 12/01/88	1-C-6SS BAFB-0137 0.0-0.5' 12/01/88	1-C-6SS BAFB-0138 1.5-2.0' 12/01/88
Percent Moisture	ASA#9	N/A	%	NS	NS	35.2	27.6	15	16.5	59.2	32.3
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	15000	1200	320	360	7400	3500
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	430	ND	110	75	230	340
Aluminum	SW6010	20.0	mg/kg	NS	NS	13100	8990	3610	5720	17500	11100
Barium	SW6010	10.0	mg/kg	NS	10,000	194	351	125	72.8	191	129
Cadmium	SW6010	1.0	mg/kg	NS	100	3.5	ND	ND	ND	4.4	2.8
Calcium	SW6010	100	mg/kg	NS	NS	4660	2240	1290	1650	4090	2270
Chromium	SW6010	3.0	mg/kg	NS	500	102	55.7	34.6	27.1	61.5	45.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	12.5	49.2	10.4	6.5	13.5	10.2
Copper	SW6010	3.0	mg/kg	NS	2,500	53.5	28.5	12.9	13.2	57.6	26.6
Iron	SW6010	10.0	mg/kg	NS	NS	21000	17400	9860	10800	23900	15100
Lead	SW6010	20.0	mg/kg	NS	1,000	245	123	ND	269	154	63.8
Magnesium	SW6010	100	mg/kg	NS	NS	2530	1800	978	1530	2920	1540
Manganese	SW6010	1.5	mg/kg	NS	NS	284	2600	565	183	645	533
Nickel	SW6010	4.0	mg/kg	NS	2,000	24.7	34.3	9.6	10.9	29.4	14.8
Potassium	SW6010	200	mg/kg	NS	NS	509	387	235	311	760	340
Sodium	SW6010	100	mg/kg	NS	NS	262	264	104	143	324	176
Vanadium	SW6010	4.0	mg/kg	NS	2,400	68.4	47.0	34.8	34.0	68.6	47.9
Zinc	SW6010	2.0	mg/kg	NS	5,000	306	107	36.1	56.4	380	183
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.046 B	0.024 B	0.050 B	0.032 B	0.041 B	0.32 B
Toluene	SW8240	0.005	mg/kg	NS	NS	0.022	0.008	ND	ND	0.044	0.46
Phenol	SW8270	0.33	mg/kg	NS	NS	3.5 B	3.0 B	1.0 BJ	1.0 BJ	1.6 BJ	1.1 B
Isophorone	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.53 J
2,6-Dinitrotoluene	SW8270	0.33	mg/kg	NS	NS	1.9 J	ND	ND	ND	ND	ND
Fluoranthene	SW8270	0.33	mg/kg	NS	NS	1.7 J	ND	ND	ND	ND	ND
Pyrene	SW8270	0.33	mg/kg	NS	NS	2.8	ND	ND	ND	ND	ND
Benzo(a)anthracene	SW8270	0.33	mg/kg	NS	NS	1.2 J	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	14	2.1	ND	ND	3.4	1.2
Chrysene	SW8270	0.33	mg/kg	NS	NS	2.3	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	SW8270	0.33	mg/kg	NS	NS	2.3	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	SW8270	0.33	mg/kg	NS	NS	2.9	ND	ND	ND	ND	ND
Benzo(a)pyrene	SW8270	0.33	mg/kg	NS	NS	1.0 J	ND	ND	ND	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-7SS BAFB-0190 0.0-0.5' 12/08/88	1-C-7SS[f] BAFB-0191 0.0-0.5' 12/08/88	1-C-7SS BAFB-0192 1.5-2.0' 12/08/88	1-C-8SS BAFB-0193 0.0-0.5' 12/08/88	1-C-8SS BAFB-0194 1.5-2.0' 12/08/88	1-C-9SS BAFB-0195 0.0-0.5' 12/08/88
Percent Moisture	ASA#9	N/A	%	NS	NS	25.3	24.2	20	25.3	21.6	13.3
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	240	220	310	1700	1000	9.2
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	67	66	ND	160	180	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	7860	11000	9590	10800	9590	9030
Barium	SW6010	10.0	mg/kg	NS	10,000	150	164	179	265	180	141
Calcium	SW6010	100	mg/kg	NS	NS	2160	2570	2350	3290	3270	2250
Chromium	SW6010	3.0	mg/kg	NS	500	60.2	132	32.8	57.3	43.2	28.7
Cobalt	SW6010	4.0	mg/kg	NS	8,000	9.5	10.2	11.6	11.1	12.8	10.1
Copper	SW6010	3.0	mg/kg	NS	2,500	22.8	18.5	18.8	26.8	19.1	16.1
Iron	SW6010	10.0	mg/kg	NS	NS	17900	18900	16600	18900	17300	17300
Lead	SW6010	20.0	mg/kg	NS	1,000	159	249	29.3	39.9	71.0	ND
Magnesium	SW6010	100	mg/kg	NS	NS	1700	2040	1940	2500	2170	2080
Manganese	SW6010	1.5	mg/kg	NS	NS	324	317	350	303	603	381
Nickel	SW6010	4.0	mg/kg	NS	2,000	16.1	18.5	16.3	21.4	20.4	16.1
Potassium	SW6010	200	mg/kg	NS	NS	388	515	475	562	497	496
Sodium	SW6010	100	mg/kg	NS	NS	161	193	200	185	189	138
Vanadium	SW6010	4.0	mg/kg	NS	2,400	59.2	49.6	45.4	58.4	51.8	49.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	54.4	100	60.5	141	93.1	34.8
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.025 B	0.034 B	0.018 B	0.017 BJ	0.023 BJ	0.021 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.019 B	0.025 B	ND	ND	ND	ND
Carbon Disulfide	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.018 J	ND
1,2-Dichloroethene (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.011 J	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	0.004 J	0.003 J	0.003 J	ND	0.013 J	ND
Tetrachloroethene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.015 J	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.007 J	0.023 J	ND
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.013 J	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.022 J	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	0.62 BJ	1.6 B	1.6 B	1.9 J	1.0 BJ	1.2 B
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.096 J
Phenanthrene	SW8270	0.33	mg/kg	NS	NS	0.37 J	ND	0.28 J	4.3	ND	ND
Anthracene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	0.52 J	ND	ND
Fluoranthene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	12	0.50 BJ	ND
Pyrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	9.2	0.47 J	ND
Benzo(a)anthracene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	4.3	ND	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.36 J	ND	ND	2.7	0.91 BJ	43 B
Chrysene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	7.9	ND	ND
Benzo(b)fluoranthene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	6.3	ND	ND
Benzo(a)pyrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	3.9	ND	ND
Indeno(1,2,3-cd)pyrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	0.62 J	ND	ND

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J: estimated value, below quantification limit
b: field blank (ambient condition blank)
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f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-9SS BAFB-0196 1.5-2.0' 12/08/88	1-C-10SS BAFB-0197 0.0-0.5' 12/08/88	1-C-10SS BAFB-0198 1.5-2.0' 12/08/88	1-C-11SS BAFB-0199 0.0-0.5' 12/08/88	1-C-11SS BAFB-0200 1.5-2.0' 12/08/88	1-C-12SS BAFB-0201 0.0-0.5' 12/08/88
Percent Moisture	ASA#9	N/A	%	NS	NS	14.3	41.6	39.9	43.3	38.7	23.8
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	11	10000	4800	5300	1800	2500
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	170	ND	410	260	180
Aluminum	SW6010	20.0	mg/kg	NS	NS	10400	13200	16000	13100	24800	11400
Barium	SW6010	10.0	mg/kg	NS	10,000	125	165	193	222	284	383
Cadmium	SW6010	1.0	mg/kg	NS	100	ND	ND	ND	1.8	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	2150	4370	4810	4390	4710	3190
Chromium	SW6010	3.0	mg/kg	NS	500	37.2	72.1	70.7	63.0	46.5	69.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.7	11.1	16.1	19.4	17.9	12.1
Copper	SW6010	3.0	mg/kg	NS	2,500	17.5	64.2	42.9	49.7	38.3	26.5
Iron	SW6010	10.0	mg/kg	NS	NS	18700	19300	23800	24300	31600	20700
Lead	SW6010	20.0	mg/kg	NS	1,000	ND	119	90.8	84.1	34.9	87.0
Magnesium	SW6010	100	mg/kg	NS	NS	1910	3540	2900	3100	3650	2390
Manganese	SW6010	1.5	mg/kg	NS	NS	250	250	498	610	481	286
Nickel	SW6010	4.0	mg/kg	NS	2,000	19.8	32.5	25.0	30.0	33.1	19.7
Potassium	SW6010	200	mg/kg	NS	NS	572	736	832	776	979	709
Sodium	SW6010	100	mg/kg	NS	NS	170	284	285	266	382	261
Vanadium	SW6010	4.0	mg/kg	NS	2,400	58.2	58.7	68.6	72.1	76.3	63.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	31.4	248	145	277	127	96.5
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.032 B	0.075 B	0.078 B	0.076 B	0.028 BJ	0.017 BJ
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.12 B	ND	0.026 BJ	0.17 B
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	ND	ND	ND	ND	0.009 J
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	0.015 J	ND	0.19	0.060	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	0.98 B	ND	1.4 B	1.6 BJ	1.8 B	1.3 B
2,4-Dinitrotoluene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.13 J
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.13 J
Phenanthrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	0.14 BJ	ND	0.13 BJ	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	0.63 BJ	ND	0.10 BJ
Fluoranthene	SW8270	0.33	mg/kg	NS	NS	ND	1.0 BJ	ND	0.74 BJ	0.29 BJ	ND
Pyrene	SW8270	0.33	mg/kg	NS	NS	ND	1.3 J	ND	0.72 J	0.31 J	ND
Butylbenzylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	0.58 J	ND	ND
Benzo(a)anthracene	SW8270	0.33	mg/kg	NS	NS	ND	0.87 J	ND	0.62 J	0.18 J	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	19 B	5.1 BJ	1.1 B	2.1 BJ	1.1 BJ	0.25 BJ
Chrysene	SW8270	0.33	mg/kg	NS	NS	ND	1.3 J	0.14 J	0.69 J	0.20 J	ND
Benzo(a)pyrene	SW8270	0.33	mg/kg	NS	NS	ND	0.62 J	ND	ND	ND	ND

NOTES: Results reported for detected analytes only.
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ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-12SS[f] BAFB-0202 0.0-0.5' 12/08/88	1-C-12SS BAFB-0203 1.5-2.0' 12/08/88
Percent Moisture	ASA#9	N/A	%	NS	NS	30.5	32.9
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	1300	910
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	140	130
Aluminum	SW6010	20.0	mg/kg	NS	NS	9810	13100
Barium	SW6010	10.0	mg/kg	NS	10,000	399	380
Calcium	SW6010	100	mg/kg	NS	NS	2630	3220
Chromium	SW6010	3.0	mg/kg	NS	500	40.0	35.3
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.7	16.4
Copper	SW6010	3.0	mg/kg	NS	2,500	21.6	25.3
Iron	SW6010	10.0	mg/kg	NS	NS	18700	21600
Magnesium	SW6010	100	mg/kg	NS	NS	2200	2490
Manganese	SW6010	1.5	mg/kg	NS	NS	296	408
Nickel	SW6010	4.0	mg/kg	NS	2,000	17.3	25.3
Potassium	SW6010	200	mg/kg	NS	NS	719	686
Sodium	SW6010	100	mg/kg	NS	NS	249	277
Vanadium	SW6010	4.0	mg/kg	NS	2,400	54.7	62.0
Zinc	SW6010	2.0	mg/kg	NS	5,000	136	103
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.020 BJ	0.021 BJ
Toluene	SW8240	0.005	mg/kg	NS	NS	0.019 J	0.015 BJ
Phenol	SW8270	0.33	mg/kg	NS	NS	0.59 BJ	0.33 BJ
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	0.11 J	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.19 BJ	0.22 BJ

NOTES: Results reported for detected analytes only.
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(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.1-3

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 1

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-1GW BAFB-0491 03/16/89	1-C-2GW BAFB-0497 03/17/89	1-C-3GW BAFB-0493 03/16/89	1-C-3GW[f] BAFB-0494 03/16/89	1-C-3GW[e] BAFB-0495 03/17/89	1-C-3GW[b] BAFB-0496 03/17/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	165	225	239	239	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	19.5	20.0	19.5	19.5	19.0	NT
pH	E150.1	N/A	pH	5-9	NS	7.13	7.06	7.06	7.06	7.00	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	70.0	68.0	90.8	87.2	7.0	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	85.4	83.0	110.8	106.4	8.5	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	185	196	249	250	ND	NT
Chloride	E325.3	1.0	mg/l	250	250	12.0	27.5	27.0	27.5	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.21	0.16	0.22	0.22	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	7.1	4.3	4.3	5.1	ND	NT
Sulfate	E375.4	1.0	mg/l	250	250	7.5	8.5	23.4	26.2	ND	NT
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	ND	ND	ND	ND	0.10	NT
Calcium	SW6010	1.00	mg/l	NS	NS	11.1	11.1	19.6	19.9	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	6.10	5.58	11.1	11.2	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	1.80	1.60	1.60	2.40	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	17.5	28.5	26.2	27.2	ND	NT
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	0.285	0.118	0.0950	ND	NT
Trichloroethene	SW8010	1	ug/l	5	5	ND	ND	8(12)	7(8)	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	1(1)	2	ND	ND	ND	ND

NOTES: Results reported for detected analytes only.
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(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix 1.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-4GW BAFB-0499 03/20/89	1-C-5GW BAFB-0498 03/17/89	1-A-1GW BAFB-0492 03/16/89	1-C-1DC BAFB-0446 02/22/89	1-C-1DC[f] BAFB-0447 02/22/89	1-C-1DC[e] BAFB-0465 02/22/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	300	203	220	30	30	NT
Temperature	E170.1	N/A	deg C	NS	NS	21.0	20.0	19.5	13.5	13.5	NT
pH	E150.1	N/A	pH	5-9	NS	7.30	7.76	7.20	7.08	7.08	7.00
Alkalinity - Total	SW403	1.0	mg/l	20	NS	71.6	76.8	81.6	22.4	20.8	7.6
Bicarbonate	SW403	1.0	mg/l	NS	NS	87.4	93.7	99.6	27.3	25.4	9.3
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	185	194	206	62.0	65.0	39.0
Chloride	E325.3	1.0	mg/l	250	250	11.5	15.5	22.5	ND	ND	ND
Fluoride	E340.2	0.050	mg/l	2	1.4	0.28	0.24	0.25	ND	ND	ND
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	4.9	6.8	5.9	1.9	3.9	1.5
Sulfate	E375.4	1.0	mg/l	250	250	5.7	8.0	10.2	4.3	4.0	ND
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	ND	ND	ND	9.0	5.0	ND
TFH-Gas	TFH-GA	0.10	mg/l	NS	NS	ND	ND	ND	0.40	0.30	ND
Calcium	SW6010	1.00	mg/l	NS	NS	9.41	15.3	11.6	4.00	3.94	3.12
Magnesium	SW6010	1.00	mg/l	NS	NS	5.10	6.77	6.19	ND	ND	ND
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	ND	0.0340	0.0300	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.60	1.60	1.70	ND	ND	ND
Sodium	SW6010	1.00	mg/l	NS	NS	30.2	20.3	29.7	2.05	1.96	ND
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0470	ND	ND	0.0360	0.0370	ND
Trichloroethene	SW8010	1	ug/l	5	5	ND	3(3)	2(3)	ND	ND	ND

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B: analyte detected in blank
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a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-1DC[b] BAFB-0466 02/22/89	1-C-1SW BAFB-0442 02/21/89	1-C-2SW BAFB-0443 02/21/89	1-C-3SW BAFB-0444 02/21/89	1-C-4SW BAFB-0445 02/21/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	NT	130	132	135	135
Temperature	E170.1	N/A	deg C	NS	NS	NT	14.5	15.5	14.5	13.2
pH	E150.1	N/A	pH	5-9	NS	NT	8.90	8.76	7.54	6.61
Alkalinity - Total	SM403	1.0	mg/l	20	NS	NT	59.2	68.4	63.6	70.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	72.2	83.4	77.6	85.4
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	NT	158	160	157	162
Chloride	E325.3	1.0	mg/l	250	250	NT	14.0	15.0	14.0	14.9
Fluoride	E340.2	0.050	mg/l	2	1.4	NT	0.12	0.11	0.11	0.12
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	NT	1.0	1.4	1.8	2.1
Sulfate	E375.4	1.0	mg/l	250	250	NT	6.8	6.3	6.1	5.8
Lead	SW7421	0.0050	mg/l	.05	.05	NT	ND	ND	0.0050	ND
Calcium	SW6010	1.00	mg/l	NS	NS	NT	15.5	15.7	15.6	14.7
Iron	SW6010	0.100	mg/l	.3	.3	NT	0.109	0.107	ND	ND
Magnesium	SW6010	1.00	mg/l	NS	NS	NT	5.62	5.74	5.73	5.45
Manganese	SW6010	0.0150	mg/l	.05	.05	NT	0.0630	0.0570	0.0510	0.049
Potassium	SW6010	1.00	mg/l	NS	NS	NT	1.50	1.60	1.50	1.6
Sodium	SW6010	1.00	mg/l	NS	NS	NT	11.3	11.4	11.4	10.5
Trichloroethene	SW8010	1	ug/l	5	5	ND	2(2)	3(3)	4(4)	2(3)

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B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.1-3

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 1

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-1GW BAFB-0560 05/31/89	1-C-2GW BAFB-0557 05/31/89	1-C-3GW BAFB-0558 05/31/89	1-C-4GW BAFB-0556 05/30/89	1-C-5GW BAFB-0576 06/05/89	1-A-1GW BAFB-0559 05/31/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	181	256	225	237	220	220
Temperature	E170.1	N/A	deg C	NS	NS	21.0	21.0	21.0	21.5	21.0	21.0
pH	E150.1	N/A	pH	5-9	NS	7.43	7.18	7.22	7.18	7.74	7.39
Alkalinity - Total	SM403	1.0	mg/l	20	NS	69.8	67.1	86.8	70.2	NT	81.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	85.2	81.9	105.9	85.6	NT	99.6
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	322	240	261	257	232	233
Chloride	E325.3	1.0	mg/l	250	250	13.9	32.8	23.4	29.3	14.7	19.9
Fluoride	E340.2	0.050	mg/l	2	1.4	0.24	0.19	0.28	0.23	0.29	0.28
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	7.4	4.7	6.2	3.9	7.2	5.2
Sulfate	E375.4	1.0	mg/l	250	250	6.6	7.1	14.7	13.1	10.3	7.6
Calcium	SW6010	1.00	mg/l	NS	NS	10.8	13.4	13.8	11.7	14.0	10.9
Magnesium	SW6010	1.00	mg/l	NS	NS	5.99	6.52	8.00	6.17	6.49	5.45
Potassium	SW6010	1.00	mg/l	NS	NS	1.60	1.75	1.62	4.80	1.40	1.40
Sodium	SW6010	1.00	mg/l	NS	NS	18.3	28.8	24.9	30.0	20.3	27.7
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	0.0330	ND	ND	0.0280
trans-1,2,-Dichloroethene	SW8010	1	ug/l	NS	NS	ND	ND	66(3)	ND	8	ND
Trichloroethene	SW8010	1	ug/l	5	5	ND	ND	14(22)	ND	4(4)	3(4)
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	2	ND	2	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 J	7 J	6 J	5 J	5 BJ	5 J
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	4 J	ND	3 J	5 J	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-1DC BAFB-0586 06/09/89	1-C-1SW BAFB-0599 06/14/89	1-C-2SW BAFB-0600 06/14/89	1-C-3SW BAFB-0601 06/14/89	1-C-4SW BAFB-0602 06/14/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	320	390	393	400	415
Temperature	E170.1	N/A	deg C	NS	NS	27.0	21.5	22.0	22.0	23.0
pH	E150.1	N/A	pH	5-9	NS	7.44	7.94	7.76	7.57	7.34
Alkalinity - Total	SM403	1.0	mg/l	20	NS	96.4	96.4	122.0	121.0	119.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	117.6	117.6	148.8	147.6	145.7
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	208	307	313	388	315
Chloride	E325.3	1.0	mg/l	250	250	26.2	55.4	52.5	52.9	52.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.15	0.23	0.24	0.24	0.24
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	1.2	1.2	0.95	2.1	1.4
Sulfate	E375.4	1.0	mg/l	250	250	16.5	12.8	13.1	13.1	12.6
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	ND	ND	ND	0.050	ND
TFH-Gas	TFH-GA	0.10	mg/l	NS	NS	ND	ND	ND	ND	0.20
Barium	SW6010	0.100	mg/l	NS	NS	0.163	0.129	0.136	0.138	0.153
Calcium	SW6010	1.00	mg/l	NS	NS	27.8	36.1	35.3	35.1	35.0
Iron	SW6010	0.100	mg/l	.3	.3	ND	0.112	ND	0.145	0.188
Magnesium	SW6010	1.00	mg/l	NS	NS	8.97	13.2	13.0	12.6	12.6
Manganese	SW6010	0.0150	mg/l	.05	.05	0.210	0.0540	0.0340	0.181	0.227
Potassium	SW6010	1.00	mg/l	NS	NS	2.60	2.70	3.20	3.10	3.50
Sodium	SW6010	1.00	mg/l	NS	NS	19.7	34.1	32.5	32.2	32.4
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0420	ND	0.0200	0.0220	0.0250
Methylene chloride	SW8010	5	ug/l	NS	NS	9(14)	ND	ND	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	3(4)	ND	ND	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	7 BJ	3 BJ	3 BJ	3 BJ	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.1-3

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 1

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-1GW BAFB-0645 09/14/89	1-C-2GW BAFB-0640 09/13/89	1-C-2GW^{R} BAFB-0677 11/02/89	1-C-3GW BAFB-0641 09/13/89	1-C-3GW^{R} BAFB-0679 11/03/89	1-C-4GW BAFB-0643 09/14/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	170	238	NT	221	NT	220
Temperature	E170.1	N/A	deg C	NS	NS	22.0	21.5	NT	21.0	NT	22.0
pH	E150.1	N/A	pH	5-9	NS	7.58	7.37	NT	6.65	NT	7.41
Alkalinity - Total	SM403	1.0	mg/l	20	NS	105.0	72.6	NT	81.0	NT	73.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	128.1	88.6	NT	98.8	NT	90.0
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	247	266	NT	270	NT	232
Chloride	E325.3	1.0	mg/l	250	250	20.0	27.0	NT	46.0	NT	22.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.21	0.17	NT	0.22	NT	0.20
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	7.5	4.3	NT	6.1	NT	2.4
Sulfate	E375.4	1.0	mg/l	250	250	7.3	7.9	NT	8.0	NT	7.4
Calcium	SW6010	1.00	mg/l	NS	NS	9.93	11.8	NT	13.8	NT	10.4
Magnesium	SW6010	1.00	mg/l	NS	NS	5.55	5.88	NT	8.02	NT	5.28
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	NT	0.0180	NT	ND
Nickel	SW6010	0.0400	mg/l	.16	.4	ND	ND	NT	0.0600	NT	ND
Potassium	SW6010	1.00	mg/l	NS	NS	2.20	2.20	NT	2.30	NT	2.20
Sodium	SW6010	1.00	mg/l	NS	NS	16.7	28.1	NT	21.6	NT	28.4
Trichloroethene	SW8010	1	ug/l	5	5	ND	NT	ND	NT	4(5)	ND
Toluene	SW8020	1	ug/l	14,300	100	2	NT	ND	NT	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	5 BJ	ND	NT	ND	NT	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-5GW BAFB-0642 09/14/89	1-A-1GW BAFB-0644 09/14/89	OB-C-1GW BAFB-0671 09/25/89	OB-C-2GW BAFB-0675 09/26/89	1-C-1DC BAFB-0676 09/27/89	1-C-1SW BAFB-0667 09/22/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	206	221	NT	NT	394	381
Temperature	E170.1	N/A	deg C	NS	NS	21.0	21.5	NT	NT	19.0	23.0
pH	E150.1	N/A	pH	5-9	NS	7.44	7.58	NT	NT	7.37	6.86
Alkalinity - Total	SM403	1.0	mg/l	20	NS	80.8	77.8	NT	NT	137.6	117.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	98.6	94.9	NT	NT	167.9	142.7
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	219	324	NT	NT	460	364
Chloride	E325.3	1.0	mg/l	250	250	43.0	19.0	NT	NT	45.7	50.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.23	0.19	NT	NT	0.23	0.35
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	7.4	5.6	NT	NT	0.22	ND
Sulfate	E375.4	1.0	mg/l	250	250	8.0	11.0	NT	NT	7.9	12.0
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	ND	ND	NT	NT	0.39	0.34
TFH-Gas	TFH-GA	0.10	mg/l	NS	NS	ND	ND	NT	NT	0.76	0.80
Aluminum	SW6010	0.200	mg/l	NS	NS	ND	0.245	NT	NT	ND	ND
Barium	SW6010	0.100	mg/l	NS	NS	ND	ND	NT	NT	ND	0.144
Calcium	SW6010	1.00	mg/l	NS	NS	14.4	11.6	NT	NT	26.9	29.2
Iron	SW6010	0.100	mg/l	.3	.3	ND	0.392	NT	NT	ND	ND
Magnesium	SW6010	1.00	mg/l	NS	NS	6.80	5.85	NT	NT	11.4	12.1
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	NT	NT	0.198	0.741
Potassium	SW6010	1.00	mg/l	NS	NS	2.00	1.90	NT	NT	3.10	4.10
Sodium	SW6010	1.00	mg/l	NS	NS	19.5	27.8	NT	NT	43.0	29.4
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	NT	NT	0.0310	0.0560
trans-1,2,-Dichloroethene	SW8010	1	ug/l	NS	NS	5	ND	ND	ND	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	3(2)	3(3)	ND	ND	2(2) B	ND
Toluene	SW8020	1	ug/l	14,300	100	ND	3	NT	NT	1	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	5 BJ	ND	NT	NT	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-2SW BAFB-0668 09/22/89	1-C-3SW BAFB-0669 09/22/89	1-C-4SW BAFB-0670 09/22/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	391	387	385
Temperature	E170.1	N/A	deg C	NS	NS	24.0	24.0	24.0
pH	E150.1	N/A	pH	5-9	NS	6.89	6.69	7.13
Alkalinity - Total	SM403	1.0	mg/l	20	NS	127.0	130.0	129.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	154.9	158.6	157.4
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	356	357	359
Chloride	E325.3	1.0	mg/l	250	250	52.0	52.0	50.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.36	0.40	0.43
Sulfate	E375.4	1.0	mg/l	250	250	11.0	8.4	8.5
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	0.18	0.41	0.88
TFH-Gas	TFH-GA	0.10	mg/l	NS	NS	0.44	0.60	0.38
Barium	SW6010	0.100	mg/l	NS	NS	0.146	0.145	0.145
Calcium	SW6010	1.00	mg/l	NS	NS	29.7	29.6	30.0
Iron	SW6010	0.100	mg/l	.3	.3	0.100	ND	ND
Magnesium	SW6010	1.00	mg/l	NS	NS	12.3	12.3	12.5
Manganese	SW6010	0.0150	mg/l	.05	.05	0.490	0.289	0.261
Potassium	SW6010	1.00	mg/l	NS	NS	3.50	3.60	4.00
Sodium	SW6010	1.00	mg/l	NS	NS	30.2	30.2	30.1
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0390	0.0590	0.0370
Trichloroethene	SW8010	1	ug/l	5	5	ND	1(2)	2(2)
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	ND	6 J	6 J

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.1-3

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 1

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-1GW BAFB-0708 11/22/89	1-C-2GW BAFB-0704 11/21/89	1-C-3GW BAFB-0705 11/21/89	1-C-4GW BAFB-0706 11/21/89	1-C-5GW BAFB-0707 11/22/89	1-A-1GW BAFB-0713 11/28/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	NT	249	200	230	219	209
Temperature	E170.1	N/A	deg C	NS	NS	NT	21.0	20.5	21.0	21.0	21.0
pH	E150.1	N/A	pH	5-9	NS	7.00	7.38	7.35	7.35	8.90	7.53
Alkalinity - Total	SM403	1.0	mg/l	20	NS	70.2	68.2	76.8	70.0	78.0	82.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	85.6	83.2	93.7	85.4	95.2	100.0
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	252	262	273	281	241	259
Chloride	E325.3	1.0	mg/l	250	250	12.2	32.4	16.4	30.8	13.7	18.2
Fluoride	E340.2	0.050	mg/l	2	1.4	0.30	0.23	0.32	0.27	0.32	0.28
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	4.1	1.3	2.4	2.1	2.0	5.6
Sulfate	E375.4	1.0	mg/l	250	250	11.9	1.4	7.3	6.4	5.3	12.6
Lead	SW7421	0.0050	mg/l	.05	.05	ND	ND	ND	ND	ND	0.0089
TPH-Diesel	TPH-DI	0.050	mg/l	NS	NS	ND	0.060	0.060	ND	ND	0.10
Calcium	SW6010	1.00	mg/l	NS	NS	10.2	12.2	13.1	11.3	12.8	11.8
Chromium	SW6010	0.0300	mg/l	NS	NS	ND	ND	ND	ND	ND	0.0311
Iron	SW6010	0.100	mg/l	.3	.3	ND	ND	ND	ND	ND	6.88
Magnesium	SW6010	1.00	mg/l	NS	NS	5.62	6.17	7.52	5.78	6.17	6.19
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	ND	ND	ND	0.142
Nickel	SW6010	0.0400	mg/l	.16	.4	ND	ND	0.0575	ND	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.68	2.02	1.87	1.92	1.49	2.19
Sodium	SW6010	1.00	mg/l	NS	NS	18.2	30.2	22.4	29.8	19.4	26.9
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	ND	ND	ND	0.0291
Trichloroethene	SW8010	1	ug/l	5	5	ND	ND	6(7)	ND	3(5)	1(1)
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	ND	3(4)	ND	ND
Diethylphthalate	SW8270	10	ug/l	NS	NS	5 BJ	7 BJ	6 BJ	6 BJ	6 BJ	8 BJ
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	9 BJ	10 B	10 B	9 BJ	7 BJ	15 B
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	6 BJ	7 BJ	7 BJ	8 BJ	7 BJ	17 B
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	30	5 J	10	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	OB-C-1GW BAFB-0740 12/11/89	OB-C-2GW BAFB-0739 12/11/89	1-C-1DC BAFB-0736 12/07/89	1-C-1SW BAFB-0732 12/06/89	1-C-2SW BAFB-0733 12/06/89	1-C-3SW BAFB-0734 12/06/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	219	2750	295	240	250	261
Temperature	E170.1	N/A	deg C	NS	NS	19.0	16.5	11.5	7.5	9.5	11.0
pH	E150.1	N/A	pH	5-9	NS	7.36	6.94	7.79	7.61	7.73	7.71
Alkalinity - Total	SM403	1.0	mg/l	20	NS	NT	NT	114.0	100.8	101.4	107.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	NT	139.1	123.0	123.7	131.0
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	NT	NT	219	206	216	191
Chloride	E325.3	1.0	mg/l	250	250	NT	NT	47.2	45.3	43.3	45.1
Fluoride	E340.2	0.050	mg/l	2	1.4	NT	NT	0.40	0.49	0.51	0.51
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	NT	NT	0.22	0.71	0.80	0.31
Sulfate	E375.4	1.0	mg/l	250	250	NT	NT	5.2	8.7	7.0	5.2
TPH-Diesel	TPH-DI	0.050	mg/l	NS	NS	NT	NT	2.3	ND	0.11	0.19
Barium	SW6010	0.100	mg/l	NS	NS	NT	NT	0.102	0.104	0.105	0.104
Calcium	SW6010	1.00	mg/l	NS	NS	NT	NT	25.5	25.9	25.5	25.1
Iron	SW6010	0.100	mg/l	.3	.3	NT	NT	ND	0.105	0.159	ND
Magnesium	SW6010	1.00	mg/l	NS	NS	NT	NT	11.2	10.8	10.7	10.9
Manganese	SW6010	0.0150	mg/l	.05	.05	NT	NT	0.0468	0.106	0.132	0.0394
Potassium	SW6010	1.00	mg/l	NS	NS	NT	NT	2.68	2.53	2.45	2.64
Sodium	SW6010	1.00	mg/l	NS	NS	NT	NT	26.4	24.8	25.3	26.4
Zinc	SW6010	0.0200	mg/l	0.110	0.012	NT	NT	0.0248	0.0227	0.0320	0.0481
Trichloroethene	SW8010	1	ug/l	5	5	1(0)	ND	1(2)	ND	ND	3(1)
Toluene	SW8020	1	ug/l	14,300	100	NT	NT	1(9)	ND	1(1)	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	NT	NT	ND	ND	7 J	9 J

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.1-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	1-C-4SW BAFB-0735 12/07/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	295
Temperature	E170.1	N/A	deg C	NS	NS	11.5
pH	E150.1	N/A	pH	5-9	NS	7.79
Alkalinity - Total	SM403	1.0	mg/l	20	NS	112.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	137.4
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	204
Chloride	E325.3	1.0	mg/l	250	250	47.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.40
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	0.18
Sulfate	E375.4	1.0	mg/l	250	250	5.5
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	0.82
Barium	SW6010	0.100	mg/l	NS	NS	0.102
Calcium	SW6010	1.00	mg/l	NS	NS	25.3
Magnesium	SW6010	1.00	mg/l	NS	NS	11.1
Manganese	SW6010	0.0150	mg/l	.05	.05	0.0472
Potassium	SW6010	1.00	mg/l	NS	NS	2.86
Sodium	SW6010	1.00	mg/l	NS	NS	26.3
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0285
Trichloroethene	SW8010	1	ug/l	5	5	8(2)
Toluene	SW8020	1	ug/l	14,300	100	1(8)

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Table 4.1.1-4
RANGES OF CONTAMINANTS DETECTED AT SITE 1

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
DISCHARGE TO DITCH				
TFH-diesel	mg/l	ND	9.0	3/4
THF-gas	mg/l	ND	0.76	2/4
manganese	mg/l	0.198	0.34	4/4
trichloroethene	ug/l	ND	1	1/4
SURFACE WATER				
TFH-diesel	mg/l	ND	200	9/16
TFH-gas	mg/l	ND	2.0	6/16
lead	mg/l	ND	0.0050	1/16
iron	mg/l	ND	0.188	8/16
manganese	mg/l	0.034	0.741	16/16
trichloroethene	ug/l	ND	8	8/16
STREAM SEDIMENTS				
TFH-diesel	mg/kg	ND	15,000	22/24
TFH-gas	mg/kg	ND	430	13/24
cadmium	mg/kg	ND	4.4	5/24
chromium	mg/kg	22.6	132	24/24
lead	mg/kg	ND	269	16/24
zinc	mg/kg	ND	380	14/24
toluene	mg/kg	ND	0.46	11/24
trichloroethene	mg/kg	ND	0.013	5/24
bis(2-ethylhexyl) phthalate	mg/kg	ND	14	6/24
benzo(a)anthracene	mg/kg	ND	4.3	5/24
benzo(a)pyrene	mg/kg	ND	3.9	3/24
benzo(b)fluoranthene	mg/kg	ND	6.3	2/24
benzo(k)fluoranthene	mg/kg	ND	2.9	1/24
chrysene	mg/kg	ND	7.9	6/24
fluoranthene	mg/kg	ND	12	2/24
N-nitrosodiphenylamine	mg/kg	ND	(0.13)	4/24
phenanthrene	mg/kg	ND	4.3	3/24
pyrene	mg/kg	ND	9.2	6/24
GROUNDWATER				
toluene	ug/l	ND	3	7/28
trans-1,2-dichloroethene	ug/l	ND	66	3/28
trichloroethene	ug/l	ND	14	11/28

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

site1TB.jl4

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study, the LOQ is equal to the detection limit as defined in the QAPP.

4.1.1.2 Sampling and Analytical Problems

4.1.1.2.1 Loss of Samples

There were no sample loss problems for Site 1 samples. Two analyses scheduled for Site 1 samples were not completed due to laboratory handling problems. One TFH-gas analysis was not completed for the first quarter groundwater sample from well 1-A-1, and a semivolatile organic analysis was not completed for the upper sample at 1-C-1SS. Neither of these analyses omissions is considered critical to data evaluation or evaluation of site conditions. In the third quarter, samples from wells 1-C-2 and 1-C-3 exceeded holding times for purgeable halocarbons and purgeable aromatics analyses. These were resampled and analyzed within holding times.

4.1.1.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil samples collected at Site 1 contained several organic compounds that were probably laboratory-induced false positive results. Methylene chloride was the most common volatile organic compound; it was detected in virtually all field samples and also in all method blanks. Acetone and carbon disulfide were detected in several samples and associated method blanks.

For semivolatile analyses conducted on soil, phenol was detected in field samples and in associated method blanks. Phenol was detected in 12 samples (both the 0- to 0.5-foot and 1.5- to 2.0-foot samples at locations 1-C-1 to 1-C-6) at concentrations of 1.0 to 3.5 mg/kg. This has been traced to a factory-contaminated bottle of acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks that the average induced contamination was 1.7 mg/kg. Other semivolatile compounds detected in some soil samples and method blanks included bis(2-ethylhexyl) phthalate, fluoranthene, phenanthrene, and di-n-butyl phthalate.

One equipment wash blank did contain TFH-diesel at 0.10 mg/l, which is twice the detection limit. However, TFH-diesel was not detected in either the field sample or the field duplicate sample taken immediately before the equipment wash blank. Therefore, the TFH-diesel in the equipment wash blank is considered a false positive result.

In the third sampling round, one method blank did contain TCE at 1 ug/l, which equals the detection limit. TCE was detected in the corresponding sample 1-C-1DC, and second column confirmation at 2 ug/l each. The source of TCE in the method blank is not known.

4.1.1.2.3 Analytical Results Obtained under Out-of-Control Conditions

In the third quarterly groundwater sampling, the 8270 analysis for well 1-C-2 had a phenol-d5 surrogate spike recovery of 100 percent which exceeded the acceptable range of 10 to 94 percent. For well 1-C-3, the nitrobenzene-d5 surrogate spike recovery of 120 percent exceeded the acceptable range of 35 to 114 percent. In the fourth round 8010 analysis for 1-C-3GW, 1-C-4GW and 1-C-5GW the bromochloromethane surrogate spike recoveries of 136, 149, and 146 percent exceeded the acceptable range of 70 to 130 percent.

4.1.1.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.1.3 Significance of Findings

Surface Water

In the first quarter, surface water sampled from the West Drainage Ditch contained TCE in all four samples at concentrations ranging from 2 to 4 ug/l. TCE was not detected in the discharge water flowing into the ditch, although the sample was taken from the northernmost culvert where most of the discharge was occurring, and was not composited from all three culverts. In the second round samples, TCE was detected in the discharge sample but not the downstream samples. In the third round, TCE was detected at 1 to 2 ug/l in the discharge and two nearest downstream samples but was not detected in the two farthest downstream samples. In the fourth round, TCE was detected at 1 ug/l in the discharge sample and 8 and 3 ug/l in the next two downstream samples, but was not detected in the two farthest downstream samples. The varied concentrations of TCE are to be expected in quarterly surface water samples. The EPA drinking water

standards MCL for TCE is 5 ug/l, as is the DHS action level. The EPA MCL goal is zero. The acute toxicity level per the EPA National Ambient Water Quality Criteria to Protect Freshwater Aquatic Life for TCE is 45,000 ug/l and the level that may cause toxicity to one species (unstated) is 21,900 ug/l. The TCE levels detected in the surface water samples at Site 1 are below the DHS action levels but above the EPA MCL goal of zero.

Discharge flowing into the ditch from the north culvert contained TFH-diesel and TFH-gas in the first sampling round. Surface water sample 1-C-4SW also contained TFH-diesel at 200 mg/l and TFH-gas at 2 mg/l, which was several times higher than the discharge water. Samples taken downstream of 1-C-4SW had no detected TFH-diesel or -gas. The three absorbent booms may be absorbing diesel and gas as a floating free phase and could, therefore, reduce the levels of TFH observed in downstream samples. In the second round, TFH-diesel was detected only in the nearest downstream sample and TFH-gas only in the next downstream sample. In the third quarter, TFH-diesel was detected in all samples at from 0.18 to 0.88 mg/l. TFH-gas was detected in all samples at from 0.38 to 0.80 mg/l. These results suggest that TFH-diesel and gas were getting past the absorbent booms during the third quarter sampling. In the fourth round TFH-diesel was detected at decreasing levels from the discharge to the third downstream sample (2.3, 0.82, 0.19, and 0.11 mg/l) and was not detected in the farthest downstream sample. These results suggest that most of the TFH-diesel compounds were being contained by the absorbent booms.

Toluene was not detected in any of the first three quarterly surface water samples. In the fourth quarter, toluene was detected in the discharge (1 ug/l) and downstream samples 1-C-4SW and 1-C-2SW at 1 ug/l.

Barium was detected in some surface water samples but not groundwater samples; iron, manganese, and zinc were detected in some surface and some groundwater samples. These metals may originate with flightline activities and be transported to Site 1 in stormwater, but are not considered to be contaminants of concern. In the first quarter, the highest concentration of iron was 0.109 mg/l (109 ug/l), which is below the EPA secondary MCL of 300 ug/l suggested to protect beneficial uses. Manganese was detected up to 0.063 mg/l (63 ug/l), slightly above the EPA secondary MCL of 50 ug/l.

In the second quarter samples, iron ranged from not detected to 0.188 mg/l and manganese increased, ranging from 0.034 to 0.227 mg/l. In addition to iron and manganese, barium was

detected in all samples at from 0.12º to 0.163 mg/l, which is below the EPA drinking water standards MCL of 1.0 mg/l. Zinc ranged from below the LOQ to 0.042 mg/l, below the EPA secondary MCL of 5.0 mg/l.

In the third quarter, iron decreased, being detected only at the 0.100 mg/l LOQ in 1-C-2SW. Manganese increased, ranging from 0.198 mg/l in the discharge sample to 0.741 mg/l in the farthest downstream sample. Barium was not detected in the discharge but was uniform in the four downstream samples, ranging from 0.144 to 0.146 mg/l. Zinc was detected in all samples at from 0.031 to 0.059 mg/l.

In the fourth quarter manganese was detected at 0.047 mg/l in 1-C-1DC and 1-C-4SW, 0.039 mg/l in 1-C-3SW, 0.132 mg/l in 1-C-2SW, and 0.106 mg/l in 1-C-1SW. Iron was only detected in the two downstream samples at 0.159 mg/l in 1-C-2SW and 0.105 mg/l in 1-C-1SW. Barium ranged from 0.102 to 0.105 mg/l in all five surface water samples. Zinc ranged from 0.023 to 0.032 mg/l in all five samples. This variability of results is common in quarterly surface water sampling. Manganese was the only metal detected above any MCL and that is a secondary MCL, based mainly on staining characteristics rather than health risks.

Soil

All but 2 of the 24 stream sediment samples (12 locations, 2 samples each location) from the West Drainage Ditch had detectable levels of TFH-diesel. In all cases, the diesel fuel components were detected in the upper and the lower samples at each location. As expected, at most of the sampling locations the highest concentration was detected in the zero to 0.5-foot sample. The highest concentration (15,000 mg/kg) was detected at the third sampling point downstream from the headwall and, therefore, the expected decrease in concentration as a function of distance from the source was not strictly observed. However, the lowest concentration of diesel components at any one sampling cross section (six samples) was at the farthest downstream cross section. The calculated LUFT cleanup standard for TFH-diesel is 1,000 mg/kg.

Thirteen of the 24 sediment samples had detectable levels of TFH-gas. Three of the samples with detected TFH-gas were from the upper sample, with no TFH-gas detection in the lower sample. The highest concentration of TFH-gas (430 mg/kg) was also in the third sampling group downstream of the headwall. TFH-gas concentrations generally cor

related with diesel concentrations and no gasoline components were detected in the farthest downstream cross section sample group. The LUFT TFH-gas cleanup standard for Site 1 is 100 mg/kg.

Toluene was detected above the LOQ in six surface sediment samples at concentrations ranging from 0.008 to 0.46 mg/kg. Five samples had toluene detections at estimated concentrations below the LOQ from 0.007 to 0.45 mg/kg. Some of the samples had unusually high LOQs due to required dilutions during analysis. Although toluene concentrations did not correlate linearly with TFH concentrations, the samples with detected toluene were primarily those samples with the highest concentrations of TFH. There currently is no state TTLC criteria for toluene; the LUFT cleanup standard calculated is 0.3 mg/kg.

Lead, detected in only one background soil sample at other sites on base (at 24.2 mg/kg), was detected in 16 of the sediment samples at concentrations from 29.3 to 269 mg/kg. Leaded aircraft and motor vehicle fuels are the probable source. As with toluene, lead concentrations were not directly correlatable to concentrations of TFH. Generally, lead was detected in the samples with highest concentrations of TFH and lead was not detected in any of the samples where TFH-diesel was below 100 mg/kg. The DHS TTLC for lead in soil is 1,000 mg/kg. The lead levels detected are below the TTLC.

Barium (1 sample), cadmium (5 samples), chromium (7 samples), and zinc (12 samples) were detected in sediment samples at levels more than two standard deviations above averaged background levels. With each of these metals, the concentrations decreased with sample depth. All detections were below respective DHS TTLC values.

Several semivolatile compounds were detected in some of the stream sediment samples (see Appendix A). Generally, these compounds were detected near or below the LOQ and, for some of the compounds (phenol, bis[2-ethylhexyl] phthalate, fluoranthene) were also detected in some method blanks. Semivolatile compounds were generally detected in the samples with highest concentrations of TFH compounds. DHS TTLC values for the detected semivolatile compounds in stream sediments are not available.

Groundwater

Groundwater at Site 1 contains TCE. TCE was detected in all four quarterly sampling rounds from 1-C-3, 1-C-5, and 1-A-1 at concentrations ranging from 2 to 8 ug/l, and second

column confirmation data are consistent with first column results except for 1-C-3 in the second round. TCE was detected at a higher level (14 ug/l, 22 ug/l in the second column) in the second round in 1-C-3 but dropped down to 4 and 6 ug/l in the third and fourth rounds. These wells are all shallow wells completed in the uppermost permeable zone, relative to deep wells 1-C-2 and 1-C-4 which are completed at a lower level in this permeable zone. TCE was not detected in the deeper wells or the background well at Site 1. The EPA drinking water standards MCL for TCE is 5 ug/l, as is the DHS action level. In previous studies at Site 1 (AeroVironment, 1987), TCE was detected in well 1-A-1 at concentrations of 100 and 58 ug/l. It is unknown why the concentration of TCE has apparently decreased so substantially.

Trans 1,2-Dichloroethene (DCE) was detected in well 1-C-3, only in the second sampling round, at 66 ug/l (but only 3 ug/l in the second column confirmation). The 66 ug/l value in the first column result is likely due to analytical interference rather than to the actual presence of that much trans 1,2-DCE.

The second column confirmation results are used to confirm the presence of a compound rather than to give quantitative results at low levels near the LOQ.

Iron was detected above the California Secondary Drinking Water Standard of 0.3 mg/l in well 1-A-1 in the third quarter (0.392 mg/l) and the fourth quarter (6.88 mg/l).

4.1.1.3.1 Zones of Contamination

It is concluded that the environment near Site 1 is being impacted by TFH-diesel and TFH-gas, toluene, TCE, and metals. Based on information collected during Stage 2-1, three zones are known to be affected.

Surface water in West Drainage Ditch has been contaminated with TFH-diesel and -gas, and TCE. Concentrations were generally highest in the culvert discharge sample and upstream surface water sample except in the third quarter when downstream samples were in ranges similar to those of upstream samples.

Contaminants, transported to the West Drainage Ditch in the discharge from the culverts, are apparently migrating into the stream sediments and may be infiltrating to groundwater. Sediment samples contained the same analytes detected in surface water samples plus chromium, cadmium, and lead,

which were not detected in the surface water. Chromium and lead were also detected in well 1-A-1 in the fourth quarter. Within the sediment samples, the TFH concentrations generally decreased in the downstream direction and in the lower sample at each sampling point. Although the lower samples generally contained TFHs, the concentration was less than the upper sample indicating a decreasing TFH concentration with depth. Based on the information collected in Stage 2-1, the lower limit of sediment contamination has not been determined. It should be noted, however, that an unknown thickness of sediments was dredged from the stream sometime prior to sampling. It is unknown if the contaminants detected represent new impacts occurring since the time of the dredging, or if the contaminants represent residual impacts that existed below the dredged materials.

Groundwater in the uppermost aquifer at the site has also been affected, although the areal extent is unknown. Samples from the deeper wells and the background (shallow) well did not indicate contamination.

4.1.1.3.2 Contaminant Migration

Contaminants are believed to be moving generally to the southwest from Site 1. Three mechanisms are responsible for the migration. First, surface water contaminated with TFH-diesel, -gas, and TCE flows southwest within the West Drainage Ditch. This flows into an ephemeral stream channel downstream of Site 1, transporting the contaminants downstream.

Secondly, the West Drainage Ditch, like all of the surface waters present at the base, is probably a "losing stream"; that is, the water in the ditch is above the groundwater table. This means that water within the ditch has the potential to infiltrate downward to the water table. Where this infiltration occurs, contaminants in the surface water can be carried through the sediments and soil towards the groundwater. The TFHs detected in the sediments are believed to have originated from the surface water, which may also be the source of TCE in the groundwater at shallow wells 1-A-1, 1-C-3, and 1-C-5 at Site 1. Whether the TCE in these wells is the result of TCE migration through soil at Site 1 or migration in groundwater from an upgradient source cannot be determined.

Thirdly, the groundwater near Site 1 flows to the southwest, towards off base areas of agricultural and private domestic supply wells. The results of the Stage 2-1 study indicate that TCE is reaching the uppermost permeable zone in the aquifer. There does not appear to be a significant downward vertical gradient within this uppermost permeable zone at

Site 1 as deep and shallow well pair 1-C-2 and 1-C-3 had no vertical gradient, while 1-C-4 and 1-C-5 had a 0.002 ft/ft downward gradient (Table 4.1.1-1). However, downward gradients may exist across zones of lower permeability deeper in the aquifer. It is not known if the contamination is migrating to the permeable zones from which nearby production wells derive water. The base water supply wells are screened in a number of zones extending down from about -27 feet NVGD to -245 feet NGVD. The upper part of these screened intervals lie at the same elevation as the deeper screened intervals at Site 1. Samples from monitoring wells 1-C-2 and 1-C-4, screened from about -25 to -45 feet NGVD, did not show any TCE. The two off-base domestic wells sampled during the third and fourth rounds also did not indicate the presence of TCE except for the unconfirmed 1 ug/l in the first column analysis of the fourth quarter sample from OB-C-1.

4.1.1.3.2.1 Potential to Move Off Site and Off Base

The potential is high for the contaminants detected at Site 1 to move both off site and off base. The unnamed stream into which the West Drainage Ditch flows crosses the base boundary less than 3,000 feet from Site 1 and flows into Hutchinson Creek about 3 miles from the base boundary. Groundwater flows to the southwest from Site 1 towards the groundwater depression west of Beale AFB. However, no contaminants have been detected in off base wells downgradient from Site 1.

4.1.1.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Groundwater flows southwest from Site 1 at approximately 82 feet per year based on results of the 72-hour pump test in well 19-C-4 and local gradient information. The gradient, and thus rate of flow, may increase nearer the agricultural wells southwest of the site.

Many factors affect contaminant transport in groundwater, and most of these factors are not well defined for this project. Some of these factors act to shorten and some to lengthen the travel time of a contaminant in groundwater. Estimates of migration rates do not include allowance for such factors as diffusion, dispersion, adsorption, or chemical changes of the contaminants in the subsurface.

The estimated peak velocity of the unnamed stream receiving flow from the West Drainage Ditch is 5 feet per second based on observations made during storm flow.

4.1.1.3.2.3 Time of Travel to Receptors

At the estimated velocity of 5 feet per second, under storm conditions stream water will cross the base boundary about 10 minutes after flowing through Site 1. In periods of dry weather, the stream flow rate may be slower.

At the estimated flow rate of 82 feet per year, groundwater presently under Site 1 will not cross the base boundary for many years. Because it is not known when TCE first entered the groundwater near Site 1, and because the subsurface hydrogeology remains poorly defined in this area, it is unknown when the contaminants will cross (or have crossed) the base boundary.

4.1.1.3.2.4 Applicability of Solute Transport Models

Solute transport models may not be applicable at Site 1 due to the nonhomogeneous soil deposits typical of Beale AFB.

4.1.1.3.2.5 Expected Spatial and Temporal Variations in Concentration

In the Phase II, Stage 1 investigation, TCE was detected in shallow monitoring well 1-A-1 in two sampling rounds at 100 and 58 ug/1. During Stage 2-1, TCE has been detected in all shallow downgradient wells at lower consistent levels. Based on these observations, a spatial pattern is difficult to discern. Though the concentration appears to be decreasing with time at well 1-A-1, an accurate estimate of continued concentration variations cannot be made.

4.1.1.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.2 DISCUSSION OF RESULTS FOR SITE 2: PHOTO WASTEWATER TREATMENT PLANT

The photo wastewater treatment plant (PWTP) has been used since 1966 to treat photo development wastewater. The plant is located in the southwest portion of the base, approximately 3,000 feet from the base boundary and less than 1,000 feet from Hutchinson Creek. The PWTP receives wastes from the photo laboratory (Building 2145, 2.5 miles to the northeast) through a dedicated pipeline. Average wastewater flow is 20,000 gallons per day. Treatment processes include equalization, chemical flocculation, settling, and filtration. Two unlined sludge ponds have been used for PWTP sludge since 1974. The ponds are used alternately to allow sludge drying. In addition, three abandoned injection wells were used for PWTP effluent disposal until injection was discontinued in April 1986. The three injection wells were abandoned by the pressure-grout method in November 1989. The injection zone (1,000 to 1,200 feet below ground surface) is not part of past or current IRP studies.

Concern at Site 2 results from the unlined sludge ponds and past pentachlorophenate (PCP)-treated PWTP effluent discharging onto the ground around the PWTP and near the abandoned injection well heads. From 1967 until 1984, whenever the treatment plant shut down for maintenance, 500 to 2,000 gallons of effluent which had Dowicide G containing PCP added to it were discharged onto the ground surface in the vicinity of the abandoned injection wells. This procedure was conducted monthly to flush out corrosion in the pipelines, but has not been conducted since February 15, 1984. Thus approximately 100,000 to 400,000 gallons of PCP-treated effluent may have been discharged to the ground surface from 1967 to 1984. In the Phase II, Stage 1 study, PCP was detected at 30 mg/kg in one boring near abandoned Injection Well No. 2 at a depth of 16.5 feet.

In the Stage 2-1 study, six sediment samples were collected from the sludge ponds and eight surface soil samples were collected near the PWTP equipment pad. Seven soil borings were drilled at Site 2; one vertical background boring; one vertical boring near two of the three abandoned injection wells; two vertical borings near abandoned Injection Well No. 2; and one angled boring beneath each of two sludge ponds. One new monitoring well was constructed. This well and five existing wells were sampled quarterly. No surface water samples were collected at Site 2.

4.1.2.1 Presentation of Results

The following section presents the results of the field investigation at Site 2. The discussion will focus on the geology and hydrogeology at the site, and present the results of chemical analyses performed on samples of groundwater and soils.

4.1.2.1.1 Site Geology

Evaluation of the geology at Site 2 was based on boreholes and wells drilled during the Stage 2-1 investigation, on wells installed during the Phase II, Stage 1 investigation (AeroVironment, 1987), and wells monitoring the PWTP sludge ponds (Radian, 1985). During the Phase II, Stage 1 investigation, a monitoring well (2-A-1) was installed adjacent to abandoned Injection Well No. 2 and screened across the water table. During the monitoring well installation program (by Radian Corporation) at the sludge ponds, four wells (2-R-1 through 4) were constructed and screened across the water table. For the current investigation, seven borings were completed at Site 2. Four of these were vertical borings drilled to a total depth of 51.5 feet each. One was a vertical boring drilled to a total depth of 28 feet. Two were angle borings drilled at 30° from vertical beneath the sludge ponds to a vertical depth of 43 feet (drilled depth 50 feet). In addition, one monitoring well was installed (2-C-1) at abandoned Injection Well No. 2 and screened in a deeper zone than adjacent well 2-A-1. The location of these wells and boreholes is shown on Figure 4.1.2-1. Soil boring logs for Stage 2-1 drilling are provided in Appendix D.

A cross-section constructed from soil boring logs of Site 2 and Site 13 wells is located on Figure 4.1.2-1 and shown in Figure 4.1.2-2. A schematic of soil types encountered in shallow soil borings is presented in Figure 4.1.2-3. A key to lithologic symbols is given in Appendix D. These figures show that soil in the vicinity of Site 2 is predominantly fine-grained, with isolated lenses of sand and gravel. It is impossible to make correlations among the boreholes, with the exception of paired wells 2-A-1 and 2-C-1. These wells are close to each other and only well 2-C-1 is shown on the cross section. Both of these wells penetrated clays and sandy clays throughout the vadose zone.

First water was contacted in a sand unit at a depth of about 92 feet BGS (-9 feet NGVD), later rising in the hole to about sea level. Beneath the sand, both boreholes encountered a clay unit which extended for 10 feet at about -20 feet NGVD. From this depth to the total 170 feet BGS depth of 2-C-1 (-87 feet NGVD), clays and water-bearing sands

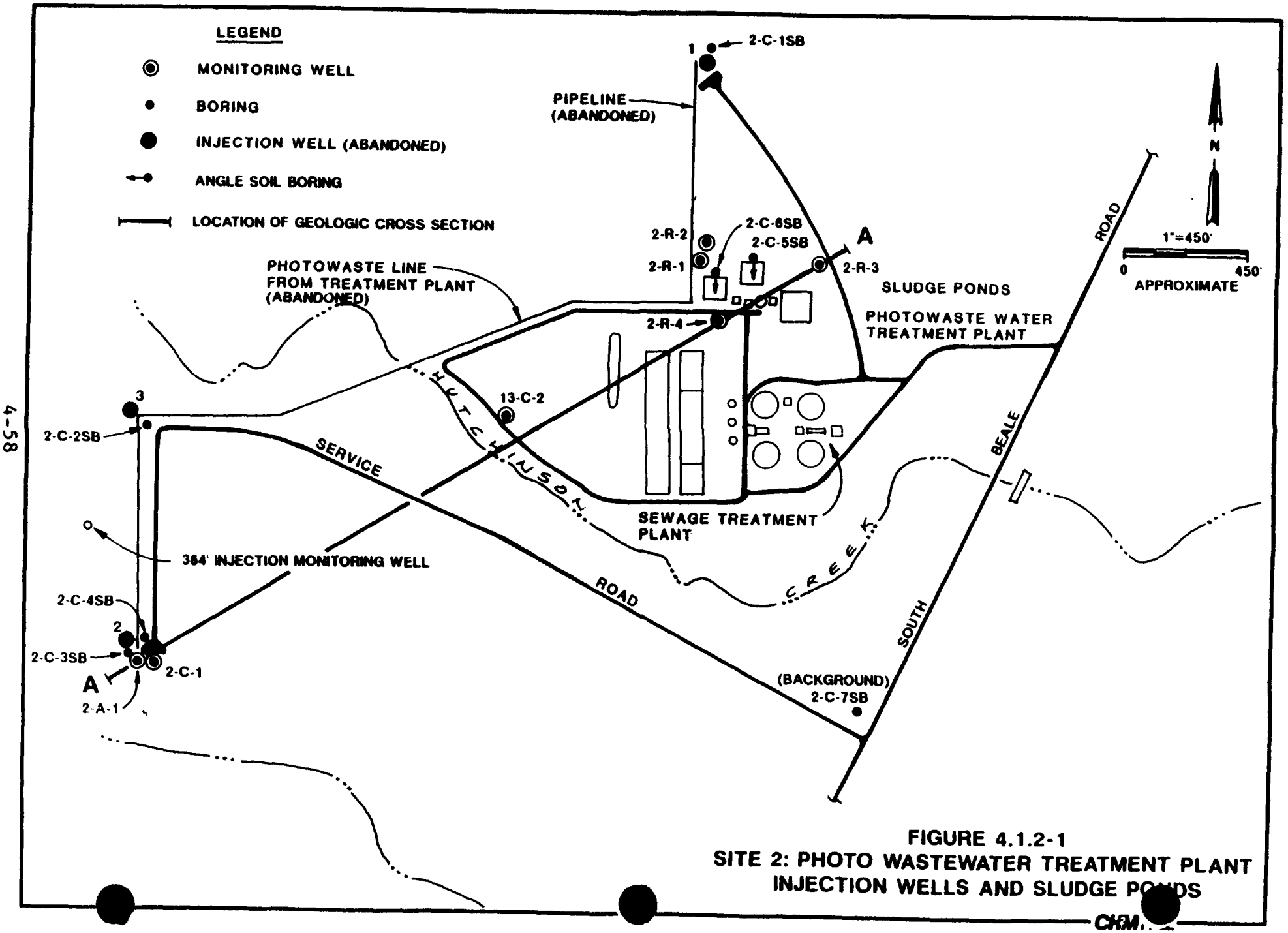
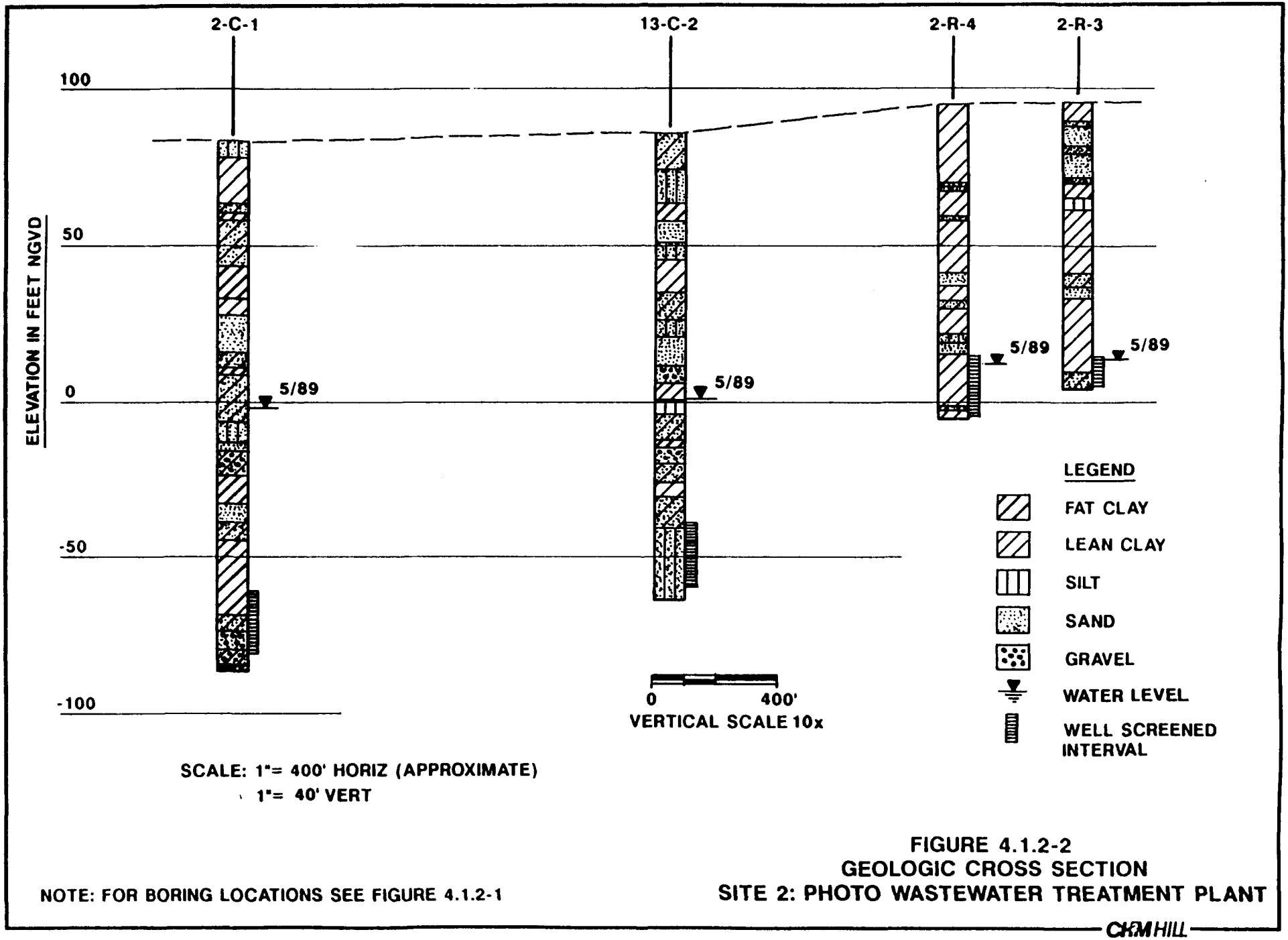


FIGURE 4.1.2-1
SITE 2: PHOTO WASTEWATER TREATMENT PLANT
INJECTION WELLS AND SLUDGE PONDS



NOTE: FOR BORING LOCATIONS SEE FIGURE 4.1.2-1

FIGURE 4.1.2-2
GEOLOGIC CROSS SECTION
SITE 2: PHOTO WASTEWATER TREATMENT PLANT

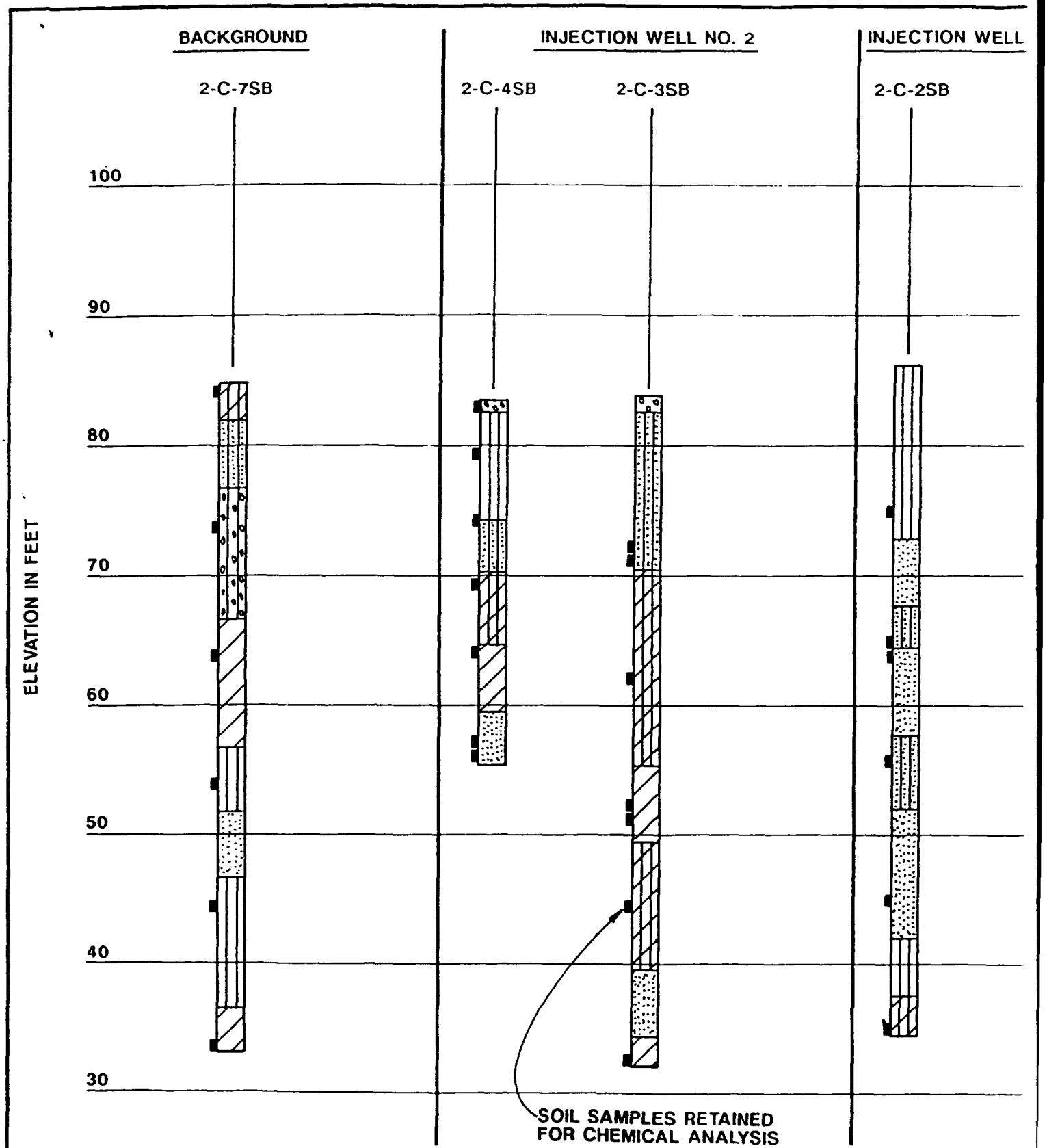
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alternated in the hole. Wells 2-R-1, -2, -3, and -4, installed by Radian Corporation for a study at the photo waste sludge ponds, encountered mainly clay, with occasional thin layers of sand or silt (Radian, 1985).

Soils at Site 2 constitute an alluvial sequence predominated by fine grained overbank deposits with occasional discontinuous sand and gravel channel deposits forming permeable zones. This sequence is typical of valley sediments deposited at the base of the Sierra Nevada foothills. Although coarser sand and gravel beds were encountered in this and previous studies, these stream channel deposits are not as common as the much finer-grained overbank and flood plain deposits that predominate.

Because stream channels constantly shift their positions through geologic time, the resulting alluvial deposits are characterized by extreme heterogeneity of particle size and distribution such that hydraulic properties are also highly variable. The meandering stream depositional environment produces relatively thin, laterally discontinuous channel deposits. Channel deposits of coarse-grained materials, which are narrow in cross section, may be continuous for long distances in the direction of stream flow. However, these pathways may not be correlatable on geologic cross-sections constructed from logs of soil borings.

Near-surface deposits at Site 2 have been mapped as Victor Formation, except for Quaternary River Deposits along Hutchinson Creek (Page, 1980). The Quaternary River Deposits are the youngest in the area, and represent the most recent alluvial deposition as Hutchinson Creek has meandered across the valley. Victor Formation deposits are an alluvial sequence deposited in Pleistocene time. These deposits overlie the older alluvial Laguna Formation deposits, which in turn overlie sediments of volcanic origin. The contact between the Victor and Laguna Formations is not readily identified in the field. No borehole at Site 2 encountered volcanic materials.



SCALE: HORIZ - NOT TO SCALE
1"= 10' VERT

NOTE: FOR BORING LOCATIONS SEE FIGURE 4.1.2-1

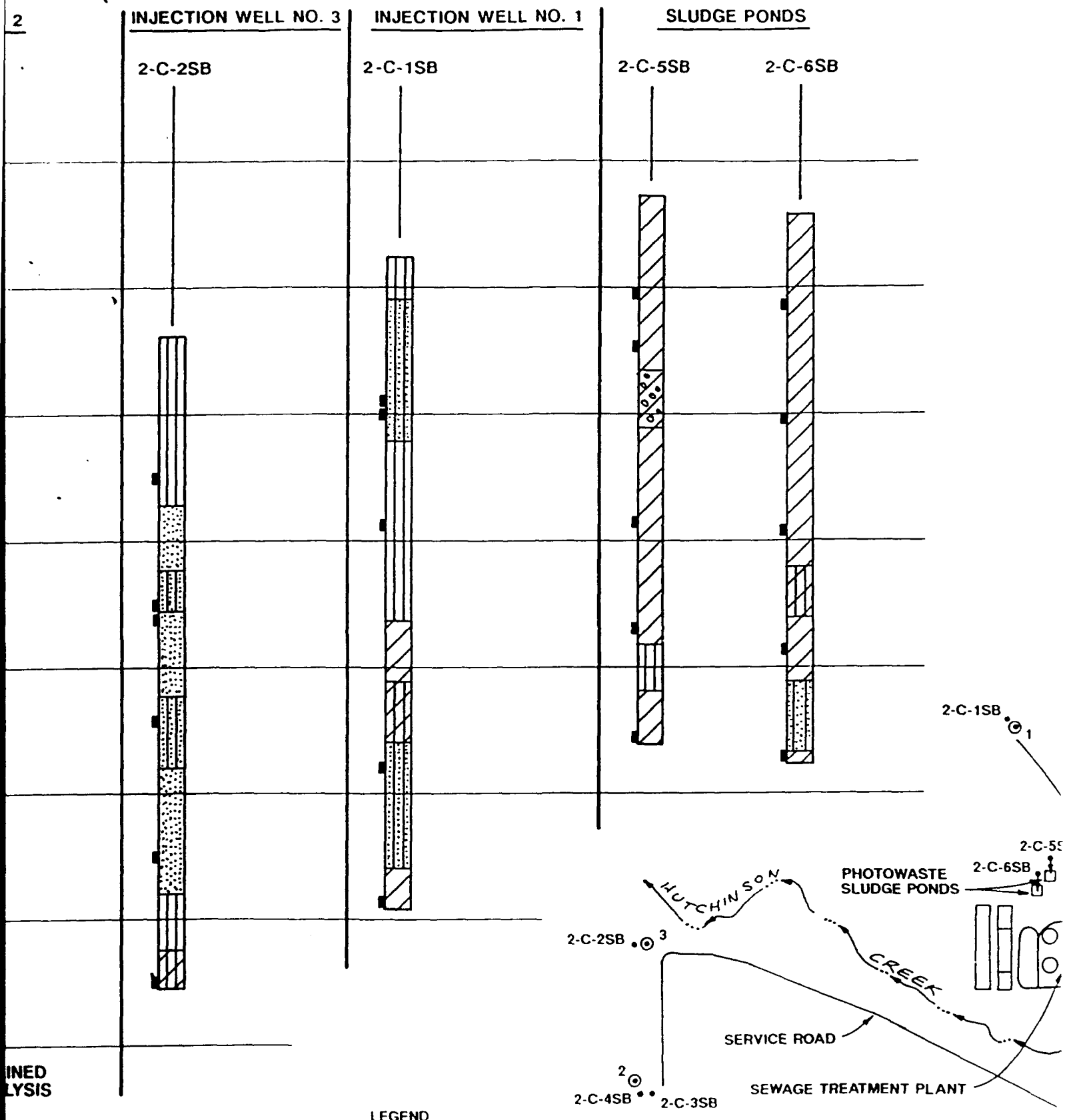


FIGURE 4.1.2
SUBSURFACE SOIL
SITE 2: PHOTO WASTEWATER

EE FIGURE 4.1.2-1

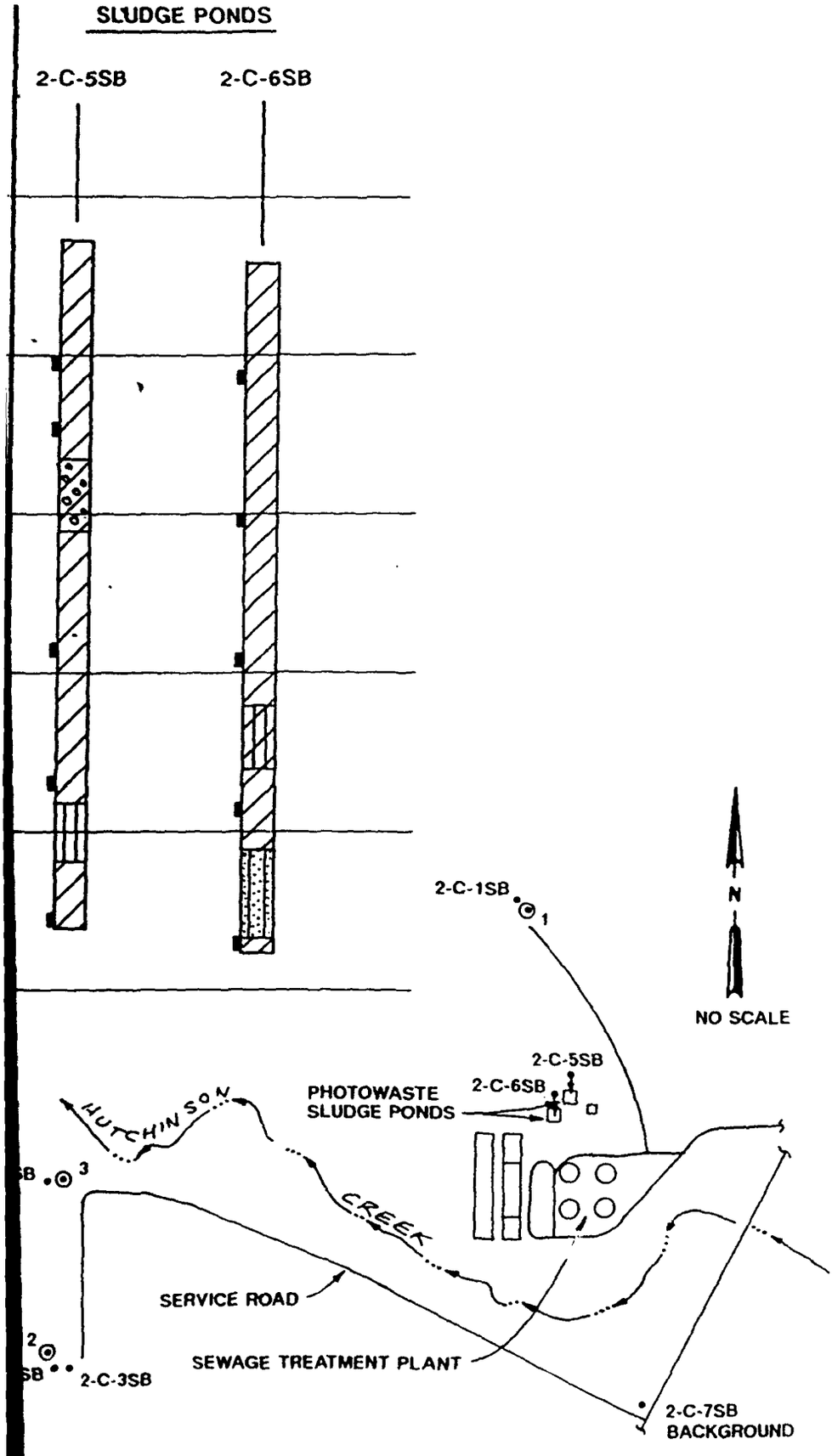


FIGURE 4.1.2-3
SUBSURFACE SOIL PROFILE
SITE 2: PHOTO WASTEWATER TREATMENT PLANT

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4.1.2.1.2 Site Hydrogeology

The first saturated permeable zone in well 2-C-1 (constructed near abandoned Injection Well No. 2) that produced water during drilling occurred at a depth of about 92 feet (-9 feet NGVD). This zone comprises a silty sand and well-graded sand which is overlain by a layer of fat clay. Water stabilized in the hole at about sea level, and may be partially confined. As drilling continued, water was produced at depths of 116 to 112 feet (-33 to -29 feet NGVD); 139 to 142 feet (-56 to -59 feet NGVD); and 157 to 170 feet (-74 to -87 feet NGVD--the bottom of the hole). The well was screened at a depth of 145 to 165 feet (-62 to -82 feet NGVD), and water rose in the well to an elevation of about -2.5 feet NGVD.

Wells previously constructed near the sludge ponds (wells 2-R-1, -2, -3, and, -4) were screened across the water table in fine-grained clays with thin interbeds of sandy clay. Groundwater may have been partially confined, with water levels rising from 2 to 7 feet in the hole after drilling contact with permeable sediments (Radian, 1985).

Groundwater levels in the deep monitoring well between abandoned Injection Wells No. 2 and 3 (Figure 4.1.2-1) have been monitored by Beale AFB since 1984. Figure 4.1.2-4 plots groundwater fluctuations in this well, which is 364 feet deep (-279 feet NGVD), and screened at intervals of 132 to 172 feet (-47 to -87 feet NGVD), 192 to 232 feet (-107 to -147 feet NGVD), and 310 to 352 feet (-225 to -267 feet NGVD). As Figure 4.1.2-4 shows, water levels in this well vary as much as 30 feet a year, presumably in response to the seasonal recharge and the demands of agricultural wells. A gradual rise in average annual water levels between 1984 and 1989 may also be observed in Figure 4.1.2-4.

Groundwater levels in other Site 2 monitoring wells are summarized in Table 4.1.2-1 and Figures 4.1.2-5 and 4.1.2-6. This table shows that groundwater in this vicinity has been rising at least since 1986. In well 2-A-1 between April 1986 and November 1989, for example, the groundwater level rose about 20 feet as shown on the hydrograph. Groundwater levels in the Radian installed wells near the sludge ponds rose from 5 to 7 feet during this same time period. The rise in these wells and the deep monitoring well is part of a regional water level rise noticed in other wells on the west side of Beale AFB. Seasonal fluctuations in Site 2 wells during 1989 were only observed in wells 2-A-1 and 2-C-1. Water levels in these wells declined slightly during the summer, possibly in response to nearby agricultural pumping.

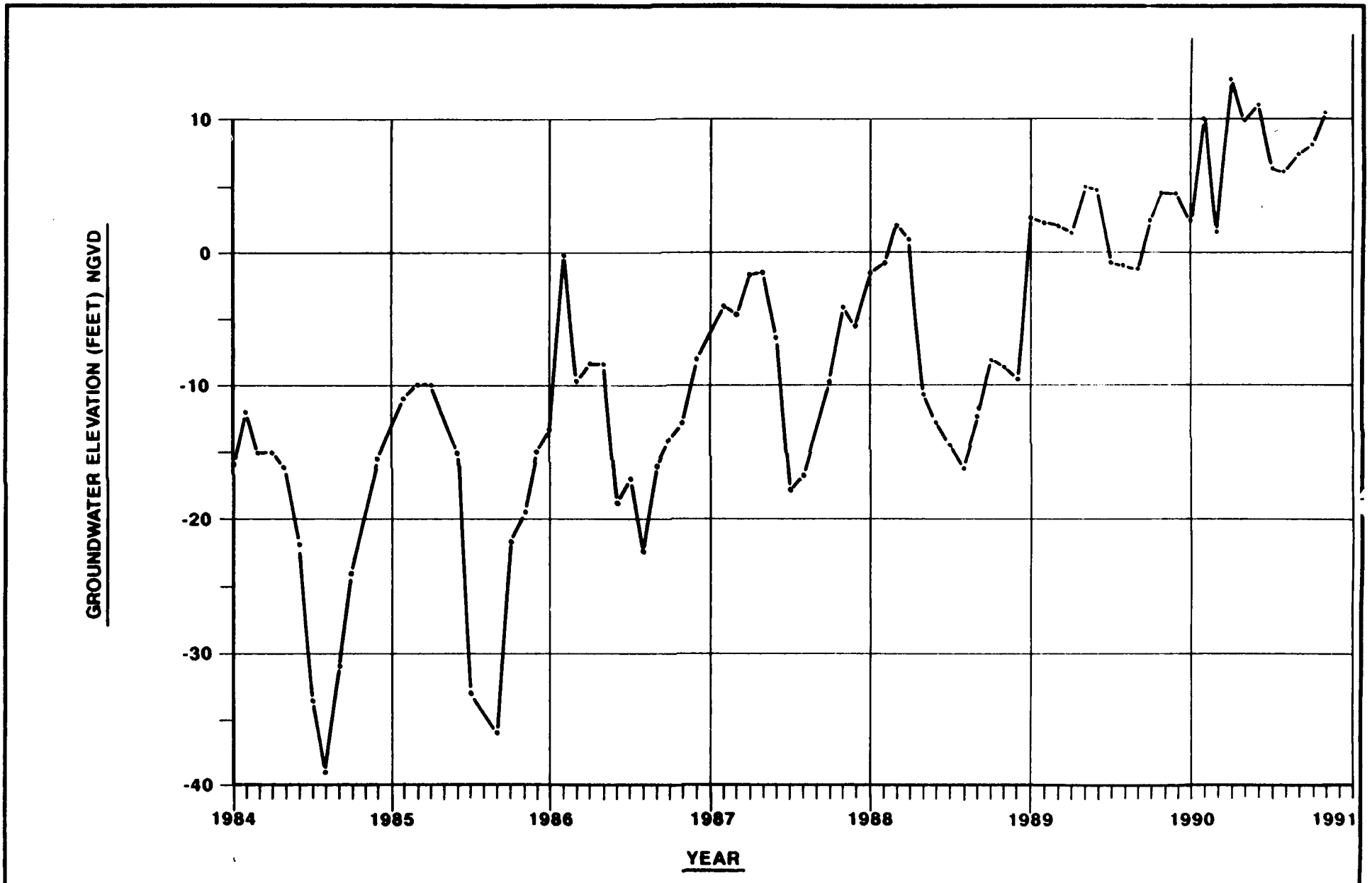
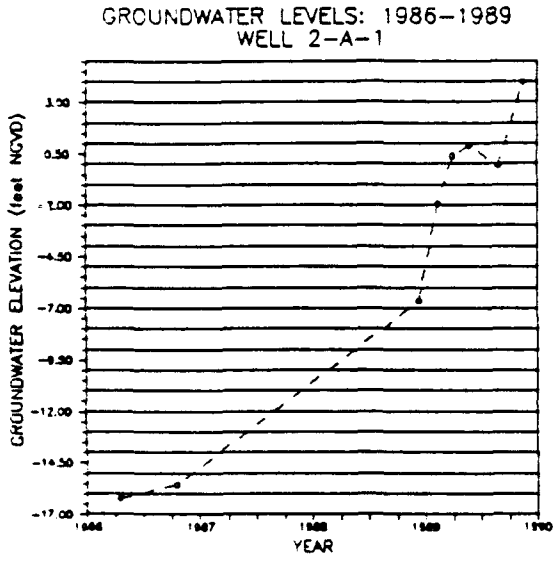
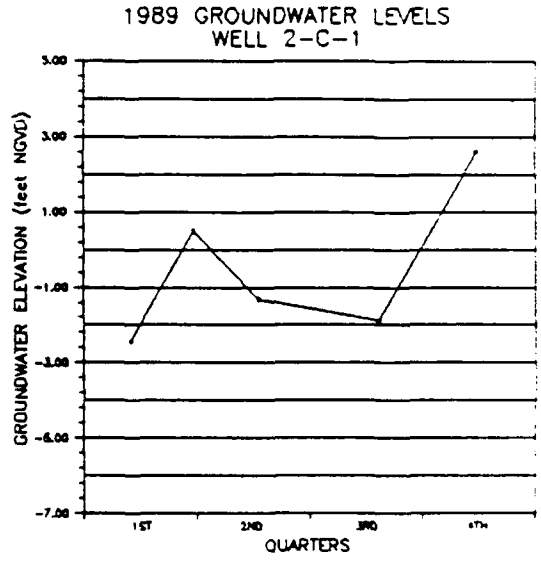


FIGURE 4.1.2-4
GROUNDWATER LEVEL HYDROGRAPH
INJECTION WELLS DEEP MONITORING WELL

Table 4.1.2-1
GROUNDWATER ELEVATIONS: SITES 2 AND 13
(FEET NGVD)

Well	Screened Interval	April 1986	October 1986	December 1988	February 1989	March 1989	May 1989	August 1989	November 1989
2-A-1	-9 to -29	-16.22	-15.57	-6.67	-1.93	0.40	0.91	-0.08	3.96
2-C-1	-62 to -82	--	--	--	-2.43	-0.48	-1.32	-1.88	2.60
2-R-1	13 to -7	5.71	--	7.68	8.83	9.65	11.36	12.31	13.25
2-R-2	17 to -3	7.05	9.05	8.70	9.03	9.82	11.52	12.48	13.38
2-R-3	15 to 5	10.44	12.27	10.71	11.21	11.85	13.53	14.57	15.36
2-R-4	14 to -6	7.83	9.62	8.86	9.62	10.50	12.30	13.23	14.11
13-A-1	8 to -12	7.15	8.20	7.10	7.49	8.01	10.27	10.42	10.71
13-A-2	14 to -6	1.15	3.16	4.77	6.21	7.38	9.06	9.43	10.60
13-C-1	-7 to -27	--	--	--	2.90	3.78	5.28	6.16	7.87
13-C-2	-39 to -59	--	--	--	-1.57	0.26	1.00	0.49	3.59
13-C-3	1 to -19	--	--	--	5.61	6.81	8.35	8.77	10.03
13-C-4	8 to -12	--	--	--	6.14	7.36	8.91	9.29	10.51
13-C-5	0 to -20	--	--	--	7.77	8.93	10.64	11.25	12.35
13-C-6	4 to -16	--	--	--	--	--	--	--	0.76

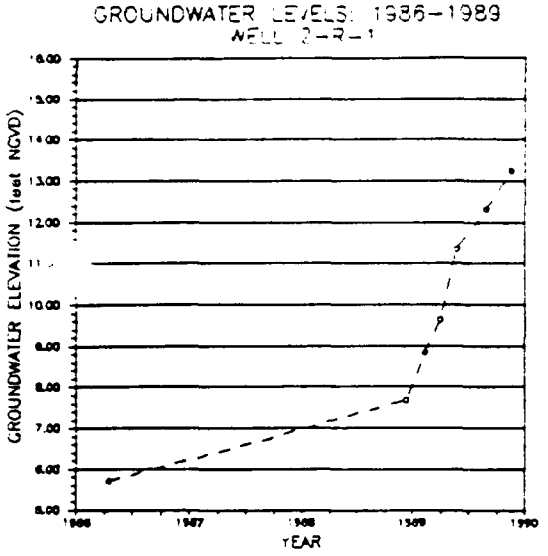


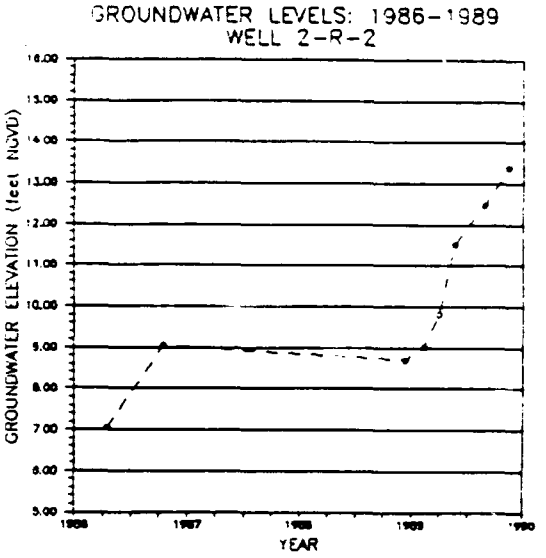


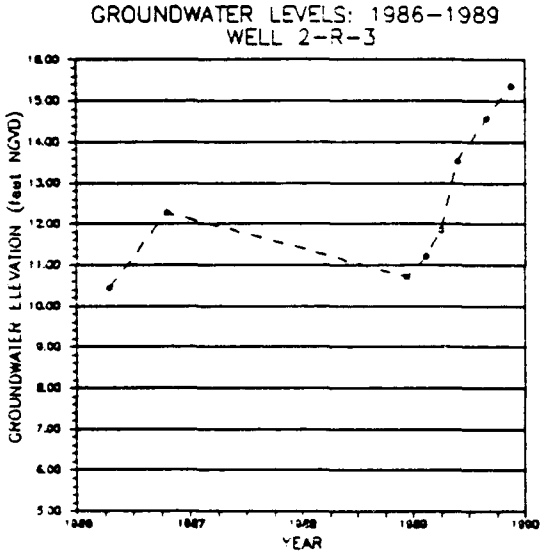
NOTE: VARYING TIME SCALES

FIGURE 4.1.2-5
MONITORING WELL HYDROGRAPH
SITE 2: PHOTO WASTEWATER TREATMENT PLANT

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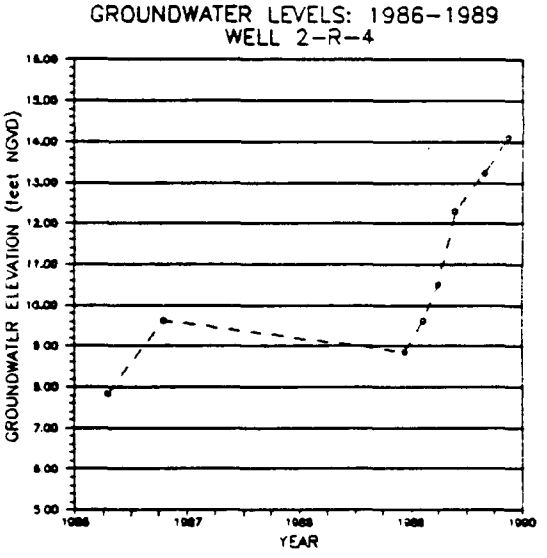


FIGURE 4.1.2-6
MONITORING WELL HYDROGRAPH
SITE 2: PHOTO WASTEWATER TREATMENT PLANT

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Groundwater levels from Site 2 (and Site 13) monitoring wells in May 1989 are plotted on Figure 4.1.2-7. This figure and Table 4.1.2-1 show that there is a vertical component of flow downward in paired wells 2-A-1 and 2-C-1, corresponding to a downward gradient in paired wells 13-C-2 and 13-C-3. Groundwater contours may not be drawn with confidence on the data in Figure 4.1.2-5, because the wells are screened at different intervals. Hence, the levels may be affected by vertical gradients. In general, wells that are screened at a deeper interval show a lower groundwater elevation at Sites 2 and 13. This may be due to these wells' location in a zone of recharge and to head losses across zones of lower permeability.

Plates 3 and 4 plot groundwater level contours based on elevations measured in March and November 1989 at Beale AFB. These plates show that in the vicinity of Site 2, groundwater is flowing to the northwest, under the influence of the groundwater depression west of the base. The horizontal gradient near Site 2 is about 20 feet per 3,000 feet, or 0.007.

Estimates of aquifer parameters for the deeper aquifer zone screened by well 2-C-1 were derived according to the Cooper-Jacob Method (1946) from the water level drawdown and recovery data generated during a 4-1/2-hour pump test of well 2-C-1 in which this well was pumped at a constant rate of 14.8 gpm. Plots of the data and a discussion of testing methodology are provided in Appendix E. Both the drawdown and recovery portion of the test yielded values of transmissivity of 7,800 gallons per day per foot, or 1,000 square feet per day and a hydraulic conductivity of 52 feet per day (0.018 cm/sec). No water level change was observed in well 2-A-1 (the shallow well paired with 2-C-1) during this test.

No aquifer tests were performed on the existing monitoring wells at the photo waste sludge ponds during the Stage 2-1 study. Pump tests performed on Site 13 wells provide an indication of aquifer parameters in the vicinity of Site 2. A discussion of these tests is included in Section 4.1.13.1.2.

4.1.2.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results which are indicators of site-specific contamination. Not all analytes are

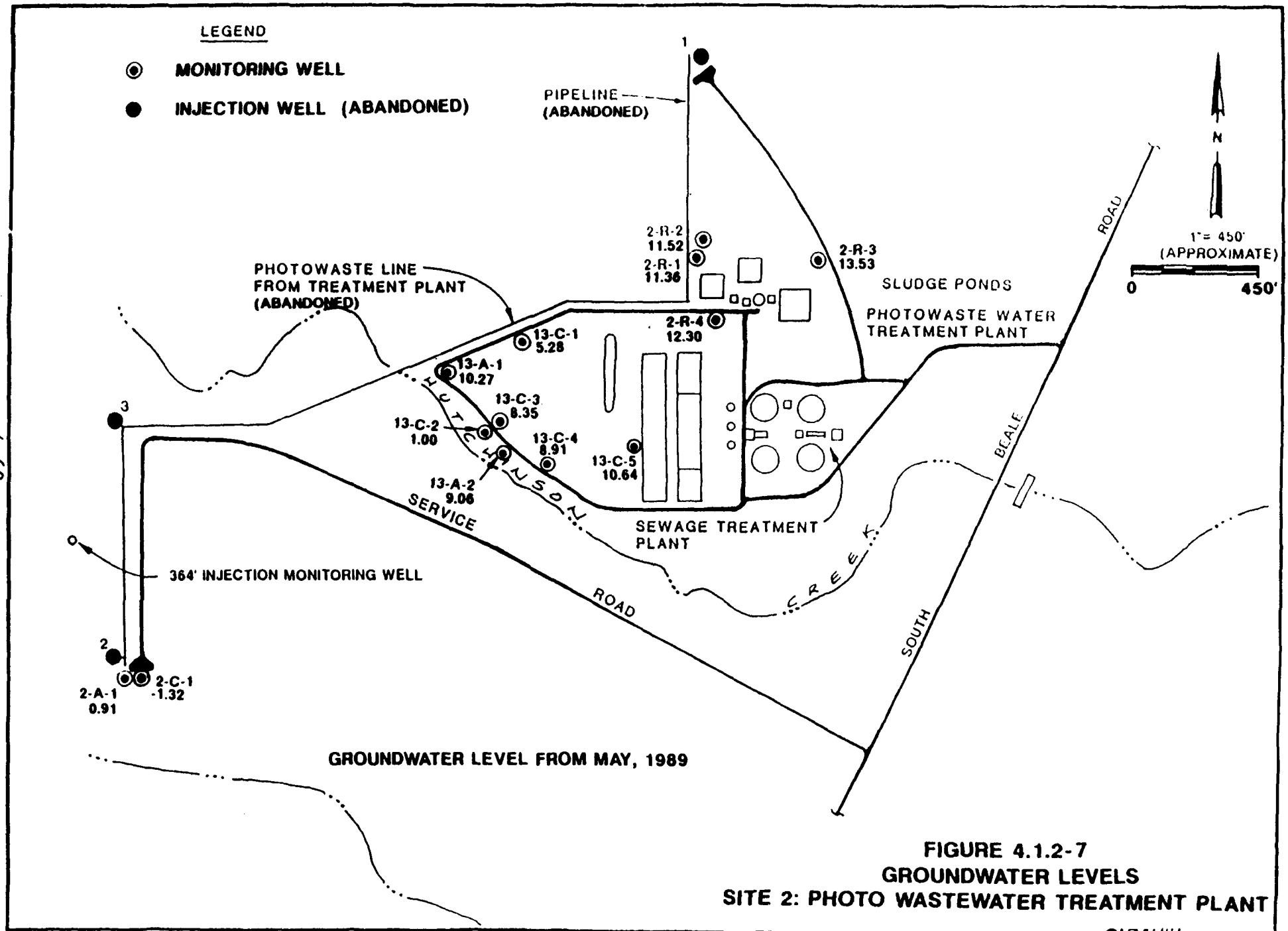


FIGURE 4.1.2-7
GROUNDWATER LEVELS
SITE 2: PHOTO WASTEWATER TREATMENT PLANT

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individually discussed or illustrated, but all detected analytes are presented in the Analytical Results table in Section 4.1.2.1.4 and in Appendix A.

Sludge Ponds and Surface Soils

Three photo waste sludge pond sediment samples were taken from each of the two unlined sludge ponds at Site 2 (Figure 4.1.2-8). Eight surface soil samples were taken from suspected spill areas near the photo wastewater treatment plant.

These sludge pond sediment and surface soil samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7470/7471), cyanide (9010), soil moisture (ASTM D2216), and TFH-gas and diesel (California method). One sludge sample was also analyzed for dioxins and furans.

The only volatile or semivolatile organic chemical detected in the sludge pond sediment or surface soil samples was toluene which was detected in 9 of 14 samples up to 1.1 mg/kg. However, only five of the nine detections were above the LOQ, four were "J" values below the LOQ. Silver was detected in the six sludge pond sediment samples at concentrations from 28.7 to 53.5 mg/kg (Figure 4.1.2-8). Lead was detected in surface soil sample 2-C-7SS at 151 mg/kg. Mercury was detected in sludge pond sediment sample 2-C-1SS at 0.14 mg/kg. Cyanide was detected in all six sludge pond sediment samples from 18.6 to 638 mg/kg and in all eight surface soil samples from 2.6 to 48.7 mg/kg (Figure 4.1.2-8). Chromium was detected in all six sludge pond sediment samples from 43.7 to 326 mg/kg and in all eight surface soil samples from 24.8 to 48.1 mg/kg. The average value of chromium in background soil samples was 31 mg/kg; 46 mg/kg is two standard deviations above the average background level.

Sludge pond sediment sample 2-C-6SS was analyzed for dioxins and furans. Tetra dioxins were 0.0017 mg/kg (1.7 ug/kg), penta dioxins 0.019 mg/kg (19 ug/kg), hexa dioxins 0.076 mg/kg (76 ug/kg), hepta dioxins 0.58 mg/kg (580 ug/kg), and octa dioxins were 1.1 mg/kg (1,100 ug/kg). Tetra furans were 0.0013 mg/kg (1.3 ug/kg), penta furans 0.012 mg/kg (12 ug/kg), hexa furans 0.038 mg/kg (38 ug/kg), hepta furans 0.19 mg/kg (190 ug/kg), and octa furans were 0.38 mg/kg (380 ug/kg).

Soil Borings

A total of 39 soil boring samples were collected at Site 2 (Figures 4.1.2-1 and -9): five from each of the two angle

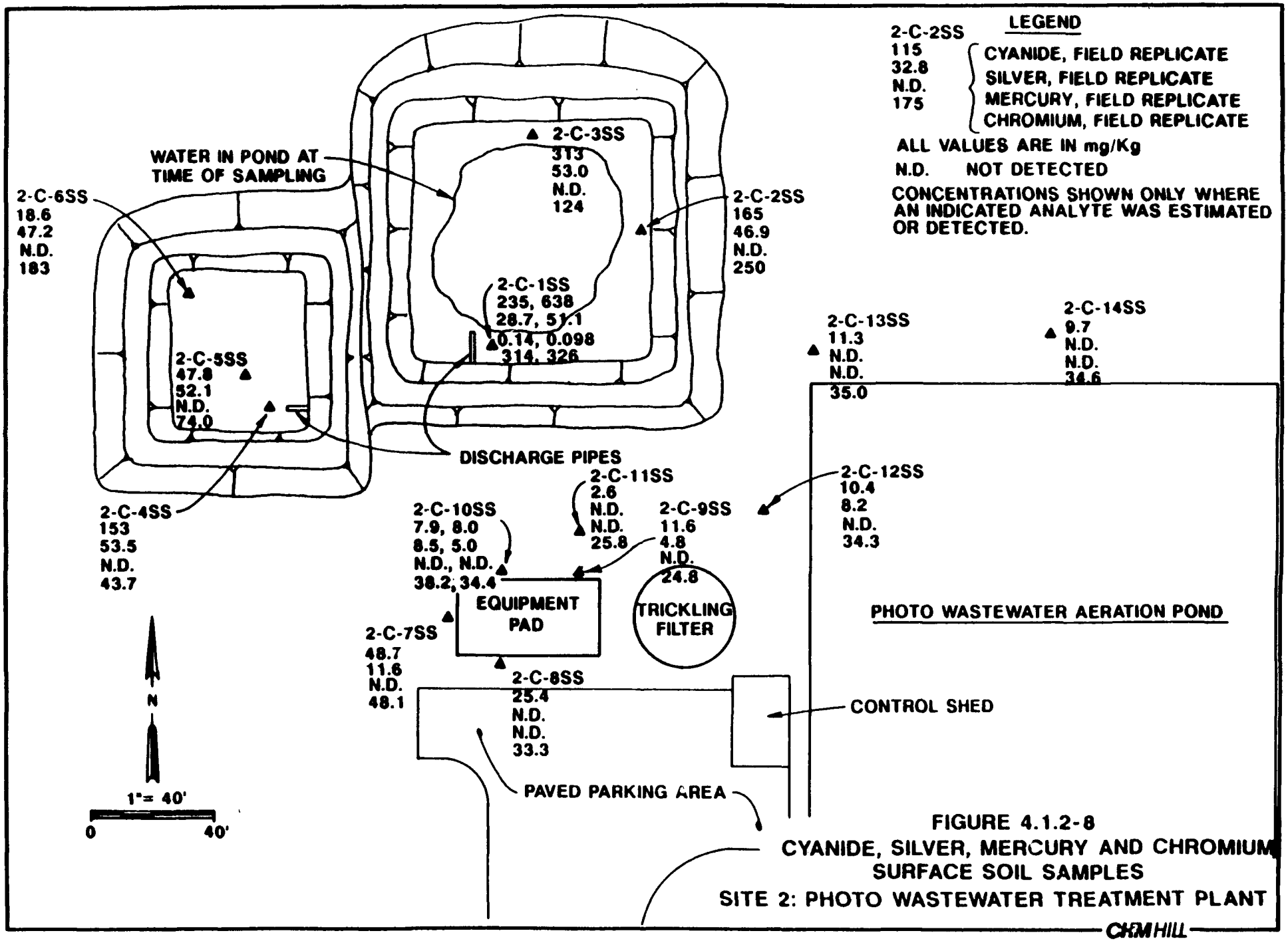


FIGURE 4.1.2-8
CYANIDE, SILVER, MERCURY AND CHROMIUM
SURFACE SOIL SAMPLES
SITE 2: PHOTO WASTEWATER TREATMENT PLANT

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borings (2-C-5SB and -6SS) under the sludge ponds, five samples from the vertical boring (2-C-1SB) at abandoned Injection Well No. 1 and five from the boring (2-C-2SB) at abandoned Injection Well No. 3, five samples from the 25-foot (2-C-4SB) and eight from the 50-foot boring (2-C-3SB) at abandoned Injection Well No. 2, and six from a vertical background boring (2-C-7SB).

Soil boring samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7270/7471), cyanide (9010), soil moisture (ASTM D2216), and TFH-diesel and -gas (California method).

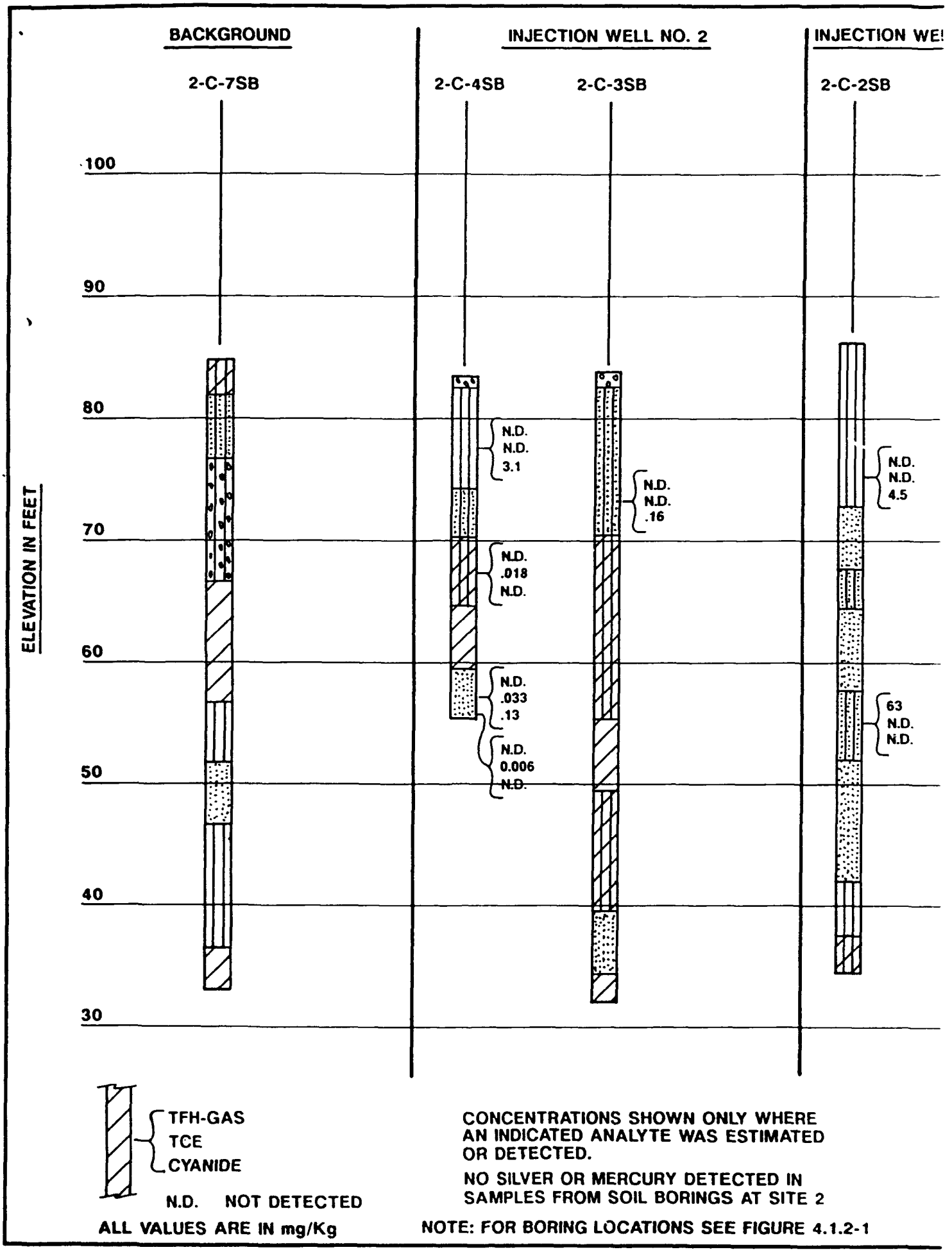
The only volatile organic compounds detected in soil borings were chloroform at 0.013 mg/kg in the 30-foot sample (actual vertical depth equals 26 feet) and benzene at 0.012 mg/kg in the 38-foot sample (actual vertical depth equals 32 feet) in boring 2-C-5SB. Semivolatile organic chemicals were detected in several soil boring samples at Site 2 at levels below the LOQ. Bis(2-ethylhexyl) phthalate was detected in six samples up to 0.13 mg/kg. Di-n-butyl phthalate was detected in four samples up to 0.48 mg/kg; 2-butanone was detected in two samples at 0.041 mg/kg. N-nitrosodiphenylamine was estimated below the LOQ in five samples.

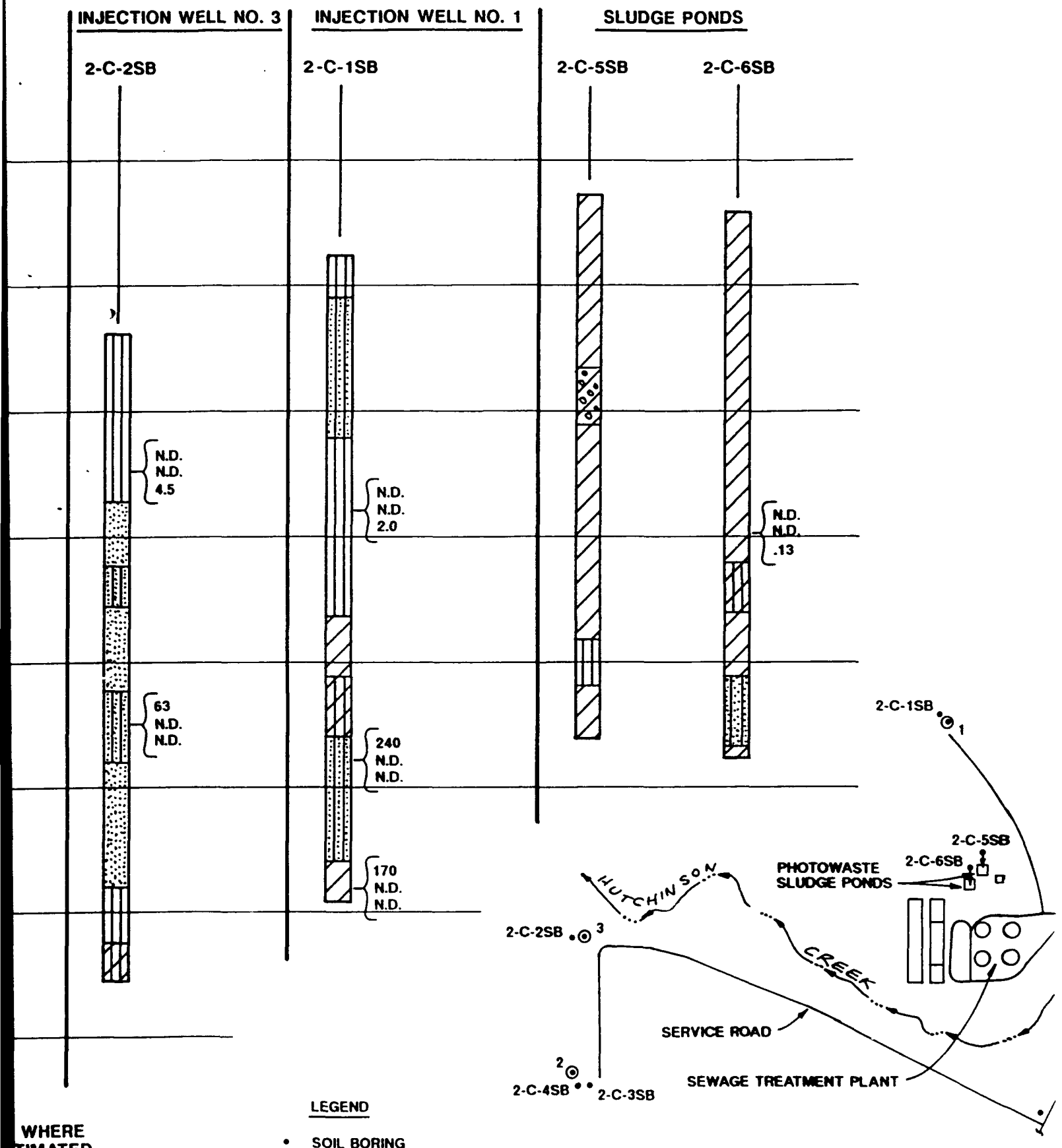
ICP metals were detected in Site 2 soil boring samples at concentrations generally similar to background levels. Silver and mercury were not detected in samples from soil borings at Site 2. Lead was detected in the 30-foot sample in boring 2-C-2SB at 29.4 mg/kg.

TFH-gas was detected in boring 2-C-1SB at 240 mg/kg at 40 feet and 170 mg/kg at 50 feet (Figure 4.1.2-9). TFH-gas was also detected at the 63 mg/kg detection limit at 30 feet in boring 2-C-2SB. Cyanide was detected in six samples up to 4.5 mg/kg (Figure 4.1.2-9).

Groundwater

During the IRP Phase II, Stage 1 investigation (AeroVironment, 1987) groundwater samples were taken in the April and October, 1986 sampling rounds at the PWTP in wells 2-R-1 to 2-R-4 and near abandoned Injection Well No. 2 in monitoring well 2-A-1. Benzene was detected in well 2-R-2 at 0.9 ug/l in both rounds and at 0.3 ug/l in well 2-R-1, which was only sampled in the second round. Toluene was detected at wells 2-R-2, 2-R-3 and 2-R-4 from 0.3 to 0.7 ug/l in the first round but not in the second. The following compounds were detected only in the first round at well 2-R-2: ethylbenzene (0.8 ug/l), chlorobenzene (0.4 ug/l), xylenes (0.4 ug/l), and dichlorobenzenes (1.8 ug/l). Barium ranged


BACKGROUND
INJECTION WELL NO. 2
INJECTION WE
2-C-7SB
2-C-4SB
2-C-3SB
2-C-2SB
ELEVATION IN FEET
100
90
80
70
60
50
40
30
N.D.
N.D.
3.1
N.D.
.018
N.D.
N.D.
.033
.13
N.D.
0.006
N.D.
N.D.
N.D.
.16
N.D.
N.D.
4.5
63
N.D.
N.D.
TFH-GAS
TCE
CYANIDE
N.D. NOT DETECTED
ALL VALUES ARE IN mg/Kg
CONCENTRATIONS SHOWN ONLY WHERE AN INDICATED ANALYTE WAS ESTIMATED OR DETECTED.
NO SILVER OR MERCURY DETECTED IN SAMPLES FROM SOIL BORINGS AT SITE 2
NOTE: FOR BORING LOCATIONS SEE FIGURE 4.1.2-1



WHERE
TIMATED

TED IN
T SITE 2

IGURE 4.1.2-1

FIGURE 4.1.2- 9
TFH-GAS, TCE, AND CYANIDE SC
SITE 2: PHOTO WASTEWATER TREA

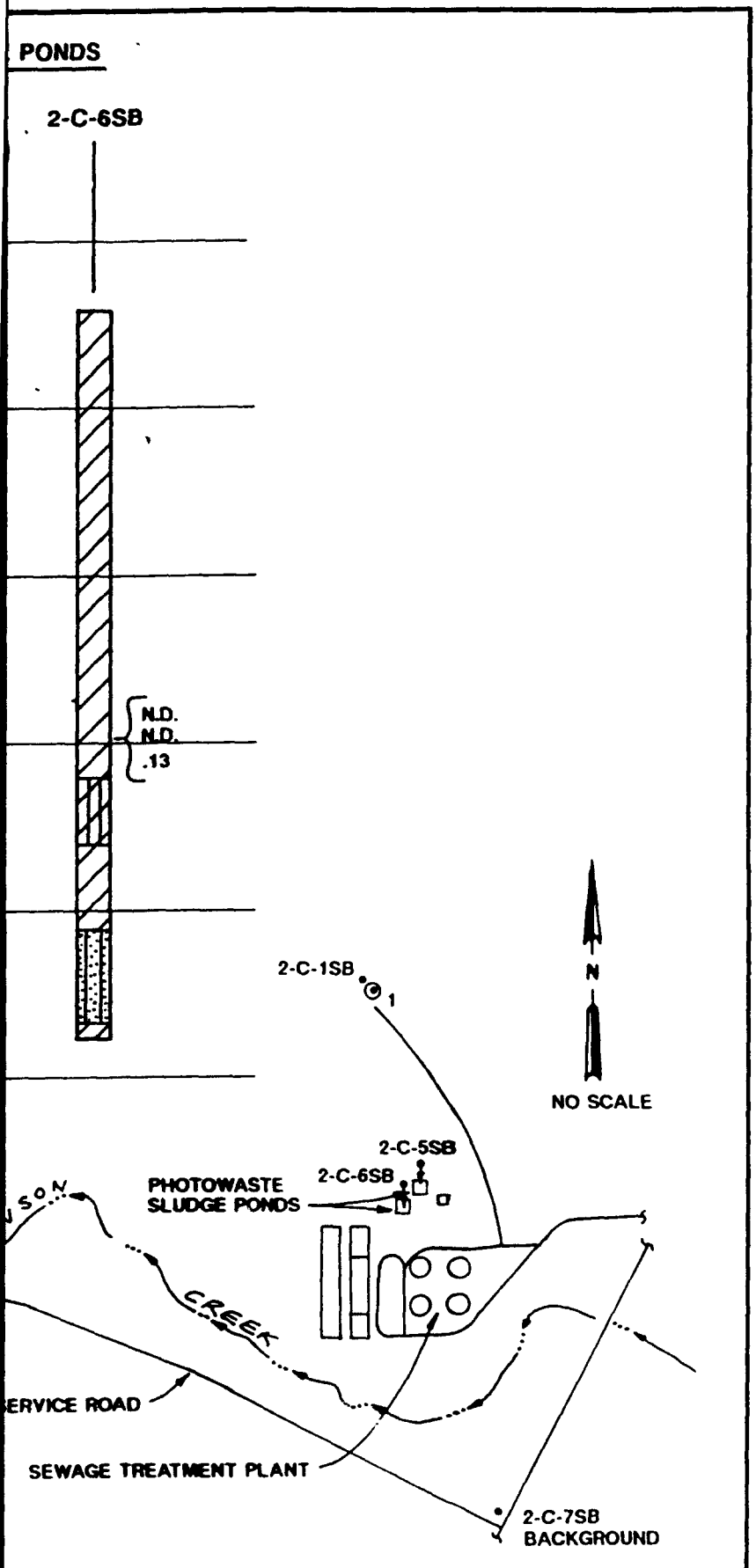


FIGURE 4.1.2- 9
TFH-GAS, TCE, AND CYANIDE SOIL SAMPLES
SITE 2: PHOTO WASTEWATER TREATMENT PLANT

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from less than 0.050 mg/l to 0.160 mg/l in the Radian wells. Silver was detected in well 2-R-1 at 0.080 mg/l in the second round. Silver was only detected in the first round in well 2-R-4 at 0.030 mg/l.

During each of the quarterly rounds of Stage 2-1 sampling at Site 2, six groundwater samples were collected: one from each of the four monitoring wells installed by Radian Corp. at the PWTP (2-R-1 to 2-R-4), one from the shallow monitoring well at abandoned Injection Well No. 2 (2-A-1) and one from the new deep monitoring well (2-C-1) at abandoned Injection Well No. 2. The three injection wells were abandoned in November 1989. Analyses performed for water samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), arsenic (7060), lead (7421), mercury (7470/7471), selenium (7740),cyanide (9010) and water quality parameters.

The only volatile organic compounds detected in the first quarterly sampling round of Stage 2-1 (Figure 4.1.2-10) were TCE in well 2-C-1 at 2 ug/l (3 ug/l in the second column confirmation) and toluene at 3 ug/l (3 ug/l in the second column confirmation). Phenol was detected below the 10 ug/l LOQ in 2-R-1. Bis(2-ethylhexyl) phthalate was detected in 2-A-1, 2-R-1, and 2-C-1 below the LOQ of 10 ug/l. Silver was not detected in any samples, with a 0.030 mg/l LOQ. Barium was not detected at Site 2 above a 0.100 mg/l LOQ. Cyanide was detected in well 2-R-4 at 0.0300 mg/l and in well 2-A-1 at 0.0200 mg/l (Figure 4.1.2-10). Arsenic, lead, mercury, selenium, and TFH-gas and -diesel were not detected in groundwater at Site 2.

At the PWTP in the first round, TDS in groundwater ranged from 231 mg/l at well 2-R-4 to 435 mg/l in 2-R-3. Sulfate was highly variable at the PWTP, being detected at 48.8 mg/l in 2-R-1 and 130 mg/l in background well 2-R-3, one of the highest levels measured at Beale AFB. However, sulfate was only 19.7 mg/l in well 2-R-4. Sulfate concentrations at these wells are consistent with those measured during sampling by Beale AFB personnel from 1985 to 1988. Nitrite plus nitrate (expressed as nitrate) ranged from 18.6 to 25.3 mg/l. Groundwater at the PWTP ranges from a magnesium-calcium sulfate to a magnesium-calcium bicarbonate type.

Groundwater in the monitoring wells at abandoned Injection Well No. 2 had 216 mg/l TDS in shallow well 2-A-1 and 192 mg/l in deep well 2-C-1. Nitrate was 16.5 mg/l in both wells. Sulfate concentrations were lower than at the PWTP with 30.5 mg/l in 2-A-1 and 12.7 mg/l in 2-C-1. Other major anions and cations were similar to levels measured throughout Beale AFB. Groundwater is magnesium-calcium bicarbonate in 2-A-1 and calcium-magnesium bicarbonate in 2-C-1.

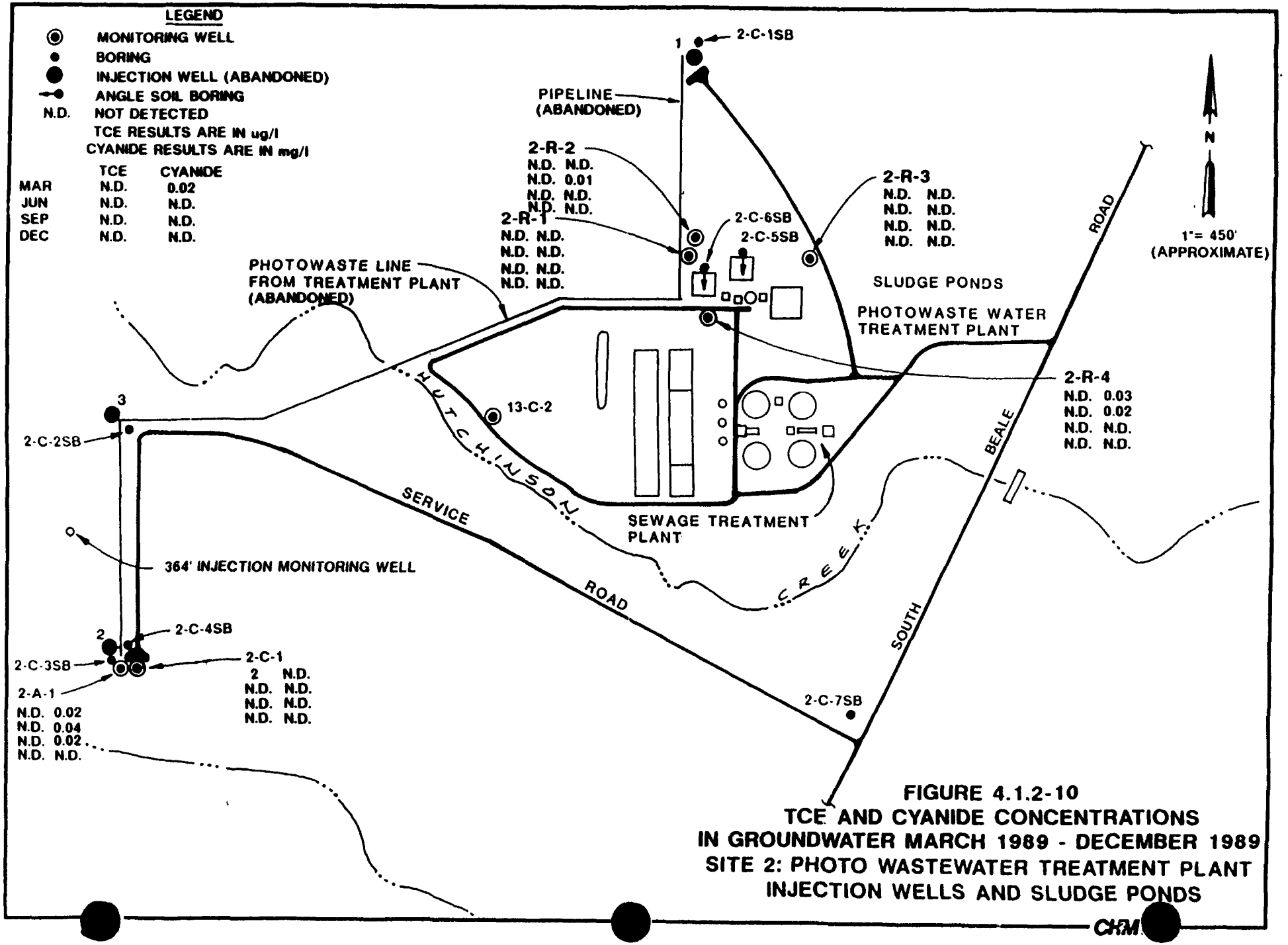


FIGURE 4.1.2-10
TCE AND CYANIDE CONCENTRATIONS IN GROUNDWATER MARCH 1989 - DECEMBER 1989
SITE 2: PHOTO WASTEWATER TREATMENT PLANT INJECTION WELLS AND SLUDGE PONDS

The only volatile organic compound detected in the second sampling round was toluene at 3 ug/l (2 ug/l in second column) in shallow well 2-A-1. Toluene was detected in 2-R-2 at 3 ug/l but was not confirmed in the second column. In 2-R-4, toluene was detected at 38 ug/l (13 ug/l in second column).

Phenol was detected at 14 ug/l at well 2-R-1. Arsenic, lead, mercury, and selenium were not detected in any wells. Cyanide was detected in well 2-A-1 at 0.0400 mg/l, in well 2-R-2 at 0.0100 mg/l, and in well 2-R-4 at 0.0200 mg/l. Water quality parameters and types were similar to the first round results.

The only volatile organic compound detected in the third sampling round was toluene at shallow well 2-A-1 at 1 ug/l. Methylene chloride (13 ug/l) and toluene (2 ug/l) were detected and confirmed in the second column in an equipment wash blank for 2-R-4 and methylene chloride at 4,700 ug/l in the ambient condition blank, but this is judged to be due to contaminated reagent grade distilled water as these compounds were not detected in the original sample or the field duplicate. Phenol was detected at 22 ug/l in 2-R-1. Arsenic, mercury, lead, selenium, and cyanide were not detected in any wells. Water quality parameters and types were similar to the first round results.

No volatile organic compounds, TFH-gas or diesel, were detected at Site 2 in the fourth sampling round. Arsenic, mercury, lead, selenium, and cyanide were not detected. Phenol was not detected. Water quality parameters and types were similar to the first round results. Nitrate ranged from 16.8 to 29.5 mg/l. Sulfate remained high at 143 mg/l at well 2-R-3.

4.1.2.1.4 Analytical Results Table

Table 4.1.2-2 presents a summary of all detected analytes for Site 2. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.2-2 are generally the lowest federal and state levels applicable to the sampled media (soil and groundwater). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.2.1.5 Discussion of Analytical Data

Samples of the photo waste sludge contained several potential contaminants including cyanide, silver, chromium, and dioxins/furans. Some of these contaminants were detected in surface soil samples from suspected spill areas, but contaminants were not consistently detected in either soil

TABLE 4.1.2-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 2

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-1SS BAFB-0057 0.0-1.0' 11/22/88	2-C-1SS[f] BAFB-0058 0.0-1.0' 11/22/88	2-C-2SS BAFB-0059 0.0-1.0' 11/22/88	2-C-3SS BAFB-0060 0.0-1.0' 11/22/88	2-C-4SS BAFB-0061 0.0-1.0' 11/22/88	2-C-5SS BAFB-0062 0.0-1.0' 11/22/88
Percent Moisture	ASA#9	N/A	%	NS	NS	33.7	28.8	30.1	30.7	20.9	21.3
Mercury	SW7471	0.060	mg/kg	NS	20	0.14	0.098	ND	ND	ND	ND
Cyanide	SW9010	0.10	mg/kg	NS	NS	235	638	165	313	153	47.8
Aluminum	SW6010	20.0	mg/kg	NS	NS	34400	29100	17900	26800	15400	15500
Barium	SW6010	10.0	mg/kg	NS	10,000	123	110	136	136	171	137
Cadmium	SW6010	1.0	mg/kg	NS	100	2.0	2.0	2.7	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	2170	1780	2190	2810	1520	1500
Chromium	SW6010	3.0	mg/kg	NS	500	314	326	250	124	43.7	74.0
Cobalt	SW6010	4.0	mg/kg	NS	8,000	35.1	22.5	6.4	43.0	30.6	35.6
Copper	SW6010	3.0	mg/kg	NS	2,500	41.5	38.8	42.2	39.2	33.9	35.2
Iron	SW6010	10.0	mg/kg	NS	NS	27600	25000	22200	29600	26000	25300
Magnesium	SW6010	100	mg/kg	NS	NS	2560	2390	2580	3480	2520	2480
Manganese	SW6010	1.5	mg/kg	NS	NS	1130	764	130	1760	599	962
Nickel	SW6010	4.0	mg/kg	NS	2,000	19.6	15.4	13.2	21.6	16.4	16.5
Potassium	SW6010	200	mg/kg	NS	NS	1010	955	1670	909	973	966
Silver	SW6010	3.0	mg/kg	NS	500	28.7	51.1	46.9	53.0	53.5	52.1
Sodium	SW6010	100	mg/kg	NS	NS	756	751	898	720	626	680
Vanadium	SW6010	4.0	mg/kg	NS	2,400	89.1	83.4	72.4	94.7	90.8	91.1
Zinc	SW6010	2.0	mg/kg	NS	5,000	92.9	46.6	46.9	56.4	37.5 B	39.3 B
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.98 B	0.69 BJ	0.69 BJ	1.0 B	0.97 B	0.94 B
Acetone	SW8240	0.010	mg/kg	NS	NS	1.7 J	1.7 J	ND	ND	4.9	0.97 J
Toluene	SW8240	0.005	mg/kg	NS	NS	0.48 J	0.96	ND	1.1	ND	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	3.3 B	3.1 B	2.7 B	2.3 B	2.5 B	2.3 B

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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-6SS BAFB-0063 0.0-1.0' 11/22/88	2-C-7SS BAFB-0064 0.0-1.0' 11/22/88	2-C-8SS BAFB-0065 0.0-1.0' 11/22/88	2-C-9SS BAFB-0066 0.0-1.0' 11/22/88	2-C-10SS BAFB-0067 0.0-1.0' 11/22/88	2-C-10SS[f] BAFB-0068 0.0-1.0' 11/22/88
Percent Moisture	ASA#9	N/A	%	NS	NS	17.6	14	19.4	18.1	17.3	17.8
Cyanide	SW9010	0.10	mg/kg	NS	NS	18.6	48.7	25.4	11.6	7.9	8.0
Aluminum	SW6010	20.0	mg/kg	NS	NS	32800	11200	13500	7830	9190	9260
Barium	SW6010	10.0	mg/kg	NS	10,000	119	77.9	96.3	65.9	125	94.2
Cadmium	SW6010	1.0	mg/kg	NS	100	ND	ND	ND	1.6	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	1600	2210	4230	2700	2760	2750
Chromium	SW6010	3.0	mg/kg	NS	500	183	48.1	33.3	24.8	38.2	34.4
Cobalt	SW6010	4.0	mg/kg	NS	8,000	12.1	15.1	21.1	17.1	27.4	15.8
Copper	SW6010	3.0	mg/kg	NS	2,500	40.7	43.4	39.1	25.9	27.1	26.3
Iron	SW6010	10.0	mg/kg	NS	NS	22800	37300	24400	17600	19200	19600
Lead	SW6010	20.0	mg/kg	NS	1,000	ND	151	ND	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	2350	2150	3100	2640	2560	2470
Manganese	SW6010	1.5	mg/kg	NS	NS	266	472	739	571	1150	727
Nickel	SW6010	4.0	mg/kg	NS	2,000	11.7	16.3	18.6	14.7	21.8	15.8
Potassium	SW6010	200	mg/kg	NS	NS	1210	581	546	440	496	547
Silver	SW6010	3.0	mg/kg	NS	500	47.2	11.6	ND	4.8	8.5	5.0
Sodium	SW6010	100	mg/kg	NS	NS	551	336	320	204	317	327
Thallium	SW6010	50.0	mg/kg	NS	700	ND	33.6 J	ND	ND	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	79.0	57.6	73.8	52.7	58.6	57.7
Zinc	SW6010	2.0	mg/kg	NS	5,000	53.5 B	131	43.4	53.4	57.6	59.7
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	1.0 B	0.004 BJ	0.003 BJ	0.010 B	0.004 BJ	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	0.013	0.25	0.026	ND	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	2.2 B	2.2 B	2.4 B	2.3 B	2.4 B	2.4 B
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.83
Tetra Furans (total)	SW8280	0.00001	mg/kg	NS	NS	0.001	NT	NT	NT	NT	NT
Penta Furans (total)	SW8280	0.00001	mg/kg	NS	NS	0.012	NT	NT	NT	NT	NT
Hexa Furans (total)	SW8280	0.00001	mg/kg	NS	NS	0.038	NT	NT	NT	NT	NT
Hepta Furans (total)	SW8280	0.00001	mg/kg	NS	NS	0.19	NT	NT	NT	NT	NT
Octa Furans (total)	SW8280	0.00001	mg/kg	NS	NS	0.38	NT	NT	NT	NT	NT
Tetra Dioxins (total)	SW8280	0.00001	mg/kg	NS	.01	0.001	NT	NT	NT	NT	NT
Penta Dioxins (total)	SW8280	0.00001	mg/kg	NS	NS	0.019	NT	NT	NT	NT	NT
Hexa Dioxins (total)	SW8280	0.00001	mg/kg	NS	NS	0.076	NT	NT	NT	NT	NT
Hepta Dioxins (total)	SW8280	0.00001	mg/kg	NS	NS	0.58	NT	NT	NT	NT	NT
Octa Dioxins (total)	SW8280	0.00001	mg/kg	NS	NS	1.1	NT	NT	NT	NT	NT

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-11SS BAFB-0069 0.0-1.0' 11/22/88	2-C-11SS^{R} BAFB-0349 0.0-1.0' 12/21/88	2-C-12SS BAFB-0070 0.0-1.0' 11/22/88	2-C-12SS^{R} BAFB-0350 0.0-1.0' 12/21/88	2-C-13SS BAFB-0071 0.0-1.0' 11/22/88	2-C-13SS^{R} BAFB-0351 0.0-1.0' 12/21/88
Percent Moisture	ASA#9	N/A	%	NS	NS	16.4	NT	8.5	NT	13.1	NT
Cyanide	SW9010	0.10	mg/kg	NS	NS	2.6	NT	10.4	NT	11.3	NT
Aluminum	SW6010	20.0	mg/kg	NS	NS	6560	NT	11500	NT	11600	NT
Barium	SW6010	10.0	mg/kg	NS	10,000	56.9	NT	96.3	NT	98.7	NT
Calcium	SW6010	100	mg/kg	NS	NS	2130	NT	3140	NT	2780	NT
Chromium	SW6010	3.0	mg/kg	NS	500	25.8	NT	34.3	NT	35.0	NT
Cobalt	SW6010	4.0	mg/kg	NS	8,000	12.0	NT	20.8	NT	25.8	NT
Copper	SW6010	3.0	mg/kg	NS	2,500	19.1	NT	30.4	NT	28.5	NT
Iron	SW6010	10.0	mg/kg	NS	NS	14000	NT	23000	NT	22400	NT
Magnesium	SW6010	100	mg/kg	NS	NS	2210	NT	3090	NT	1860	NT
Manganese	SW6010	1.5	mg/kg	NS	NS	725	NT	793	NT	1010	NT
Nickel	SW6010	4.0	mg/kg	NS	2,000	14.4	NT	17.5	NT	15.0	NT
Potassium	SW6010	200	mg/kg	NS	NS	335	NT	929	NT	575	NT
Silver	SW6010	3.0	mg/kg	NS	500	ND	NT	8.2	NT	ND	NT
Sodium	SW6010	100	mg/kg	NS	NS	159	NT	258	NT	177	NT
Vanadium	SW6010	4.0	mg/kg	NS	2,400	40.6	NT	70.1	NT	73.9	NT
Zinc	SW6010	2.0	mg/kg	NS	5,000	33.5	NT	40.2	NT	32.9	NT
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	0.28 J	NT	0.55 J	NT	0.36 J
Phenol	SW8270	0.33	mg/kg	NS	NS	2.5 B	NT	2.2 B	NT	2.0 B	NT

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-14SS BAFB-0072 0.0-1.0' 11/22/88	2-C-14SS[R] BAFB-0352 0.0-1.0' 12/21/88	2-C-1SB BAFB-0096 10.0-11.5' 12/05/88	2-C-1SB[f] BAFB-0097 11.5-13.0' 12/05/88	2-C-1SB BAFB-0098 20.0-21.5' 12/05/88	2-C-1SB BAFB-0099 30.0-31.5' 12/05/88
Percent Moisture	ASA#9	N/A	%	NS	NS	14.7	NT	18.2	19.4	20.7	25.1
Cyanide	SW9010	0.10	mg/kg	NS	NS	9.7	NT	ND	ND	2.0	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	13100	NT	12200	12500	15100	23000
Barium	SW6010	10.0	mg/kg	NS	10,000	127	NT	58.3	170	158	115
Calcium	SW6010	100	mg/kg	NS	NS	3330	NT	3920	4330	5550	5780
Chromium	SW6010	3.0	mg/kg	NS	500	34.6	NT	34.6	40.2	49.1	31.5
Cobalt	SW6010	4.0	mg/kg	NS	8,000	22.3	NT	13.4	26.2	20.2	17.4
Copper	SW6010	3.0	mg/kg	NS	2,500	30.0	NT	48.3	67.5	49.2	59.3
Iron	SW6010	10.0	mg/kg	NS	NS	25200	NT	29600	46300	27100	39300
Magnesium	SW6010	100	mg/kg	NS	NS	3280	NT	5950	7360	7180	5340
Manganese	SW6010	1.5	mg/kg	NS	NS	882	NT	292	1340	836	845
Nickel	SW6010	4.0	mg/kg	NS	2,000	16.4	NT	19.6	27.0	28.9	30.7
Potassium	SW6010	200	mg/kg	NS	NS	469	NT	1340	385	832	1110
Sodium	SW6010	100	mg/kg	NS	NS	134	NT	290	326	299	563
Thallium	SW6010	50.0	mg/kg	NS	700	ND	NT	63.1	67.7	ND	131
Vanadium	SW6010	4.0	mg/kg	NS	2,400	79.0	NT	91.0	159	60.3	89.5
Zinc	SW6010	2.0	mg/kg	NS	5,000	38.5	NT	57.7	72.7	61.9	80.1
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	NT	ND	0.022 B	0.024 B	0.030 B	0.033 B
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	0.34 J	0.10	0.046	0.11	0.16
Phenol	SW8270	0.33	mg/kg	NS	NS	2.2 B	NT	ND	ND	ND	ND
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	ND	NT	ND	0.047 J	ND	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	NT	0.15 BJ	0.088 BJ	0.20 BJ	0.19 BJ
Di-n-octyl phthalate	SW8270	0.33	mg/kg	NS	NS	0.28 J	NT	ND	ND	ND	ND

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TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-1SB BAFB-0100 40.0-41.5' 12/05/88	2-C-1SB BAFB-0101 50.0-51.5' 12/05/88	2-C-2SB BAFB-0102 10.0-11.5' 12/05/88	2-C-2SB BAFB-0103 20.0-21.5' 12/05/88	2-C-2SB[f] BAFB-0104 21.5-23.0' 12/05/88	2-C-2SB BAFB-0105 30.0-31.5' 12/05/88
Percent Moisture	ASA#9	N/A	%	NS	NS	18.2	31.3	19.2	18.7	19.3	20.4
Cyanide	SW9010	0.10	mg/kg	NS	NS	ND	ND	4.5	ND	ND	ND
TPH-Gas	TPH-GA	50	mg/kg	NS	NS	240	170	ND	ND	ND	63
Aluminum	SW6010	20.0	mg/kg	NS	NS	16100	21800	17200	13900	14300	35200
Barium	SW6010	10.0	mg/kg	NS	10,000	43.3	147	125	89.1	147	202
Calcium	SW6010	100	mg/kg	NS	NS	4900	4960	4520	3060	3430	5250
Chromium	SW6010	3.0	mg/kg	NS	500	34.2	29.8	43.3	26.8	26.3	47.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	15.9	14.6	25.7	11.7	13.6	20.1
Copper	SW6010	3.0	mg/kg	NS	2,500	56.7	52.0	58.8	31.7	37.3	61.8
Iron	SW6010	10.0	mg/kg	NS	NS	37900	30000	35500	27100	26900	42100
Lead	SW6010	20.0	mg/kg	NS	1,000	ND	ND	ND	ND	ND	29.4
Magnesium	SW6010	100	mg/kg	NS	NS	6670	5970	6930	4020	4210	8890
Manganese	SW6010	1.5	mg/kg	NS	NS	413	820	975	309	855	510
Nickel	SW6010	4.0	mg/kg	NS	2,000	20.8	34.1	28.1	22.1	25.4	51.3
Potassium	SW6010	200	mg/kg	NS	NS	648	975	322	603	719	1760
Sodium	SW6010	100	mg/kg	NS	NS	210	450	250	226	245	288
Thallium	SW6010	50.0	mg/kg	NS	700	75.9	95.3	ND	82.4	87.6	110
Vanadium	SW6010	4.0	mg/kg	NS	2,400	101	59.0	90.2	59.4	58.1	84.2
Zinc	SW6010	2.0	mg/kg	NS	5,000	66.4	74.8	64.2	49.4	54.3	90.7
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	*0.033 B*	*0.052 B*	*0.026 B*	*0.049 B*	*0.032 B*	*0.045 B*
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.10	0.16	0.19	0.064
Toluene	SW8240	0.005	mg/kg	NS	NS	0.13	0.10	0.007	0.024	0.027	0.082
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.087 BJ	0.31 BJ	0.12 BJ	0.26 BJ	0.12 BJ	0.41 B

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TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-2SB BAFB-0109 40.0-41.5' 12/06/88	2-C-2SB BAFB-0110 50.0-51.5' 12/06/88	2-C-3SB BAFB-0114 5.0-6.5' 12/07/88	2-C-3SB BAFB-0115 10.0-11.5' 12/07/88	2-C-3SB[f] BAFB-0116 11.5-13.0' 12/07/88	2-C-3SB BAFB-0117 15.0-16.5' 12/07/88
Percent Moisture	ASA#9	N/A	%	NS	NS	20.8	19	13.4	17.2	16.7	28.8
Cyanide	SW9010	0.10	mg/kg	NS	NS	ND	ND	ND	0.16	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	12400	15900	6630	9010	8420	21600
Barium	SW6010	10.0	mg/kg	NS	10,000	107	167	39.5	59.9	62.8	153
Calcium	SW6010	100	mg/kg	NS	NS	3430	5250	2550	3390	2690	3650
Chromium	SW6010	3.0	mg/kg	NS	500	31.1	38.9	21.9 B	26.1 B	38.3 B	53.5 B
Cobalt	SW6010	4.0	mg/kg	NS	8,000	15.2	18.5	8.9	19.3	26.8	12.2
Copper	SW6010	3.0	mg/kg	NS	2,500	41.0	49.3	24.0	36.6	43.5	49.7
Iron	SW6010	10.0	mg/kg	NS	NS	25800	27700	15000 B	15900 B	25200 B	31300 B
Magnesium	SW6010	100	mg/kg	NS	NS	5130	7520	2680	3190	3310	5800
Manganese	SW6010	1.5	mg/kg	NS	NS	598	979	196	553	569	617
Nickel	SW6010	4.0	mg/kg	NS	2,000	22.7	33.7	11.0	14.5	21.6	35.7
Potassium	SW6010	200	mg/kg	NS	NS	1090	1730	ND	ND	ND	983
Sodium	SW6010	100	mg/kg	NS	NS	188	193	264	298	297	528
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	ND	ND	ND	77.0
Vanadium	SW6010	4.0	mg/kg	NS	2,400	60.5	47.4	57.2	52.4	85.2	71.1
Zinc	SW6010	2.0	mg/kg	NS	5,000	59.0	86.3	30.0 B	39.5 B	39.3 B	61.2 B
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.026	0.026	0.013	0.012	0.016	0.007 B
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.20	6.6	4.1	0.017
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.006 J	0.005 J	0.006 J	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.003 J	0.042	0.014	0.002 J	ND	0.058
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.25 J	0.48	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.077 J	0.079 J	ND	ND	ND	ND

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e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-3SB BAFB-0118 20.0-21.5' 12/07/88	2-C-3SB BAFB-0119 25.0-26.5' 12/07/88	2-C-3SB BAFB-0120 30.0-31.5' 12/07/88	2-C-3SB BAFB-0121 40.0-41.5' 12/07/88	2-C-3SB BAFB-0122 50.0-51.5' 12/07/88	2-C-4SB BAFB-0123 5.0-6.5' 12/08/88
Percent Moisture	ASA#9	N/A	%	NS	NS	24.8	25	25.6	18.4	21.9	17
Cyanide	SW9010	0.10	mg/kg	NS	NS	ND	ND	ND	ND	ND	3.1
Aluminum	SW6010	20.0	mg/kg	NS	NS	16900	19700	21600	15400	22700	11500
Barium	SW6010	10.0	mg/kg	NS	10,000	133	165	159	185	134	84.2
Calcium	SW6010	100	mg/kg	NS	NS	3600	4240	4260	5810	5570	3650
Chromium	SW6010	3.0	mg/kg	NS	500	29.8 B	33.3 B	32.1 B	47.1 B	38.3 B	35.8 B
Cobalt	SW6010	4.0	mg/kg	NS	8,000	10.2	21.3	22.8	30.3	24.3	18.1
Copper	SW6010	3.0	mg/kg	NS	2,500	41.1	46.3	50.7	66.3	44.4	49.5
Iron	SW6010	10.0	mg/kg	NS	NS	19900 B	25100 B	36000 B	37700 B	30500 B	24600 B
Magnesium	SW6010	100	mg/kg	NS	NS	5740	7880	5940	7840	8660	4390
Manganese	SW6010	1.5	mg/kg	NS	NS	328	600	961	1200	827	652
Nickel	SW6010	4.0	mg/kg	NS	2,000	27.7	43.5	39.8	25.2	38.3	21.7
Potassium	SW6010	200	mg/kg	NS	NS	944	1220	1320	515	1410	265
Sodium	SW6010	100	mg/kg	NS	NS	314	309	284	174	270	290
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	88.4	68.6	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	41.5	62.8	94.4	134	42.9	84.2
Zinc	SW6010	2.0	mg/kg	NS	5,000	67.8 B	67.3 B	65.5 B	78.9	72.3	46.0
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.008 B	0.024 B	0.009 B	0.007 B	0.008 B	0.065 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.020	0.041	0.038	0.20	0.069	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.11	0.064	0.13	0.043	0.083	0.16
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	0.099 J	ND

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-4SB BAFB-0124 10.0-11.5' 12/08/88	2-C-4SB BAFB-0125 15.0-16.5' 12/08/88	2-C-4SB BAFB-0126 20.0-21.5' 12/08/88	2-C-4SB BAFB-0186 25.0-26.5' 12/08/88	2-C-4SB[f] BAFB-0187 26.5-28.0' 12/08/88	2-C-5SB BAFB-0292 7.5-9.0' 12/20/88
Percent Moisture	ASA#9	N/A	%	NS	NS	6.7	22.6	22.1	20.3	5.6	14.2
Cyanide	SW9010	0.10	mg/kg	NS	NS	ND	ND	ND	0.13	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	5640	15500	19000	11700	5930	13500
Barium	SW6010	10.0	mg/kg	NS	10,000	38.9	109	171	117	53.1	177
Calcium	SW6010	100	mg/kg	NS	NS	2840	3310	4160	3010	1680	3760
Chromium	SW6010	3.0	mg/kg	NS	500	17.1 B	24.5 B	31.1 B	27.1	25.0	34.7
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.8	28.4	18.0	13.8	7.9	22.1
Copper	SW6010	3.0	mg/kg	NS	2,500	23.6	41.5	50.3	45.5	29.3	43.8
Iron	SW6010	10.0	mg/kg	NS	NS	15600 B	28600 B	33000 B	21000	13900	26700
Magnesium	SW6010	100	mg/kg	NS	NS	2680	5400	5490	5330	3390	5290
Manganese	SW6010	1.5	mg/kg	NS	NS	326	327	1210	598	275	793
Nickel	SW6010	4.0	mg/kg	NS	2,000	10.4	25.8	32.0	23.8	19.1	18.6
Potassium	SW6010	200	mg/kg	NS	NS	ND	1110	1040	1180	634	315
Sodium	SW6010	100	mg/kg	NS	NS	140	296	345	266	175	591
Thallium	SW6010	50.0	mg/kg	NS	700	ND	86.7	87.9	ND	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	50.6	73.8	78.3	49.8	26.1	88.1
Zinc	SW6010	2.0	mg/kg	NS	5,000	26.2	53.6	69.2	69.4	37.9	54.1
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.059 B	0.10 B	0.073 B	0.069	0.049	0.007
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	0.018	ND	0.033	0.006	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.001 J	0.16	0.15	0.039	0.036	0.047
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.11 J	0.22 J	ND	ND	NT

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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-5SB[R] BAFB-0535 10.0-11.5' 05/03/89	2-C-5SB BAFB-0294 17.0-19.0' 12/20/88	2-C-5SB[R] BAFB-0536 20.0-21.5' 05/03/89	2-C-5SB[R] BAFB-0537 30.0-31.5' 05/03/89	2-C-5SB[R] BAFB-0538 31.5-33.0' 05/03/89	2-C-5SB BAFB-0296 37.5-39.0' 12/20/88
Percent Moisture	ASA#9	N/A	%	NS	NS	NT	12.1	NT	21.1	22.5	26.4
Aluminum	SW6010	20.0	mg/kg	NS	NS	NT	13800	NT	17000	21700	14300
Barium	SW6010	10.0	mg/kg	NS	10,000	NT	95.9	NT	147	145	133
Calcium	SW6010	100	mg/kg	NS	NS	NT	4850	NT	4540	3510	3740
Chromium	SW6010	3.0	mg/kg	NS	500	NT	40.5	NT	42.7	37.9	23.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	NT	23.0	NT	16.5	20.6	14.9
Copper	SW6010	3.0	mg/kg	NS	2,500	NT	50.5	NT	43.2	39.5	36.1
Iron	SW6010	10.0	mg/kg	NS	NS	NT	28600	NT	30200	34300	26100
Magnesium	SW6010	100	mg/kg	NS	NS	NT	3540	NT	7530	5470	5030
Manganese	SW6010	1.5	mg/kg	NS	NS	NT	617	NT	627	761	575
Nickel	SW6010	4.0	mg/kg	NS	2,000	NT	24.2	NT	29.3	33.8	24.5
Potassium	SW6010	200	mg/kg	NS	NS	NT	341	NT	938	1230	639
Sodium	SW6010	100	mg/kg	NS	NS	NT	461	NT	449	413	476
Thallium	SW6010	50.0	mg/kg	NS	700	NT	74.1	NT	ND	ND	86.4
Vanadium	SW6010	4.0	mg/kg	NS	2,400	NT	91.5	NT	60.8	93.8	57.1
Zinc	SW6010	2.0	mg/kg	NS	5,000	NT	56.7	NT	61.7	62.7	60.5
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	NT	0.006	NT	0.015 J	0.012	0.005 J
Acetone	SW8240	0.010	mg/kg	NS	NS	NT	0.008 J	NT	0.032 B	ND	0.012 J
Chloroform	SW8240	0.005	mg/kg	NS	NS	NT	ND	NT	0.013 J	ND	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	NT	ND	NT	ND	ND	0.018
Vinyl Acetate	SW8240	0.010	mg/kg	NS	NS	NT	ND	NT	ND	ND	0.008 J
Benzene	SW8240	0.005	mg/kg	NS	NS	NT	ND	NT	ND	ND	0.012
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	NT	ND	NT	ND	ND	0.011 J
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	0.032	NT	0.18	0.081	0.086
N-Nitrosodimethylamine	SW8270	0.33	mg/kg	NS	NS	0.060 J	NT	0.056 J	ND	ND	NT

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b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-5SB[R] BAFB-0539 40.0-41.5' 05/03/89	2-C-5SB BAFB-0297 47.5-49.0' 12/20/88	2-C-5SB[R] BAFB-0540 50.0-51.5' 05/03/89	2-C-6SB BAFB-0298 8.5-10.0' 12/21/88	2-C-6SB BAFB-0299 18.5-20.0' 12/21/88	2-C-6SB BAFB-0300 28.5-30.0' 12/21/88
Percent Moisture	ASA#9	N/A	%	NS	NS	NT	18.8	NT	14.2	21.1	20.4
Cyanide	SW9010	0.10	mg/kg	NS	NS	NT	ND	NT	ND	ND	0.13
Aluminum	SW6010	20.0	mg/kg	NS	NS	NT	21300	NT	10900	22700	14600
Barium	SW6010	10.0	mg/kg	NS	10,000	NT	150	NT	131	90.7	415
Beryllium	SW6010	0.50	mg/kg	NS	75	NT	ND	NT	ND	0.76	0.75
Calcium	SW6010	100	mg/kg	NS	NS	NT	6220	NT	2060	5720	4670
Chromium	SW6010	3.0	mg/kg	NS	500	NT	66.0	NT	31.7	64.9	39.7
Cobalt	SW6010	4.0	mg/kg	NS	8,000	NT	28.8	NT	31.7	25.3	36.7
Copper	SW6010	3.0	mg/kg	NS	2,500	NT	65.1	NT	32.1	73.4	47.9
Iron	SW6010	10.0	mg/kg	NS	NS	NT	43300	NT	24600	49300	30700
Magnesium	SW6010	100	mg/kg	NS	NS	NT	8250	NT	3240	9070	7840
Manganese	SW6010	1.5	mg/kg	NS	NS	NT	839	NT	1160	550	1960
Nickel	SW6010	4.0	mg/kg	NS	2,000	NT	31.0	NT	16.3	36.1	43.7
Potassium	SW6010	200	mg/kg	NS	NS	NT	567	NT	408	900	641
Sodium	SW6010	100	mg/kg	NS	NS	NT	232	NT	225	430	313
Vanadium	SW6010	4.0	mg/kg	NS	2,400	NT	134	NT	83.8	143	84.9
Zinc	SW6010	2.0	mg/kg	NS	5,000	NT	81.7	NT	37.6	85.7	63.4
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	NT	0.005 J	NT	ND	ND	ND
Acetone	SW8240	0.010	mg/kg	NS	NS	NT	0.023	NT	ND	ND	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	NT	0.041	NT	ND	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	0.027	NT	0.82	ND	0.25 J
N-Nitrosodimethylamine	SW8270	0.33	mg/kg	NS	NS	0.066 J	NT	0.67 J	ND	ND	ND

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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-6SB BAFB-0301 38.5-40.0' 12/21/88	2-C-6SB BAFB-0302 48.5-50.0' 12/21/88	2-C-7SB BAFB-0090 0.0-1.5' 12/02/88	2-C-7SB BAFB-0091 10.0-11.5' 12/02/88	2-C-7SB[R] BAFB-0420 10.0-10.5' 01/20/89	2-C-7SB BAFB-0092 20.0-21.5' 12/02/88
Percent Moisture	ASA#9	N/A	%	NS	NS	26.4	14.8	16.9	13.1	NT	7.9
Aluminum	SW6010	20.0	mg/kg	NS	NS	27400	11300	16800	14600	NT	10000
Barium	SW6010	10.0	mg/kg	NS	10,000	186	180	126	75.8	NT	46.3
Beryllium	SW6010	0.50	mg/kg	NS	75	0.82	ND	ND	ND	NT	ND
Calcium	SW6010	100	mg/kg	NS	NS	5490	4080	5200	4990	NT	6000
Chromium	SW6010	3.0	mg/kg	NS	500	36.5	31.5	42.6	33.9	NT	25.7
Cobalt	SW6010	4.0	mg/kg	NS	8,000	17.7	27.8	24.1	20.7	NT	11.9
Copper	SW6010	3.0	mg/kg	NS	2,500	61.8	52.6	54.4	50.7	NT	27.1
Iron	SW6010	10.0	mg/kg	NS	NS	37500	31100	31500	27800	NT	18700
Magnesium	SW6010	100	mg/kg	NS	NS	8860	6470	5420	5200	NT	3320
Manganese	SW6010	1.5	mg/kg	NS	NS	682	1070	882	636	NT	444
Nickel	SW6010	4.0	mg/kg	NS	2,000	43.5	21.1	29.4	21.9	NT	16.3
Potassium	SW6010	200	mg/kg	NS	NS	1330	282	481	368	NT	271
Sodium	SW6010	100	mg/kg	NS	NS	446	168	162	151	NT	221
Thallium	SW6010	50.0	mg/kg	NS	700	89.8	ND	ND	ND	NT	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	64.9	96.9	98.6	86.2	NT	54.7
Zinc	SW6010	2.0	mg/kg	NS	5,000	96.5	61.7	56.9	52.4	NT	34.0
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	ND	ND	0.034 B	0.20	NT	0.22 B
Acetone	SW8240	0.010	mg/kg	NS	NS	2.3	ND	0.018	0.77	NT	0.38
1,1,2,2-Tetrachloroethane	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	NT	0.008 J
Toluene	SW8240	0.005	mg/kg	NS	NS	0.30 J	ND	ND	ND	NT	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	ND	ND	0.83 B	NT	ND	NT
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	0.20 J	NT	ND	NT
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	NT	0.13 J	NT

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-7SB[R] BAFB-0421 20.0-20.5' 01/20/89	2-C-7SB[R] BAFB-0422 20.5-21.0' 01/20/89	2-C-7SB BAFB-0093 30.0-31.5' 12/02/88	2-C-7SB[R] BAFB-0423 30.0-30.5' 01/20/89	2-C-7SB BAFB-0094 40.0-41.5' 12/02/88	2-C-7SB BAFB-0095 50.0-51.5' 12/02/88
Percent Moisture	ASA#9	N/A	%	NS	NS	NT	NT	16.7	NT	19.2	22.5
Aluminum	SW6010	20.0	mg/kg	NS	NS	NT	NT	11500	NT	23300	28000
Barium	SW6010	10.0	mg/kg	NS	10,000	NT	NT	79.0	NT	144	64.1
Beryllium	SW6010	0.50	mg/kg	NS	75	NT	NT	ND	NT	0.62	ND
Calcium	SW6010	100	mg/kg	NS	NS	NT	NT	2970	NT	5540	7820
Chromium	SW6010	3.0	mg/kg	NS	500	NT	NT	20.4	NT	36.8	44.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	NT	NT	12.0	NT	19.8	16.8
Copper	SW6010	3.0	mg/kg	NS	2,500	NT	NT	33.0	NT	71.7	58.2
Iron	SW6010	10.0	mg/kg	NS	NS	NT	NT	20500	NT	35400	39000
Magnesium	SW6010	100	mg/kg	NS	NS	NT	NT	3830	NT	6920	8090
Manganese	SW6010	1.5	mg/kg	NS	NS	NT	NT	562	NT	847	468
Nickel	SW6010	4.0	mg/kg	NS	2,000	NT	NT	24.8	NT	31.1	26.7
Potassium	SW6010	200	mg/kg	NS	NS	NT	NT	600	NT	915	710
Sodium	SW6010	100	mg/kg	NS	NS	NT	NT	252	NT	218	266
Thallium	SW6010	50.0	mg/kg	NS	700	NT	NT	60.3	NT	70.3	101
Vanadium	SW6010	4.0	mg/kg	NS	2,400	NT	NT	50.9	NT	101	73.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	NT	NT	48.5	NT	74.6	78.7
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	NT	NT	0.048 B	NT	0.19 B	0.048 B
Acetone	SW8240	0.010	mg/kg	NS	NS	NT	NT	0.23	NT	1.1	0.34
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	NT	ND	NT	0.015 J	0.008
Phenol	SW8270	0.33	mg/kg	NS	NS	ND	ND	NT	ND	ND	0.13 J
Benzoic Acid	SW8270	1.6	mg/kg	NS	NS	ND	ND	NT	ND	ND	0.27 J
Phenanthrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	NT	ND	ND	0.059 J
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	NT	ND	0.22 BJ	0.46 B
Fluoranthene	SW8270	0.33	mg/kg	NS	NS	ND	ND	NT	ND	ND	0.065 J
Pyrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	NT	ND	ND	0.072 J
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.12 J	0.095 J	NT	ND	ND	0.11 J
Chrysene	SW8270	0.33	mg/kg	NS	NS	ND	ND	NT	ND	ND	0.065 J

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 2

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-1GW BAFB-0477 03/07/89	2-C-1GW[f] BAFB-0478 03/07/89	2-C-1GW[e] BAFB-0476 03/07/89	2-C-1GW[b] BAFB-0480 03/07/89	2-A-1GW BAFB-0481 03/08/89	2-R-1GW BAFB-0464 02/20/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	239	239	NT	NT	250	328
Temperature	E170.1	N/A	deg C	NS	NS	18.5	18.5	18.0	NT	18.0	19.3
pH	E150.1	N/A	pH	5-9	NS	6.91	6.91	7.00	NT	7.28	6.81
Alkalinity - Total	SM403	1.0	mg/l	20	NS	96.4	96.4	2.8	NT	86.4	65.2
Bicarbonate	SM403	1.0	mg/l	NS	NS	117.6	117.6	3.4	NT	105.4	79.5
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	192	186	5.0	NT	216	292
Chloride	E325.3	1.0	mg/l	250	250	16.8	16.8	ND	NT	21.8	27.8
Fluoride	E340.2	0.050	mg/l	2	1.4	0.20	0.21	ND	NT	0.15	0.15
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	16.5	17.5	0.18	NT	16.5	25.3
Sulfate	E375.4	1.0	mg/l	250	250	12.7	12.2	ND	NT	30.5	48.8
Cyanide	SW9010	0.0100	mg/l	NS	NS	ND	ND	ND	NT	0.0200	ND
Calcium	SW6010	1.00	mg/l	NS	NS	22.4	22.2	ND	NT	21.2	30.2
Iron	SW6010	0.100	mg/l	.3	.3	ND	ND	ND	NT	0.763	ND
Magnesium	SW6010	1.00	mg/l	NS	NS	13.1	13.0	ND	NT	14.0	20.8
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	ND	NT	0.0820	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.40	1.60	ND	NT	ND	ND
Sodium	SW6010	1.00	mg/l	NS	NS	14.1	14.0	ND	NT	14.1	13.0
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0340	0.0320	ND	NT	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	2(3)	2(3)	ND	ND	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	3(3)	3(4)	ND	ND	ND	ND
Phenol	SW8270	10	ug/l	NS	NS	ND	ND	ND	ND	ND	7 J
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	4 J	6 J	3 J	NT	4 J	3 J

NOTES Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-R-2GW BAFB-0463 02/17/89	2-R-3GW BAFB-0460 02/17/89	2-R-4GW BAFB-0462 02/17/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	250	556	235
Temperature	E170.1	N/A	deg C	NS	NS	17.1	18.0	18.0
pH	E150.1	N/A	pH	5-9	NS	6.96	6.94	6.83
Alkalinity - Total	SM403	1.0	mg/l	20	NS	58.0	74.0	102.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	70.8	90.3	124.4
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	236	435	231
Chloride	E325.3	1.0	mg/l	250	250	18.7	63.7	21.4
Fluoride	E340.2	0.050	mg/l	2	1.4	0.15	0.12	0.15
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	24.1	19.9	18.6
Sulfate	E375.4	1.0	mg/l	250	250	31.3	130	19.7
Cyanide	SW9010	0.0100	mg/l	NS	NS	ND	ND	0.0300
Calcium	SW6010	1.00	mg/l	NS	NS	21.3	50.0	22.4
Magnesium	SW6010	1.00	mg/l	NS	NS	14.5	33.4	15.6
Sodium	SW6010	1.00	mg/l	NS	NS	11.2	19.7	.9

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.2-2

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 2

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-1GW BAFB-0572 06/05/89	2-C-1GW[f] BAFB-0573 06/05/89	2-C-1GW[e] BAFB-0574 06/05/89	2-C-1GW[b] BAFB-0575 06/05/89	2-A-1GW BAFB-0571 06/02/89	2-R-1GW BAFB-0589 06/12/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	241	241	NT	NT	240	330
Temperature	E170.1	N/A	deg C	NS	NS	19.0	19.0	NT	NT	19.5	20.0
pH	E150.1	N/A	pH	5-9	NS	7.40	7.40	NT	NT	7.37	6.91
Alkalinity - Total	SM403	1.0	mg/l	20	NS	NT	NT	NT	NT	78.0	72.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	NT	NT	NT	95.2	88.8
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	2560	294	6.0	NT	248	277
Chloride	E325.3	1.0	mg/l	250	250	17.5	16.5	ND	NT	19.9	29.1
Fluoride	E340.2	0.050	mg/l	2	1.4	0.19	0.19	ND	NT	0.14	0.14
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	18.3	19.1	0.36	NT	21.0	29.2
Sulfate	E375.4	1.0	mg/l	250	250	12.1	10.5	ND	NT	14.4	48.7
Cyanide	SW9010	0.0100	mg/l	NS	NS	ND	ND	ND	NT	0.0400	ND
Calcium	SW6010	1.00	mg/l	NS	NS	20.5	20.3	ND	NT	20.1	28.0
Magnesium	SW6010	1.00	mg/l	NS	NS	12.6	12.4	ND	NT	13.5	19.3
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	ND	NT	0.0550	ND
Potassium	SW6010	1.00	mg/l	NS	NS	ND	ND	ND	NT	1.20	2.10
Sodium	SW6010	1.00	mg/l	NS	NS	12.2	12.1	ND	NT	10.6	13.2
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0230	ND	ND	NT	ND	ND
Chloroform	SW8010	1	ug/l	NS	100	ND	ND	3(2)	3(3)	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	ND	6(5)	3(2)	ND
Phenol	SW8270	10	ug/l	NS	NS	ND	ND	ND	NT	ND	14
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	5 BJ	5 BJ	6 BJ	NT	5 BJ	7 BJ
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	ND	ND	ND	NT	ND	3 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	27	7 J	26	NT	5 J	4 J

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-R-2GW BAFB-0588 06/12/89	2-R-3GW BAFB-0587 06/09/89	2-R-4GW BAFB-0594 06/13/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	265	610	268
Temperature	E170.1	N/A	deg C	NS	NS	19.0	20.5	19.5
pH	E150.1	N/A	pH	5-9	NS	7.17	6.88	6.93
Alkalinity - Total	SM403	1.0	mg/l	20	NS	64.0	79.2	88.2
Bicarbonate	SM403	1.0	mg/l	NS	NS	78.1	96.6	107.6
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	234	468	263
Chloride	E325.3	1.0	mg/l	250	250	19.9	66.8	20.1
Fluoride	E340.2	0.050	mg/l	2	1.4	0.14	0.12	0.14
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	29.2	19.6	19.5
Sulfate	E375.4	1.0	mg/l	250	250	28.6	116	15.7
Cyanide	SW9010	0.0100	mg/l	NS	NS	0.0100	ND	0.0200
Calcium	SW6010	1.00	mg/l	NS	NS	20.8	51.8	21.6
Magnesium	SW6010	1.00	mg/l	NS	NS	14.1	34.1	14.7
Potassium	SW6010	1.00	mg/l	NS	NS	ND	ND	1.60
Sodium	SW6010	1.00	mg/l	NS	NS	11.4	20.0	12.2
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	6(1)	ND
Toluene	SW8020	1	ug/l	14,300	100	3	ND	38(13)
Phenol	SW8270	10	ug/l	NS	NS	13	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	7 J	6 BJ	5 J
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	3 J	ND	ND
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	3 J	11	2 J

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 2

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-1GW BAFB-0647 09/15/89	2-A-1GW BAFB-0646 09/15/89	2-R-1GW BAFB-0648 09/15/89	2-R-2GW BAFB-0638 09/12/89	2-R-3GW BAFB-0658 09/19/89	2-R-4GW BAFB-0652 09/18/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	257	228	330	267	570	246
Temperature	E170.1	N/A	deg C	NS	NS	19.0	19.0	19.0	19.5	19.5	19.0
pH	E150.1	N/A	pH	5-9	NS	7.46	7.28	7.17	7.36	7.29	7.29
Alkalinity - Total	SM403	1.0	mg/l	20	NS	92.8	76.6	70.6	59.6	99.6	92.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	113.2	93.5	86.1	72.7	121.5	112.2
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	293	267	347	284	609	280
Chloride	E325.3	1.0	mg/l	250	250	16.0	18.0	26.0	20.0	69.0	20.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.18	0.14	0.11	0.10	ND	0.14
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	20.1	16.6	28.8	25.4	20.9	19.9
Sulfate	E375.4	1.0	mg/l	250	250	11.0	15.0	53.0	35.0	123	17.0
Cyanide	SW9010	0.0100	mg/l	NS	NS	ND	0.0200	ND	ND	ND	ND
Calcium	SW6010	1.00	mg/l	NS	NS	22.4	19.8	29.3	21.8	59.9	20.7
Iron	SW6010	0.100	mg/l	.3	.3	0.351	ND	ND	ND	ND	ND
Magnesium	SW6010	1.00	mg/l	NS	NS	12.9	12.6	19.1	14.6	33.3	13.0
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.0900	ND	ND	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.70	1.30	1.10	ND	ND	1.30
Sodium	SW6010	1.00	mg/l	NS	NS	11.4	9.24	12.3	11.2	19.2	11.6
Toluene	SW8020	1	ug/l	14,300	100	ND	1	ND	ND	ND	ND
Phenol	SW8270	10	ug/l	NS	NS	ND	ND	22	ND	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	ND	ND	9 J	ND	ND	5 J
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	15	ND	22	ND	ND	28

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-R-4GW[f] BAFB-0653 09/18/89	2-R-4GW[e] BAFB-0654 09/18/89	2-R-4GW[b] BAFB-0655 09/18/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	246	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	19.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.29	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	82.0	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	100.0	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	277	18.0	NT
Chloride	E325.3	1.0	mg/l	250	250	20.0	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.12	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	20.2	ND	NT
Sulfate	E375.4	1.0	mg/l	250	250	17.0	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	21.3	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	13.6	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	1.20	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	11.6	ND	NT
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	13(14)	4700(1800)
Toluene	SW8020	1	ug/l	14,300	100	ND	2(2)	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	ND	5 J	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	6 J	NT

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.2-2

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 2

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	2-C-1GW BAFB-0711 11/27/89	2-A-1GW BAFB-0710 11/27/89	2-R-1GW BAFB-0722 11/30/89	2-R-2GW BAFB-0723 11/30/89	2-R-3GW BAFB-0724 11/30/89	2-R-4GW BAFB-0712 11/28/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	249	238	330	250	60	250
Temperature	E170.1	N/A	deg C	NS	NS	18.0	18.0	19.0	19.0	19.0	18.0
pH	E150.1	N/A	pH	5-9	NS	7.40	7.00	7.28	7.30	7.24	7.35
Alkalinity - Total	SM403	1.0	mg/l	20	NS	76.8	70.2	80.0	73.4	100.4	80.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	93.7	85.6	97.6	89.5	122.5	97.6
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	187	227	284	243	474	288
Chloride	E325.3	1.0	mg/l	250	250	16.9	22.4	26.6	20.3	67.3	20.4
Fluoride	E340.2	0.050	mg/l	2	1.4	0.20	0.16	0.16	0.17	0.14	0.17
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	21.0	16.8	29.5	26.9	20.0	20.5
Sulfate	E375.4	1.0	mg/l	250	250	11.5	24.2	49.5	33.2	143	24.5
Calcium	SW6010	1.00	mg/l	NS	NS	21.4	20.2	30.8	22.6	58.0	20.4
Magnesium	SW6010	1.00	mg/l	NS	NS	12.8	13.2	19.3	14.7	31.7	13.2
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.117	ND	ND	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.17	ND	1.56	ND	ND	ND
Sodium	SW6010	1.00	mg/l	NS	NS	12.3	10.3	13.8	11.7	18.4	12.1
Diethylphthalate	SW8270	10	ug/l	NS	NS	4 BJ	7 BJ	ND	ND	ND	7 BJ
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	9 BJ	14 B	13	11	8 J	14 B
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	9 BJ	14 B	12 B	9 BJ	9 BJ	15 B
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	8 J	ND	ND	28	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

boring samples collected under the sludge pits or near the abandoned injection wells. Table 4.1.2-3 presents the range of contaminants encountered for each of the media sampled (sludge, soil, groundwater), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections or surrogate spike recoveries.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the LOQ. In some cases these detections may represent laboratory "noise" and the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study the LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank. Occasionally, the detection limits are higher than the contract LOQ due to required dilutions or analytical interferences. In these cases, the J qualifiers are applied to the actual achieved laboratory detection limits noted on a sample-specific basis in Appendix A.

4.1.2.2 Sampling and Analytical Problems

4.1.2.2.1 Loss of Samples

There were no sample loss problems for Site 2 samples. A total of eleven soil samples were resampled due to missed holding times. Four surface soil samples were resampled for volatile organics (8240), and seven soil boring samples were resampled for semivolatile organics (8270). In addition, two TFH-gas analyses were not completed due to laboratory handling problems. The omission of these two analyses is not considered critical to the final evaluation of site conditions.

4.1.2.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil and water samples collected at Site 2 contained several organic compounds that were probably laboratory or field induced false positive results. Many of the soil samples collected contained acetone and methylene chloride. These are common laboratory contaminants and were also found in some of the method blanks.

Table 4.1.2-3
RANGES OF CONTAMINANTS DETECTED AT SITE 2

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SLUDGE SAMPLES				
mercury	mg/kg	ND	0.14	1/6
cyanide	mg/kg	18.6	638	6/6
silver	mg/kg	28.7	53.5	6/6
chromium	mg/kg	43.7	326	6/6
toluene	mg/kg	ND	1.1	2/6
tetra dioxins	mg/kg	0.0017	0.0017	1/1
penta dioxins	mg/kg	0.019	0.019	1/1
hexa dioxins	mg/kg	0.076	0.076	1/1
hepta dioxins	mg/kg	0.580	0.580	1/1
octa dioxins	mg/kg	1.070	1.070	1/1
tetra furans	mg/kg	0.0013	0.0013	1/1
penta furans	mg/kg	0.012	0.012	1/1
hexa furans	mg/kg	0.038	0.038	1/1
hepta furans	mg/kg	0.190	0.190	1/1
octa furans	mg/kg	0.380	0.380	1/1
SURFACE SOILS				
cyanide	mg/kg	2.6	48.7	8/8
silver	mg/kg	ND	11.6	4/8
chromium	mg/kg	24.8	48.1	8/8
lead	mg/kg	ND	151	1/8
toluene	mg/kg	ND	(0.55)	7/8
bis(2-ethylhexyl) phthalate	mg/kg	ND	0.83	1/8
SOIL BORINGS				
cyanide	mg/kg	ND	4.5	6/39
TFH-gas	mg/kg	ND	240	3/39
chromium	mg/kg	23.1	66.0	39/39
lead	mg/kg	ND	29.4	1/39
toluene	mg/kg	ND	0.82	33/39
trichloroethene	mg/kg	ND	0.033	5/39
bis(2-ethylhexyl) phthalate	mg/kg	ND	0.13	6/39
di-n-butyl phthalate	mg/kg	ND	0.48	4/39
2-butanone	mg/kg	ND	0.041	2/39
n-nitrosodiphenylamine	mg/kg	ND	(0.67)	5/39
chloroform	mg/kg	ND	0.013	1/39
benzene	mg/kg	ND	0.012	1/39
GROUNDWATER				
toluene	ug/l	ND	38	6/24
trichloroethene	ug/l	ND	2	1/24
phenol	ug/l	ND	22	3/24
bis(2-ethylhexyl) phthalate	ug/l	ND	28	8/24
cyanide	mg/l	ND	0.03	6/24

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

Several soil samples contained the semivolatile compounds bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, and N-nitrosodiphenylamine. Di-n-butyl phthalate was also detected in the method blank. The phthalate compounds were commonly detected in samples from throughout the base and are probably false positive results.

Phenol was detected in 14 surface soil samples (2-C-1SS to 14SS) at concentrations ranging from 2.0 mg/kg to 3.3 mg/kg and at 0.83 mg/kg in the 0- to 1.5-foot sample at boring 2-C-7SB. This has been traced to a factory contaminated bottle of acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks that the induced contamination was 1.7 mg/kg.

Toluene was detected in most of the soil samples at low concentrations. This occurred for samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent suggests that it is a false positive result.

Chromium, iron, and zinc, among other metals, were detected in soil samples. For a few soil samples, chromium, iron, and zinc were also detected in the associated method blank. Zinc was detected in the blanks for surface soil samples 2-C-4SS and -6SS. Iron and chromium were detected in the blanks for all depths from soil boring 2-C-3SB and from 5 through 20 feet from soil boring 2-C-4SB. This does not mean, however, that these metals should be considered false positive results for these samples. They are naturally occurring metals that were consistently found in soil samples at higher concentrations than detected in the blank.

Six soil replicate QC samples were collected at Site 2. The replicate analyses were very comparable, with a few exceptions. The replicate of sludge sample 2-C-1SS had high RPDs for cyanide (92 percent), silver (56 percent), mercury (35 percent), and zinc (66 percent). This may be a reflection of true variability in the waste materials. A replicate sample in soil boring 2-C-4SB, at a depth of 25 feet, had a much higher moisture content than the replicate sample. Most metals were also higher in the original sample, as was TCE, which had an RPD of 138 percent. This variability is probably a reflection of a change in geologic materials between the first and second sample.

A replicate QC sample, plus an equipment wash blank and ambient condition blank, were collected at well 2-C-1 in the first quarter. The replicate analysis results were almost identical to the original sample. The compound bis(2-ethylhexyl) phthalate was tentatively identified below the LOQ in the equipment blank. The ambient condition blank was free of contaminants.

In the second quarter groundwater sampling round at well 2-C-1, chloroform was detected at 3 ug/l in the equipment wash blank and in the ambient condition blank. Toluene was also detected in the ambient condition blank at 6 ug/l. As neither of these compounds was detected in the normal environmental sample or the field replicate, it is likely that these are false positive results or due to contaminated blank water.

In the third quarterly sampling at well 2-R-4, methylene chloride was not detected in the normal environmental sample or the replicate sample. However, methylene chloride was detected in both the ambient condition blank at 4,700 ug/l (1,800 ug/l in second column) and the equipment wash blank at 13 ug/l (14 ug/l in second column). This has been traced to contaminated Type 1 organic free water, which occurred in a number of blanks during the third sampling round. In each case, the normal environmental sample did not contain methylene chloride but the blanks did.

In the fourth quarter sampling Di-n-butylphthalate was detected in the method blank for all samples. Diethylphthalate was tentatively identified below the LOQ and in the method blank for 2-A-1, 2-C-1 and 2-R-4. N-Nitrosodiphenylamine was detected in the sample and the method blank at 2-A-1 and 2-R-4, and was tentatively identified below the LOQ in 2-C-1 and at the LOQ in the method blank.

4.1.2.2.3 Analytical Results Obtained under Out-of-Control Conditions

In the second quarterly sampling round, the 8270 analysis for well 2-C-1 had a 2,4,6-tribromophenol surrogate spike recovery of 150 percent which exceeded the acceptable range of 10 to 123 percent. For well 2-R-1 the p-terphenyl-d14 surrogate spike recovery was 27 percent which is below the acceptable range of 33 to 141 percent.

In the third quarterly sampling round, the 8010 analysis for well 2-R-2 had a bromochloromethane surrogate spike recovery of 141 percent and well 2-R-3 had 153 percent. Both of these exceeded the acceptable range of 70 to 130 percent. The 8270 analysis for well 2-R-4 equipment wash blank had a phenol-d5 surrogate spike recovery of 100 percent which exceeded the acceptable range of 10 to 94 percent.

In the fourth quarterly sampling round the 8010 analyses for wells 2-A-1 and 2-C-1 had bromochloromethane surrogate spike recoveries of 132 and 144 percent, which exceeded the acceptable range of 70 to 130 percent.

4.1.2.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.2.3 Significance of Findings

Fourteen surface soil samples were collected at Site 2, at locations shown in Figure 4.1.2-8. Three sediment samples were collected from each sludge pond and eight near the PWTP equipment pad. It was anticipated that the sludge ponds, where PWTP suspended solids are discharged and allowed to settle, would contain the highest concentration of contaminants because of the presence of waste sludges. The area adjacent to the PWTP was considered a splash area where fluids from the treatment process may have leaked or spilled during plant operation. Potential contaminants were expected here also, although at lesser concentrations.

Sediment

Cyanide and silver were detected in sediment samples from the sludge ponds. Mercury was detected in only two samples (2-C-1SS and its field replicate; see Figure 4.1.2-8). Cyanide was detected in 2-C-1SS to 2-C-6SS at concentrations of 18.6 to 638 mg/kg. Silver was detected in the sludge pond samples from 28.7 to 53.5 mg/kg. All metals detected were below respective DHS TTLC levels.

Dioxins and furans were also detected in one sample (2-C-6SS) randomly selected for that analysis. The only dioxin compound listed in the TTLC criteria is 2,3,7,8-tetrachlorodibenzo-p-dioxin (tetraCDD). The detected concentration of total tetraCDD isomers is 0.0017 mg/kg (1.7 ug/kg). The TTLC is 0.01 mg/kg. By the TTLC criteria, the sediment sampled is not a hazardous material.

An evaluation of toxicity equivalency was conducted to assess the approximate concentration of tetra through hepta isomer groups based on relative toxicity to 2,3,7,8 tetraCDD. The results are given in Table 4.1.2-4. Because analysis of individual dioxin and furan congeners (210 potential congeners) was not conducted, the concentration of 2,3,7,8 congeners within each isomer group was estimated. This was based on the total possible 2,3,7,8 congeners which could occur within each isomer group, assuming each congener has an equal possibility of occurring. For example, the hexaCDD isomer group has 10 congeners of which 3 are 2,3,7,8 isomers. Therefore, the detected concentration of 0.076 mg/kg (76 ug/kg), for hexaCDD is multiplied by 3/10 to obtain the estimated 2,3,7,8 congener concentration = 0.023 mg/kg (22.8 ug/kg).

Table 4.1.2-4
TOXICITY EQUIVALENCY OF DIOXIN AND FURAN ISOMER GROUPS
SEDIMENT SAMPLE 2-C-6SS - 0.0 TO 1.0 FOOT

Isomer Groups[a]	Detected[b] Concentration (ug/kg)	Estimated 2,3,7,8[c] Cogener Concentration (ug/kg)	EPA[d] TEF	CDHS[e] TEF	EPA[f] RTC (ug/kg)	CDHS[g] RTC (ug/kg)
Furan Groups						
TetraCDF	1.3	0.03	0.1	1.0	0.003	0.030
PentaCDF	11.9	0.85	0.1	1.0	0.085	0.850
HexaCDF	38	9.50	0.01	0.03	0.095	0.285
HeptaCDF	194	97.00	0.001	0.03	0.097	2.910
Total CDFs	245.2	107.38			0.280	4.075
Dioxin Groups						
Tetra CDD	1.7	0.08	1.0	1.0	0.080	0.080
PentaCDD	19	1.36	0.5	1.0	0.680	1.360
HexaCDD	76	22.80	0.04	0.03	0.921	0.684
HeptaCDD	583	291.50	0.001	0.03	0.292	8.745
Total CDDs	679.7	315.73			1.973	10.869
TOTAL CDFs AND CDDs	924.9	423.11			2.253	14.944

[a]Isomer groups analyzed. OctaCDD and OctaCDF were detected but are not part of toxicity equivalency evaluation.

[b]Concentration of dioxin and furan groups detected. Actual concentrations may be higher based on low spike recovery data.

[c]Estimated concentration of 2,3,7,8 cogeners based upon possible number of 2,3,7,8 isomers within each isomer group.

[d]U.S. EPA Toxicity Equivalency Factor.

[e]California Department of Health Services Toxicity Equivalency Factor.

[f]U.S. EPA Relative Toxicity Concentration (Estimated 2,3,7,8 Cogener Concentration x EPA TEF).

[g]California Department of Health Services Relative Toxicity Concentration (Estimated 2,3,7,8 Cogener Concentration x CDHS TEF).

Information in this Table derived from, "Chlorinated Dibenzo-P-Dioxin and Dibenzofuran Contamination in California from Chlorophenol Wood Preservative Use." Report No. 88-5WQ Division of Water Quality, State Water Resources Control Board, March 1988.

The toxicity equivalency analysis was completed using both EPA and California DHS Toxicity Equivalency Factors (TEF). The total relative toxicity concentration (RTC) by the EPA method equals 0.002 mg/kg (2.253 ug/kg) for both dioxins and furans. The DHS method yields a relative toxicity concentration of 0.015 mg/kg (14.944 ug/kg) that is over seven times higher than the EPA method.

Caution should be used when applying the RTC results to decision making processes. The RTC results vary widely depending on assumptions made and methods used in the calculation.

Surface Soil

Cyanide and silver were detected in surface soil samples from the splash area adjacent to the PWTP. Cyanide was detected at concentrations of 2.6 to 48.7 mg/kg in all splash area samples. Silver was detected in the splash area samples from 4.8 to 11.6 mg/kg in four of the eight samples and not detected in the remaining four. The TTLC for silver is 500 mg/kg. By these criteria, none of the surface samples collected and analyzed represent hazardous waste.

Soil Borings

Barium, cadmium, copper, silver, and vanadium concentrations in the soil samples from the angled borings beneath the sludge ponds (see Figure 4.1.2-11 for schematic) compare closely with those detected in samples from the Site 2 background soil boring (cadmium and silver not detected in any borings), indicating that metals are probably not leaching into the soil from the sludge ponds. The absence of silver in these samples indicates that, though present in the photo waste stream and in surface samples from the sludge ponds, is probably not migrating through the soil.

TFH-gas was detected in soil samples from two borings at unrelated locations, as shown in Figure 4.1.2-9. The 40- and 50-foot samples from 2-C-1SB, near abandoned Injection Well No. 1, had TFH-gas concentrations of 240 and 170 mg/kg. TFH-gas was detected in the 30-foot sample from 2-C-2SB at 60 mg/kg.

The ICP metal scan on soil samples from Site 2 generally detected metals at similar concentrations to those in background soil samples on base. However, thallium was more widespread in Site 2 samples than at other sites, although it occurred at concentrations similar to those in background borings on base. The thallium results were probably due to interference problems with the ICP analysis. Lead was detected in the 30-foot sample from 2-C-2SB at 29.4 mg/kg. Lead at this level in an isolated location may be naturally occurring, or a false positive, with no relation to the

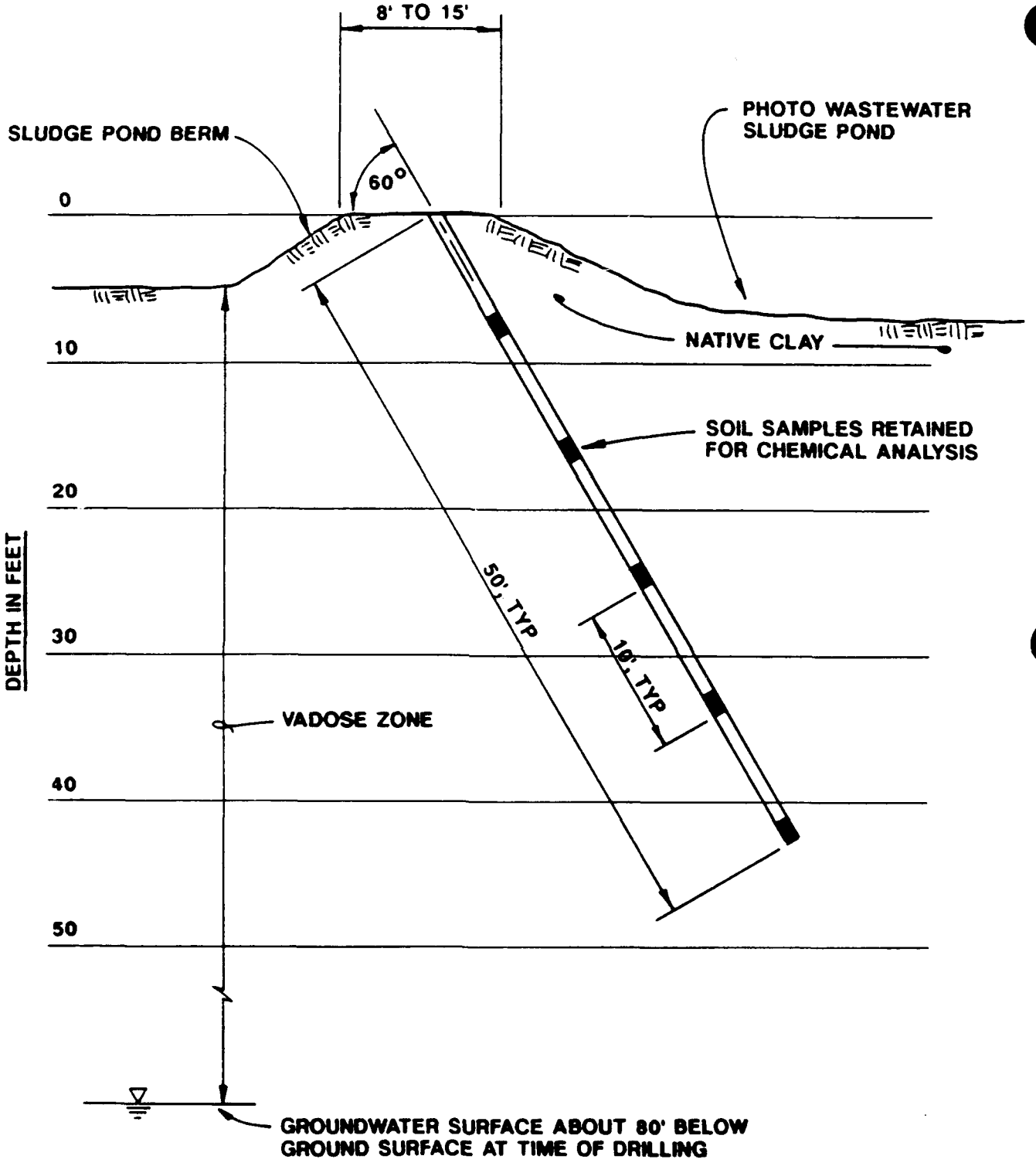


FIGURE 4.1.2-11
SCHEMATIC SECTION
ANGLED BOREHOLE FOR SLUDGE POND
SITE 2: PHOTO WASTEWATER TREATMENT PLANT

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photo waste stream. Lead was only detected in 1 of 31 background samples and that was 24.2 mg/kg from the 0- to 1.5-foot surface sample at the background boring at Site 3, the Fire Protection Training Area, where the lead in the background boring could be related to training activities at the site. Therefore, any reported detection could represent either contamination, natural variability or native materials, or a false positive result. The TTLC for lead is 1,000 mg/kg.

Separate analyses for mercury and cyanide were also performed on all soil samples from Site 2. Mercury was not detected in samples from any borings. Cyanide was detected in six samples from five borings at concentrations from 0.13 to 4.5 mg/kg, as illustrated in Figure 4.1.2-9. In 2-C-3SB and 2-C-4SB, near abandoned Injection Well No. 2, cyanide was detected in samples from 5, 10, and 25 feet at concentrations of 3.1, 0.16, and 0.13 mg/kg. Cyanide was detected at 4.5 mg/kg in the 10-foot sample from 2-C-2SB, near abandoned Injection Well No. 3. Cyanide was also detected in the 20-foot sample from 2-C-1SB, near abandoned Injection Well No. 1, at 2.0 mg/kg. The 27.5-foot sample (actual vertical depth equals 23.8 feet) from 2-C-6SB, beneath the western sludge pond, had a 0.13 mg/kg cyanide concentration at the LOQ. A TTLC for cyanide is not available.

All soil samples from Site 2 were analyzed for volatile organic compounds. TCE was detected in samples from 15-, 25-, and 26.5-foot depths in boring 2-C-4SB, near abandoned Injection Well No. 2, at 0.018, 0.033, and 0.006 mg/kg concentrations. The 26.5 foot sample is a field replicate of the 25-foot sample. The detection limit for TCE in these analyses was 0.006 mg/kg. The TTLC for TCE in soil is 2,040 mg/kg. By this criteria, the TCE concentrations detected at Site 2 do not constitute a hazardous waste.

Toluene was detected in samples from all borings. The 2-C-6SB 8.5-foot sample (actual vertical depth equals 7.4 feet) had toluene at 0.82 mg/kg, which was the highest detected toluene concentration at Site 2. It is possible that this represents an environmental impact, but at the concentrations observed, this cannot be confirmed. It is also possible that the toluene represents a false positive. The LUFT cleanup standard computed for samples containing toluene at Site 2 is 0.3 mg/kg.

Groundwater

Groundwater samples were collected and analyzed for four quarterly sampling rounds from five existing and one new monitoring well at Site 2 during the Stage 2-1 study. TCE was detected at 2 ug/l in the first round in both a normal environmental sample and a field replicate from 2-C-1, but was not detected in 2-C-1 or any other wells in the second,

third, and fourth rounds. This monitoring well is near abandoned Injection Well No. 2 and soil boring 2-C-4SB. The state drinking water standard MCL for TCE is 5 ug/l. Phenol was estimated to be 7 ug/l in well 2-R-1 below the 10 ug/l LOQ in the first quarter, at 14 ug/l in the second quarter, and at 22 ug/l in the third quarter, but was not detected in the fourth quarterly sampling. Cyanide was detected in 2-R-4 at 0.0300 mg/l in the first quarter, at 0.0200 mg/l in the second quarter, and was not detected in the third or fourth quarters. Cyanide was detected in 2-A-1 at 0.0200 mg/l in the first quarter, at 0.0400 mg/l in the second quarter, and 0.0200 mg/l again in the third quarter. Cyanide was detected in 2-R-2 at the 0.0100 mg/l LOQ in the second quarter. Cyanide was not detected in any fourth quarter samples.

4.1.2.3.1 Zones of Contamination

The soil contamination zones within the areas investigated during Stage 2-1 at Site 2 are the sludge ponds, the area adjacent to the PWTP, and soil near abandoned Injection Well No. 2.

Surface samples from the sludge ponds contained silver at concentrations above background levels but below TTLCs. Silver was not detected in any of the soil samples from the angled soil boring beneath each sludge pond, although chromium, iron, magnesium, vanadium, and zinc were detected at levels between four and five standard deviations above averaged levels for the metals from background soil borings on base. All detected metals were at concentrations below TTLCs.

Although soil borings were not drilled in the PWTP equipment pad area, analyte concentrations from surface samples in this area were generally less than those from sediment samples in the sludge ponds. The lack of similar analytes in samples from the angled borings at the sludge ponds indicates that metals or other compounds characteristic of photo waste probably have not migrated beyond the surficial soil.

PCP, though previously included in the waste stream as an antislime agent (Beale AFB, 1989), was not detected in any sediment or surface samples. Based on information from a sanitary treatment plant worker (Guerro, 1989) and system operation records (AeroVironment, Inc. 1987), an estimated maximum of 0.5 to 1 gallon of PCP per month was discharged onto the ground surface at each abandoned injection well head. The PCP was mixed with the 500 to 2,000 gallons of effluent discharged monthly at the well heads during the 18 years of this operation.

Although PCP was detected in one soil sample at abandoned Injection Well No. 2 in the Phase II, Stage 1 study, PCP was not detected in either boring near the abandoned injection

well in the Stage 2-1 study. The soil in areas adjacent to abandoned Injection Wells No. 1 and 3, based on soil sampled during the Stage 2-1 study, also show no signs of PCP contamination. PCP rapidly degrades with exposure to ultraviolet light and would not be expected to persist in the open environment (EPA, 1986). In water PCP is photochemically reduced to isometric tri- and tetrachlorophenols (EPA, 1986), although no evidence of these compounds were found. PCP also biodegrades due to microbial action. These unsubstantiated phenomena may have acted on PCP in effluent water when it was discharged onto the ground surface, or acted on PCP in the soil. Since no characteristic PCP breakdown compounds were detected, it is concluded that PCP and related compounds either do not currently exist at the abandoned injection well heads or the sampling locations missed localized PCP tainted soil.

Soil in one of two borings (2-C-4SB) near monitoring well 2-C-1 and abandoned Injection Well No. 2 contained TCE to the total depth sampled of 28 feet. The vertical extent of TCE could not be determined because TCE was detected in the deepest soil sample, albeit the TCE concentration at the 28-foot sample depth (56 feet NGVD) was the lowest in the boring. The source of this TCE is not known. No records of TCE in the photo wastewater were found.

In groundwater, phenol was detected in the first three sample rounds at well 2-R-1. Cyanide was detected in the first two of three rounds at well 2-R-4, in the first three rounds at 2-A-1, but only in the second round at well 2-R-2. Cyanide was not detected in the fourth round. These chemicals may represent an environmental impact at these locations. The extent of impact is unknown.

4.1.2.3.2 Contaminant Migration

Metals characteristic of the photo wastewater detected in the surface samples at the sludge ponds, surface samples from near the PWTP, and soil samples from borings at abandoned Injection Wells No. 1 and 3 are apparently not migrating, based on information collected during the Phase II, Stage 1 and Stage 2-1 studies. Metals detected in the sediment samples from the sludge ponds were not detected in the soil borings beneath the ponds. Evidence of migration of metals through the clay deposits at Site 2 was not detected in the Stage 2-1 study. Such migration of metals is not expected at Site 2.

TCE detected in the soil boring 2-C-4SB near abandoned Injection Well No. 2 may be migrating towards the groundwater. TCE was detected at well 2-C-1 in the first but not in later sampling rounds. TCE in the soil cannot be concluded to be the sole source of the TCE in the groundwater. TCE has been detected in soil and groundwater samples from Site 13 (soil

boring 13-C-2SB and all monitoring wells), at locations both cross-and downgradient from well 2-C-1 and boring 2-C-4SB (see Figure 4.1.13-1).

Hutchinson Creek is perched above the water table and is probably a losing stream. Therefore, water percolating through the soil would probably not flow into the creek, but vertically towards the groundwater table. Therefore contaminants in the soil at Site 2 probably will not be transported into the creek unless carried by surface runoff.

4.1.2.3.2.1 Potential to Move Off Site and Off Base

The potential for compounds in the soil to move either off the site or off the base is considered low unless these migrate to the groundwater.

The potential for TCE and cyanide detected in the groundwater to move off site and off base is considered high.

4.1.2.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Linear groundwater velocity can be roughly estimated using the equation $v = Ki/n$, where v = average linear groundwater velocity, K = hydraulic conductivity, i = groundwater gradient, and n = effective porosity. The hydraulic conductivity was estimated in the 72-hour test at well 19-C-4 to be about 28 feet per day. The regional groundwater gradient (i) in the vicinity of Site 2, taken from Plate 3, March 1989, Groundwater Elevations at Beale AFB, is about i = 0.007 foot per foot. The estimated effective porosity (n) for permeable sediments, through which groundwater will flow preferentially, is 20 percent (0.20). Using these values gives:

$$v = Ki/n = (28 \text{ ft/day} \times 0.007/0.20) = 0.98 \text{ ft/day},$$

or for a yearly value:

$$0.98 \text{ ft/day} \times 365 \text{ days/yr} = 360 \text{ ft/yr}$$

The direction of flow is generally to the northwest.

4.1.2.3.2.3 Time of Travel to Receptors

The nearest potential downgradient receptor is the off-base residence approximately 3,000 feet northwest of Site 2. Using only the average linear groundwater velocity, the estimated travel time for groundwater from Site 2 to the residence is approximately 8 years. However, many factors affect contaminant transport in groundwater, and most of these factors are not well defined in this project. Some of these factors act to shorten and some to lengthen the travel time of a contaminant in groundwater. This estimate does

not include any of the possible effects of dispersion, diffusion, adsorption, or chemical changes in the subsurface. A well at the residence has been sampled during the third and fourth sampling rounds. This sampling effort is presented in Section 4.1.13 with the Site 13 discussion.

4.1.2.3.2.4 Applicability of Solute Transport Models

Solute transport models may not be applicable at Site 2. Available data are not sufficient to support model assumptions or estimate unknown factors.

4.1.2.3.2.5 Expected Spatial and Temporal Variations in Concentration

Based on the irregular detections of TCE and cyanide in groundwater at Site 2, accurate estimates of spatial and temporal variations cannot be made.

4.1.2.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.3 ISCUSSION OF RESULTS FOR SITE 3: FIRE PROTECTION TRAINI AREAS

Training exercises have been conducted at Site 3 (Figure 4.1.3-1) in FPTA No. 1 and FPTA No. 2 since 1958. From 1958 to 1971, the fire department conducted live fire training exercises at FPTA No. 1. During this period, combustible waste chemicals were accumulated in a shallow 2-foot-deep basin. These chemicals were reported to have included waste oils, spent solvents, and aviation fuel. These chemicals were burned weekly in the basin as part of fire training exercises. No volume estimate of chemicals used for exercises was available. The basin area did not have a liner, nor was there any preapplication of water to prevent the percolation of waste chemicals into the soil. The materials were applied directly to the soil and ignited (Engineering-Science, 1984). The Phase II Stage 1 investigation did not locate FPTA No. 1. FPTA No. 1, which is no longer visible to someone walking on the site, was located by inspecting aerial photographs (1973 and 1987) from the base civil engineering department. The aerial photographs were not of high enough quality to reproduce for this report.

FPTA No. 2, located about 200 feet northwest of FPTA No. 1, began operating in 1972 when use of FPTA No. 1 was discontinued. FPTA No. 2 consists of a shallow unlined basin 150 feet in diameter surrounded by a 12-inch berm. Inside the basin is a mock-up aircraft used for fire training exercises. Fire training exercises involve simulated fires in and around the mock aircraft. The unlined basin is flooded with water before exercises. The native clay surface soil allows the water to pond, minimizing infiltration. During and after exercises, the contaminated jet fuel used for fire training floats on the water ponded in the mock-up basin. About 100 feet south of the mock-up is an unlined overflow basin designed to hold liquid drained from FPTA No. 2. Residual water and fuel are left in the overflow basin to evaporate.

Two 25,000-gallon underground storage tanks are located at Site 3. They are designated as the north tank and the south tank. The north tank contains jet fuel used by the base fire department for live fire training in the adjacent fire pit. The south tank has traditionally contained contaminated fuel, hydraulic fluid, and waste solvents. Underground fuel lines run from the tanks to the fuel nozzles at the mock-up in the fire pit.

Ten soil borings were drilled and sampled at Site 3: one vertical background boring, four vertical borings in the FPTA No. 1 area, two angled borings under FPTA No. 2, one

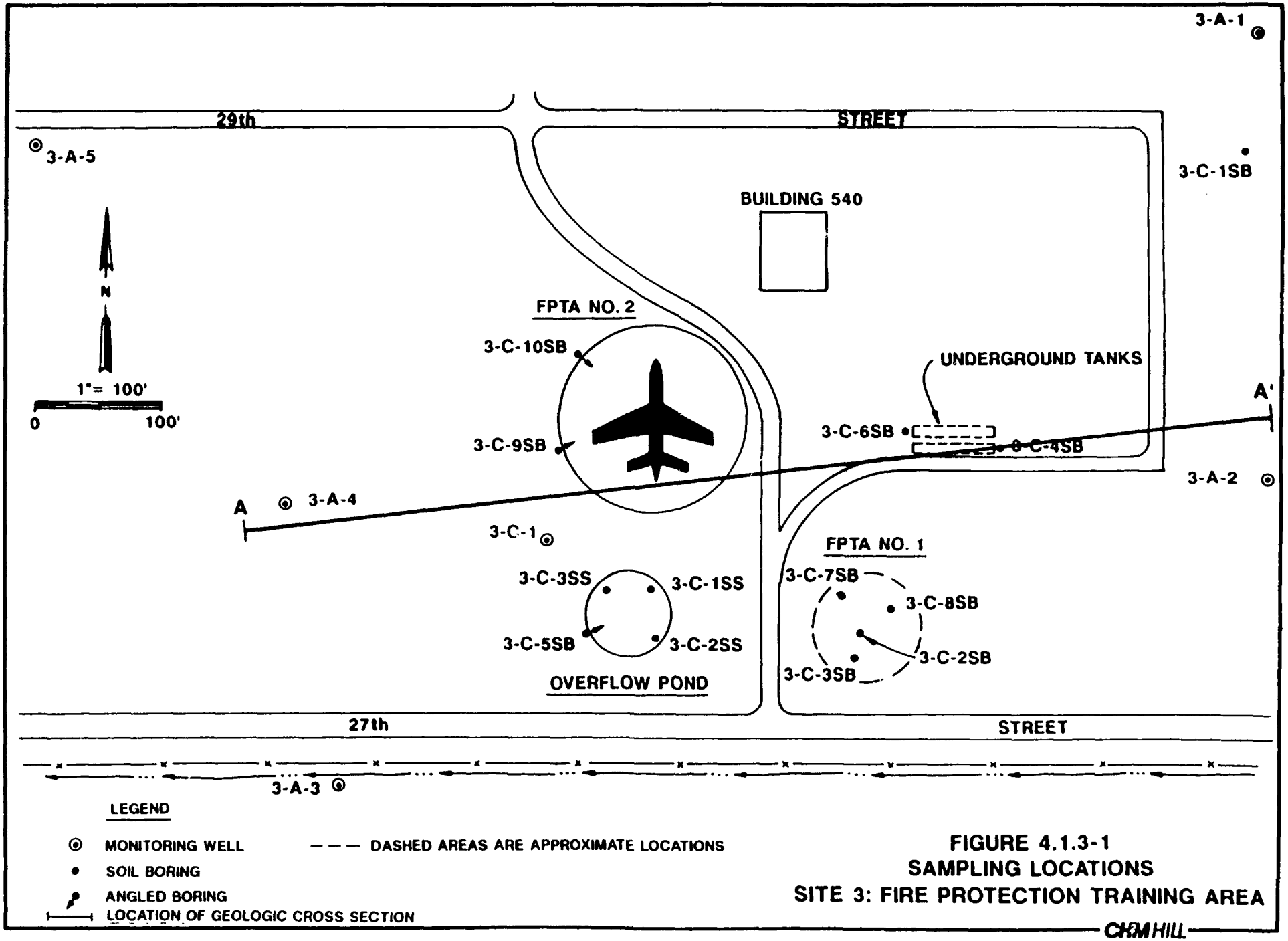


FIGURE 4.1.3-1
SAMPLING LOCATIONS
SITE 3: FIRE PROTECTION TRAINING AREA

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angled boring under the overflow basin, and two vertical borings near the underground tanks. Soil contamination was detected in samples from all borings except the background.

Three surface soil samples were collected from the overflow basin, and contaminants were detected in these samples also.

One new monitoring well was constructed during Stage 2-1. This and five existing wells were sampled during two semi-annual sampling rounds. No contamination has been detected in any of the wells.

4.1.3.1 Presentation of Results

The following section presents the results of the field investigation at Site 3. The discussion focuses on the geology and hydrogeology at the site and presents the results of chemical analyses performed on samples of groundwater, surface water, and soils.

4.1.3.1.1 Site Geology

Evaluation of the geology at Site 3 is based on boreholes and wells drilled during the Stage 2-1 investigation and on wells installed during the Phase II, Stage 1 investigation (AeroVironment, 1987). During the current investigation, 10 soil borings were drilled at Site 3: one vertical background boring drilled to a total depth of 51.5 feet, four vertical borings in the FPTA No. 1 area drilled to total depths of 21.5 feet, two angled borings under FPTA No. 2 drilled to total depths of 49 feet (42 feet vertically), one angled boring under the overflow basin drilled 48.5 feet deep (42 feet vertically), and two vertical borings near the underground tanks drilled to total depths of 51.5 feet. In addition, one monitoring well was drilled between the FPTA and the overflow pond to a depth of 140 feet BGS (-34 feet NGVD). During the Phase II, Stage 1 investigation, five monitoring wells had been constructed at Site 3 and screened at or near the water table. The location of these wells and boreholes is shown in Figure 4.1.3-1. Soil boring logs are provided in Appendix D.

A cross section constructed from selected soil boring logs of Site 3 wells and boreholes is shown in Figure 4.1.3-2. A schematic of soil types encountered in shallow soil borings is presented in Figure 4.1.3-3. These figures show that near-surface soil in the vicinity of Site 3 is predominantly fine-grained, becoming increasingly coarse-grained with depth. The log of well 3-A-5 shows sand through almost the entire interval. The sand lies mainly below about 40-45 feet in depth (65-70 feet NGVD) on the eastern sides of the site, and below about about 50 feet in depth (50 feet

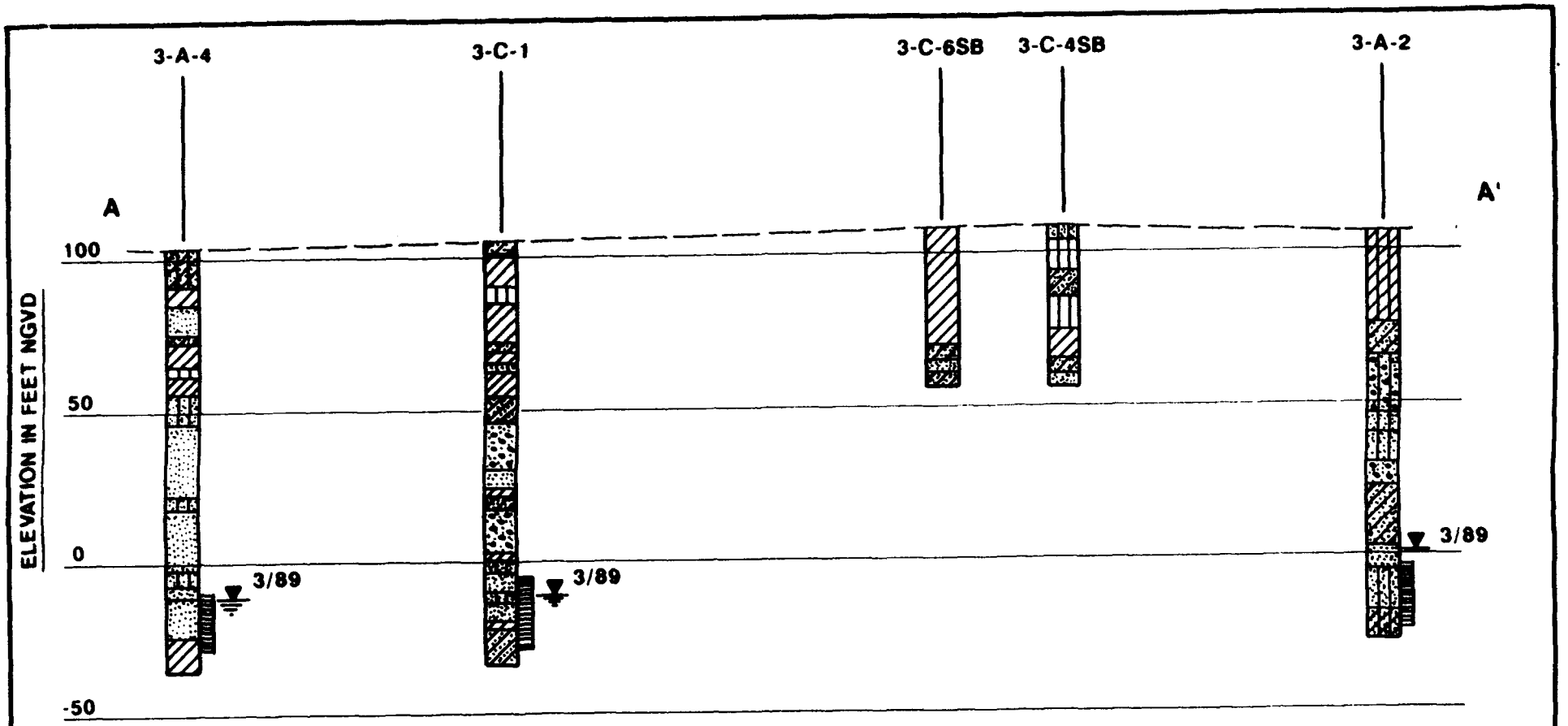


FIGURE 4.1.3-2
GEOLOGIC CROSS SECTION
SITE 3: FIRE PROTECTION TRAINING AREA

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NGVD) on the south and west side of the site. All of the wells are screened in the sand units in unconfined groundwater. The bottom of each screen terminates in clay, which appears to form the basal boundary of the coarse-grained deposits.

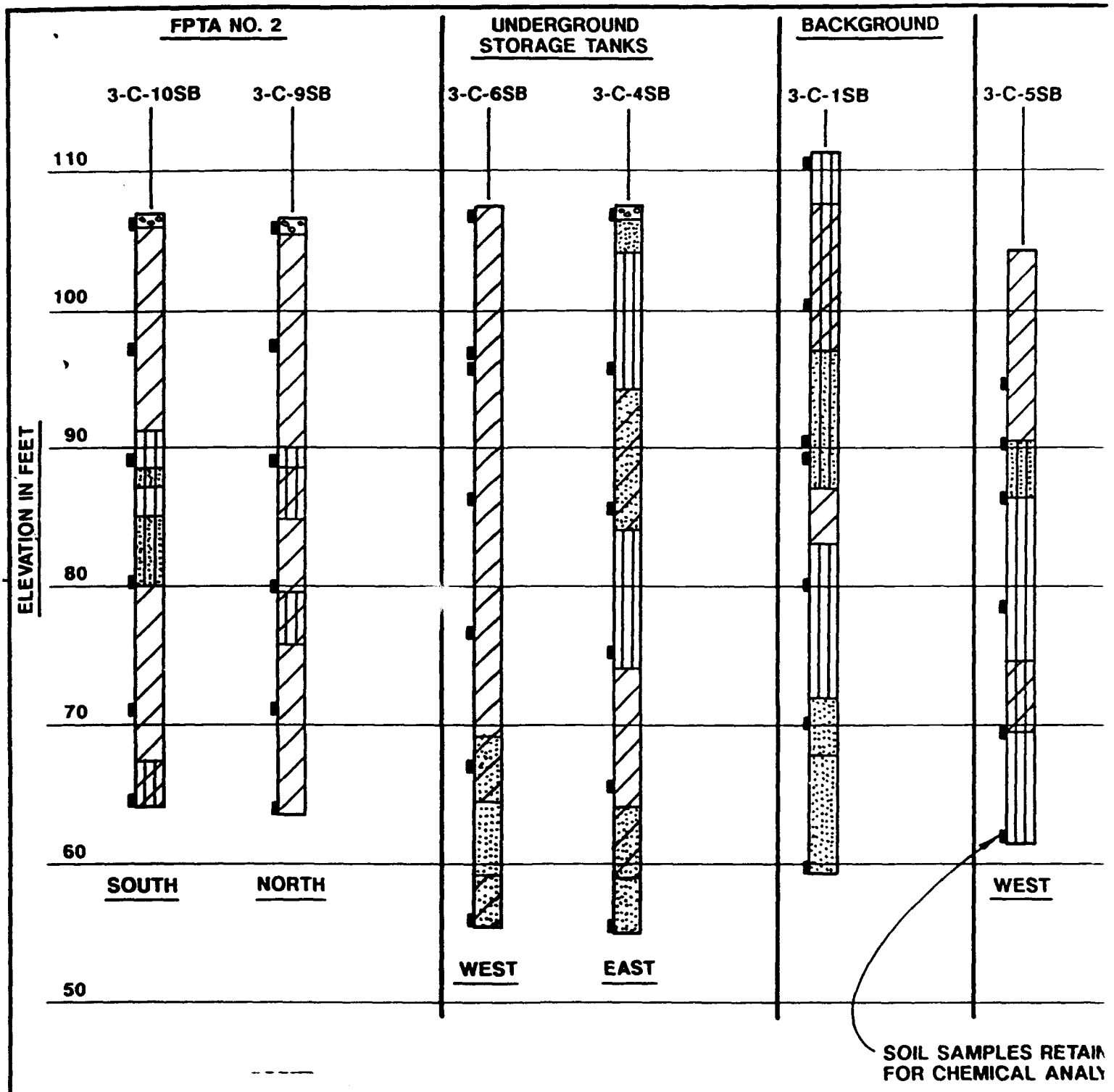
This clay lies at about 117 feet in depth (-5 feet NGVD) in well 3-A-1. The log suggests that the clay may be decomposed bedrock. The clay was encountered at about 122 feet in depth (-16 feet NGVD) in well 3-A-2. It lies deeper to the west, from about 124 feet in depth (-18 feet NGVD) in well 3-C-1 to about 142 feet in depth (-39 feet NGVD) in well 3-A-4.

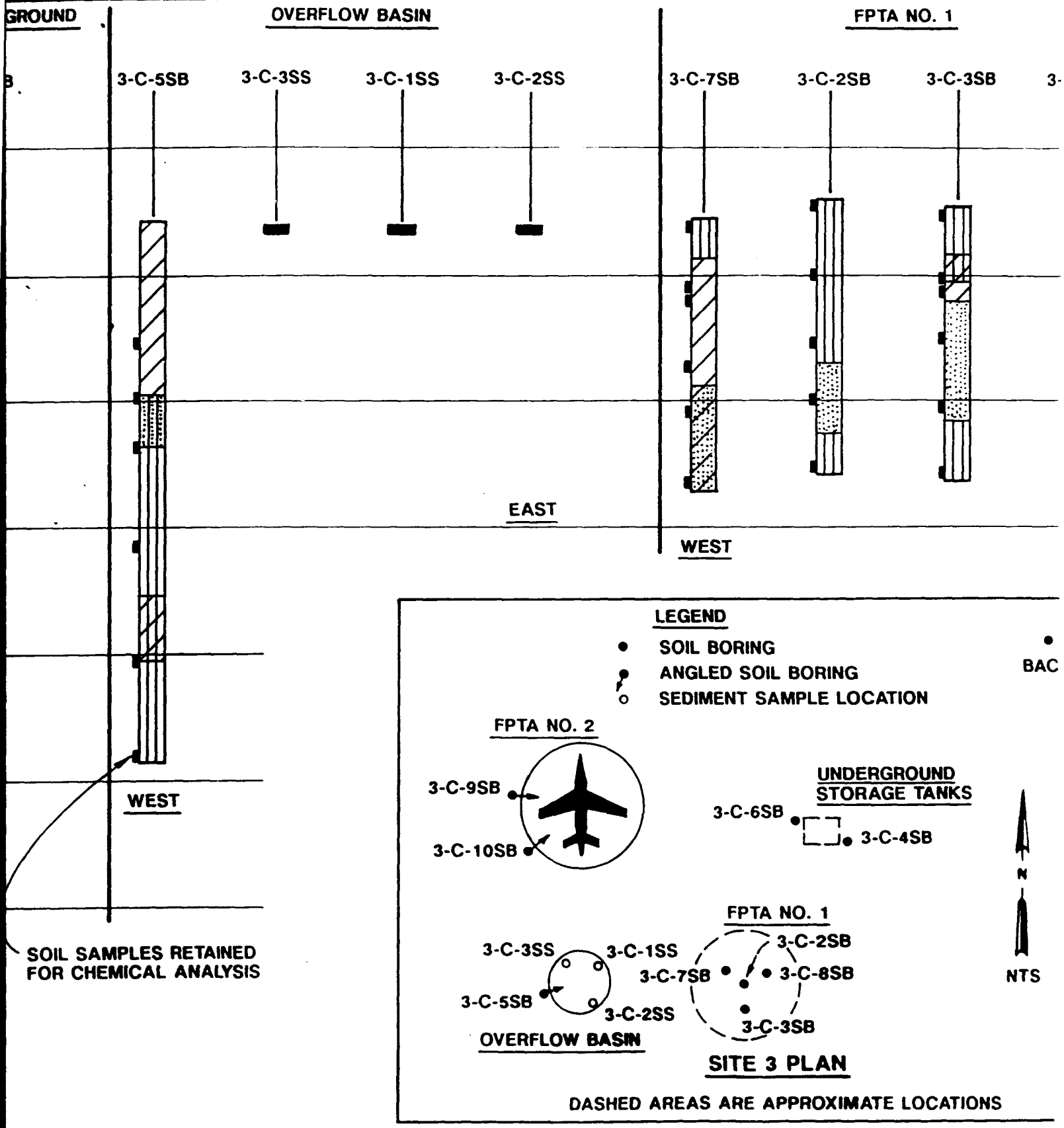
Near-surface deposits at Site 3 constitute an alluvial sequence that has been mapped as belonging to the Laguna Formation (Page, 1980). These are continental alluvial deposits of the Pleistocene and Pliocene Epochs composed of silt, sand, clay, and gravel. These deposits overlie the older volcanic rocks from the Sierra Nevada in the stratigraphic section at Beale AFB. The volcanic rocks outcrop about 1 mile east of Site 3 in the foothills (Page, 1980). Based on the colors described in the logs of the boreholes, no volcanic material was encountered at Site 3 with the possible exception of the basal clay. This clay may be the weathered product of the volcanic sediments.

4.1.3.1.2 Site Hydrogeology

The first saturated permeable zone in well 3-C-1 occurred at about 119 feet in depth (-13 feet NGVD) as the bit entered a coarse sand unit. After completion and development of this well, the water level stabilized at about 118 feet in depth (-12 feet NGVD). It is likely that the groundwater is unconfined in the coarse, poorly graded sand and the silty sands that overlie the coarse sand. The sands are underlain by a fat clay at about 124 feet BGS (-18 feet NGVD). Groundwater appears to be unconfined in all of the wells installed during the Phase II, Stage 1 investigation.

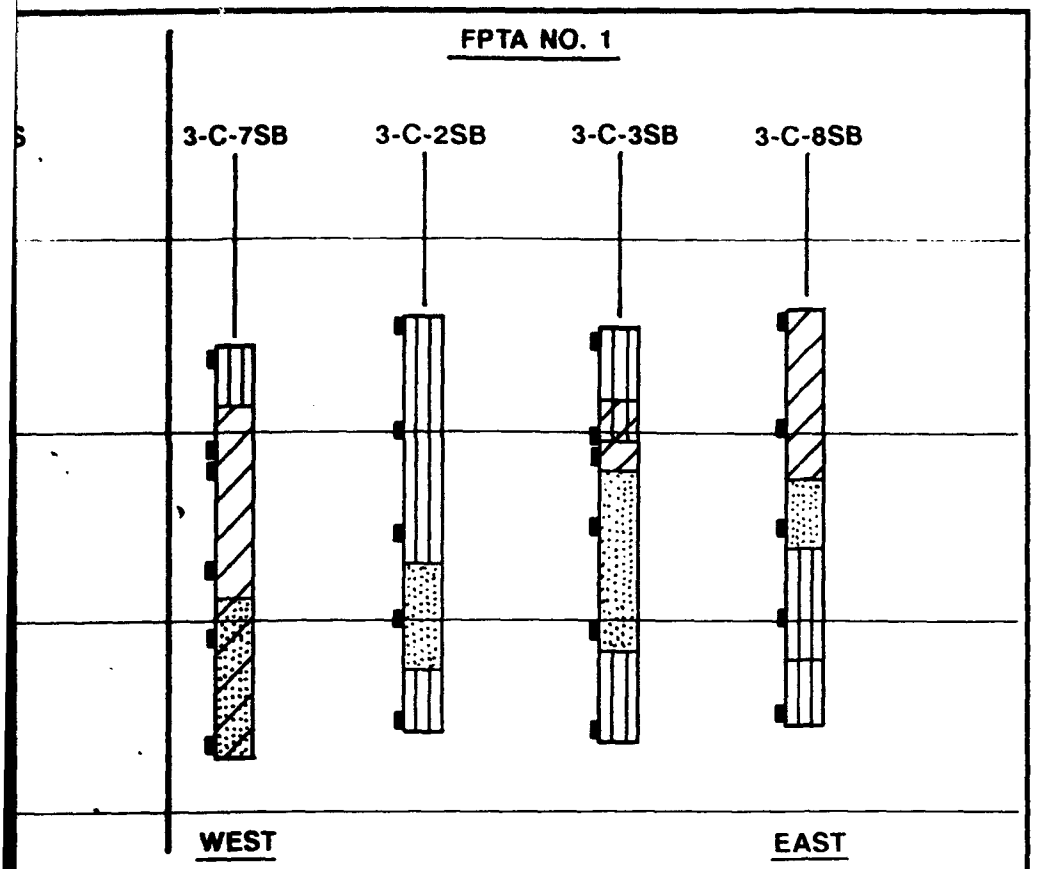
Groundwater levels in Site 3 monitoring wells between April 1986 and November 1989 together with screened intervals are summarized in Figures 4.1.3-4 and 4.1.3-5, and Table 4.1.3-1. This table shows that there has been a large rise in groundwater levels in wells 3-A-3, 3-A-4, and 3-A-5 on the western side of the site. In well 3-A-5 between April 1986 and November 1989, for example, the groundwater level rose over 14 feet. The groundwater level in well 3-A-4 rose


FPTA NO. 2
UNDERGROUND STORAGE TANKS
BACKGROUND
3-C-10SB
3-C-9SB
3-C-6SB
3-C-4SB
3-C-1SB
3-C-5SB
110
100
90
80
70
60
50
ELEVATION IN FEET
SOUTH
NORTH
WEST
EAST
WEST
SOIL SAMPLES RETAIN
FOR CHEMICAL ANALY
CLAY
SILT
SAND
GRAVEL
SCALE: HORIZ - NOT
1"= 10' VERT



SCALE: HORIZ - NOT TO SCALE
1"= 10' VERT

FIGURE 4.1.3-3
SOIL PROFILE
SITE 3: FIRE PROTECTION TRAIN



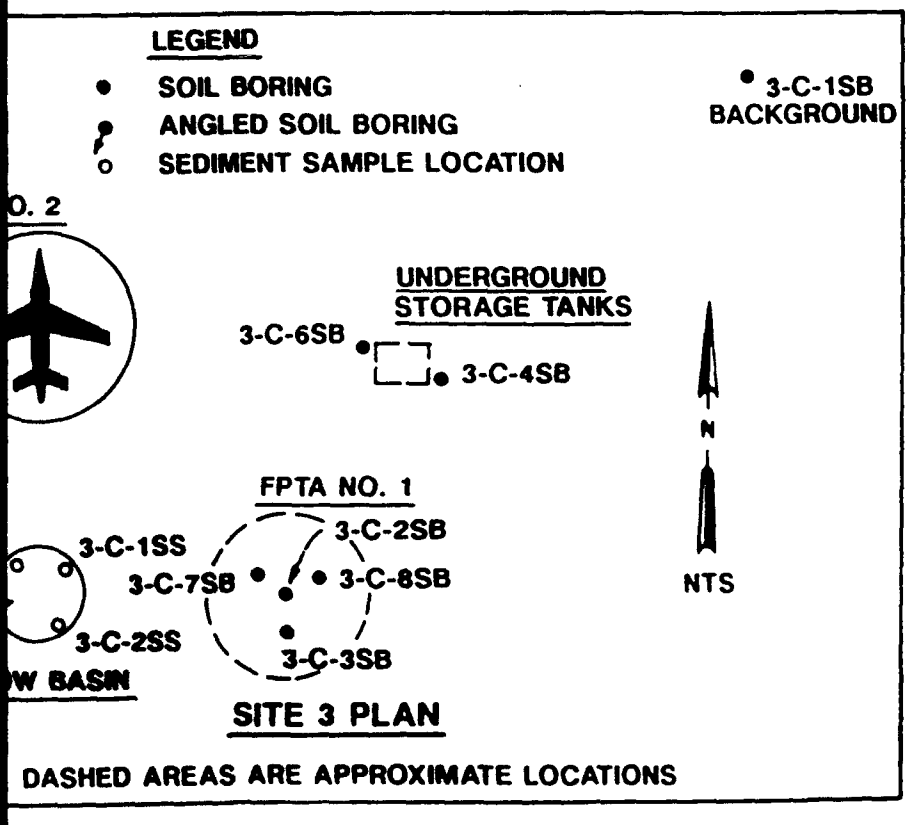
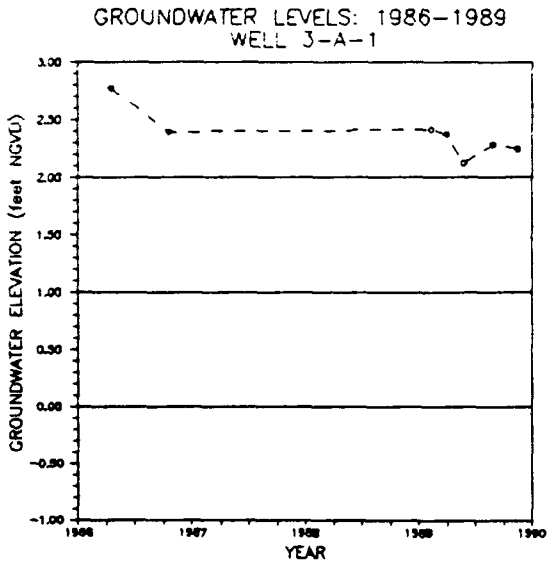
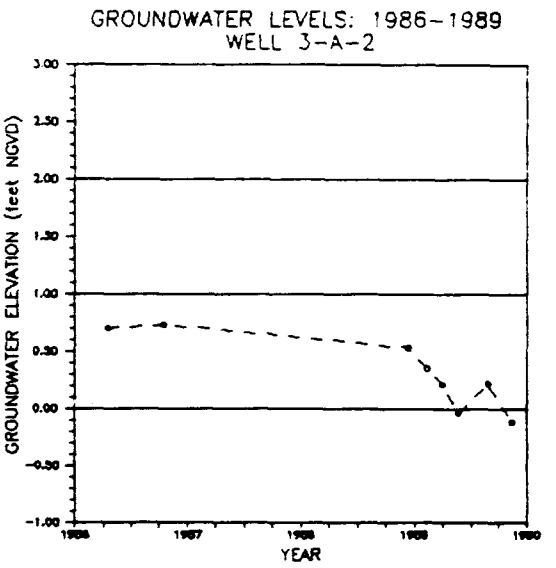


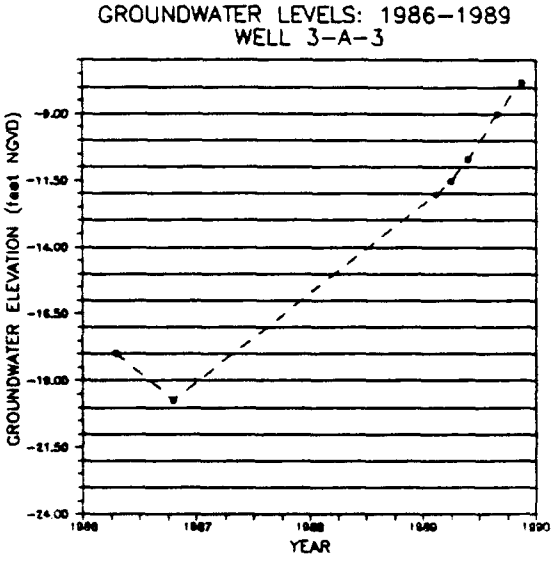
FIGURE 4.1.3-3
SOIL PROFILE
SITE 3: FIRE PROTECTION TRAINING AREA

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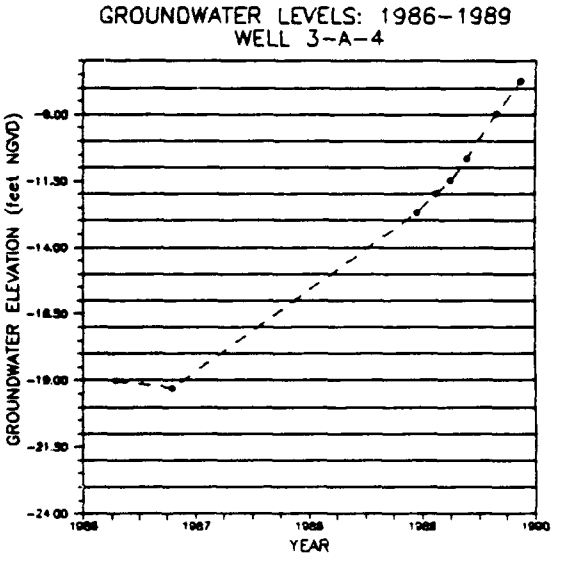
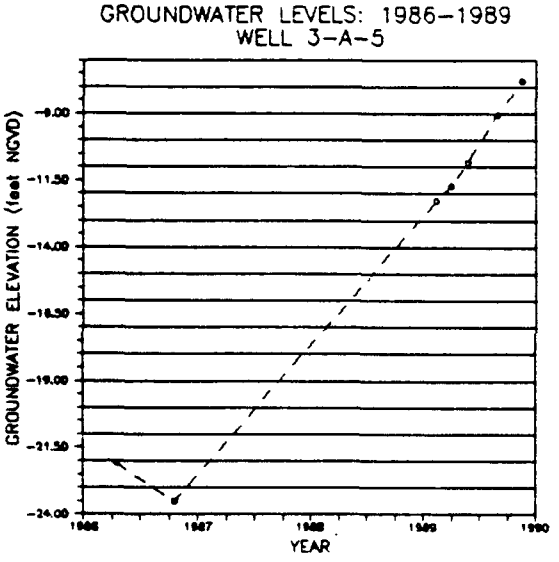
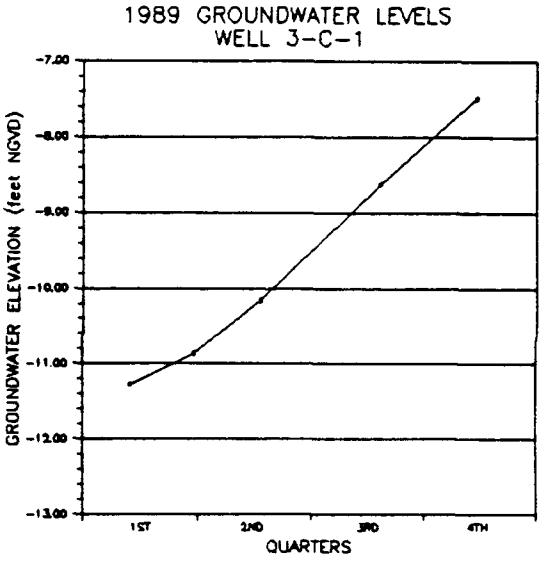


FIGURE 4.1.3-4

MONITORING WELL HYDROGRAPH
SITE 3: FIRE PROTECTION TRAINING AREA

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NOTE: VARYING TIME SCALES

FIGURE 4.1.3-5
MONITORING WELL HYDROGRAPH
SITE 3: FIRE PROTECTION TRAINING AREA

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Table 4.1.3-1
GROUNDWATER ELEVATIONS: SITE 3
(FEET NGVD)

Well	Screened Interval	April 1986	October 1986	January 1989	March 1989	May 1989	August 1989	November 1989
3-A-1	10 to -10	2.77	2.39	2.68	2.37	2.12	2.28	2.24
3-A-2	-3 to -23	0.70	0.73	0.61	0.21	-0.04	0.22	-0.12
3-A-3	-14 to -34	-17.97	-19.73	-12.15	-11.53	-10.71	-9.02	-7.82
3-A-4	-7 to -27	-18.91	-19.30	-12.13	-11.48	-10.66	-8.95	-7.73
3-A-5	-10 to -30	-22.08	-23.51	-12.24	-11.71	-10.83	-9.05	-7.79
3-C-1	-4 to -24	--	--	-12.41	-10.86	-9.95	-8.63	-7.49

over 11 feet, while the level in well 3-A-3 rose over 10 feet. Groundwater levels in wells 3-A-1 and 3-A-2 actually declined less than a foot between 1986 and 1989. The pattern in these wells is typical of wells constructed on the east side of Beale AFB.

Groundwater levels from Site 3 monitoring wells in March 1989 are plotted on Figure 4.1.3-6. Plate 3 plots groundwater level contours based on elevations measured in March 1989 at Beale AFB, while Figure 4.1.3-7 plots similar data for May 1989 in the north area of Beale AFB. These figures show that in the vicinity of Site 3, groundwater is flowing to the southwest.

The groundwater level figures also show that the horizontal gradient increases sharply to the east of Site 3, across the geologic boundary between unconsolidated alluvium in the Central Valley and consolidated rocks in the foothills of the Sierra Nevada. According to Figure 4.1.3-6, the hydraulic gradient increases at Site 3 from about 0.003 on the west side of Site 3 to about 0.02 on the east side. The horizontal gradient west of Site 3 may not be accurately estimated because of the lack of data points.

The increase in hydraulic gradient and the difference in groundwater hydrographs suggests that two hydrogeologic regimes are present at Site 3. Wells on the west side of the site are completed in unconsolidated alluvium typical of the Central Valley. The rise of water levels in these wells

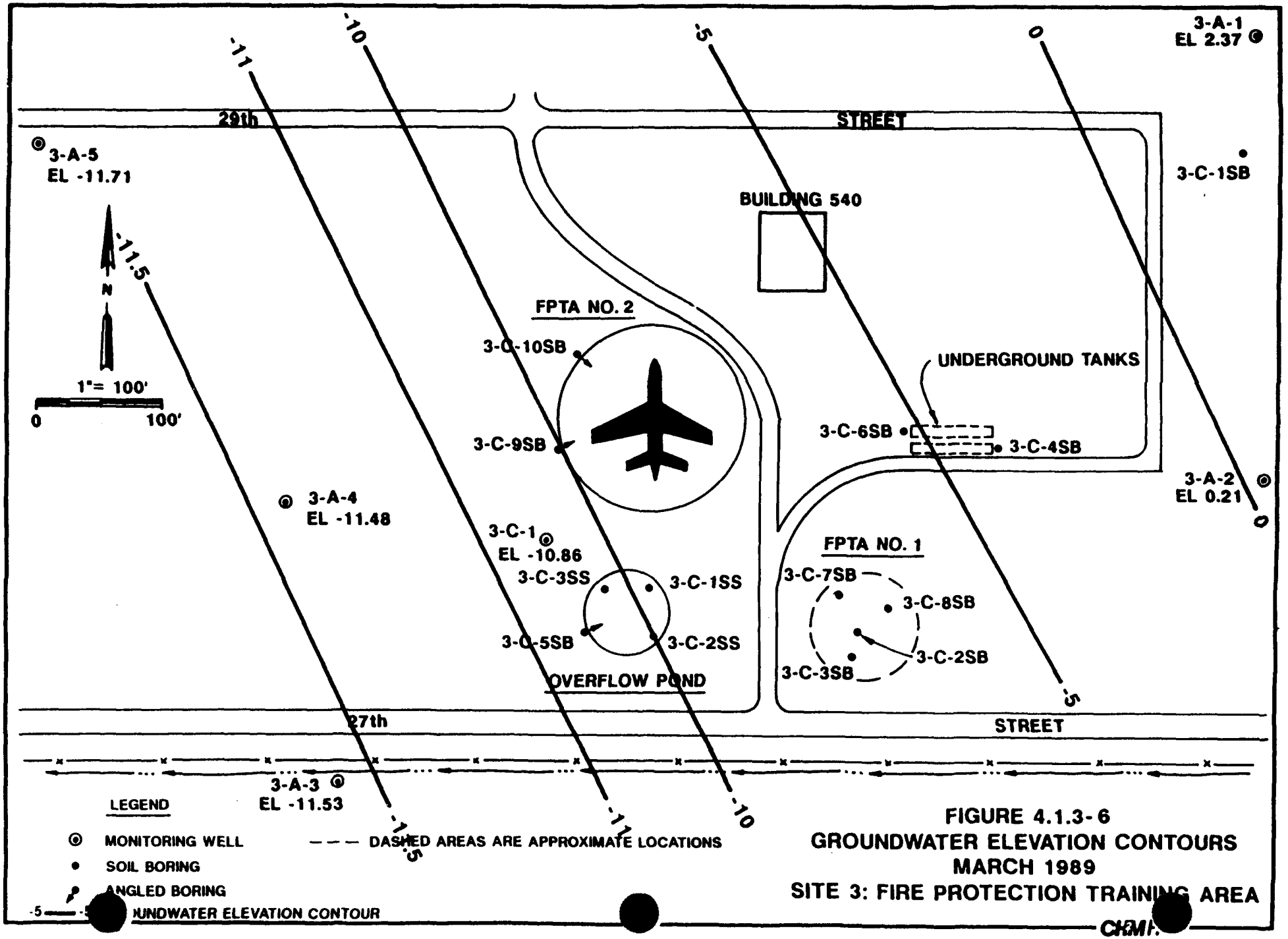


FIGURE 4.1.3-6
GROUNDWATER ELEVATION CONTOURS
MARCH 1989
SITE 3: FIRE PROTECTION TRAINING AREA

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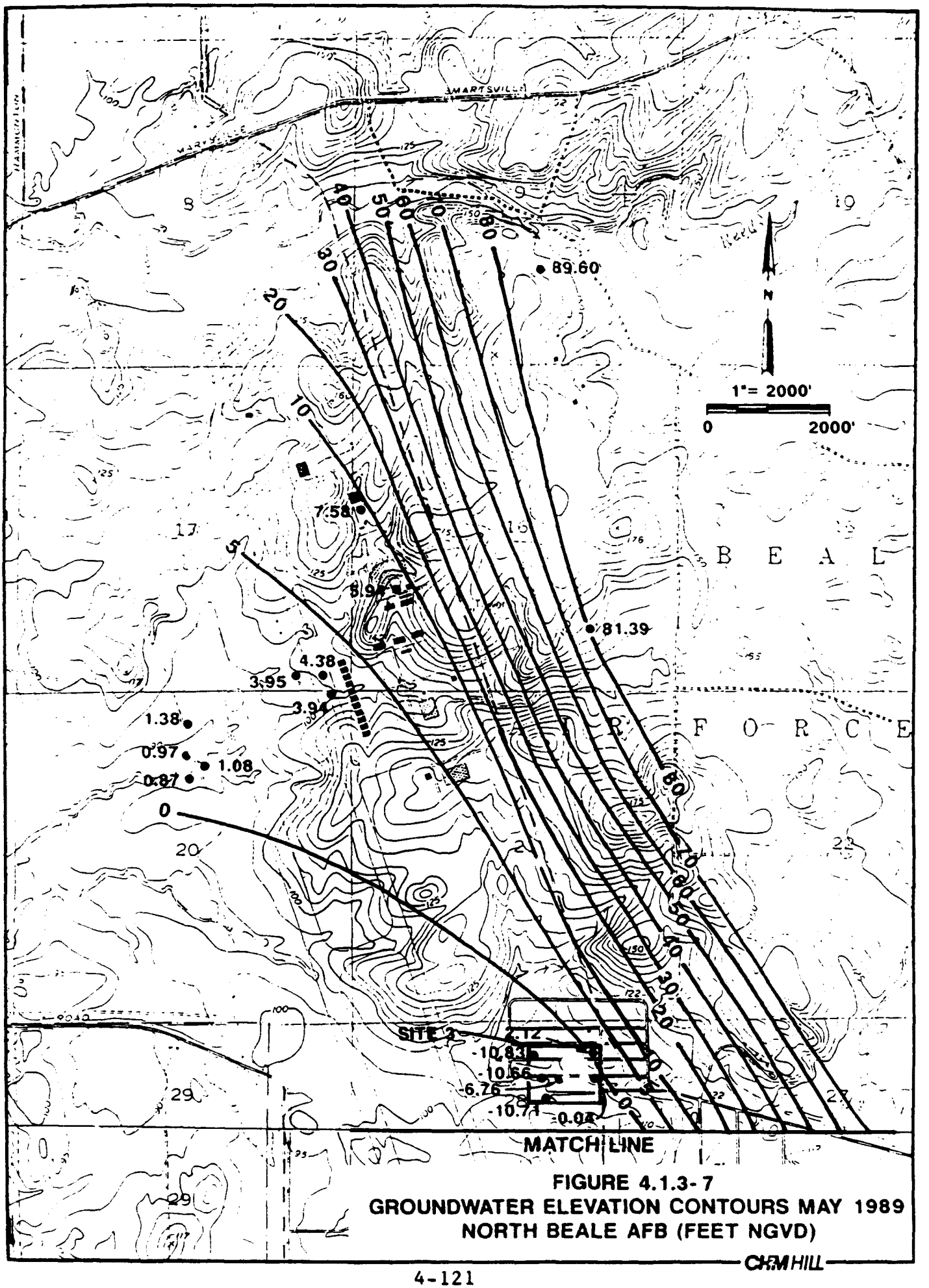


FIGURE 4.1.3-7
GROUNDWATER ELEVATION CONTOURS MAY 1989
NORTH BEALE AFB (FEET NGVD)

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between 1986 and 1989 is probably part of the regional water level rise exhibited in the other wells located on the west side of Beale AFB. This rise is presumably due to a reduction in agricultural pumping west of the base or an increase in groundwater recharge or both. The hydraulic gradient in this alluvium is toward the groundwater depression west of Beale AFB.

The groundwater level on the east side of Site 3 is over 11 feet higher than on the west side (Figure 4.1.3-6). According to soil boring logs, wells 3-A-1 and 3-A-2 are completed in a purplish clay which is possibly decomposed bedrock. Overlying the clay is about 7 feet of purplish silty fine sand. Above this unit are brown sands that continue upward for 60-70 feet. Both wells are screened across the contacts among the sands and clay (AeroVironment, 1987). Thus, groundwater may be flowing through or over the altered surface of a consolidated rock unit in wells 3-A-1 and 3-A-2. Water levels in wells 3-A-1 and 3-A-2 may therefore be dynamically perched on a zone of residual clay, flowing to the southwest down-dip above consolidated rock. Water level fluctuations in these wells may be more closely related to the availability of up-gradient recharge than to changes in the groundwater depression west of the base. Groundwater in wells 3-A-1 and 3-A-2 reflects the characteristics of a hydrogeological regime more typical of the foothills of the Sierra Nevada.

Aquifer parameters for the permeable zone screened by well 3-C-1 were derived according to the Cooper-Jacob Method (1946) from the water level data generated during a 3-1/2-hour drawdown and 3-1/2-hour recovery test. Plots of the data and a discussion of testing methodology are provided in Appendix E. These tests yielded an average value of transmissivity of 310 square feet per day, and an average hydraulic conductivity of 22 feet per day (7.8×10^{-3} cm/sec.)

Water levels were monitored in well 3-A-4 during the test, but no change was observed. An estimated value of average interstitial groundwater velocity may be estimated by substitution into Darcy's Law. Assuming a hydraulic conductivity of 28 feet per day, as estimated in the 72-hour pump test in well 19-C-4, a hydraulic gradient of 0.003, and an effective porosity of 0.20, the estimated groundwater velocity is about 0.4 feet per day, or 150 feet per year.

4.1.3.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given with Appendix A and in Appendix F.

Discussion of analytical results in this and following subsections and presentation of analytical results in figures and tables are limited to results which are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.3.1.4 and in Appendix A.

Soil Samples

A total of 55 soil samples were collected from 10 soil borings: one background boring, four 20-foot borings in the area of FPTA No. 1, one angled boring beneath the overflow basin, two angled borings beneath FPTA No. 2, and two borings near the underground storage tanks. Three additional surface soil samples were collected from the overflow basin. These soil boring and surface soil samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7470/7471), soil moisture (ASTM D2216), and TFH-diesel and -gas (California method).

TFH-diesel was detected in all three surface soil samples and in 29 of the 55 soil boring samples at concentrations up to 23,000 mg/kg. Likewise, TFH-gas was detected in 26 of the soil samples up to 5,100 mg/kg, but not in any of the surface samples. TFH-diesel and -gas concentrations are shown in Figure 4.1.3-8.

Mercury was detected in 21 of the 55 soil boring samples above the 0.060 mg/kg LOQ, but not in any of the surface samples. Detected mercury concentrations ranged from 0.068 mg/kg to a maximum 0.58 mg/kg. Mercury concentrations are shown in Figure 4.1.3-8.

Lead was the only ICP metal detected at levels above the range observed in other soil samples on base. Lead was detected in all three surface samples, and in 5 of the 55 soil samples. Lead generally occurred at levels above the LOQ in near surface soil samples from borings in FPTAs No. 1 and No. 2. The highest detected lead concentration was 534 mg/kg, in the FPTA No. 1. Lead was also detected in the 0- to 1.5-foot sample in the background boring, which was the only lead detected in any background sample at Beale AFB. Detected lead concentrations and locations are shown in Figure 4.1.3-9.

Nine volatile organic compounds were detected at levels above the LOQ in surface samples and soil borings at Site 3: total xylenes, benzene, TCE, 1,2-DCE, and trans-1,2-DCE, toluene, 2-butanone, tetrachloroethene, and ethylbenzene. The concentrations of the first five of these compounds are illustrated in Figure 4.1.3-10. One or more of the former

volatile organics were detected at various depths in borings 3-C-2SB, 3-C-7SB, and 3-C-8SB in FPTA No. 1; in 3-C-10-SB at FPTA No. 2, in 3-C-5-SB at the overflow basin, and in 3-C-4SB at the underground storage tanks.

Two semivolatile organic compounds were detected in surface soil samples at levels above the LOQ. Bis(2-ethylhexyl) phthalate was detected in all three and di-n-butyl phthalate in one of the three surface soil samples. However, these phthalate compounds are ubiquitous in soil samples basewide and in the laboratory and may represent false positives.

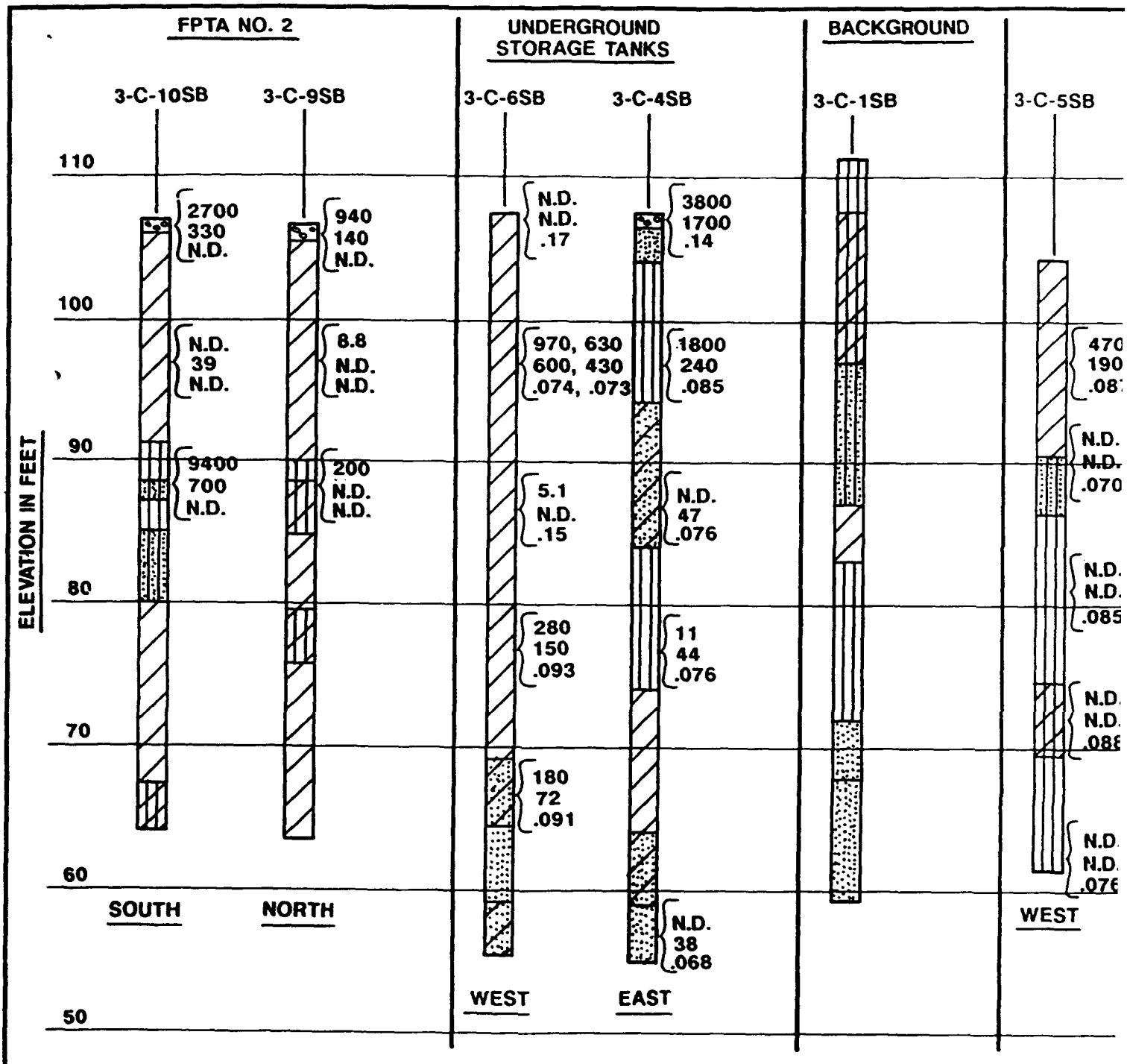
Four semivolatile compounds were detected in samples from the soil borings at levels above the LOQ. Di-n-butyl phthalate, 2-methylnaphthalene, 4-methyl 2-pentanone, and naphthalene were detected in 6, 9, 3, and 5 of the 55 soil samples, respectively. The 2-methylnaphthalene and naphthylene concentrations are shown in Figure 4.1.3-9. Bis(2-ethylhexyl) phthalate and phenanthrene were detected in four and two samples, respectively, at levels below the LOQ.

Groundwater Samples

In the two semiannual rounds of water sampling at Site 3, groundwater samples have been collected from each of six monitoring wells (five existing, one new). Analyses performed for water samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), arsenic (7060), lead (7421), mercury (7470/7471), selenium (7740), water quality parameters, and TFH-diesel and -gas (California method).

TFH-gas, toluene, and bis(2-ethylhexyl) phthalate were the only potential contaminants detected in the first semiannual round groundwater samples from Site 3. TFH-gas was 0.10 mg/l in the 3-C-1 first round replicate sample. Toluene was detected at levels up to 6 ug/l in three of the six samples, but was also detected in the field blank. Bis(2-ethylhexyl) phthalate was detected at 10 ug/l in 3-A-1. Arsenic was detected in 3-A-2 at 0.011 mg/l and vanadium at 0.069 mg/l.

TDS varied from 256 mg/l to 305 mg/l in the first round groundwater samples at Site 3. The minimum TDS was measured in 3-C-1 (replicate) and the maximum in 3-A-4. Water type varies from sodium-calcium bicarbonate to calcium-sodium chloride-bicarbonate. Site 3 background wells 3-A-1 and 3-A-2 have higher milliequivalent percentages for sodium (46 and 51 percent) than other areas at Beale AFB. Nitrate plus



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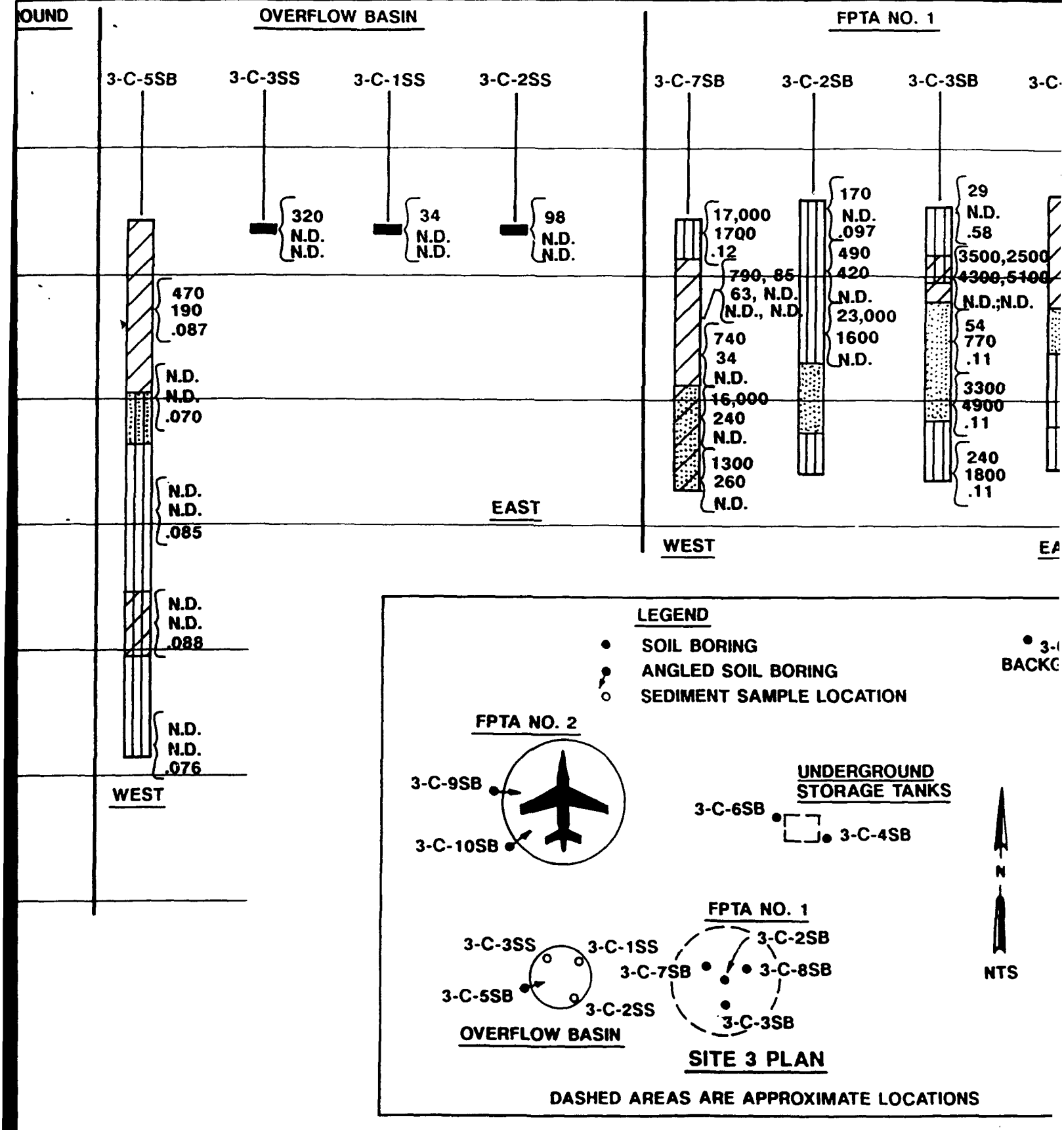
TFH - DIESEL ; FIELD REPLICATE
TFH - GAS ; FIELD REPLICATE
MERCURY; FIELD REPLICATE

CLAY
SILT
SAND
GRAVEL

N.D. NOT DETECTED
N.D.* CONCENTRATION ESTIMATED BELOW LABORATORY L.O.Q.
NOTE: ALL VALUES ARE IN mg/Kg

CONCENTRATIONS SHOWN ONLY WHERE AN INDICATED ANALYTE WAS ESTIMATED OR DETECTED. ALL BORINGS WERE SAMPLED OVER THEIR ENTIRE DEPTH.

SCALE: HORIZ - NC
1"= 10' VEF

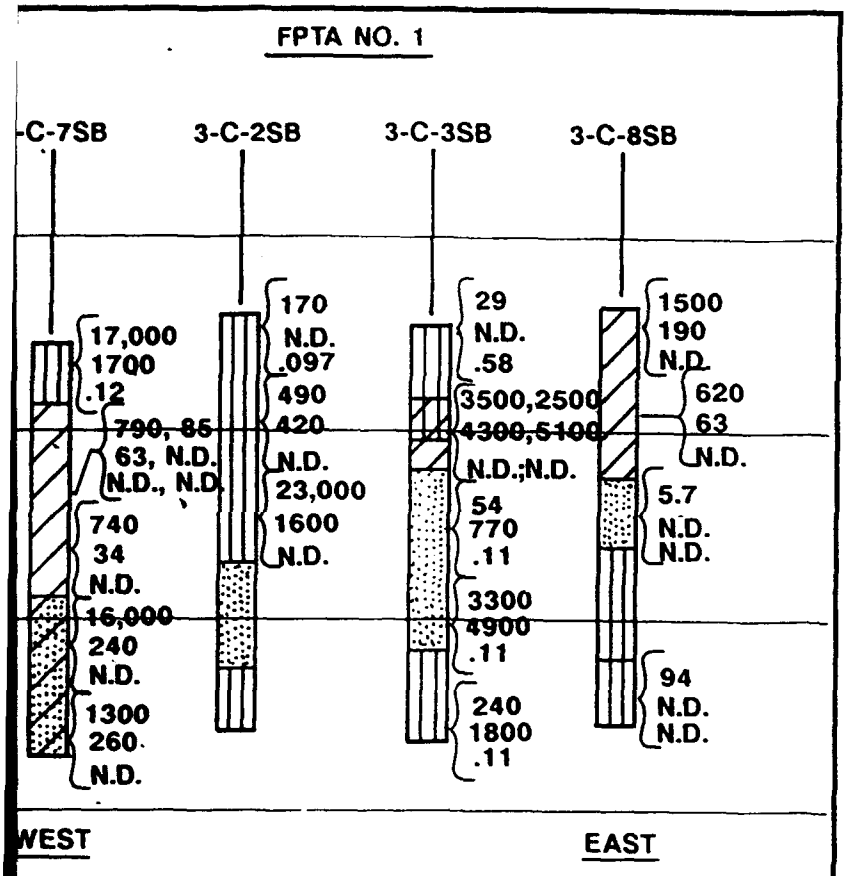


SCALE: HORIZ - NOT TO SCALE
1"= 10' VERT

FIGURE 4.1.3-8
TFH-DIESEL, TFH-GAS, AND MER
SOIL SAMPLES
SITE 3: FIRE PROTECTION TRAININ

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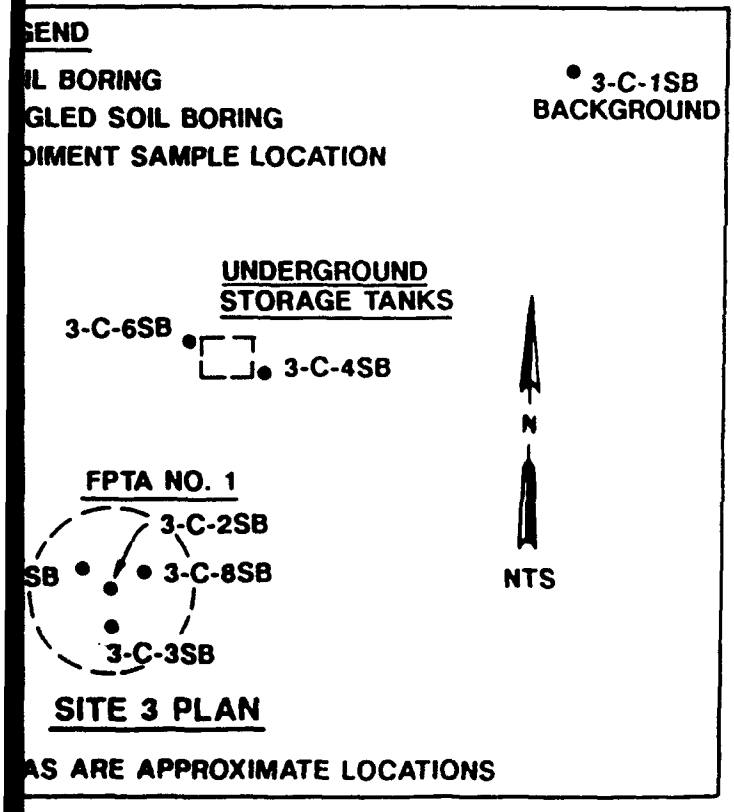
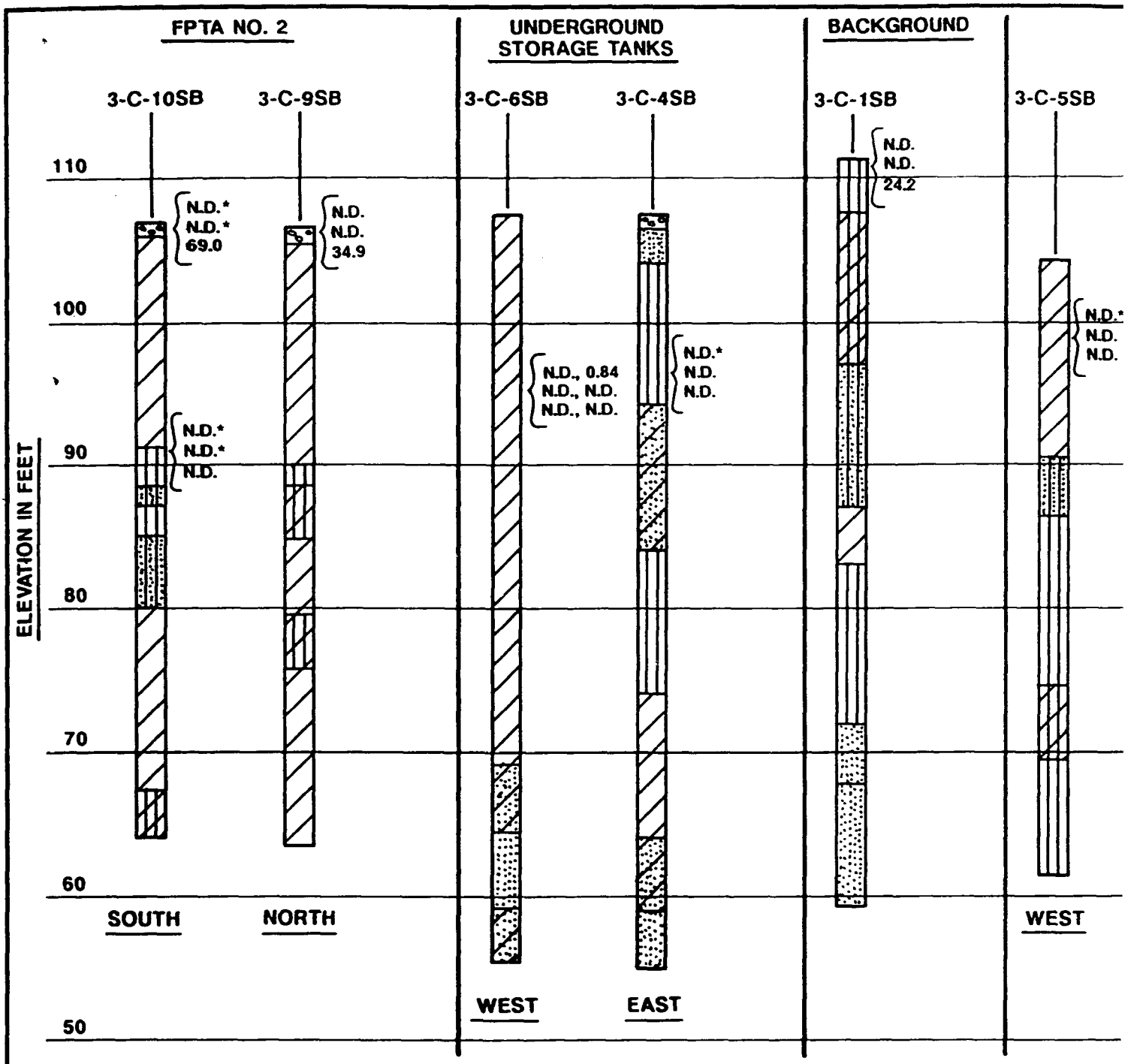


FIGURE 4.1.3-8
TFH-DIESEL, TFH-GAS, AND MERCURY
SOIL SAMPLES
SITE 3: FIRE PROTECTION TRAINING AREA

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LEGEND

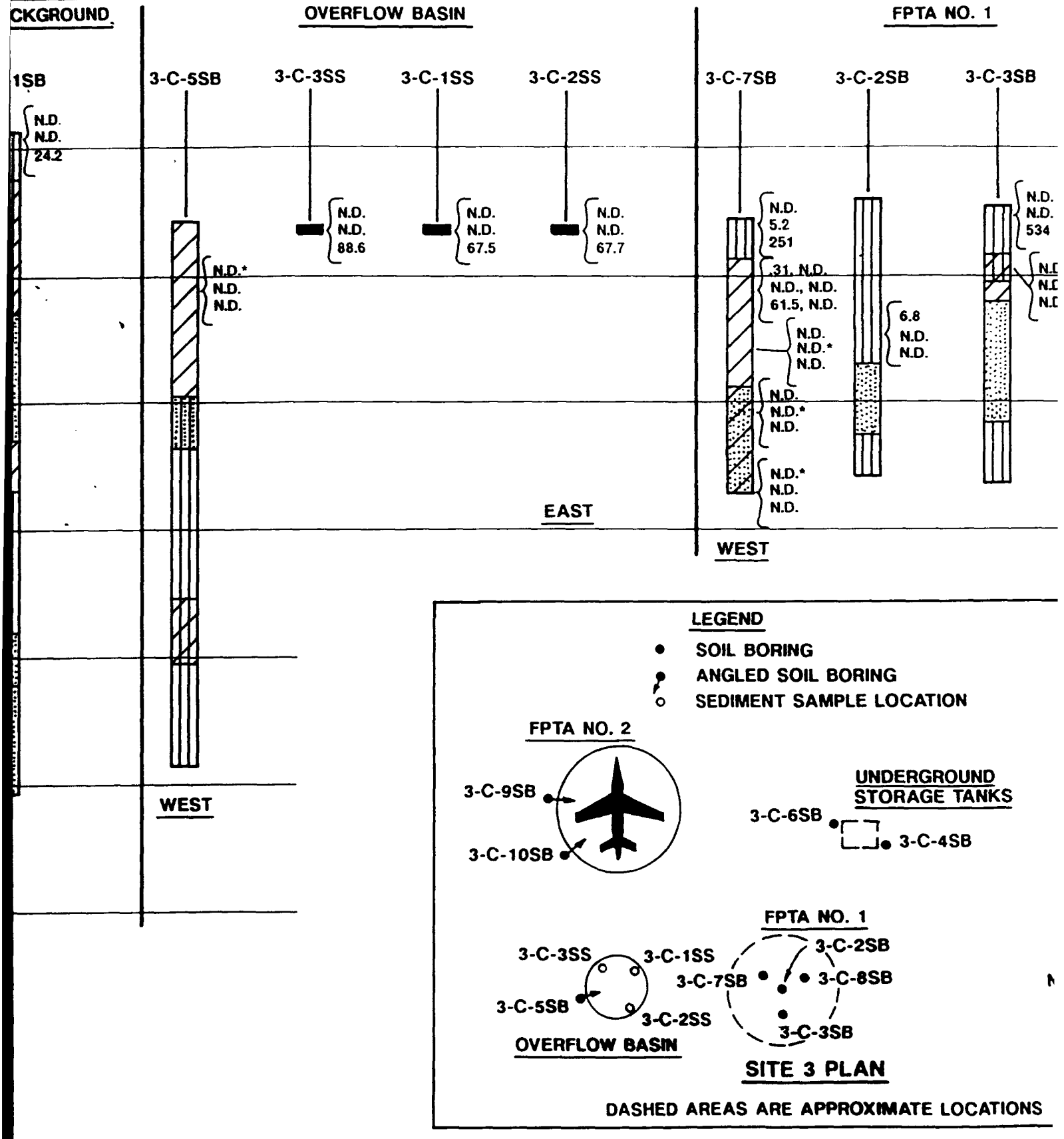
2 - METHYLNAPHTHALENE
NAPHTHYLENE
LEAD

CLAY
SILT
SAND
GRAVEL

N.D. NOT DETECTED
N.D.* CONCENTRATION ESTIMATED BELOW LABORATORY L.O.Q.
NOTE: ALL VALUES ARE IN mg/Kg

CONCENTRATIONS SHOWN ONLY WHERE AN INDICATED ANALYTE WAS ESTIMATED OR DETECTED. ALL BORINGS WERE SAMPLED OVER THEIR ENTIRE DEPTH.

SCALE: HORIZ - NC
1"= 10' VEF



SCALE: HORIZ - NOT TO SCALE
1"= 10' VERT

NGS

FIGURE 4.1.3-9
SEMI-VOLATILE ORGANICS
SOIL SAMPLES
SITE 3: FIRE PROTECTION TI

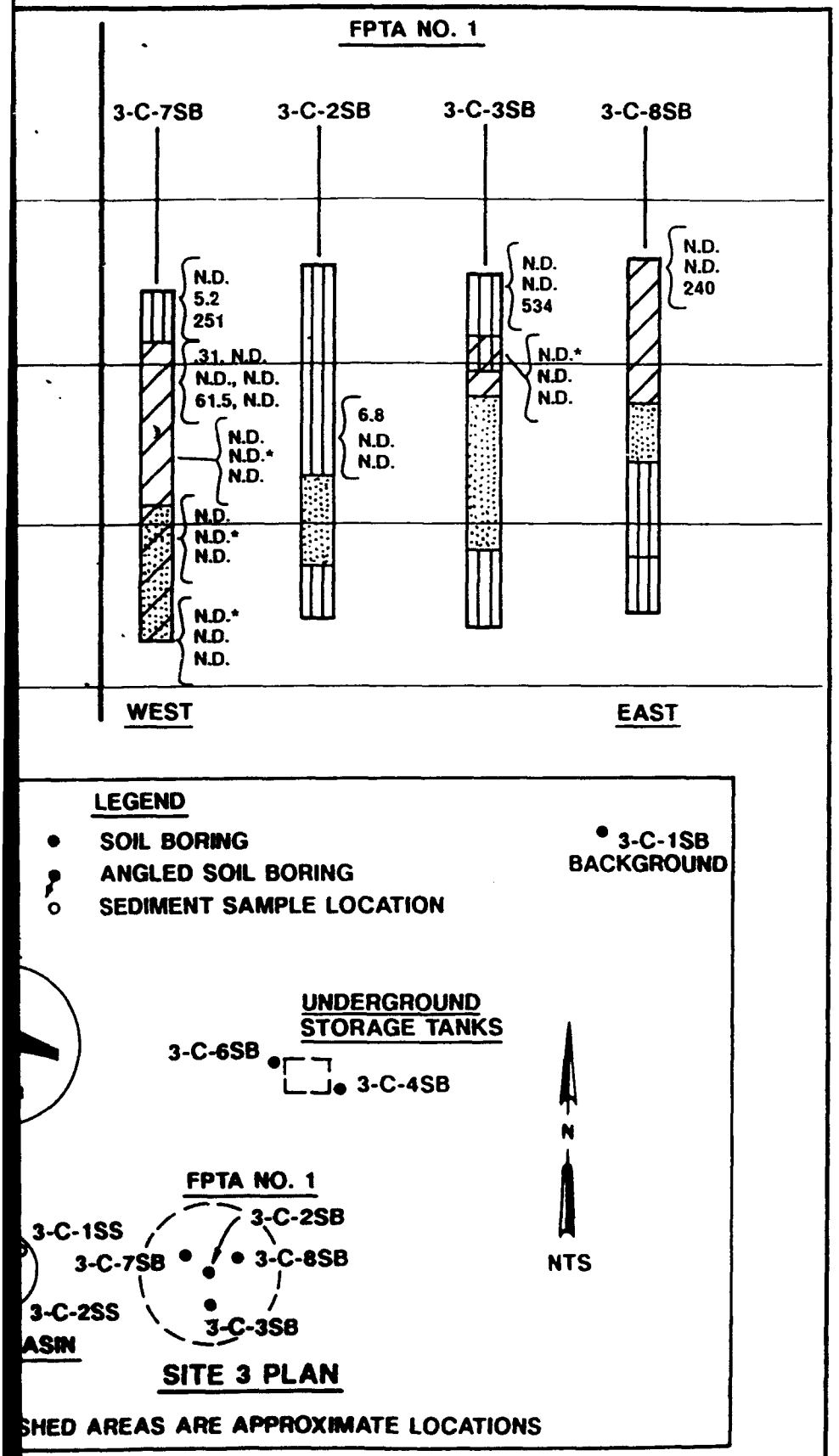
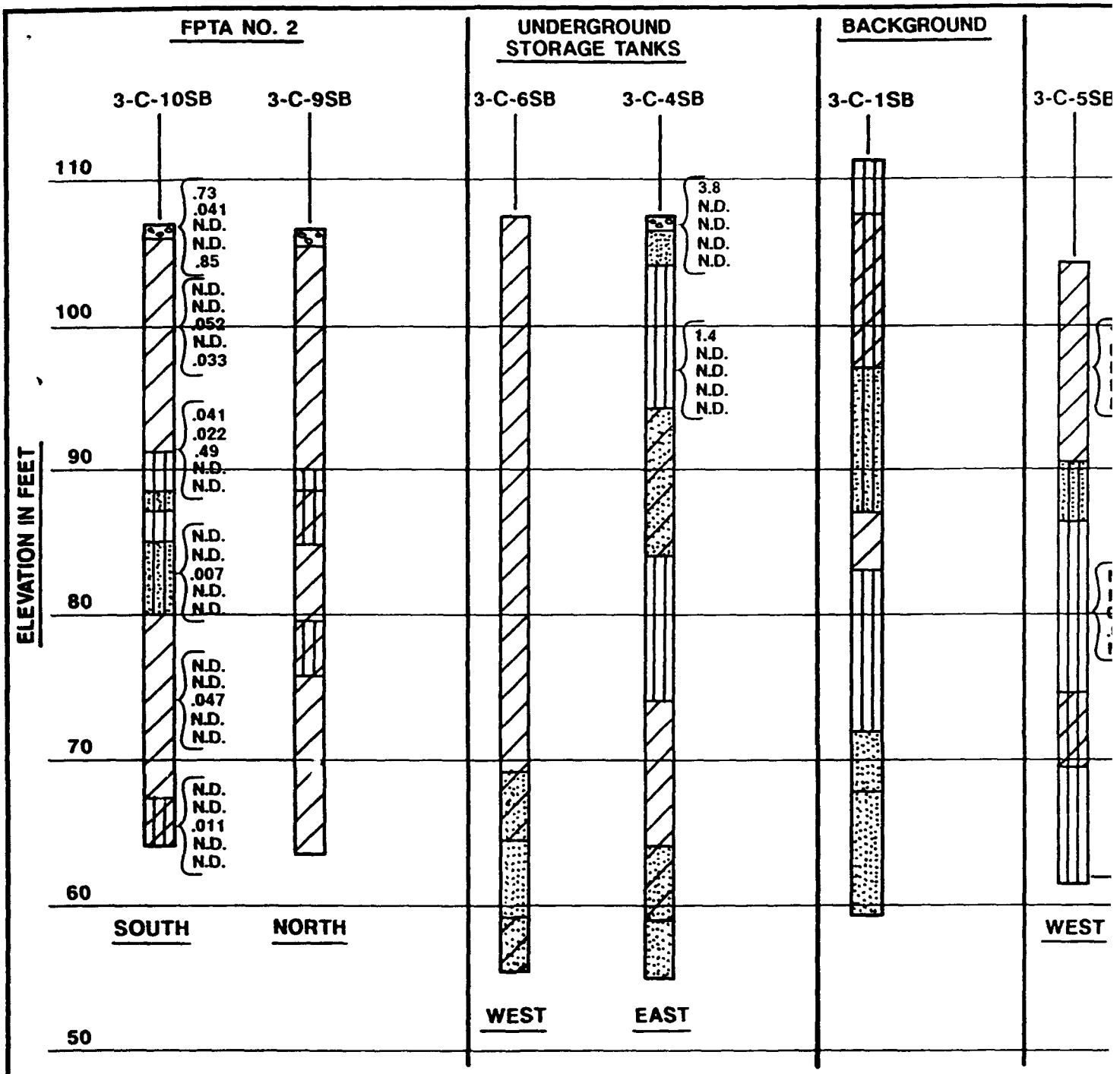


FIGURE 4.1.3-9
SEMI-VOLATILE ORGANICS AND LEAD
SOIL SAMPLES
SITE 3: FIRE PROTECTION TRAINING AREA

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LEGEND



- XYLENES (TOTAL)
- BENZENE
- TCE
- 1, 2 - DCE
- TRANS - 1, 2 - DCE

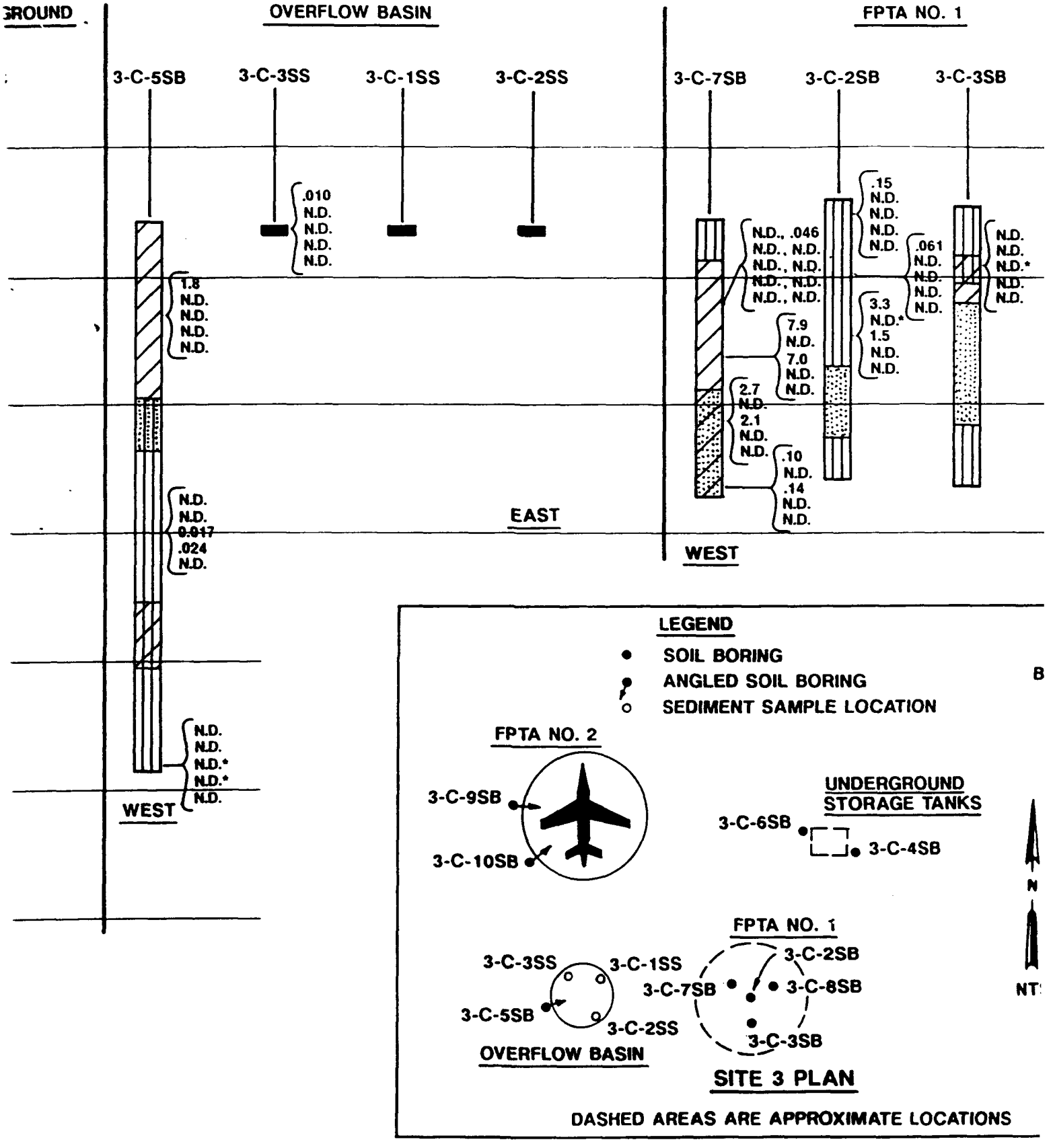


- CLAY
- SILT
- SAND
- GRAVEL

N.D. NOT DETECTED
N.D.* CONCENTRATION ESTIMATED BELOW LABORATORY L.O.Q.
NOTE: ALL VALUES ARE IN mg/Kg

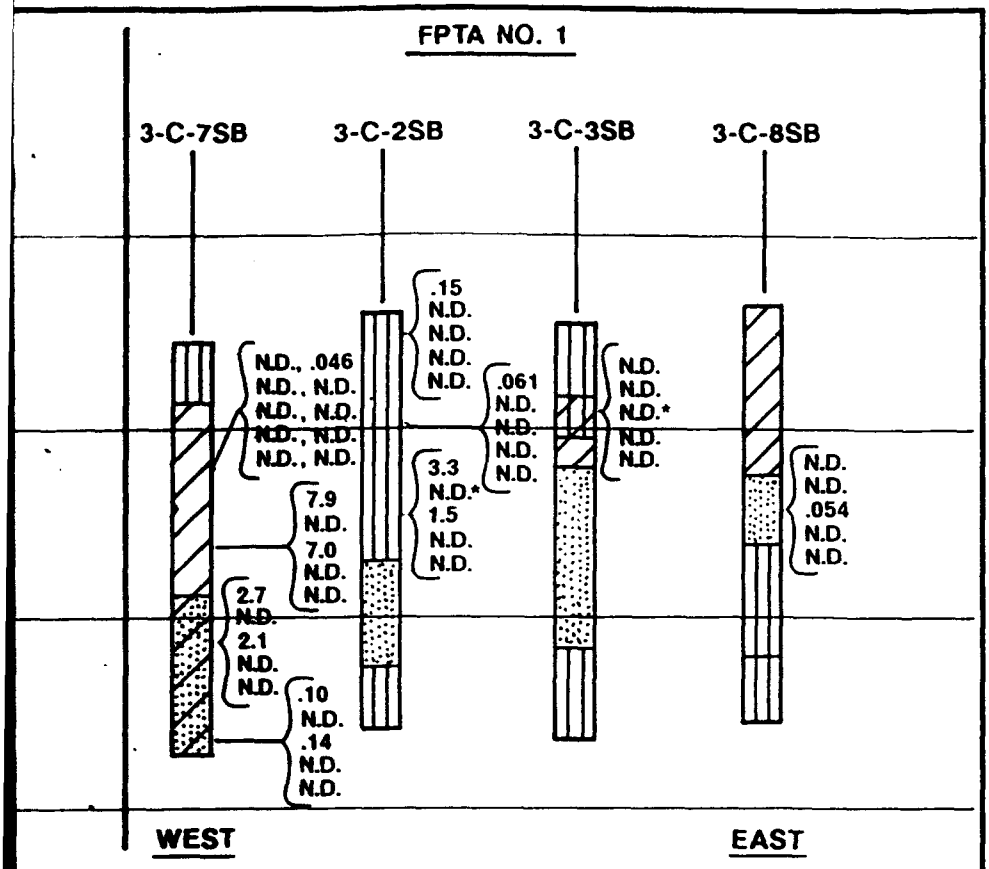
CONCENTRATIONS SHOWN ONLY WHERE AN INDICATED ANALYTE WAS ESTIMATED OR DETECTED.
ALL BORINGS WERE SAMPLED OVER THEIR ENTIRE DEPTH.

SCALE: HORIZ - 1"= 10'



SCALE: HORIZ - NOT TO SCALE
1"= 10' VERT

FIGURE 4.1.3-1(
VOLATILE ORGANI
SOIL SAMPLES
SITE 3: FIRE PROTECTION TRA



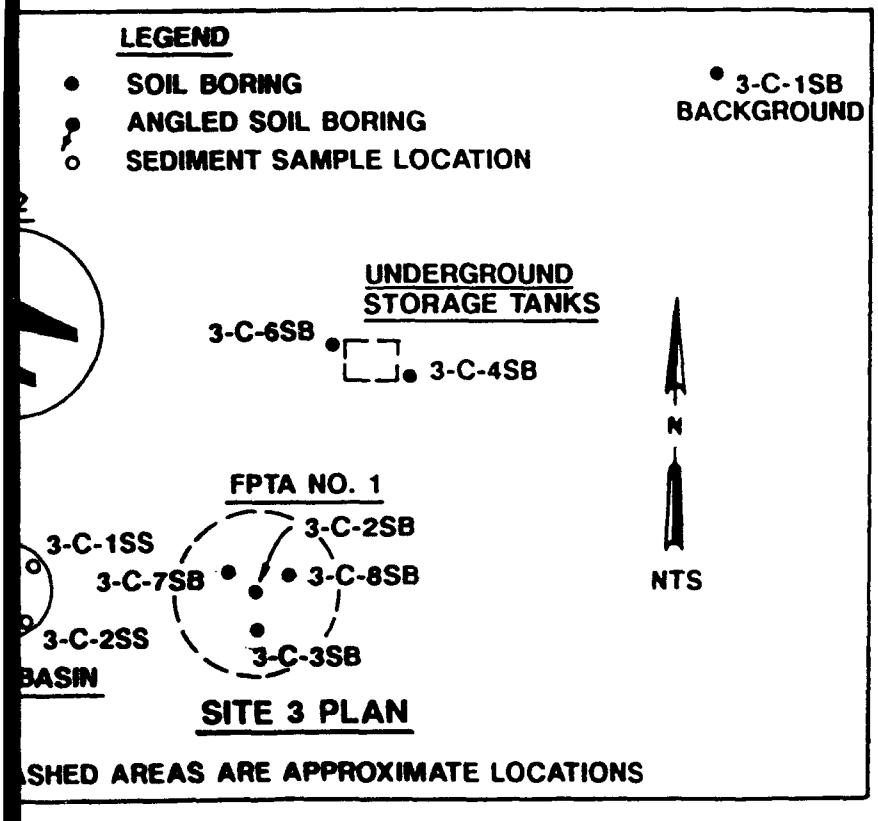


FIGURE 4.1.3-10
VOLATILE ORGANICS
SOIL SAMPLES
SITE 3: FIRE PROTECTION TRAINING AREA

CH2MHILL

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nitrite (expressed as nitrate) varied from 6.4 to 8.6 mg/l. Sulfate ranged from 7.7 to 15.4 mg/l. All the water quality parameters are within ranges observed in groundwater samples from other sites at Beale AFB.

In the second semiannual sampling round at Site 3 (September 1989), no volatile or semivolatile organic compounds were detected except for bis(2-ethylhexyl) phthalate in well 3-A-1 at 17 ug/l. Arsenic was detected for the second time in well 3-A-2 at 0.012 mg/l. No lead, mercury, selenium, TFH-diesel, or TFH-gas were detected in any well in this round. Water quality parameters were similar to the first sampling round with TDS ranging from 244 to 326 mg/l, nitrate from 5.1 to 8.7 mg/l, and sulfate from 8.3 to 20.0 mg/l. Water type again varied from sodium-calcium bicarbonate to calcium-sodium chloride-bicarbonate.

4.1.3.1.4 Analytical Results Table

Table 4.1.3-2 presents a summary of all detected analytes for Site 3. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.3-2 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of Applicable or Relevant and Appropriate Requirements (ARARs) is given in Appendix I.

4.1.3.1.5 Discussion of Analytical Data

Contaminants in the form of fuel hydrocarbons (TFH and BETX compounds), chlorinated solvents, mercury, and lead were detected in soil samples collected within the FPTA No. 2 overflow basin and/or in a soil boring drilled beneath the basin. The same contaminants were also detected in soil borings drilled near the current and previous fire training areas and near the underground storage tanks. Table 4.1.3-3 presents the range of contaminants encountered for each of the media samples (surface soil, soil, groundwater), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections or surrogate spike recoveries.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants

TABLE 4.1.3-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 3

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-1SS BAFB-0073 0.0-1.0' 11/23/88	3-C-2SS BAFB-0074 0.0-1.0' 11/23/88	3-C-3SS BAFB-0075 0.0-1.0' 11/23/88	3-C-1SB BAFB-0214 0.0-1.5' 12/12/88	3-C-1SB BAFB-0215 10.0-11.5' 12/12/88	3-C-1SB BAFB-0217 20.0-21.5' 12/12/88
Percent Moisture	ASA#9	N/A	%	NS	NS	30.1	28.4	32.2	10.6	21.2	21.6
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	34	98	320	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	16700	11700	16400	9500	17500	18500
Barium	SW6010	10.0	mg/kg	NS	10,000	275	207	224	142	280	210
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	0.74	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	3760	3590	4100	2840	5140	3970
Chromium	SW6010	3.0	mg/kg	NS	500	45.9	31.6	38.1	23.9	38.5	27.8
Cobalt	SW6010	4.0	mg/kg	NS	8,000	17.2	16.8	14.7	16.8	17.8	14.0
Copper	SW6010	3.0	mg/kg	NS	2,500	55.2	57.5	65.2	32.1	26.8	38.3
Iron	SW6010	10.0	mg/kg	NS	NS	24300	17600	24600	19700	23600	22100
Lead	SW6010	20.0	mg/kg	NS	1,000	67.5	67.7	88.6	24.2	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	4150	4500	4790	3930	6470	6280
Manganese	SW6010	1.5	mg/kg	NS	NS	412	517	450	527	1320	621
Nickel	SW6010	4.0	mg/kg	NS	2,000	20.0	19.6	22.1	16.8	33.6	33.0
Potassium	SW6010	200	mg/kg	NS	NS	1270	1060	1470	660	635	1220
Sodium	SW6010	100	mg/kg	NS	NS	280	251	358	132	371	422
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	ND	55.9	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	64.4	41.9	52.5	57.4	50.8	41.1
Zinc	SW6010	2.0	mg/kg	NS	5,000	132 B	84.8 B	110 B	58.8	43.9	63.6
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.032	0.004 BJ	0.006 B	0.027	0.031	0.036
Acetone	SW8240	0.010	mg/kg	NS	NS	0.096 B	ND	ND	ND	ND	0.008 B
Toluene	SW8240	0.005	mg/kg	NS	NS	0.068 B	0.003 BJ	ND	0.031	0.040	0.011
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	0.007	ND	ND	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	2.9 B	2.9 B	2.8 B	1.9 B	2.3 B	2.0 B
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.59	ND	ND	1.2	0.87
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	1.4	1.4	1.6	ND	0.15 J	0.23 J

NOTES: Results reported for detected analytes only.
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f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-1SB[f] BAFB-0218 21.5-23.0' 12/12/88	3-C-1SB BAFB-0219 30.0-31.5' 12/12/88	3-C-1SB BAFB-0220 40.0-41.5' 12/12/88	3-C-1SB BAFB-0221 50.0-51.5' 12/12/88	3-C-2SB BAFB-0222 0.0-1.5' 12/12/88	3-C-2SB BAFB-0223 5.0-6.5' 12/12/88
Percent Moisture	ASA#9	N/A	%	NS	NS	23	24.4	20	9.1	7.4	17
Mercury	SW7471	0.060	mg/kg	NS	20	ND	ND	ND	ND	0.097	ND
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	ND	ND	ND	170	490
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	ND	ND	ND	ND	420
Aluminum	SW6010	20.0	mg/kg	NS	NS	15800	14900	16400	8260	5790	9250
Barium	SW6010	10.0	mg/kg	NS	10,000	173	183	179	124	80.6	484
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	ND	ND	0.60
Calcium	SW6010	100	mg/kg	NS	NS	3970	4990	4430	3270	3570	4060
Chromium	SW6010	3.0	mg/kg	NS	500	20.8	11.2	15.0	8.1	20.5	30.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	16.4	7.7	10.4	5.0	10.8	26.1
Copper	SW6010	3.0	mg/kg	NS	2,500	31.9	18.5	22.5	15.4	24.3	26.5
Iron	SW6010	10.0	mg/kg	NS	NS	21800	19200	15500	13100	14000	20000
Magnesium	SW6010	100	mg/kg	NS	NS	3950	4400	5290	2430	2760	4550
Manganese	SW6010	1.5	mg/kg	NS	NS	745	522	541	483	522	1770
Nickel	SW6010	4.0	mg/kg	NS	2,000	26.0	10.1	11.8	8.0	28.3	24.2
Potassium	SW6010	200	mg/kg	NS	NS	1000	833	1380	803	508	422
Sodium	SW6010	100	mg/kg	NS	NS	526	698	408	441	162	360
Vanadium	SW6010	4.0	mg/kg	NS	2,400	53.8	34.5	23.8	29.6	50.5	61.1
Zinc	SW6010	2.0	mg/kg	NS	5,000	54.2	32.8	38.4	32.1	42.8	35.9
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.030	0.058	0.039	0.026	0.078	0.089
Acetone	SW8240	0.010	mg/kg	NS	NS	0.008 B	0.009 B	0.009 B	0.008 B	0.12	0.28
Toluene	SW8240	0.005	mg/kg	NS	NS	0.002 J	0.006	0.022	0.001 J	0.074	0.057
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.022 J	ND
Xylenes (o+m)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.062	0.051
Xylenes (p)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.074	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.14	0.051
Phenol	SW8270	0.33	mg/kg	NS	NS	1.9 B	1.7 B	1.9 B	1.8 B	2.1 B	2.2 B
4-Methylphenol	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	1.3 J	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.82	0.70	0.69	0.66	ND	ND

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-2SB BAFB-0224 10.0-11.5' 12/12/88	3-C-2SB BAFB-0225 15.0-16.5' 12/13/88	3-C-2SB BAFB-0260 20.0-21.5' 12/13/88	3-C-3SB BAFB-0261 0.0-1.5' 12/13/88	3-C-3SB[R] BAFB-0544 0.0-1.5' 05/03/89	3-C-3SB BAFB-0262 5.0-6.5' 12/13/88
Percent Moisture	ASA#9	N/A	%	NS	NS	18.1	13.1	16.8	13.6	NT	18
Mercury	SW7471	0.060	mg/kg	NS	20	ND	ND	ND	0.58	NT	ND
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	23000	ND	ND	29	NT	3500
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	1600	ND	ND	ND	NT	4300
Aluminum	SW6010	20.0	mg/kg	NS	NS	15500	8420	10200	14100	NT	13800
Barium	SW6010	10.0	mg/kg	NS	10,000	178	87.9	109	348	NT	444
Cadmium	SW6010	1.0	mg/kg	NS	100	ND	ND	ND	4.5	NT	ND
Calcium	SW6010	100	mg/kg	NS	NS	4640	3300	3260	3850	NT	5020
Chromium	SW6010	3.0	mg/kg	NS	500	33.2	16.1	26.7	61.1	NT	44.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	13.4	9.1	8.9	10.3	NT	28.8
Copper	SW6010	3.0	mg/kg	NS	2,500	35.7	29.2	21.6	125	NT	35.9
Iron	SW6010	10.0	mg/kg	NS	NS	25200	16800	23600	19200	NT	24000
Lead	SW6010	20.0	mg/kg	NS	1,000	ND	ND	ND	534	NT	ND
Magnesium	SW6010	100	mg/kg	NS	NS	5030	2570	3270	2720	NT	5620
Manganese	SW6010	1.5	mg/kg	NS	NS	441	354	361	285	NT	1540
Nickel	SW6010	4.0	mg/kg	NS	2,000	29.3	13.8	14.4	19.7	NT	29.8
Potassium	SW6010	200	mg/kg	NS	NS	611	437	625	648	NT	378
Silver	SW6010	3.0	mg/kg	NS	500	ND	ND	ND	4.7	NT	ND
Sodium	SW6010	100	mg/kg	NS	NS	611	442	338	293	NT	470
Thallium	SW6010	50.0	mg/kg	NS	700	ND	94.9	ND	ND	NT	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	41.3	45.6	46.4	47.9	NT	57.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	50.1	41.0	43.1	25.0	NT	46.1
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.81	0.006	0.009	ND	NT	ND
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	0.15	0.042	0.058	NT	ND
1,2-Dichloroethene (total)	SW8240	0.005	mg/kg	NS	NS	0.069 J	ND	0.006	0.021	NT	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.008 J	NT	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	1.2	ND	ND	0.052	NT	ND
Benzene	SW8240	0.005	mg/kg	NS	NS	0.19 J	ND	ND	0.017	NT	ND
Tetrachloroethene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.003 J	NT	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	0.008	0.055	0.76	NT	1.3 J
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	0.39	ND	ND	0.044	NT	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	2.7	ND	ND	0.32	NT	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	ND	1.4 B	1.7 B	NT	ND	1.7 B
2-methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	6.8	ND	ND	NT	ND	ND
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	NT	0.027 J	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.54	0.70 B	NT	ND	0.94 B
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.078 J	0.070 BJ	NT	ND	ND

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-3SB[f] BAFB-0263 6.5-8.0' 12/13/88	3-C-3SB BAFB-0264 10.0-11.5' 12/13/88	3-C-3SB BAFB-0265 15.0-16.5' 12/13/88	3-C-3SB BAFB-0266 20.0-21.5' 12/13/88	3-C-4SB BAFB-0267 0.5-2.0' 12/13/88	3-C-4SB BAFB-0268 10.0-11.5' 12/14/88
Percent Moisture	ASA#9	N/A	%	NS	NS	22.8	21.6	25	21.1	13.2	18
Mercury	SW7471	0.060	mg/kg	NS	20	ND	0.11	0.11	0.11	0.14	0.085
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	2500	54	3300	240	3800	1800
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	5100	770	4900	1800	1700	240
Aluminum	SW6010	20.0	mg/kg	NS	NS	15800	19400	16800	16700	7820	13200
Barium	SW6010	10.0	mg/kg	NS	10,000	282	250	157	152	129	261
Beryllium	SW6010	0.50	mg/kg	NS	75	0.65	ND	ND	0.63	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	4950	5190	4920	4560	2790	3990
Chromium	SW6010	3.0	mg/kg	NS	500	38.5	38.5	26.7	33.5	19.6	44.6
Cobalt	SW6010	4.0	mg/kg	NS	8,000	10.0	16.6	14.7	12.0	9.6	17.1
Copper	SW6010	3.0	mg/kg	NS	2,500	39.1	45.8	39.7	34.5	30.3	36.5
Iron	SW6010	10.0	mg/kg	NS	NS	21900	28100	25900	26100	14100	25200
Magnesium	SW6010	100	mg/kg	NS	NS	6100	6100	5650	4820	3200	5740
Manganese	SW6010	1.5	mg/kg	NS	NS	665	653	500	483	289	837
Nickel	SW6010	4.0	mg/kg	NS	2,000	30.7	33.7	26.7	20.3	20.7	34.6
Potassium	SW6010	200	mg/kg	NS	NS	479	906	1150	101	369	878
Sodium	SW6010	100	mg/kg	NS	NS	477	563	491	426	191	273
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	80.8	ND	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	40.5	57.3	56.8	47.5	37.2	62.6
Zinc	SW6010	2.0	mg/kg	NS	5,000	49.0	67.0	64.5	62.5	46.5	55.1
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	ND	ND	0.43 J	0.028 BJ	3.3 B	3.2 B
Acetone	SW8240	0.010	mg/kg	NS	NS	1.6 J	1.7	1.9	0.12 B	0.48 J	0.86
2-Butanone	SW8240	0.010	mg/kg	NS	NS	1.0 J	0.89 J	0.97 J	0.042 J	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.83	ND	1.6	0.027 J	ND	ND
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.62
Xylenes (o+m)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	1.8	1.4
Xylenes (p)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	2.0	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	3.8	1.4
Phenol	SW8270	0.33	mg/kg	NS	NS	ND	1.7 B	1.6 B	1.6 B	2.4 B	2.0 B
2-Methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.63 J
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	1.3 BJ	0.27 BJ	1.2 B	0.34 BJ	1.3 BJ	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.26 BJ	ND	0.12 BJ	ND	ND

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-4SB BAFB-0269 20.0-21.5' 12/14/88	3-C-4SB BAFB-0270 30.0-31.5' 12/14/88	3-C-4SB BAFB-0271 40.0-41.5' 12/14/88	3-C-4SB BAFB-0272 50.0-51.5' 12/14/88	3-C-5SB BAFB-0240 7.0-8.5' 12/14/88	3-C-5SB BAFB-0241 12.0-13.5' 12/14/88
Percent Moisture	ASA#9	N/A	%	NS	NS	21.2	21.2	25.4	12.2	19.1	20.6
Mercury	SW7471	0.060	mg/kg	NS	20	0.076	0.076	ND	0.068	0.087	ND
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	11	ND	ND	470	ND
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	47	44	ND	38	190	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	15600	9590	8240	8490	7810	15400
Barium	SW6010	10.0	mg/kg	NS	10,000	166	120	158	156	321	241
Calcium	SW6010	100	mg/kg	NS	NS	4150	3300	4100	3670	3780	5260
Chromium	SW6010	3.0	mg/kg	NS	500	27.4	9.4	4.7	8.2	26.0	32.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	12.6	7.0	8.6	5.7	19.8	15.1
Copper	SW6010	3.0	mg/kg	NS	2,500	45.9	16.5	16.1	25.3	33.4	41.3
Iron	SW6010	10.0	mg/kg	NS	NS	21800	12800	6100	11100	13800	25700
Magnesium	SW6010	100	mg/kg	NS	NS	6220	3010	4170	2680	4510	5610
Manganese	SW6010	1.5	mg/kg	NS	NS	383	341	362	539	628	602
Nickel	SW6010	4.0	mg/kg	NS	2,000	22.8	7.5	7.5	8.2	22.2	31.1
Potassium	SW6010	200	mg/kg	NS	NS	1280	330	1070	854	383	605
Sodium	SW6010	100	mg/kg	NS	NS	368	352	328	391	566	553
Vanadium	SW6010	4.0	mg/kg	NS	2,400	38.5	30.5	11.5	21.6	53.5	55.0
Zinc	SW6010	2.0	mg/kg	NS	5,000	71.1	27.7	36.3	56.0	37.5	47.0
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.067 B	3.8 B	0.069 B	0.045 B	2.7 B	0.17 BJ
Acetone	SW8240	0.010	mg/kg	NS	NS	0.014	0.39 J	0.012	0.006	1.2	1.4
2-Butanone	SW8240	0.010	mg/kg	NS	NS	0.047	ND	ND	0.010 J	ND	ND
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.87
Toluene	SW8240	0.005	mg/kg	NS	NS	0.12	ND	0.027	0.004 J	ND	ND
Xylenes (o+m)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.91	ND
Xylenes (p)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.91	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	1.8	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	2.4 B	2.3 B	1.9 B	1.9 B	1.9 B	2.4 B
2-Methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	0.33 J	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.11 BJ	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.41 BJ	0.39 BJ	0.31 BJ	0.34 BJ	0.35 BJ	0.30 BJ

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R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-5SB BAFB-0242 17.0-18.5' 12/14/88	3-C-5SB BAFB-0243 27.0-28.5' 12/14/88	3-C-5SB BAFB-0244 37.0-38.5' 12/14/88	3-C-5SB BAFB-0245 47.0-48.5' 12/13/88	3-C-6SB BAFB-0273 0.0-1.5' 12/14/88	3-C-6SB BAFB-0274 10.0-11.5' 12/14/88
Percent Moisture	ASA#9	N/A	%	NS	NS	14.4	18.1	20.6	20.7	19.1	19.4
Mercury	SW7471	0.060	mg/kg	NS	20	0.070	0.085	0.088	0.076	0.17	0.074
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	ND	ND	ND	ND	970
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	ND	ND	ND	ND	600
Aluminum	SW6010	20.0	mg/kg	NS	NS	8760	9240	10300	9520	20100	16300
Barium	SW6010	10.0	mg/kg	NS	10,000	117	603	710	346	351	336
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	ND	0.74	ND
Calcium	SW6010	100	mg/kg	NS	NS	3350	3860	4860	4850	4150	4940
Chromium	SW6010	3.0	mg/kg	NS	500	18.7	23.2	16.4	9.7	34.1	51.4
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.7	27.8	26.2	10.2	18.5	19.9
Copper	SW6010	3.0	mg/kg	NS	2,500	28.4	18.3	25.2	15.1	52.4	31.9
Iron	SW6010	10.0	mg/kg	NS	NS	20900	14500	13600	6310	32000	23200
Magnesium	SW6010	100	mg/kg	NS	NS	2940	3550	4690	4550	5500	5650
Manganese	SW6010	1.5	mg/kg	NS	NS	606	1940	2360	1010	937	1220
Nickel	SW6010	4.0	mg/kg	NS	2,000	18.7	17.1	15.1	9.3	39.8	31.5
Potassium	SW6010	200	mg/kg	NS	NS	479	501	932	1390	618	757
Sodium	SW6010	100	mg/kg	NS	NS	436	415	336	280	409	270
Vanadium	SW6010	4.0	mg/kg	NS	2,400	56.2	49.3	51.0	17.7	72.8	47.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	47.3	32.8	33.0	24.0	63.3	46.9
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.22 B	0.031 B	0.026 B	0.096 B	0.056 B	ND
Acetone	SW8240	0.010	mg/kg	NS	NS	1.0	ND	0.016	ND	0.007 B	ND
1,2-Dichloroethene (total)	SW8240	0.005	mg/kg	NS	NS	ND	0.020	ND	0.003 J	ND	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	0.017	ND	0.005 J	ND	ND
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	0.54	ND	ND	ND	0.003 J	ND
Tetrachloroethene	SW8240	0.005	mg/kg	NS	NS	ND	ND	0.001 J	ND	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.008 J	ND	ND	0.020	0.46	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	2.3 B	2.1 B	2.4 B	2.4 B	2.6 B	1.5 B
Phenanthrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	0.15 J	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.26 BJ	0.33 BJ	ND	0.35 BJ	ND	ND

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-6SB BAFB-0275 11.5-13.0' 12/14/88	3-C-6SB BAFB-0276 20.0-21.5' 12/14/88	3-C-6SB BAFB-0277 30.5-32.0' 12/14/88	3-C-6SB BAFB-0278 40.0-41.5' 12/14/88	3-C-6SB BAFB-0279 50.0-51.5' 12/15/88	3-C-6SB[R] BAFB-0418 50.0-50.5' 01/19/89
Percent Moisture	ASA#9	N/A	%	NS	NS	17.8	21.3	24.9	23.1	17.6	19.3
Mercury	SW7471	0.060	mg/kg	NS	20	0.073	0.15	0.093	0.091	NT	ND
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	630	5.1	280	180	ND	NT
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	430	ND	150	72	ND	NT
Aluminum	SW6010	20.0	mg/kg	NS	NS	15900	13900	18000	22000	7170	NT
Barium	SW6010	10.0	mg/kg	NS	10,000	229	137	189	99.1	112	NT
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	0.67	ND	ND	NT
Calcium	SW6010	100	mg/kg	NS	NS	4460	4330	6360	4530	4040	NT
Chromium	SW6010	3.0	mg/kg	NS	500	49.3	28.7	16.0	18.2	7.3	NT
Cobalt	SW6010	4.0	mg/kg	NS	8,000	18.2	12.7	25.3	10.4	6.6	NT
Copper	SW6010	3.0	mg/kg	NS	2,500	34.8	46.9	20.0	24.7	27.3	NT
Iron	SW6010	10.0	mg/kg	NS	NS	24800	22500	20100	26800	8250	NT
Magnesium	SW6010	100	mg/kg	NS	NS	5710	4610	4980	6150	3220	NT
Manganese	SW6010	1.5	mg/kg	NS	NS	719	402	634	302	291	NT
Nickel	SW6010	4.0	mg/kg	NS	2,000	35.4	27.2	13.2	16.9	6.3	NT
Potassium	SW6010	200	mg/kg	NS	NS	1110	775	599	1300	874	NT
Sodium	SW6010	100	mg/kg	NS	NS	292	370	280	307	223	NT
Vanadium	SW6010	4.0	mg/kg	NS	2,400	52.2	42.2	34.1	33.9	13.3	NT
Zinc	SW6010	2.0	mg/kg	NS	5,000	52.1	60.1	37.5	45.6	37.6	NT
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	3.0 B	3.3 B	2.8 B	4.0 B	0.008 J	NT
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	0.66	0.30 J	0.31 J	0.042 B	NT
Chloroform	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.012 J	NT
2-Hexanone	SW8240	0.010	mg/kg	NS	NS	10	ND	ND	ND	ND	NT
Toluene	SW8240	0.005	mg/kg	NS	NS	0.32 J	ND	ND	ND	0.083	NT
Phenol	SW8270	0.33	mg/kg	NS	NS	ND	0.99 B	0.97 B	1.1 B	ND	NT
2-Methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	0.84	ND	ND	ND	ND	NT
Phenanthrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	0.10 J	ND	ND	NT
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	0.46 B	NT
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.29 BJ	0.23 BJ	0.29 BJ	0.33 BJ	ND	NT

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-6SB[R] BAFB-0419 50.5-51.0' 01/19/89	3-C-7SB BAFB-0363 0.0-1.5' 01/04/89	3-C-7SB BAFB-0364 5.0-6.5' 01/04/89	3-C-7SB[f] BAFB-0365 6.5-8.0' 01/04/89	3-C-7SB BAFB-0366 10.0-11.5' 01/04/89	3-C-7SB BAFB-0367 15.0-16.5' 01/04/89
Percent Moisture	ASA#9	N/A	%	NS	NS	19.4	17	16.9	17.7	22.8	19.8
Mercury	SW7471	0.060	mg/kg	NS	20	ND	0.12	ND	ND	ND	ND
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	NT	17000	790	85	740	16000
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	NT	1700	63	ND	34	240
Aluminum	SW6010	20.0	mg/kg	NS	NS	NT	10300	20500	15600	19200	21100
Barium	SW6010	10.0	mg/kg	NS	10,000	NT	161	224	269	236	155
Beryllium	SW6010	0.50	mg/kg	NS	75	NT	ND	0.60	0.61	ND	ND
Cadmium	SW6010	1.0	mg/kg	NS	100	NT	2.9	ND	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	NT	3240	5080	4910	5220	5210
Chromium	SW6010	3.0	mg/kg	NS	500	NT	37.6	72.6	50.9	42.2	31.0
Cobalt	SW6010	4.0	mg/kg	NS	8,000	NT	11.9	18.1	20.7	18.1	11.2
Copper	SW6010	3.0	mg/kg	NS	2,500	NT	98.0	44.5	34.5	66.7	45.1
Iron	SW6010	10.0	mg/kg	NS	NS	NT	18000	35900	24800	30100	29100
Lead	SW6010	20.0	mg/kg	NS	1,000	NT	251	61.5	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	NT	2590	6280	5430	5620	5950
Manganese	SW6010	1.5	mg/kg	NS	NS	NT	343	650	1010	709	367
Nickel	SW6010	4.0	mg/kg	NS	2,000	NT	18.1	30.2	31.0	33.9	30.8
Potassium	SW6010	200	mg/kg	NS	NS	NT	699	517	498	829	1150
Silver	SW6010	3.0	mg/kg	NS	500	NT	4.0	ND	ND	ND	ND
Sodium	SW6010	100	mg/kg	NS	NS	NT	205	309	272	548	461
Thallium	SW6010	50.0	mg/kg	NS	700	NT	ND	ND	ND	ND	77.4
Vanadium	SW6010	4.0	mg/kg	NS	2,400	NT	53.7	71.2	60.0	66.6	51.5
Zinc	SW6010	2.0	mg/kg	NS	5,000	NT	141	59.7	46.5	81.5	70.1
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	NT	ND	0.022	0.028	ND	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	NT	ND	ND	ND	7.0	2.1
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	0.73 J	0.028	0.032	0.67 J	0.77 J
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	NT	0.42 J	ND	ND	1.9	0.69 J
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	NT	ND	ND	0.046	7.9	2.7
Naphthalene	SW8270	0.33	mg/kg	NS	NS	NT	5.2	ND	ND	0.60 J	0.41 J
2-Methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	NT	ND	0.31 J	ND	ND	ND
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	NT	0.41 BJ	0.079 BJ	0.077 BJ	ND	0.12 BJ
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	NT	0.49 BJ	0.32 BJ	0.44 B	0.45 BJ	0.047 BJ
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	NT	0.20 BJ	0.13 BJ	0.12 BJ	0.16 BJ	ND

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B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-7SB BAFB-0368 20.0-21.5' 01/04/89	3-C-8SB BAFB-0369 0.0-1.5' 01/05/89	3-C-8SB BAFB-0370 5.0-6.5' 01/05/89	3-C-8SB BAFB-0371 10.0-11.5' 01/05/89	3-C-8SB BAFB-0372 15.0-16.5' 01/05/89	3-C-8SB BAFB-0373 20.0-21.5' 01/05/89
Percent Moisture	ASA#9	N/A	%	NS	NS	13.8	15.7	18	12.4	22.7	14.7
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	1300	1500	620	5.7	ND	94
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	260	190	63	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	9010	8400	11300	11100	23500	5290
Barium	SW6010	10.0	mg/kg	NS	10,000	61.5	170	365	120	195	87.3
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	0.73	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	2380	3060	3670	3110	5370	2190
Chromium	SW6010	3.0	mg/kg	NS	500	28.0	28.0	42.4	24.8	54.3	19.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	5.8	13.0	24.4	6.2	18.1	12.9
Copper	SW6010	3.0	mg/kg	NS	2,500	18.6	35.2	27.2	34.4	50.2	18.8
Iron	SW6010	10.0	mg/kg	NS	NS	20400	16100	22100	19300	30900	14700
Lead	SW6010	20.0	mg/kg	NS	1,000	ND	240	ND	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	2220	2610	4560	3320	7180	1950
Manganese	SW6010	1.5	mg/kg	NS	NS	152	401	1060	211	449	306
Nickel	SW6010	4.0	mg/kg	NS	2,000	12.8	16.6	27.6	17.1	38.7	11.0
Potassium	SW6010	200	mg/kg	NS	NS	464	534	378	331	1550	ND
Sodium	SW6010	100	mg/kg	NS	NS	194	227	313	363	605	252
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	ND	ND	70.8	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	63.1	52.8	66.3	48.7	50.2	62.3
Zinc	SW6010	2.0	mg/kg	NS	5,000	29.9	70.6	38.8	39.5	85.3	29.0
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	ND	0.079	5.4	0.015	0.062	0.053
Acetone	SW8240	0.010	mg/kg	NS	NS	0.017	0.049	2.7	0.047	0.040	0.042
Carbon Disulfide	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.003 J	ND	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	0.019	ND	0.88 J	0.018	0.012 J	0.014
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	0.14	ND	0.71 J	0.054	ND	ND
Tetrachloroethene	SW8240	0.005	mg/kg	NS	NS	0.008	ND	ND	ND	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.20	0.14	0.85	0.023	0.034	0.072
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	0.063	ND	ND	ND	ND	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	0.10	ND	ND	ND	ND	ND
2-Methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	0.29 J	ND	0.13 J	ND	ND	ND
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	0.066 BJ	ND	ND	ND	ND	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.32 BJ	ND	0.15 BJ	0.19 BJ	0.28 BJ	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.10 BJ	ND	0.11 BJ	0.11 BJ	0.070 BJ	ND

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J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-9SB BAFB-0322 0.0-1.5' 01/11/89	3-C-9SB BAFB-0323 7.5-9.0' 01/11/89	3-C-9SB BAFB-0324 17.5-19.0' 01/11/89	3-C-9SB BAFB-0325 27.5-29.0' 01/11/89	3-C-9SB BAFB-0326 37.5-39.0' 01/11/89	3-C-9SB BAFB-0327 47.5-49.0' 01/11/89
Percent Moisture	ASA#9	N/A	%	NS	NS	13.5	20.8	16.5	20.8	21.4	29.6
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	940	8.8	200	ND	ND	ND
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	140	ND	ND	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	6940	13400	8980	9470	8400	12600
Barium	SW6010	10.0	mg/kg	NS	10,000	125	294	172	162	1150	277
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	0.88	ND	0.76	0.64	ND
Calcium	SW6010	100	mg/kg	NS	NS	2250	4360	3860	3410	4720	5430
Chromium	SW6010	3.0	mg/kg	NS	500	26.8	27.7	18.0	22.7	12.7	19.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.1	34.2	9.2	13.9	44.9	15.6
Copper	SW6010	3.0	mg/kg	NS	2,500	35.4	30.7	21.6	22.7	15.3	24.1
Iron	SW6010	10.0	mg/kg	NS	NS	16200	19400	16500	25800	7260	22700
Lead	SW6010	20.0	mg/kg	NS	1,000	34.9	ND	ND	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	2890	5620	3010	3470	3830	6150
Manganese	SW6010	1.5	mg/kg	NS	NS	325	920	444	558	3780	1050
Nickel	SW6010	4.0	mg/kg	NS	2,000	16.2	20.2	18.0	17.7	12.7	22.7
Potassium	SW6010	200	mg/kg	NS	NS	358	455	ND	732	483	938
Sodium	SW6010	100	mg/kg	NS	NS	180	611	444	385	346	714
Vanadium	SW6010	4.0	mg/kg	NS	2,400	47.4	41.7	38.8	83.6	69.7	55.0
Zinc	SW6010	2.0	mg/kg	NS	5,000	57.9	49.5	33.5	41.4	19.1	47.2
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	ND	0.042 B	0.023 B	0.028 B	0.028 B	0.045 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.052 B	ND	0.012 B	0.013 B	0.008 BJ	0.007 BJ
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.019	0.019	ND	0.041

NOTES: Results reported for detected analytes only.
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J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-10SB BAFB-0328 0.0-1.5' 01/12/89	3-C-10SB BAFB-0329 7.5-9.0' 01/12/89	3-C-10SB BAFB-0330 17.5-19.0' 01/12/89	3-C-10SB BAFB-0331 27.5-29.0' 01/12/89	3-C-10SB BAFB-0407 37.5-39.0' 01/12/89	3-C-10SB BAFB-0408 47.5-49.0' 01/12/89
Percent Moisture	ASA#9	N/A	%	NS	NS	15.6	23.3	26.7	13.7	22.8	27.7
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	2700	ND	9400	ND	ND	ND
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	330	39	700	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	7330	13200	22100	10900	9250	17000
Barium	SW6010	10.0	mg/kg	NS	10,000	152	169	207	235	1410	260
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	0.65	0.68	ND	0.78	ND
Calcium	SW6010	100	mg/kg	NS	NS	2710	3000	4470	3060	5030	6200
Chromium	SW6010	3.0	mg/kg	NS	500	26.9	28.0	40.8	26.3	12.8	19.4
Cobalt	SW6010	4.0	mg/kg	NS	8,000	9.5	11.3	13.6	18.5	24.6	15.2
Copper	SW6010	3.0	mg/kg	NS	2,500	47.7	36.8	49.0	24.3	22.0	28.5
Iron	SW6010	10.0	mg/kg	NS	NS	14900	20700	25000	20400	8060	25000
Lead	SW6010	20.0	mg/kg	NS	1,000	69.0	ND	ND	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	2750	5740	6850	3430	4300	7340
Manganese	SW6010	1.5	mg/kg	NS	NS	437	369	553	983	4570	784
Nickel	SW6010	4.0	mg/kg	NS	2,000	13.0	23.5	46.9	19.7	14.2	18.0
Potassium	SW6010	200	mg/kg	NS	NS	486	378	1150	823	803	1180
Sodium	SW6010	100	mg/kg	NS	NS	259	587	804	344	334	959
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	79.4	ND	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	47.3	50.5	51.4	55.6	70.2	56.0
Zinc	SW6010	2.0	mg/kg	NS	5,000	70.7	55.1	66.3	47.7	23.3	53.4
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.049 B	0.010 B	0.044 B	0.006 B	0.009 B	0.011 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.70	0.022	0.067 J	0.012	0.009 J	0.014
trans-1,2-Dichloroethene	SW8240	0.005	mg/kg	NS	NS	0.85	0.033	ND	ND	ND	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	0.14	0.018	0.041 J	0.009 J	0.010 J	0.014
Vinyl Acetate	SW8240	0.010	mg/kg	NS	NS	0.033 J	ND	ND	ND	ND	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	0.052	0.49	0.007	0.047	0.011
Benzene	SW8240	0.005	mg/kg	NS	NS	0.041	ND	0.022	ND	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.40	0.065	0.18	0.029	0.096	0.19
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	0.10	ND	ND	ND	ND	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	0.72	ND	0.041	ND	ND	ND
Naphthalene	SW8270	0.33	mg/kg	NS	NS	0.78 J	ND	1.4 J	ND	ND	ND
2-Methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	1.9 J	ND	3.3 J	ND	ND	ND

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B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 3

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-1GW BAFB-0521 04/03/89	3-C-1GW[f] BAFB-0522 04/03/89	3-C-1GW[e] BAFB-0519 04/03/89	3-C-1GW[b] BAFB-0520 04/03/89	3-A-1GW BAFB-0511 03/29/89	3-A-2GW BAFB-0513 03/30/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	283	283	NT	NT	350	NT
Temperature	E170.1	N/A	deg C	NS	NS	20.8	20.8	NT	NT	22.0	NT
pH	E150.1	N/A	pH	5-9	NS	6.96	6.96	NT	NT	7.05	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	79.8	77.6	NT	NT	80.4	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	97.4	94.7	NT	NT	98.1	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	267	256	37.0	NT	299	291
Chloride	E325.3	1.0	mg/l	250	250	42.2	42.4	ND	NT	50.3	59.5
Fluoride	E340.2	0.050	mg/l	2	1.4	0.22	0.22	ND	NT	0.24	0.18
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	8.4	8.2	0.48	NT	7.84	6.38
Sulfate	E375.4	1.0	mg/l	250	250	8.9	15.4	ND	NT	11.6	15.2
Arsenic	SW7060	0.0050	mg/l	.05	.05	ND	NT	ND	NT	ND	0.0110
TFH-Gas	TFH-GA	0.10	mg/l	NS	NS	ND	0.10	ND	NT	ND	ND
Calcium	SW6010	1.00	mg/l	NS	NS	20.8	21.2	ND	NT	28.2	25.8
Magnesium	SW6010	1.00	mg/l	NS	NS	9.73	9.90	ND	NT	10.9	11.5
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	ND	NT	0.0310	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.80	1.80	ND	NT	2.00	2.10
Sodium	SW6010	1.00	mg/l	NS	NS	23.6	23.8	ND	NT	26.2	32.7
Vanadium	SW6010	0.0400	mg/l	NS	NS	ND	ND	ND	NT	ND	0.0690
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.344	0.348	ND	NT	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	1(2)	1(3)	ND	2(1)	4	ND
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	ND	ND	NT	10	4 J

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-A-3GW BAFB-0524 04/03/89	3-A-4GW BAFB-0518 03/31/89	3-A-5GW BAFB-0523 04/03/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	257	300	321
Temperature	E170.1	N/A	deg C	NS	NS	21.4	21.0	21.8
pH	E150.1	N/A	pH	5-9	NS	7.06	7.34	7.07
Alkalinity - Total	SM403	1.0	mg/l	20	NS	81.2	82.2	83.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	99.1	100.3	102.0
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	260	305	282
Chloride	E325.3	1.0	mg/l	250	250	33.7	46.4	54.6
Fluoride	E340.2	0.050	mg/l	2	1.4	0.24	0.26	0.24
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	7.8	8.6	5.7
Sulfate	E375.4	1.0	mg/l	250	250	8.7	9.1	7.7
Calcium	SW6010	1.00	mg/l	NS	NS	19.7	20.6	25.8
Magnesium	SW6010	1.00	mg/l	NS	NS	9.13	9.39	12.3
Potassium	SW6010	1.00	mg/l	NS	NS	1.60	1.70	2.50
Sodium	SW6010	1.00	mg/l	NS	NS	23.4	22.2	27.2
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	0.0220
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	6(1)
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	1 J	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 3

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-C-1GW BAFB-0634 09/08/89	3-A-1GW BAFB-0633 09/08/89	3-A-2GW BAFB-0639 09/13/89	3-A-2GW^{Rn} BAFB-0678 11/03/89	3-A-3GW BAFB-0635 09/11/89	3-A-4GW BAFB-0636 09/12/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	300	341	368	NT	274	311
Temperature	E170.1	N/A	deg C	NS	NS	21.5	21.5	21.0	NT	21.5	21.0
pH	E150.1	N/A	pH	5-9	NS	7.39	7.40	7.90	NT	7.62	7.66
Alkalinity - Total	SM403	1.0	mg/l	20	NS	71.6	81.0	105.2	NT	78.9	76.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	87.4	98.8	128.3	NT	96.3	92.7
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	244	250	326	NT	247	266
Chloride	E325.3	1.0	mg/l	250	250	43.7	47.8	54.0	NT	38.0	46.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.15	0.17	0.070	NT	0.12	0.13
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	7.9	8.7	5.1	NT	7.0	7.2
Sulfate	E375.4	1.0	mg/l	250	250	10.0	20.0	16.0	NT	10.0	15.0
Arsenic	SW7060	0.0050	mg/l	.05	.05	ND	ND	0.0120	NT	ND	ND
Calcium	SW6010	1.00	mg/l	NS	NS	20.7	25.8	28.9	NT	22.5	22.6
Magnesium	SW6010	1.00	mg/l	NS	NS	9.31	10.5	12.1	NT	9.17	9.68
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.0251	ND	NT	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.97	2.22	2.50	NT	2.11	2.30
Sodium	SW6010	1.00	mg/l	NS	NS	22.4	23.8	29.7	NT	21.8	27.1
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	5 J	ND	ND	NT	ND	ND
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	17	ND	NT	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
n: 8010 and 8020 analyses performed, no analytes detected
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.3-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	3-A-5GW BAFB-0637 09/12/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	329
Temperature	E170.1	N/A	deg C	NS	NS	21.0
pH	E150.1	N/A	pH	5-9	NS	7.58
Alkalinity - Total	SM403	1.0	mg/l	20	NS	83.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	102.2
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	296
Chloride	E325.3	1.0	mg/l	250	250	51.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.13
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	5.6
Sulfate	E375.4	1.0	mg/l	250	250	8.3
Calcium	SW6010	1.00	mg/l	NS	NS	23.3
Magnesium	SW6010	1.00	mg/l	NS	NS	10.5
Potassium	SW6010	1.00	mg/l	NS	NS	2.70
Sodium	SW6010	1.00	mg/l	NS	NS	22.4

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Table 4.1.3-3
RANGES OF CONTAMINANTS DETECTED AT SITE 3

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SURFACE SOILS				
TFH-diesel	mg/kg	34	320	3/3
lead	mg/kg	67.5	88.6	3/3
bis(2-ethylhexyl) phthalate	mg/kg	1.4	1.6	3/3
di-n-buthyl phthalate	mg/kg	ND	0.59	1/3
xylenes	mg/kg	ND	0.007	1/3
SOIL BORINGS				
TFH-diesel	mg/kg	ND	23,000	29/55
TFH-gas	mg/kg	ND	5,100	26/55
mercury	mg/kg	ND	0.58	21/55
lead	mg/kg	ND	534	5/55
2-butanone	mg/kg	ND	(0.97)	20/55
toluene	mg/kg	ND	1.6	36/55
trichloroethene	mg/kg	ND	7.0	13/55
tetrachloroethene	mg/kg	ND	0.008	2/55
1,2-dichloroethane	mg/kg	ND	(0.069)	5/55
trans-1,2-dichloroethene	mg/kg	ND	0.85	2/55
ethylbenzene	mg/kg	ND	1.9	8/55
benzene	mg/kg	ND	(0.19)	4/55
xylenes (total)	mg/kg	ND	7.9	13/55
bis(2-ethylhexyl) phthalate	mg/kg	ND	(0.23)	4/55
di-n-butyl phthalate	mg/kg	ND	1.2	6/55
2-methylnaphthalene	mg/kg	ND	6.8	9/55
4-methyl-2-pentanone	mg/kg	ND	0.87	3/55
phenanthrene	mg/kg	ND	(0.15)	2/55
napthalene	mg/kg	ND	5.2	5/55
GROUNDWATER				
TFH-gas	mg/l	ND	0.10	1/12
arsenic	mg/l	ND	0.012	2/12
toluene	ug/l	ND	6.0	3/12
bis(2-ethylhexyl) phthalate	ug/l	ND	17.0	3/12

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

detected in some soil samples were tentatively identified below the LOQ. Some of these detections may represent laboratory "noise," and the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study the LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.3.2 Sampling and Analytical Problems

4.1.3.2.1 Loss of Samples

There were no sample loss problems for Site 3 samples. One soil sample was resampled due to a holding time violation for mercury. One water sample in the second semiannual round was resampled because of a holding time violation for purgeable halocarbons and purgeable aromatics. All scheduled analyses were completed for Site 3 samples.

4.1.3.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil samples collected at Site 3 contained several organic compounds that were probably laboratory- or field-induced false positive results. Many of the soil samples collected contained acetone and methylene chloride. These are common laboratory contaminants and were also found in some of the method blanks at similar concentrations.

Several soil samples contained the semivolatile compounds bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, and N-nitrosodiphenylamine. These compounds were also detected in some of the method blanks at similar concentrations. The phthalate compounds were commonly detected in samples from throughout the base and are probably false positive results.

Phenol was detected in over half of the soil samples at concentrations ranging from 0.97 mg/kg to 2.3 mg/kg, with all but two of the detections in the range of 1.1 mg/kg to 2.3 mg/kg. Phenol contamination in soil samples has been traced to a factory contaminated bottle of acetone used in the method extraction process. The laboratory estimated from analysis of soil method blanks that the induced contamination was 1.7 mg/kg.

Toluene was detected in most of the soil samples. This occurred for samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent suggests that it is a false positive

result in most cases. Where toluene is believed to actually be present, such as at FPTA No. 1, it is discussed in the text.

Four field replicate QC soil samples were collected at Site 3. For the most part, the analytical results are very similar, with the exception of toluene (discussed above) and one TFH-diesel with an RPD of 161 percent. In addition, TFH-gas, xylenes, and 2-methylnaphthalene were detected in one sample but not confirmed in the corresponding replicate sample.

During the first sampling round, one groundwater replicate sample was collected at well 3-C-1, as well as one equipment wash blank and one ambient condition blank. Replicate results were very comparable, except for TFH-gas, which was detected in the replicate at the LOQ and not in the normal sample. The equipment wash blank had TDS of 37 mg/l, which is higher than expected for deionized water. The ambient condition blank had toluene detected at 2 ug/l (1 ug/l in the second column), with a detection limit of 1 ug/l. Toluene was detected both in the normal environmental sample at 1 ug/l (2 ug/l in the second column) and in the field replicate at 1 ug/l (3 ug/l in the second column), but not in the equipment wash blank.

4.1.3.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 3 samples.

4.1.3.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.3.3 Significance of Findings

TFH-diesel and -gas were detected in borings from all four areas at Site 3: FPTA No. 1, FPTA No. 2, the overflow basin, and underground storage tanks (see Figure 4.1.3-8).

Volatile organics were detected in soil samples from all four areas at Site 3 (Figure 4.1.3-10). Two semivolatile organic compounds were detected in samples from all four areas at Site 3, although only three samples had concentrations above the LOQs (Figure 4.1.3-9). Other than lead, the ICP metal concentrations detected at Site 3 were generally within the range of those detected in soil samples from other sites on base. The detection limits for lead ranged from 20 mg/kg to 25 mg/kg. Lead was detected in the surface

sample from the background boring at 24.2 mg/kg, as shown in Figure 4.1.3-9 which indicates that leaded fuel may have been spilled there at some time.

FPTA No. 1

In the FPTA No. 1 area, TFH-diesel concentrations ranged from 5.7 to 23,000 mg/kg and was detected in 18 of 22 soil samples collected from the four 20-foot borings. TFHs were detected in samples from all sampling depths in the FPTA No. 1, including 20 feet (the deepest). At this sample depth, TFH-diesel concentrations were from 94 to 1,300 mg/kg and TFH-gas concentrations were from 260 to 1,800 mg/kg. In 3-C-3SB, the TFH concentrations were greater in the 20-foot sample than in the surface sample.

The contaminated area at FPTA No. 1 is estimated to be a circle approximately 60 feet in diameter. Contamination migrating downward under the influence of gravity should move predominantly vertically but may spread beyond the original area due to dispersion around soil particles and/or flow along low permeability boundaries. The vertical extent of TFH contamination below the depth of samples taken is unknown and estimating the depth of contamination at FPTA No. 1 by comparison with other areas of Site 3 which have both TFH contamination and deeper borings is not appropriate. The lack of a liner system or prewetting operations during fire training at FPTA No. 1 has apparently facilitated greater infiltration of TFH into the soil than at FPTA No. 2.

In FPTA No. 1, xylenes and TCE were detected in three of the four borings. Total xylenes were detected at concentrations from 0.046 to 7.9 mg/kg at depths below ground surface of zero, 5, 10, and 15 feet. Total xylenes were not detected at greater depths in any other borings at Site 3. TCE was quantified at depths of 10, 15, and 20 feet, and estimated below the LOQ at a depth of 5 feet. The concentration at 20 feet was 0.14 mg/kg. TCE was detected at lower concentrations at greater depths in other borings on Site 3. The lateral extent of volatile organic contamination at FPTA No. 1 is believed to approximate the edges of the contamination source areas. The vertical extent of xylene contamination is believed limited to depths below ground surface of 15 feet. The vertical extent of TCE contamination cannot be determined based on the soil investigation performed at FPTA No. 1. No DHS TTLC for xylenes is available. The LUFT xylene cleanup standard computed for this site is 1 mg/kg. The DHS TTLC for TCE is 2,040 mg/kg.

Toluene was detected in samples from all four borings at FPTA No. 1. Many of the samples are at levels below 0.05 mg/kg and may represent false positive results. However, several samples range from about 0.1 to greater than 1 mg/kg and probably represent actual toluene contaminated soils. Boring 3-C-7SB had toluene detected at from 0.2 to 0.77 mg/kg in the surface 10-, 15-, and 20-foot samples but only 0.028 mg/kg at 5 feet. Ethylbenzene and xylene were detected in all but the 5-foot sample. Boring 3-C-3SB had toluene detected at from 0.76 to 1.6 mg/kg in the 0- to 1.5-, 5- to 6.5-, and 15- to 16.5-foot samples, which is probably true contamination. Ethylbenzene and xylene were only detected in the surface sample.

In FPTA No. 1, 2-methylnaphthalene was detected at 6.8 mg/kg at a depth of 10 feet in 3-C-2SB. Naphthalene was detected in the surface sample in boring 3-C-7SB at 5.2 mg/kg. Both compounds were detected in other samples at levels below the LOQ.

Naphthalene and 2-methylnaphthalene are constituents of jet fuels JP-5 and JP-8 (AFESC, 1981), and may also be constituents of other jet fuels. Although no evidence indicating use of JP-5 and JP-8 at Beale AFB was encountered, the presence of naphthalenes in soil samples from beneath the fire training area is not unexpected.

Lead was detected in three surface samples from the FPTA No. 1 at concentrations of 240, 251, and 534 mg/kg. One sample from a 5-foot depth in 3-C-7SB had a lead concentration of 61.5 mg/kg. The DHS TTLC for lead in soil is 1,000 mg/kg. Based on this criteria, the detected lead levels at FPTA No. 1, although relatively high for the base, do not constitute a hazardous waste.

FPTA No. 2

TFH-diesel and -gas were detected in soil samples from angled borings beneath the FPTA No. 2 to a maximum 17.5- to 19-foot sample depth (actual vertical depth equals 16 feet). TFH-diesel concentrations ranged from 8.8 to 9,400 mg/kg in five samples; TFH-gas concentrations ranged from 39 to 700 mg/kg in four samples. The highest concentration for each TFH was detected in the 17.5- to 19.0-foot sample (actual vertical depth equals 16 feet) from 3-C-10SB. No TFHs were detected below this depth in either boring. Each angled boring had a total vertical depth of 42 feet. In these borings, the vertical extent of TFH contamination is estimated to be 15 to 20 feet. The LUFT TFH-diesel and gas cleanup standards are 1,000 mg/kg and 100 mg/kg.

In angled boring 3-C-10SB in FPTA No. 2, xylenes, benzene, TCE, and trans-1,2-DCE were detected. The xylene concentrations were 0.73 mg/kg at zero feet and 0.041 mg/kg at 17.5 to 19 feet (actual vertical depth 16 feet). Benzene was detected in the surface and 17.5- to 19-foot samples at 0.041 and 0.022 mg/kg. Toluene was detected at 0.40 mg/kg in the surface sample, 0.065 mg/kg at 7.5 to 9 feet, 0.18 mg/kg at 17.5 to 19 feet, 0.029 mg/kg at 27.5 to 29 feet, 0.096 mg/kg at 37.5 to 39 feet, and 0.19 mg/kg at 47.5 to 49 feet. The surface and 17.5- to 19-foot results probably represent actual toluene contamination as the concentrations are higher than other samples and benzene and xylenes were also detected in these two samples. TCE was detected in all except the surface sample ranging from 0.011 to 0.49 mg/kg. The 0.011 mg/kg concentration was in the deepest (42 feet) sample. Trans-1,2-DCE was detected in the surface and 7.5-foot samples at 0.85 and 0.033 mg/kg. The LUFT cleanup standards for xylene and benzene are 1.0 and 0.3 mg/kg. The DHS TTLC for TCE is 2,040 mg/kg; none is available for DCE.

Semivolatile organic compounds were detected in angled boring 3-C-10SB in the FPTA No. 2. Samples from the surface and 17.5 to 19 feet had concentrations of 2 methylnaphthalene and naphthalene below the LOQ.

The surface samples from two angled borings in FPTA No. 2 had lead concentrations of 34.9 and 69.0 mg/kg.

Overflow Basin

Beneath the overflow basin, TFH-diesel and -gas were detected at 470 and 190 mg/kg in the 8-foot soil sample (actual vertical depth equals 7 feet) from angled soil boring 3-C-5SB. TFH-diesel was also detected at concentrations from 34 to 320 mg/kg in the three sediment samples collected from the overflow basin. In the angled boring drilled, the vertical limit of TFH contamination is estimated to be 7 to 10 feet.

Three volatile organic compounds were detected in soil samples from angled boring 3-C-5SB beneath the overflow basin. Xylenes were detected in the 7.5- to 9-foot sample (7 feet vertically) at 1.8 mg/kg. TCE was detected in the 27.5- to 29-foot sample (24 feet vertically) at 0.017 mg/kg and was estimated in the 47.5- to 49-foot sample (42 feet vertically) below the LOQ. 1,2-DCE was detected at 0.020 mg/kg in the 27.5- to 29-foot sample and below the LOQ in the 47.5- to 49-foot sample. Xylene was detected at 0.007 mg/kg in sediment sample 3-C-3SS. The LUFT cleanup standard for xylene is 1.0 mg/kg.

Mercury was detected in soil samples to a vertical depth of 42 feet at concentrations from 0.070 to 0.088 mg/kg beneath the overflow basin. The DHS TTLC for mercury is 20 mg/kg.

The three sediment samples from the overflow basin had lead detected at 67.5, 67.7, and 88.6 mg/kg. No lead was detected in soil samples from the angled boring beneath the overflow basin. The DHS TTLC for lead is 1,000 mg/kg.

Underground Storage Tanks

TFH-diesel and-gas were also detected in the two vertical borings near the underground storage tanks. Soil samples above a depth of 15 feet ranged in concentrations from 630 to 3,800 mg/kg for TFH-diesel and 240 to 1,700 mg/kg for TFH-gas in three samples. The concentrations in samples from 20 feet were relatively low compared to the FPTA areas; 5.1 mg/kg for TFH-diesel in 3-C-6SB and 47 mg/kg for TFH-gas in 3-C-4SB. The soil samples from 30 feet had concentrations of 11 and 280 mg/kg for TFH-diesel and 44 and 150 mg/kg for TFH-gas in borings 3-C-4SB and 3-C-6SB, respectively. The boring 3-C-6SB sample from 40 feet had 180 and 72 mg/kg TFH-diesel and -gas concentrations. Boring 3-C-4SB had 38 mg/kg TFH-gas in the deepest (50 feet) sample. The LUFT cleanup standards for TFH-diesel and -gas at Site 3 are 1,000 mg/kg and 100 mg/kg. The lateral extent of this contamination is likely limited to the immediate area of the underground tanks. While the TFH concentrations appear to decrease with depth, its limits are still unknown.

In the two borings near the underground storage tanks, xylenes were detected in two samples from boring 3-C-4SB. Xylene concentrations of 3.8 and 1.4 mg/kg were detected in the surface and 10-foot samples. The LUFT cleanup standard for xylene is 1.0 mg/kg.

In the 10-foot sample from boring 3-C-6SB, 2-methylnaphthalene was detected at 0.84 mg/kg near the underground storage tanks. It was also detected below the LOQ in boring 3-C-4SB.

No lead was detected in soil samples from the underground storage tank area.

Groundwater

Only TFH-gas (0.10 mg/l, 3-C-1, first round replicate sample) was detected in groundwater sampled in the two semiannual rounds at Site 3. Because of the lack of confirmation in the normal sample or subsequent semiannual samples, the TFH-gas detection is suspect. Toluene and bis(2-ethylhexyl) phthalate detected in the groundwater from this site

are not believed to be contaminants. Arsenic was detected in samples from background well 3-A-2 in both rounds at 0.0110 and 0.0120 mg/l. This is below the federal and state MCL of 0.05 mg/l. As well 3-A-2 is an upgradient well for Site 3, the arsenic is believed to be naturally occurring.

4.1.3.3.1 Zones of Contamination

At Site 3, the zones of contamination are believed to be limited to the four areas investigated in Stage 2-1, as discussed above. The Phase II, Stage 1 study detected oil and grease contamination at FPTA No. 2 and near the underground storage tanks. Stage 2-1 confirms and further delineates the extent of contamination at these areas and also provides new information in the FPTA No. 1 area and the overflow basin.

In all four areas the lateral extent of soil contamination is judged to be limited approximately to the boundary of the structure(s) which act as the contaminant source. Groundwater is approximately 110 feet below the ground surface at Site 3. Contamination migrating downward under the influence of gravity should move predominantly vertically but may spread beyond the original area due to dispersion around soil particles and flow along low permeability boundaries.

FPTA No. 1

The apparent vertical extent of soil contamination in FPTA No. 1 cannot be determined from the investigation conducted in Stage 2-1 because TFH-diesel and -gas were detected in the deepest samples from three of the borings in the area.

FPTA No. 2

Based on the two borings drilled beneath the FPTA No. 2 during Stage 2-1, the vertical extent of TFH soil contamination is limited to the 16-foot vertical sample depth. TCE soil contamination is present at the 42-foot vertical sample depth and may extend deeper. However, the TCE concentrations generally decreased within the depth investigated.

Overflow Basin

The apparent vertical extent of TCE and 1,2-DCE, based on one angled soil boring completed in Stage 2-1, is about 30 feet. Since mercury was detected in the deepest sample from 3-C-5SB, the lower limit of detectable mercury concentrations cannot be estimated beneath the overflow basin.

Underground Storage Tanks

The vertical extent of contamination in the underground storage tank area is at least 50 feet. The TFH-gas contamination is believed to extend beyond this depth, although the TFH concentrations do decrease with depth. The lower limit of soil containing detectable levels of TFHs cannot be determined from the work conducted through Stage 2-1.

Total xylenes and 2-methylnaphthalene were detected in two borings at the 10-foot depth near the underground storage tanks. Volatile and semivolatile compounds were not detected below this depth.

Groundwater

Contamination was not detected in the groundwater at Site 3 during the Phase II, Stage 1 work. Through the two rounds of sampling (semiannual at Site 3) in Stage 2-1, only TFH-gas was detected (at the LOQ) in one replicate sample.

4.1.3.3.2 Contaminant Migration

No significant groundwater contamination has been detected at Site 3 and no surface water other than direct runoff leaves Site 3. While the likelihood for contaminant migration is low, contaminants in the soil may continue to move downward to groundwater. Contaminants (if any) in the groundwater would move with the regional groundwater flow to the west.

4.1.3.3.2.1 Potential to Move Off Site and Off Base

At present, contaminants at the levels detected at Site 3 are not expected to move off the site or off the base. Based on drainage ditch sediment samples collected during Phase II, Stage 1, surface water apparently does not transport contaminants from Site 3.

The potential for TFH-gas detected in one replicate groundwater sample to move off site and off base is considered low.

4.1.3.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Groundwater flows west from Site 3 at approximately 150 feet per year.

4.1.3.3.2.3 Time of Travel to Receptors

The potential receptors include firefighters in training (discontinued) and base personnel handling wastes. Travel to off base receptors is unlikely.

4.1.3.3.2.4 Applicability of Solute Transport Models

Due to the complex alluvial deposits and lack of detected analytes in the groundwater, solute transport models are not applicable at Site 3.

4.1.3.3.2.5 Expected Spatial and Temporal Variations in Concentration

Spatial or temporal variations in groundwater chemistry were not detected in the two semiannual sampling rounds at Site 3.

4.1.3.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.4 DISCUSSION OF RESULTS FOR SITE 4: BATTERY SHOP DRY WELL

From 1972 to 1983, approximately 24 gallons per month of neutralized lead battery acid were discharged to the dry well, which is adjacent to the battery shop (Building 1088; see Figure 4.1.4-1). Over 11 years, an estimated 3,200 gallons were discharged. The neutralized acid may have had high lead concentrations. The dry well is 4 feet in diameter, approximately 20 feet in depth, and filled with cobblestones. Use of the dry well was discontinued in 1983.

One angled soil boring was drilled beneath the dry well to determine soil pore fluid characteristics, soil pH, and ICP metal concentrations.

4.1.4.1 Presentation of Results

This section presents the results of the field investigation at Site 4. The discussion focuses on the geology and hydrogeology at the site and presents the results of chemical analyses performed on samples of groundwater and soils.

4.1.4.1.1 Site Geology

Evaluation of the geology at Site 4 is based on a borehole drilled during the current Stage 2-1 investigation and on a well installed during the Phase II, Stage 1 investigation (AeroVironment, 1987). During the current investigation, one angled soil boring was drilled at Site 4 beneath the battery shop dry well to a depth of 49 feet (vertical distance of 42 feet). During the Phase II, Stage 1 investigation, one monitoring well was constructed at Site 4 and screened across the water table. The locations of the well and borehole are shown in Figure 4.1.4-1. Soil boring logs are provided in Appendix D.

A cross-section constructed from soil boring logs of the Site 4 well and borehole is shown in Figure 4.1.4-2. A key to lithologic symbols is given in Appendix D. This cross-section shows that near-surface soil in the vicinity of Site 4 is predominantly fine-grained clay, becoming mainly coarse-grained sand and silty sand below a depth of about 5 feet. Because the borehole and well were drilled only about 24 feet apart, the geologic units may be correlated between the holes. The cross-section shows sand through almost the entire interval of both holes, varying from silty sand to sandy gravel at about the same depth intervals. Lenses of clay and silty clay are present within the sand units. The borehole in which well 4-A-1 was constructed was terminated in a clay unit at a depth of about 140 feet

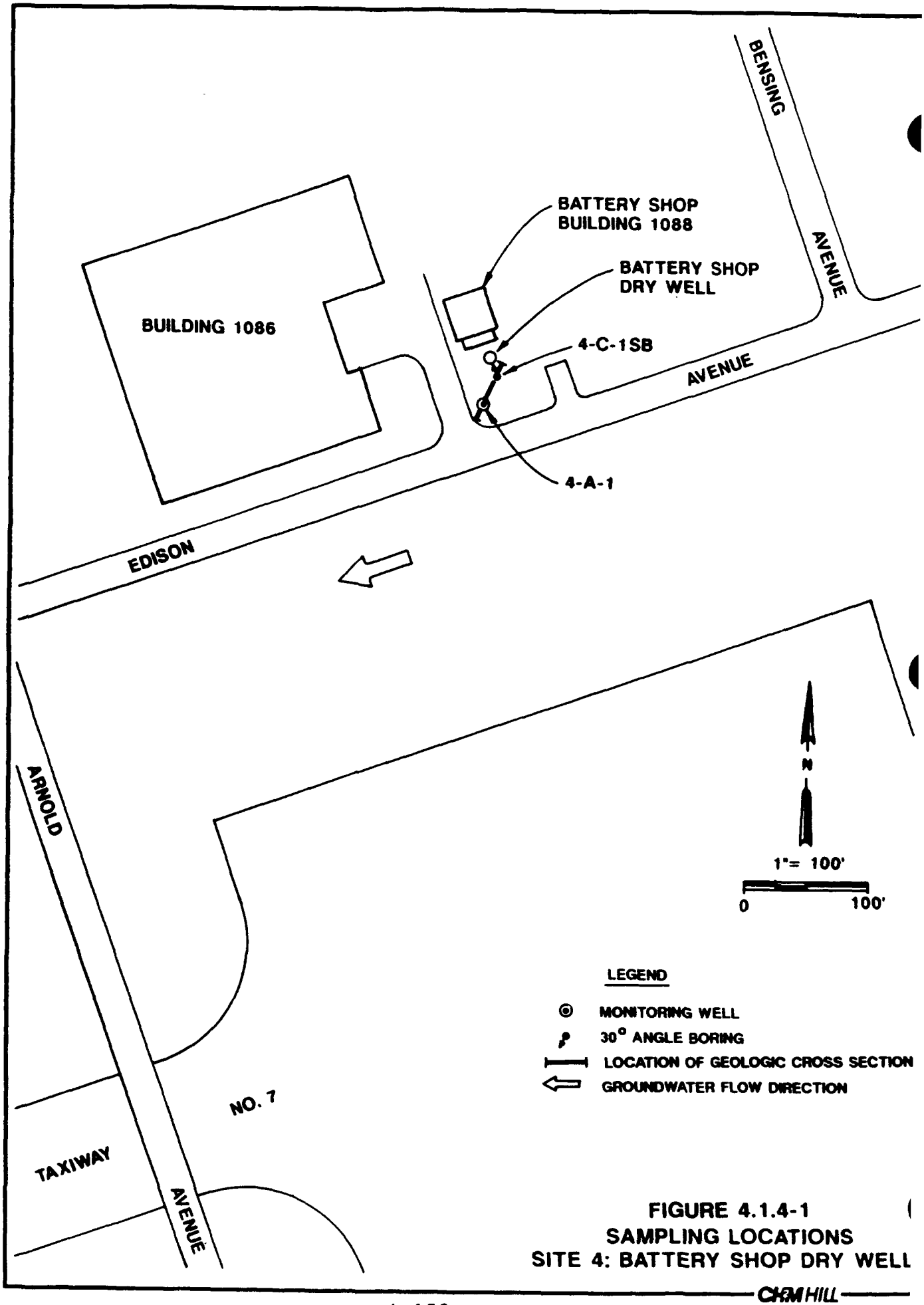
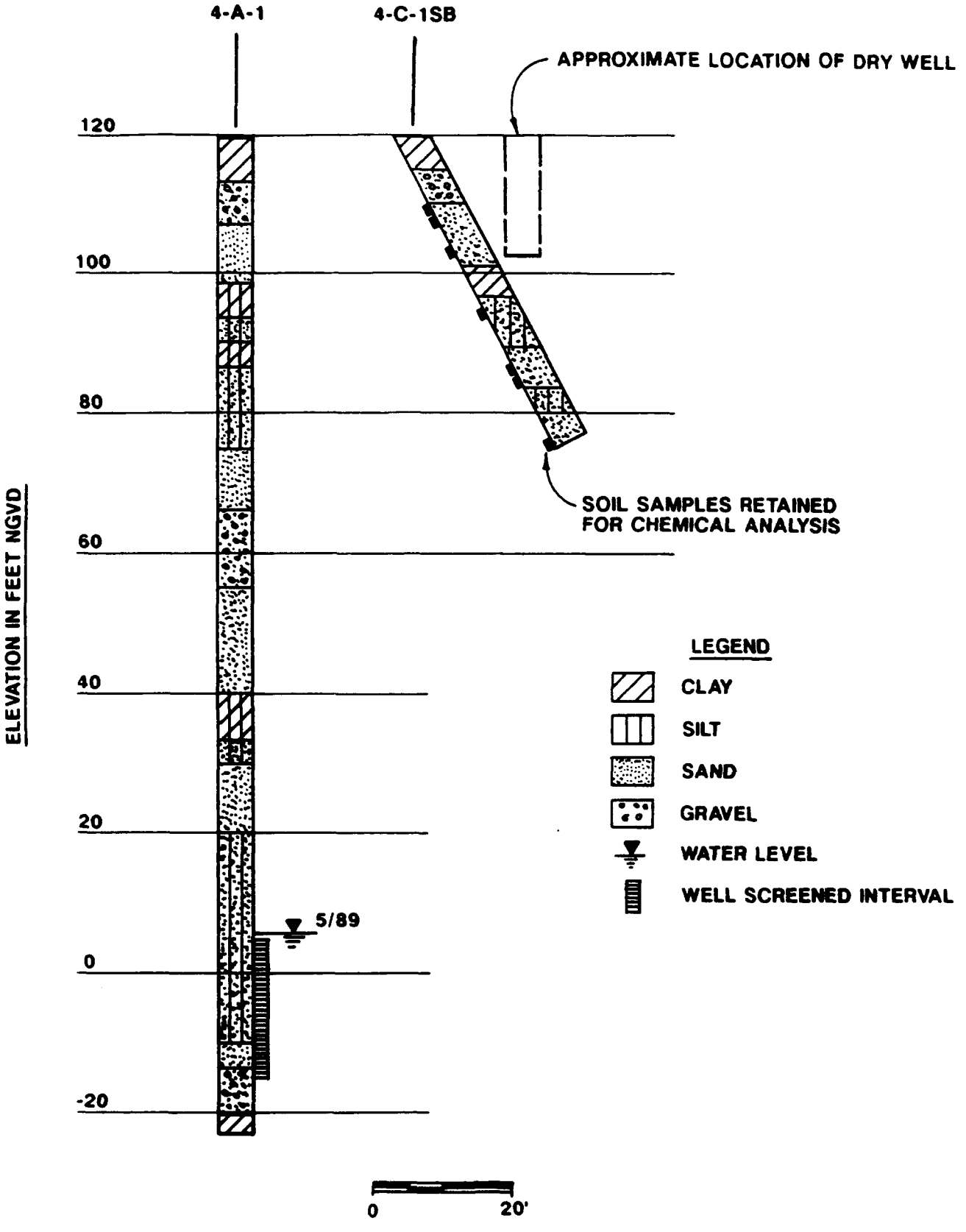


FIGURE 4.1.4-1
SAMPLING LOCATIONS
SITE 4: BATTERY SHOP DRY WELL

CH2M HILL



SCALE: 1"=20' HORIZ
1"=20' VERT

FIGURE 4.1.4-2
GEOLOGIC CROSS SECTION
SITE 4: BATTERY SHOP DRY WELL

CH2M HILL

(-20 feet NGVD). However, the extent of this unit and its impact on hydraulic characteristics of the groundwater are unknown.

Soils at Site 4 constitute an alluvial sequence. At the surface, the deposits at Site 4 have been mapped as belonging to the Laguna Formation (Page, 1980). These are continental alluvial deposits of the Pleistocene and Pliocene Epoch composed of clay, silt, sand, and gravel and are pre- dominantly coarse-grained deposits. These deposits overlie the older volcanic rocks from the Sierra Nevada in the stratigraphic section at Beale AFB. The volcanic rocks outcrop about 1 mile east of Site 4 in the foothills (Page, 1980). Based on the colors described in the logs of the boreholes, no volcanic material was encountered in borings at Site 4.

4.1.4.1.2 Site Hydrogeology

The first saturated permeable zone in well 4-A-1 that produced water during drilling occurred at a depth of about 124 feet (-5 feet NGVD) as the cuttings became increasingly wet in a silty fine sand unit. After completion and development of this well, the water level remained at about -5 feet NGVD. It is likely that the groundwater is unconfined in the sand units that lie under Site 4. The nearest clay unit lying over the groundwater occurs at an elevation of 33 to 40 feet NGVD. As described above, the sands are underlain by a clay unit at a depth of about 140 feet (about -21 feet NGVD).

Groundwater levels in well 4-A-1 between April 1986 and November 1989 are summarized in Table 4.1.4-1 and Figure 4.1.4-3. This table shows that the groundwater level in this well has risen over 13 feet during this period. This rise corresponds to a regional water level rise observed in other shallow monitoring wells in the vicinity and may be due to a reduction in agricultural pumping west of the base or to an increase in regional recharge. The water level rose over 3 feet between December 1988 and November 1989.

Table 4.1.4-1
GROUNDWATER ELEVATIONS: SITE 4

Well	Screened Interval	Apr. 1986	Oct. 1986	Dec. 1988	Feb. 1989	March 1989	May 1989	Aug. 1989	Nov. 1989
4-A-1	5 to -15	-5.81	-3.59	4.46	4.73	5.43	5.94	7.10	7.71

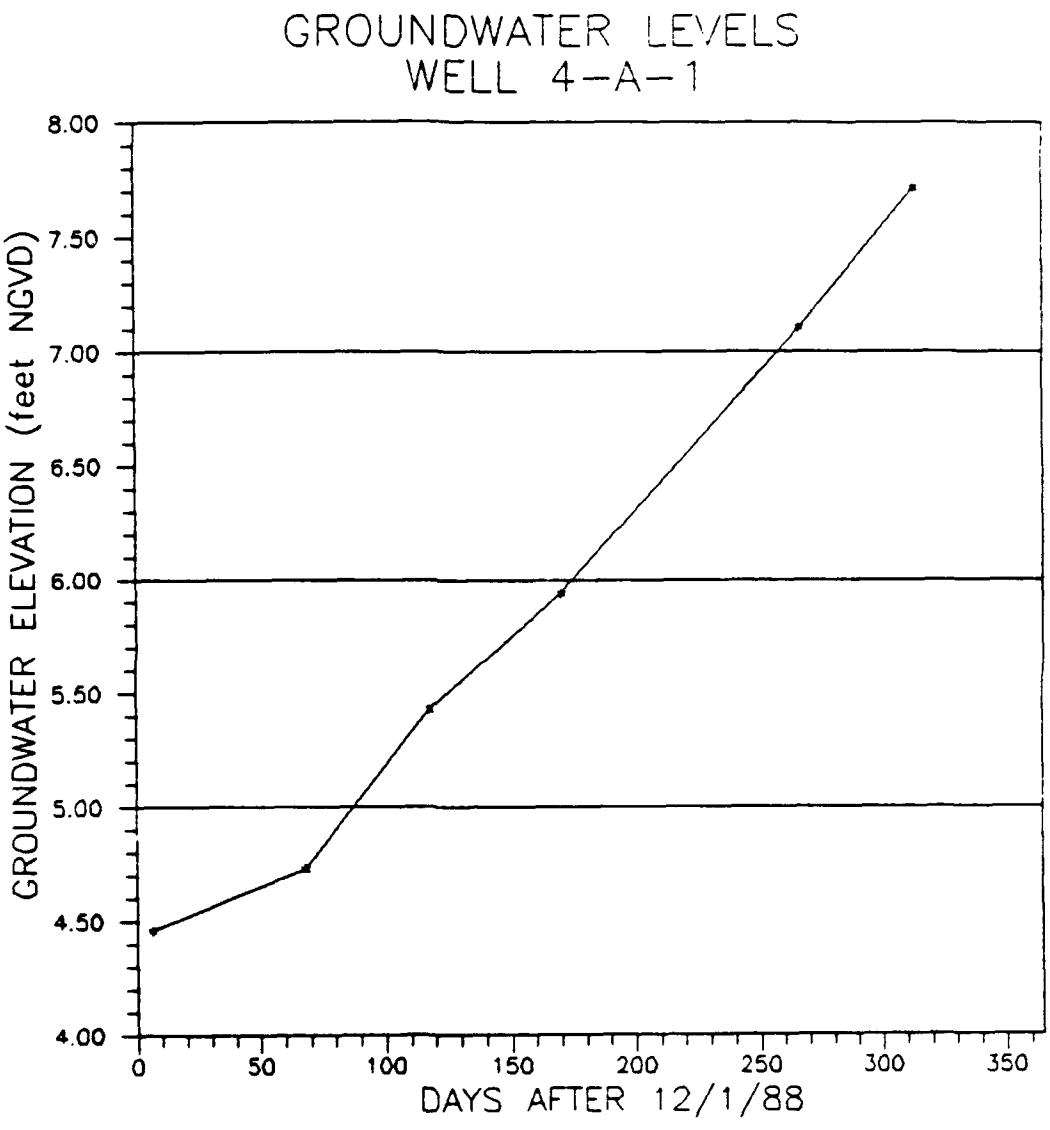


FIGURE 4.1.4-3
MONITORING WELL HYDROGRAPH
SITE 4: BATTERY SHOP DRY WELL

CH2MHILL

Contours of groundwater levels taken in May 1989 from monitoring wells screened across the water table in the flightline area of Beale AFB are plotted in Figure 4.1.4-4. Groundwater levels taken across Beale AFB in March and November 1989 are plotted in Plates 3 and 4. Groundwater contours drawn on these levels show that groundwater flows toward the southwest in the vicinity of Site 4. The gradient increases to the east of well 4-A-1, from about 0.003 to about 0.02. This change appears to be in response to a change in hydrogeologic regimes from unconsolidated sediments of the Central Valley to consolidated rocks of the Sierra Nevada foothills. The change is also an artifact of the bending of flowlines toward the groundwater depression west of Beale AFB. Aquifer parameters in the immediate vicinity of Site 4 are unknown because no tests were performed on existing well 4-A-1 during the Stage 2-1 investigation.

4.1.4.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are in Appendices A and F. Discussion of analytical results in this and following subsections and presentation of analytical results in figures and tables are limited to results that are indicators of site-specific contamination. Though not all analytes are individually discussed or illustrated, all are presented in the Analytical Results Table in Section 4.1.4.1.4 and in Appendix A.

Five soil boring samples and two duplicates were collected at Site 4 (Figure 4.1.4-1) from the 50-foot angle boring, 4-C-1SB, beneath the 20-foot-deep cobble-filled battery shop dry well. These soil boring samples were analyzed for ICP metals (6010), soil moisture (ASTM D2216), soil pH (9045) and TFH-diesel and -gas (California method). Due to the nature of wastes disposed at this site, no additional organic analyses were performed.

ICP metals in the 17.5- to 19- and 37.5- to 39-foot (16 and 33 feet vertically) samples at boring 4-C-1SB contained lower levels of aluminum, calcium, iron, magnesium, manganese, and zinc than the 11-foot (10 feet vertically) sample or background levels at Beale AFB. Aluminum, iron, and zinc were at low levels in the 37.5- to 39- and 47.5- to 49-foot samples (33 and 42 feet vertically), as well. The following metals were detected at concentrations greater than two standard deviations above background levels: barium in the 27.5- to 29- and 37.5- to 39-foot samples, manganese in the 27.5- to 29-foot through 47.5 to 49-foot samples, and sodium in all samples. Only the 17.5- to 19-foot sample had

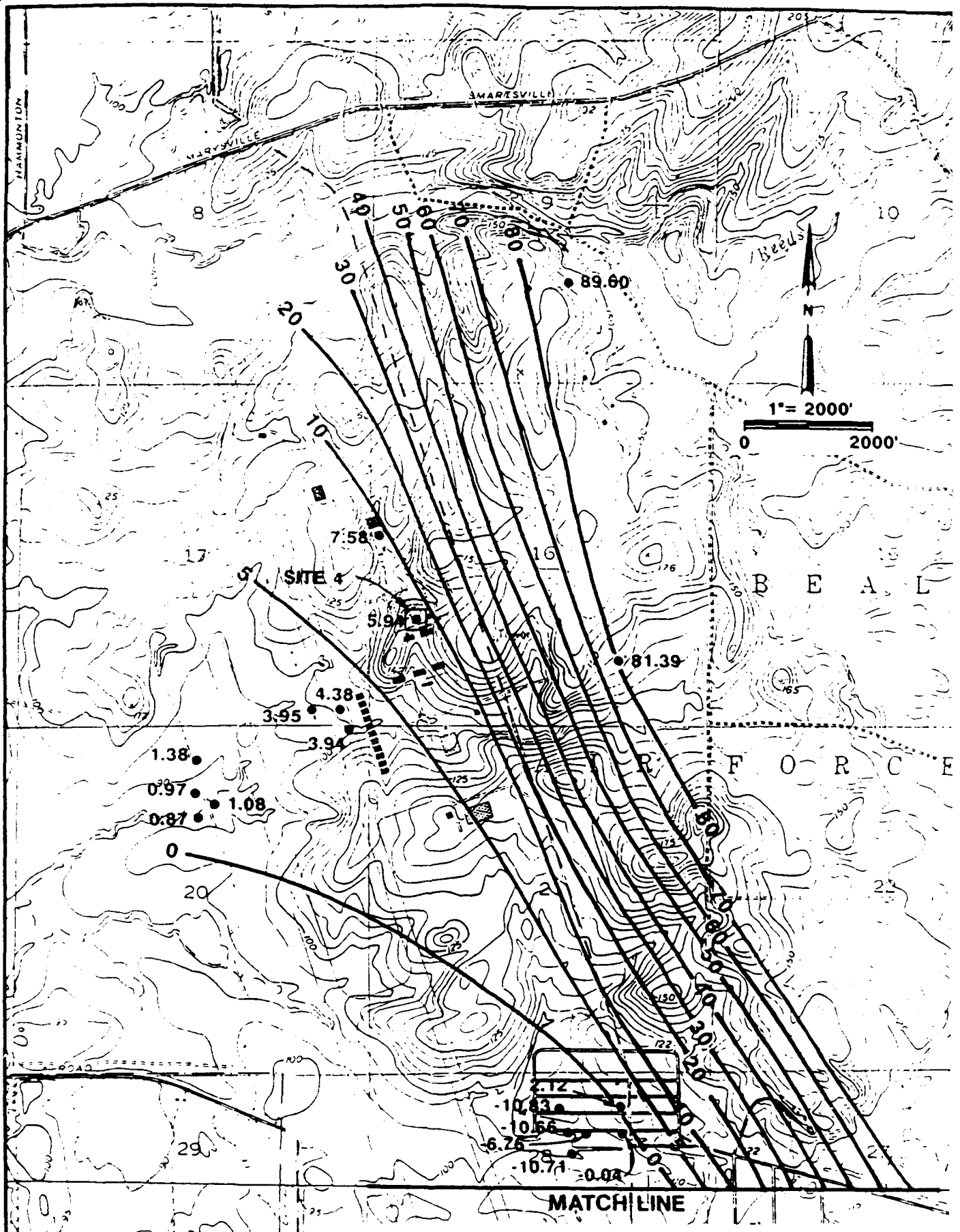


FIGURE 4.1.4-4
GROUNDWATER ELEVATION CONTOURS MAY 1989
NORTH BEALE AFB (FEET NGVD)

CH2M HILL

detected cadmium (2.7 mg/kg) and lead (110 mg/kg). Beryllium was detected in the 27.5 to 29-foot sample at 1.1 mg/kg. It was only detected in 1 of 31 background samples at 0.62 mg/kg. Soil pH ranged from 6.2 to 7.4 except in the 27.5- to 29-foot sample, which had a pH of 3.6. TFH-diesel and -gas were not detected.

During the IRP Phase II, Stage 1 investigation (AeroVironment, 1987), TCE was detected in well 4-A-1 at 0.2 ug/l in the April and 0.1 ug/l in the October 1986 sampling rounds. Barium was detected at 0.060 mg/l in the first round and at 0.250 mg/l in the second round.

In the two Stage 2-1 semiannual rounds of water sampling at Site 4, one groundwater sample was collected during each round from monitoring well 4-A-1 installed by AeroVironment in 1986 (Fig. 4.1.4-1). Analyses performed for the water samples were ICP metals (6010), lead (7421), water quality parameters, and TFH-diesel and -gas.

Lead, TFH-diesel, and TFH-gas were not detected in groundwater at Site 4 during the first semiannual sampling round of this investigation (April 1989). TDS was 161 mg/l in 4-A-1. Major anions and cation concentrations were generally similar to other sites near the flightline. Nitrite plus nitrate (expressed as nitrate) was 12.5 mg/l. Sulfate is lower than at most areas at Beale AFB at 3.8 mg/l. Fluoride was 0.32 mg/l. Groundwater at Site 4 is a sodium-calcium bicarbonate type.

In the second sampling round at Site 4 (September 1989), results were very similar to results of the first round. Again, lead, TFH-diesel, and TFH-gas were not detected. Water quality parameters and type were similar to those of the first round. Sulfate dropped to 1.2 mg/l.

4.1.4.1.4 Analytical Results Table

Table 4.1.4-2 presents a summary of all analyses and detected analytes for Site 4. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.4-2 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

TABLE 4.1.4-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 4

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	4-C-1SB BAFB-0409 11.0-12.5' 01/17/89	4-C-1SB[f] BAFB-0410 12.5-14.0' 01/17/89	4-C-1SB BAFB-0411 17.5-19.0' 01/18/89	4-C-1SB BAFB-0412 27.5-29.0' 01/18/89	4-C-1SB BAFB-0413 37.5-39.0' 01/18/89	4-C-1SB[f] BAFB-0414 39.0-40.5' 01/18/89
Percent Moisture	ASA#9	N/A	%	NS	NS	23.9	22.4	24.9	21.6	13.7	12.2
Soil PH	SW9045	N/A	N/A	5-9	NS	6.2	6.2	7.6	3.6	6.4	NT
Aluminum	SW6010	20.0	mg/kg	NS	NS	18100	15200	5650	15400	6340	5440
Barium	SW6010	10.0	mg/kg	NS	10,000	251	213	154	569	492	286
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	1.1	ND	ND
Cadmium	SW6010	1.0	mg/kg	NS	100	ND	ND	2.7	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	4550	4200	1460	2320	1710	1660
Chromium	SW6010	3.0	mg/kg	NS	500	11.0	9.5	10.0	47.2	7.1	6.4
Cobalt	SW6010	4.0	mg/kg	NS	8,000	13.0	11.0	ND	16.6	5.0	6.4
Copper	SW6010	3.0	mg/kg	NS	2,500	22.3	26.9	28.1	27.6	13.9	7.3
Iron	SW6010	10.0	mg/kg	NS	NS	22500	18200	16100	25100	8490	8510
Lead	SW6010	20.0	mg/kg	NS	1,000	ND	ND	110	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	3310	2890	1120	2360	2380	2060
Manganese	SW6010	1.5	mg/kg	NS	NS	1190	950	75.1	2930	2320	1320
Nickel	SW6010	4.0	mg/kg	NS	2,000	10.6	7.5	ND	29.8	6.6	4.7
Potassium	SW6010	200	mg/kg	NS	NS	ND	ND	533	1390	1010	877
Sodium	SW6010	100	mg/kg	NS	NS	874	796	2380	1160	569	505
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	ND	ND	24.7 J	23.0 J
Vanadium	SW6010	4.0	mg/kg	NS	2,400	45.6	36.6	44.9	68.2	19.7	15.9
Zinc	SW6010	2.0	mg/kg	NS	5,000	66.5	51.4	36.1	53.3	29.1	19.4

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.4-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	4-C-1SB BAFB-0415 47.5-49.0' 01/18/89
Percent Moisture	ASA#9	N/A	%	NS	NS	14.6
Soil PH	SW9045	N/A	N/A	5-9	NS	6.3
Aluminum	SW6010	20.0	mg/kg	NS	NS	11200
Barium	SW6010	10.0	mg/kg	NS	10,000	171
Calcium	SW6010	100	mg/kg	NS	NS	3780
Chromium	SW6010	3.0	mg/kg	NS	500	6.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	5.0
Copper	SW6010	3.0	mg/kg	NS	2,500	11.7
Iron	SW6010	10.0	mg/kg	NS	NS	7740
Magnesium	SW6010	100	mg/kg	NS	NS	1790
Manganese	SW6010	1.5	mg/kg	NS	NS	429
Potassium	SW6010	200	mg/kg	NS	NS	457
Sodium	SW6010	100	mg/kg	NS	NS	802
Thallium	SW6010	50.0	mg/kg	NS	700	15.2
Vanadium	SW6010	4.0	mg/kg	NS	2,400	14.1
Zinc	SW6010	2.0	mg/kg	NS	5,000	16.4

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.4-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 4

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	4-A-1GW BAFB-0525 04/04/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	162
Temperature	E170.1	N/A	deg C	NS	NS	21.0
pH	E150.1	N/A	pH	5-9	NS	7.08
Alkalinity - Total	SM403	1.0	mg/l	20	NS	66.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	81.5
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	161
Chloride	E325.3	1.0	mg/l	250	250	9.2
Fluoride	E340.2	0.050	mg/l	2	1.4	0.32
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	12.5
Sulfate	E375.4	1.0	mg/l	250	250	3.8
Calcium	SW6010	1.00	mg/l	NS	NS	10.6
Magnesium	SW6010	1.00	mg/l	NS	NS	5.83
Potassium	SW6010	1.00	mg/l	NS	NS	1.90
Sodium	SW6010	1.00	mg/l	NS	NS	18.9

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.4-2

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 4

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	4-A-1GW BAFB-0628 09/07/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	172
Temperature	E170.1	N/A	deg C	NS	NS	21.5
pH	E150.1	N/A	pH	5-9	NS	7.49
Alkalinity - Total	SM403	1.0	mg/l	20	NS	59.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	72.7
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	176
Chloride	E325.3	1.0	mg/l	250	250	9.8
Fluoride	E340.2	0.050	mg/l	2	1.4	0.26
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	12.9
Sulfate	E375.4	1.0	mg/l	250	250	1.2
Calcium	SW6010	1.00	mg/l	NS	NS	10.2
Magnesium	SW6010	1.00	mg/l	NS	NS	5.36
Potassium	SW6010	1.00	mg/l	NS	NS	1.07
Sodium	SW6010	1.00	mg/l	NS	NS	17.1

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

4.1.4.1.5 Discussion of Analytical Data

The only suspected heavy metal contaminant detected at Site 4 was lead, which was encountered in the angled soil boring (15 feet vertically) from a sample depth of 17.5 to 19.0 feet at a concentration of 110 mg/kg. Soil pH was 3.6 at a sample depth of 27.5 to 29.0 feet (24 feet vertically), but was within one pH unit of neutral for all other samples. Sodium was also encountered in all soil samples at greater than two standard deviations above background concentrations.

No data corrections have been made based on method blank detections. Analytical data are believed to accurately represent site conditions at the time of sampling.

4.1.4.2 Sampling and Analytical Problems

4.1.4.2.1 Loss of Samples

There were no sample loss problems for Site 4 samples. The only omitted analysis was one soil pH for the sample from 39.0 to 40.5 feet (34 feet vertically). The omission of this analysis is not considered critical to the final evaluation of site conditions because the omitted analysis is for a replicate sample. The pH was determined for the original sample from 37.5 to 39.0 feet (32.5 feet vertically).

4.1.4.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

No organic analyses were conducted for Site 4 other than for TFH-diesel and -gas. None of the analytes detected are suspected of being false positive results.

Two soil replicate QC samples were collected from the boring at Site 4. Both of the replicate analyses were comparable with the original samples for all analytes.

4.1.4.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 4 samples.

4.1.4.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.4.3 Significance of Findings

Soil

No TFH-diesel or -gas was detected in any soil samples from boring 4-C-1SB. Soil pH ranged from 6.2 to 7.6 in most samples, except for the sample at 27.5 feet (actual depth equals 24 feet) which had a pH of 3.6. This sample was collected from approximately directly below the backfilled dry well and is interpreted to be residual from battery shop dry well operations.

Lead was detected at the 17.5-foot sample depth (vertical depth 15 feet) at 110 mg/kg and not in any other samples. This is higher than the single lead detection (24.2 mg/kg) out of the 31 samples taken from base background borings at Sites 2, 3, 6, 13, 15, and 19, and in most soil samples on base, other than those near a known or suspected lead source. Although no analyses were available for the neutralized acid from lead batteries, the neutralized acid is anticipated to have contained some dissolved lead. The source of the lead detected in the soil is interpreted to be the battery shop dry well. The DHS TTLC for lead is 1,000 mg/kg.

Sodium concentrations in samples from boring 4-C-1SB were much greater (up to 7 standard deviations) than averaged values from background borings at other sites on base. The source of the sodium may have been the buffering compound used to neutralize the battery acid. High barium concentrations (up to 6 standard deviations greater) were also noted in the boring. The potential source of barium is unknown.

Aluminum, calcium, iron, chromium, nickel, magnesium, vanadium, and zinc concentrations in the soil below a depth of about 30 feet were generally two to three standard deviations below average background values for those metals. The relatively low metal concentrations are generally similar to concentrations in sand samples from background borings and may be a characteristic of the coarse-grained soil below the dry well at Site 4 or due to leaching by partially neutralized acids.

Groundwater

Groundwater was sampled and analyzed twice from the one well at Site 4. Water quality parameters for the sample were of similar magnitude to groundwater samples from other sites near the flight line. No TFH-diesel, TFH-gas, or lead were

detected. The groundwater does not appear to be contaminated at the location of the monitoring well on Site 4.

4.1.4.3.1 Zones of Contamination

Soil

Contamination detected in the soil was limited to above-background concentrations of sodium, barium, beryllium, cadmium, manganese, and lead. Lower than average concentrations of metals, including chromium, calcium, and iron, were detected below depths of about 30 feet. A pH value of 3.6 was detected in the sample from 30 feet.

Metals detected above background were more than two standard deviations above averaged levels in background soil boring samples from other IRP sites on base. Therefore these metals may not be naturally occurring. The sodium and lead can be attributed to operations and materials used at the neutralized battery acid dry well. The source of barium, beryllium, and manganese is not known.

Likewise, the relatively low concentrations of metals discussed above were detected below the two standard deviation interval of the averaged background levels. This is interpreted as indicative of secondary contamination effects because low metal concentrations were probably caused by the acidic environment. The 3.6 pH soil sampled from a depth of 24 feet represents acidic contamination. In a low pH environment there are an abundance of hydrogen cations that will preferentially bond to any available anions. This chemical action will displace metal cations that may have been naturally occurring in the soil, forcing them into solution in the buffered acid as it moves through the vadose zone. The metal cations, especially multivalent cations such as chromium, calcium, and iron, will remain in solution.

Based on the one angled soil boring drilled at Site 4, the depth of soil affected by the neutralized acid dry well cannot be determined. However, within the soil sampled, no metal concentrations were detected above TTLCs.

Groundwater

No contaminants were detected in groundwater at Site 4, based on Stage 2-1 sampling from 4-C-1.

4.1.4.3.2 Contaminant Migration

Migration of contamination detected in the soil at Site 4 has occurred as discussed above. However, groundwater has

not been impacted, based on sampling to date from the Site 4 monitoring well. Migration by surface water is not likely at Site 4.

4.1.4.3.2.1 Potential to Move Off Site and Off Base

Based on detected conditions at Site 4, the potential for contamination to move off the site or off base is very low. If metals migrate through the soil to groundwater below Site 4, the potential to move off the site or off the base would increase.

4.1.4.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Presently, contaminant migration is not expected from Site 4. Groundwater flows generally to the west at Site 4. If contaminants from Site 4 reach the groundwater, migration would be towards the west.

4.1.4.3.2.3 Time of Travel to Receptors

Based on present conditions, contaminant migration is not expected from Site 4.

4.1.4.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 4 because of the lack of well-defined values required for input to a model and the lack of detected contamination in the groundwater.

4.1.4.3.2.5 Expected Spatial and Temporal Variations in Concentration

Spatial or temporal variations in groundwater chemistry were not detected in the two semiannual sampling rounds at Site 4.

4.1.4.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.5 DISCUSSION OF RESULTS FOR SITE 5: SR-71 SHELTERS DRAINAGE AREA

From 1966 to 1990, ground operation of SR-71 aircraft resulted in about 300 gallons per week (about 375,000 gallons over the 24-year period) of JP-7 jet fuel being leaked onto the hangar floors and shelter apron area. Some fuel ran off the taxiway into an oil-water separator. Runoff also flowed onto soil and gravel between the SR-71 shelter apron and flightline taxiways and enters a nearby storm sewer. This storm sewer flows into the West Drainage Ditch (Site 1).

In the Phase II, Stage 1 study, six soil borings and one monitoring well were sampled and analyzed. Oil and grease were detected in three of the borings at 16.5-foot depths (total boring depth) at concentrations ranging from 400 to 4,000 mg/kg. No contamination was detected in the groundwater in the initial IRP study.

In the Stage 2-1 study, two rounds of surface water samples, four surface soil samples, samples from four soil borings, and two rounds of groundwater samples from one new and one existing monitoring well were collected and analyzed. Generally TFH contamination was detected in the near surface soil and surface water. TCE was detected in one sample from one of the two monitoring wells.

4.1.5.1 Presentation of Results

4.1.5.1.1. Site Geology

Evaluation of local geology at Site 5 is based on drilling activities completed during the current Stage 2-1 Remedial Investigation and on the well drilled during the Phase II, Stage 1 investigation. During the current investigation, four boreholes were drilled to a depth of 50 feet. In addition, a well was installed across the water table to a total depth of 128 feet (-18 feet NGVD). During the Phase II, Stage 1 investigation, a well was constructed across the water table and the borehole advanced to a depth of 140 feet (-32 feet NGVD). The location of these wells and boreholes is shown on Figure 4.1.5-1. Soil boring logs are provided in Appendix D.

A geologic cross-section was prepared by projecting soil boring logs of wells 5-A-1 and 5-C-1 and soil borings 5-C-1SB, 5-C-2SB, and 5-C-3SB. The location of this cross-section is shown on Figure 4.1.5-1. The cross-section is presented on Figure 4.1.5-2. As shown on Figure 4.1.5-2, subsurface materials at Site 5 are comprised of an alluvial

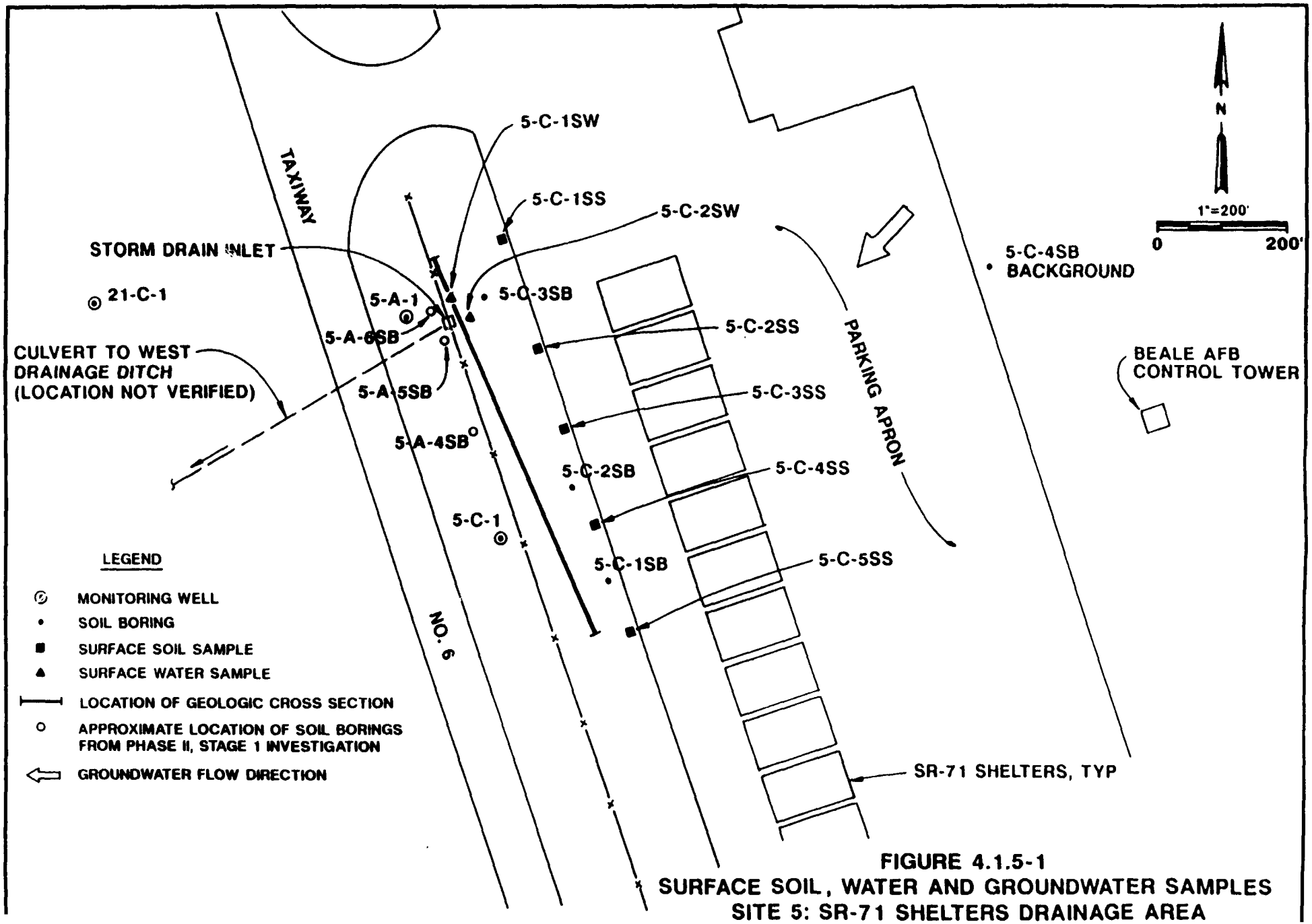
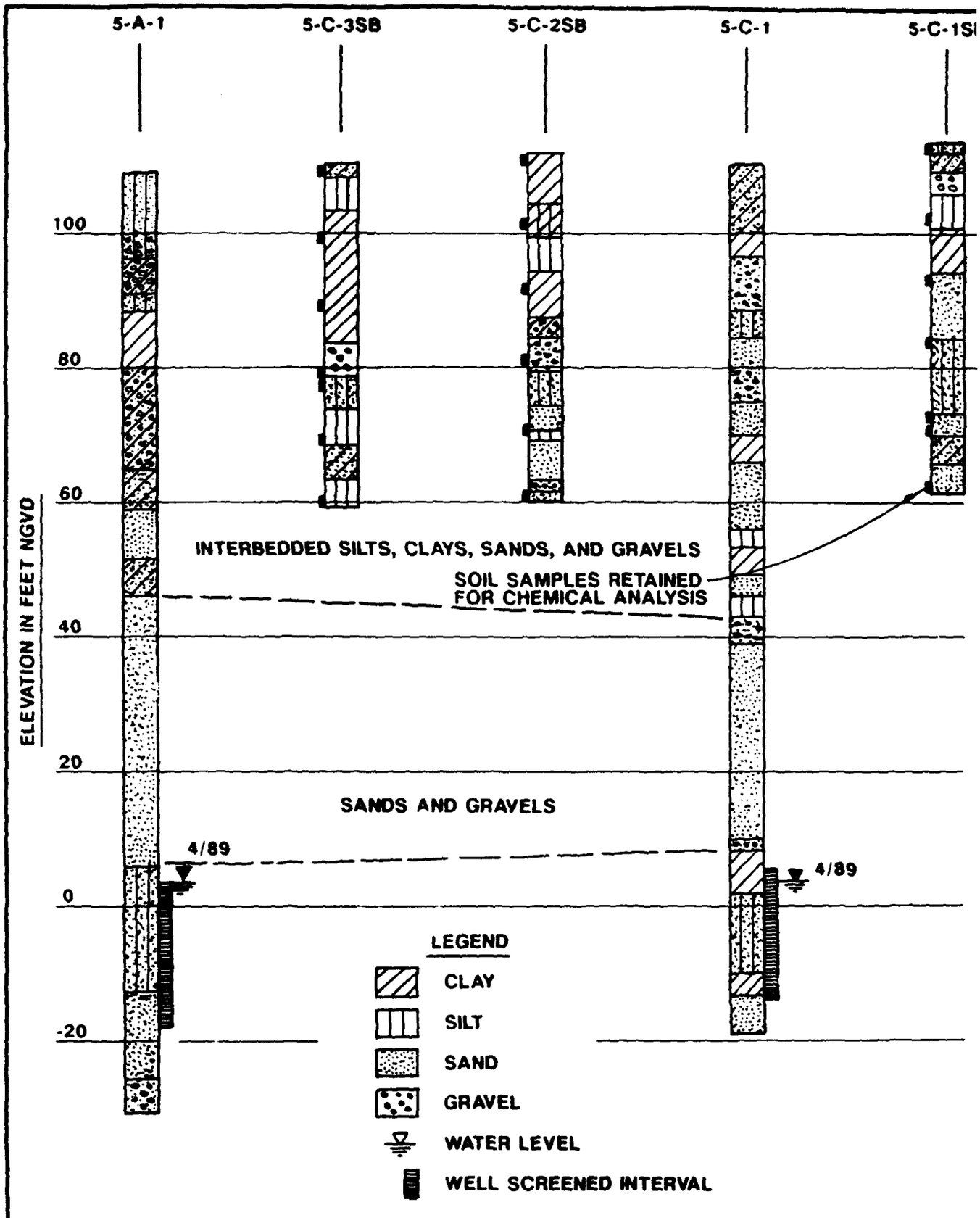


FIGURE 4.1.5-1
SURFACE SOIL, WATER AND GROUNDWATER SAMPLES
SITE 5: SR-71 SHELTERS DRAINAGE AREA



NOTE: FOR SOIL BORING LOCATIONS SEE FIGURE 4.1.5-1

SCALE: HORIZ NOT TO SCALE
1"= 20' VERT

FIGURE 4.1.5-2
SOIL PROFILE
SITE 5: SR-71 SHELTERS DRAINAGE AREA

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sequence of clays, silts, sands, and gravels. Although it is difficult to make correlations among the boreholes in the near-surface materials, a correlation may be made between coarse-grained materials encountered in wells 5-A-1 and 5-C-1 below an elevation of about 65 feet in depth (45 feet NGVD). From this point to the bottom of the boreholes, the wells are completed in a thick sequence of sands and gravels, with an interval of silty sand lying from about 105 to 122 feet in depth (+5 to -12 feet NGVD). In well 5-C-1, the silty sand is overlain by a well-indurated clay lens, which may partly confine the groundwater in a limited area around well 5-C-1. The thick, coarse-grained sequence observed in the two wells may be correlated with a similar sequence located about 70 to 140 feet in depth (20 feet to -50 feet NGVD) in wells at Site 1. The greater depth to these materials at Site 1 may reflect a westerly dip in the materials.

Surface soils at Site 5 have been mapped as Redding-Corning Gravelly Loams, which is derived from mixed sources and formed on old alluvial fans or terraces (Herbert and Begg, 1969; SCS, 1985). These fans and terraces are part of the dissected alluvial uplands which have been assigned to the Laguna Formation. The Laguna Formation consists of continental deposits of Pleistocene-Pliocene Epoch which range from fine-grained, compacted materials to coarse poorly-sorted gravels. Sediments of the Laguna Formation are nonvolcanic in origin, which distinguishes them from the volcanics of the Sierra Nevada over which they lie. The Laguna Formation typically contains consolidated layers that locally restrict the vertical flow of water, and dip gently to the southwest (Page, 1980).

Soil boring logs from Site 5 (Appendix D) contain many references to indurated materials at various depths in the boreholes. Based on color references, no volcanic materials were contacted. Subsurface materials consisted of a heterogeneous mixture of alluvial sediments. Thus, the boreholes at Site 5 were probably drilled entirely in the Laguna Formation.

4.1.5.1.2 Site Hydrogeology

Near-surface groundwater at Site 5 appears to flow under mainly unconfined conditions. In well 5-C-1, cuttings were moist in silty sand immediately beneath a well-indurated clay unit at about 108 feet in depth (2 feet NGVD). The borehole did not actually produce water during drilling until a well-graded sand was encountered at 123 feet in depth (an elevation of -13 feet NGVD) below a thin clay layer. Following construction of the well, the water level stabilized at about 3 feet NGVD. The clay unit was not ob-

served during the drilling of well 5-A-1. Groundwater in this well appeared to be unconfined (AeroVironment, 1987). Both wells are completed in permeable sands and gravels to their total depth.

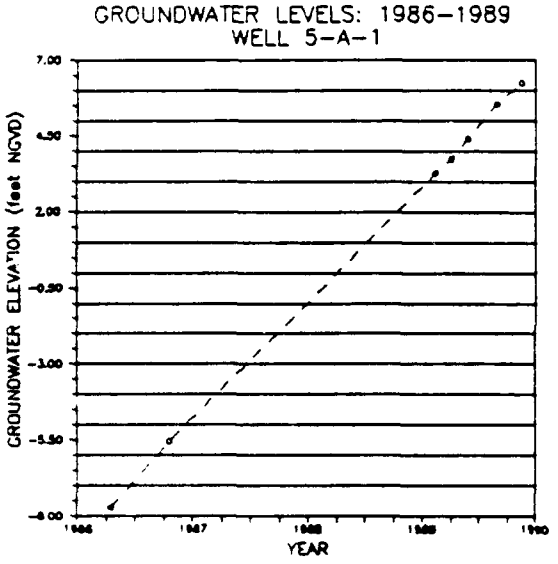
Table 4.1.5-1 and Figure 4.1.5-3 present groundwater level data collected during the Phase II and Stage 2-1 investigations. The data show that the water level rose nearly 14 feet in well 5-A-1 between April 1986 and November 1989. This rise is similar to the 17-foot rise observed during the same period nearby at Site 1, and apparently corresponds to a regional rise in the water table. Water levels in both Site 5 wells rose throughout 1989.

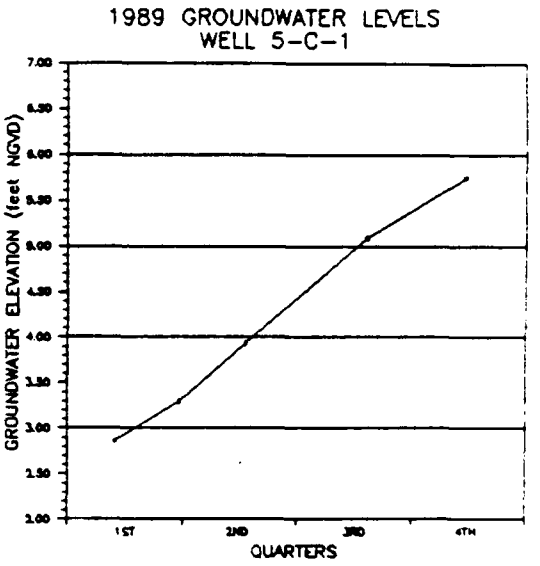
Table 4.1.5-1
GROUNDWATER ELEVATIONS: SITE 5
(FEET NGVD)

Well	Screened Interval	Apr. 1986	Oct. 1986	Feb. 1989	March 1989	May 1989	Aug. 1989	Nov. 1989
5-A-1	-8 to -28	-7.71	-5.54	3.26	3.74	4.38	5.54	6.22
5-C-1	6 to -14	--	--	2.86	3.30	3.94	5.09	5.75

Figure 4.1.5-4 presents groundwater contours plotted from groundwater elevations in wells in the north area of Beale AFB that are screened across the uppermost permeable zone. The figure shows that groundwater is flowing to the south-southwest at an average gradient of about 1 foot per 625 feet, or 0.0016. This flow direction is apparently influenced by a groundwater depression located to the west of Beale AFB. The regional impact of the depression is seen on Plates 3 and 4. This depression apparently causes flow lines to bend to the south in the vicinity of Site 5, which effectively lowers the hydraulic gradient. The low gradient may also reflect the presence of relativley more coarse-grained materials in the north part of the base, although the data are insufficient to confirm this.

This plate also shows a steepening of the groundwater gradient immediately to the east of Site 5. This gradient change may reflect a change in groundwater flow from consolidated to unconsolidated geologic materials at the edge of the Central Valley. A 4-hour pump test at a rate of 8.5 gpm was performed on well 5-C-1, followed by 4 hours of monitored recovery. Water levels were also monitored in nearby wells 5-A-1 and 21-C-1 during the test, but there was no response in these wells to the pumping in well 5-C-1. The lack of response may be attributed to the low pumping





NOTE: VARYING TIME SCALES

FIGURE 4.1.5-3
MONITORING WELL HYDROGRAPI
SITE 5: SR71 HANGAR RUNOFF ARI

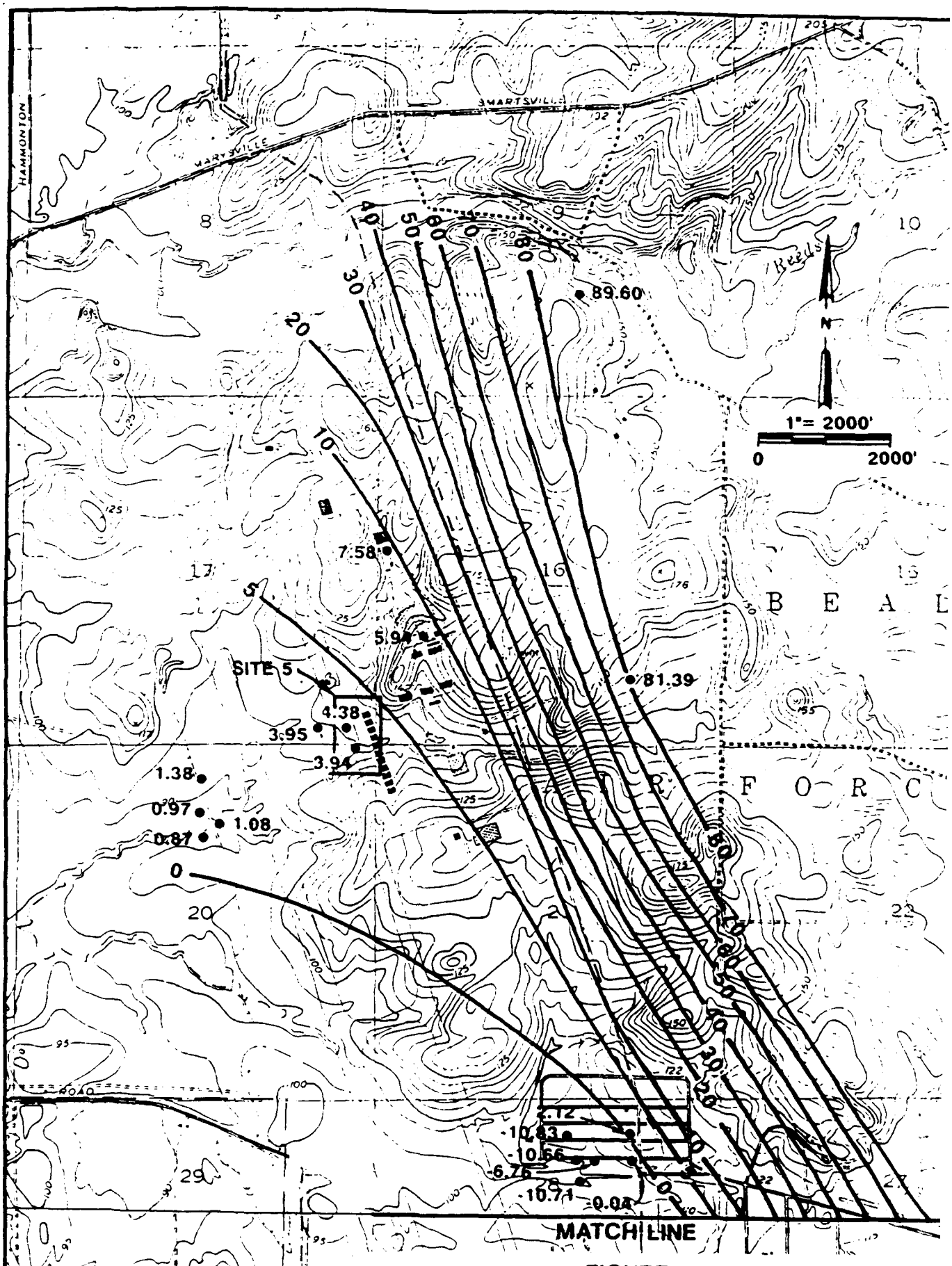


FIGURE 4.1.5-4
GROUNDWATER ELEVATION CONTOURS MAY 19
NORTH BEALE AFB (FEET NGVD)

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rate, the short duration of pumping, unconfined aquifer conditions, and distance to these wells (350 feet to well 5-A-1, and 700 feet to well 21-C-1). Drawdown and recovery data were analyzed according to the Cooper-Jacob semilog method. Plots of the aquifer tests and a discussion of the method of analysis is included in Appendix E. The average value of transmissivity obtained from the test was about 5,600 gallons per day per foot, or 750 square feet per day. The average value obtained for hydraulic conductivity was about 44 feet per day (1.6×10^{-2} cm/sec). These values are typical for the sand with silt and sands in which well 5-C-1 is screened (Freeze and Cherry, 1979).

The average linear velocity of groundwater flow may be estimated by substituting into Darcy's Law. Using the hydraulic conductivity derived from the 72-hour pump test in well 19-C-4 of 28 feet per day, the measured hydraulic gradient of 0.0016, and an estimated effective transport porosity of 0.20, the estimated velocity of groundwater movement beneath Site 5 is about 0.22 feet per day, or 82 feet per year.

4.1.5.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.5.1.4 and in Appendix A.

Surface Water

In each of the two semiannual rounds of water sampling at Site 5, two surface water runoff samples were taken at the edge of the apron west of the SR-71 shelters during rainfall events. Groundwater samples were collected from monitoring wells 5-A-1 and 5-C-1 (Figure 4.1.5-5). Analyses performed on the surface water runoff and groundwater samples were purgeable halocarbons (8010), ICP metals (6010), water quality parameters, and TFH-diesel and -gas.

Purgeable halocarbons and TFH-gas were not detected in surface water samples in the two semiannual sampling rounds. TFH-diesel was detected at 0.20 mg/l in surface water sample 5-C-1SW and 0.30 mg/l in 5-C-2SW (March 1989), and 0.16 and 2.2 mg/l (September 1989). In these samples, TDS was 102 and 72 mg/l (March 1989) and 27 and 10 mg/l (September

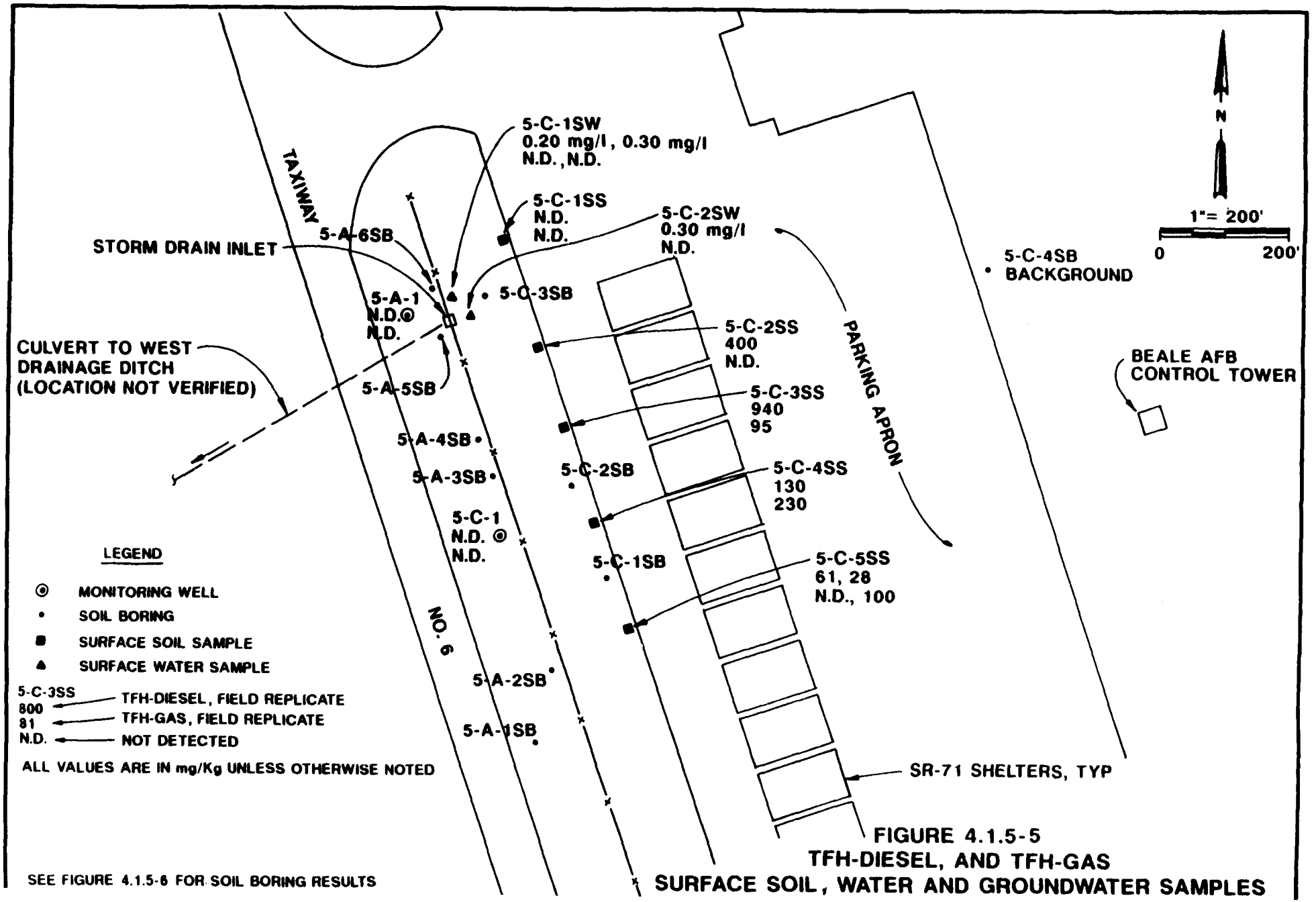


FIGURE 4.1.5-5
TFH-DIESEL, AND TFH-GAS
SURFACE SOIL, WATER AND GROUNDWATER SAMPLES

1989), nitrate 1.3 and 0.82 mg/l (March 1989) and 0.31 and 0.35 mg/l (September 1989), and zinc 0.889 and 0.208 mg/l (March 1989) and 0.028 and 0.070 mg/l (September 1989). Chloride and fluoride were not detected in either round. Other common ions typical of surface runoff were detected at low levels.

Soil

During the IRP Phase II, Stage 1 investigation (AeroVironment, 1987) six soil borings were drilled west of the fence between the shelters and Taxiway No. 6. No contamination was detected in borings south of the three northernmost SR-71 shelters (Figure 4.1.5-5). Boring 5-A-6SB had oil and grease detected at 400 mg/kg in the surface sample, 4,000 mg/kg in the 6-foot sample and 1,100 mg/kg in the 16-foot sample. Boring 5-A-5SB had 400 mg/kg oil and grease in all three soil samples. Boring 5-A-4SB had oil and grease detected at 500 mg/kg in the surface sample and 400 mg/kg at 16 feet.

During Stage 2-1 activities, five surface soil samples were collected at Site 5 (Figure 4.1.5-5). Twenty-four soil samples were taken from three 50-foot vertical borings (5-C-1SB, 5-C-2SB, 5-C-3SB). These borings were located east of the fence in the gravel area west of the SR-71 shelters. A background boring (5-C-4SB) was drilled in the grassy area east of the parking apron and the shelters. These surface soil and soil boring samples were analyzed for soil moisture (ASTM D2216) and TFH-diesel and -gas (California method). No organic or metals analyses were performed on soil samples at this site.

In this investigation TFH-diesel was detected in the four southern surface soil samples at concentrations of 28 (duplicate of 5-C-5SS) to 940 mg/kg (5-C-3SS, Figure 4.1.5-5). TFH-gas was detected in the three southern samples at concentrations from 95 to 230 mg/kg.

In samples from the soil borings TFH-diesel was only detected in the surface samples (0-1.5 ft) in boring 5-C-2SB at 3.5 mg/kg and in boring 5-C-3SB at 16 mg/kg (Figure 4.1.5-6). TFH-gas was not detected in any soil boring samples.

Groundwater

During sampling rounds of the IRP Phase II, Stage 1 investigation in 1986 (AeroVironment, 1987), TCE was detected in well 5-A-1 at 0.2 ug/l in April and 0.1 ug/l in October. Barium was detected at 0.060 mg/l in the first round and 0.250 mg/l in the second round.

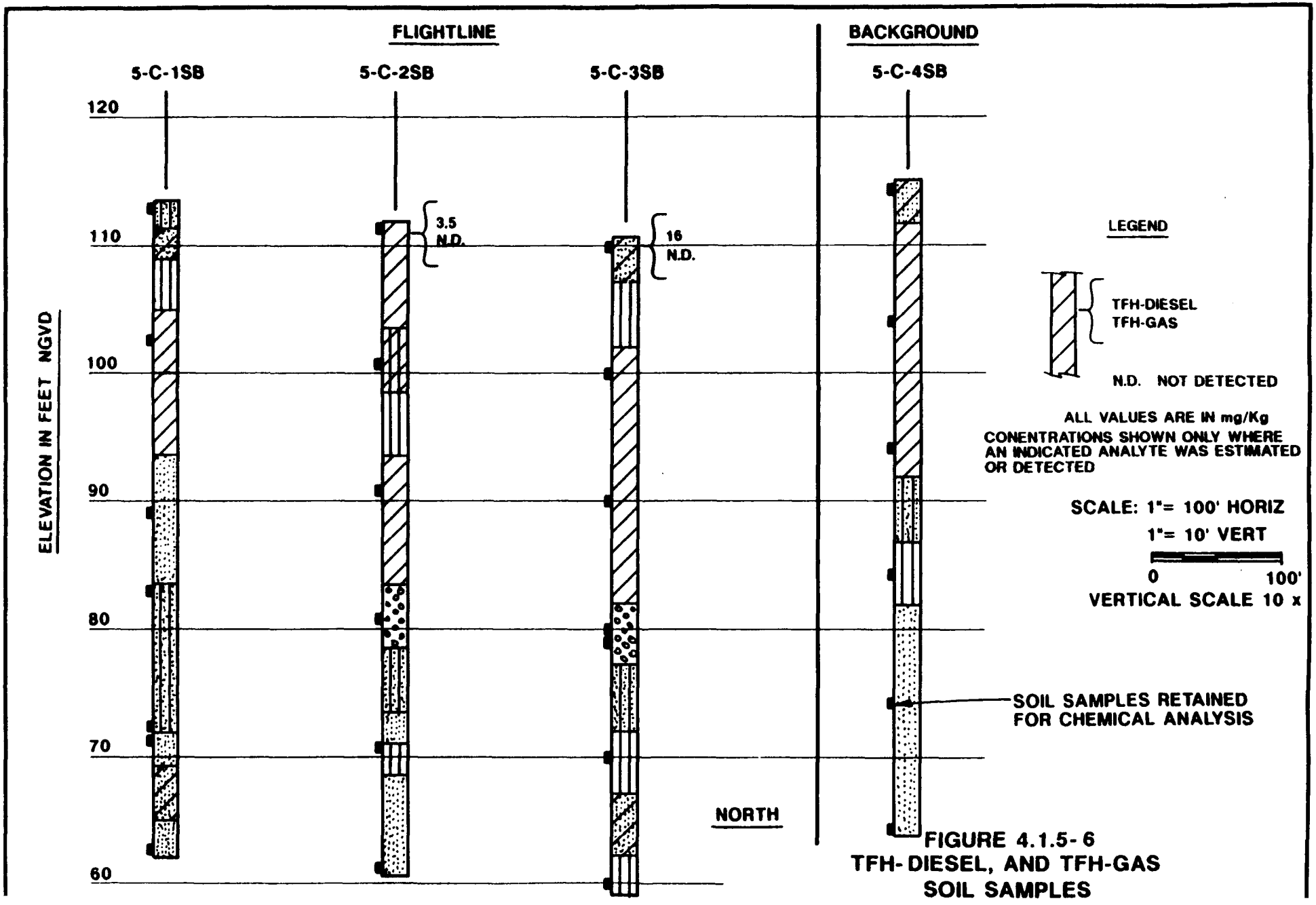


FIGURE 4.1.5-6
TFH-DIESEL, AND TFH-GAS
SOIL SAMPLES

Purgeable halocarbons, TFH-gas, and TFH-diesel were not detected in groundwater at Site 5 during the first semiannual sampling round of this investigation (March, 1989). In the ICP metals (6010) analysis calcium, magnesium, potassium, sodium, and zinc were detected. TDS ranged from 174 to 182 mg/l. Major anions and cation concentrations at these wells are similar to other sites near the flightline at Beale AFB. Fluoride was 0.30 mg/l in both wells. Nitrite plus nitrate (expressed as nitrate) was 9.8 to 10.2 mg/l. Sulfate is lower than at most sites at Beale at 4.9 to 5.1 mg/l.

In samples collected during the final semiannual round of Stage 2-1, TCE was detected in the 5-C-1 sample at 66 ug/l (60 ug/l in second column). In the sample from 5-A-1, manganese was detected at 0.109 mg/l and zinc at 0.070 mg/l. TFHs were not detected in groundwater samples. TDS were 254 and 191 mg/l in 5-A-1 and 5-C-1; chloride was 9.5 and 12.8 mg/l, fluoride at 0.20 and 0.18 mg/l, sulfate at 6.0 and 8.0 mg/l, and nitrate plus nitrite (expressed as nitrate) at 11.4 and 12.7 mg/l. Groundwater at Site 5 is a sodium-calcium bicarbonate type.

4.1.5.1.4 Analytical Results Table

Table 4.1.5-2 presents a summary of all detected analytes for Site 5. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.5-2 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of Applicable or Relevant and Appropriate Requirements (ARARs) is given in Appendix I.

4.1.5.1.5 Discussion of Analytical Data

The only contaminants detected at Site 5 were fuel hydrocarbons and TCE. Surface water runoff contained diesel components and both diesel and gas components were detected in surface soils. Diesel components were also detected in two of the four soil borings, but only in the first sample collected from each boring (zero to 1.5 feet). TCE was detected at 66 ug/l in the second semiannual sampling round at well 5-C-1. Table 4.1.5-3 presents the range of contaminants encountered for each of the media sampled (surface runoff, surface soil, soil borings), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

TABLE 4.1.5-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 5

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-1SS BAFB-0029 0.0-1.0' 11/18/88	5-C-2SS BAFB-0030 0.0-1.0' 11/18/88	5-C-3SS BAFB-0031 0.0-1.0' 11/18/88	5-C-4SS BAFB-0032 0.0-1.0' 11/18/88	5-C-5SS BAFB-0033 0.0-1.0' 11/18/88	5-C-5SS[f] BAFB-0034 0.0-1.0' 11/18/88
Percent Moisture	ASA#9	N/A	%	NS	NS	8.2	12.7	14.7	18	16.9	12
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	400	940	130	61	28
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	ND	95	230	ND	100

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-1SB BAFB-0380 0.0-3.0' 01/09/89	5-C-1SB BAFB-0381 10.0-11.5' 01/09/89	5-C-1SB BAFB-0382 23.0-24.5' 01/09/89	5-C-1SB BAFB-0383 30.0-31.5' 01/09/89	5-C-1SB BAFB-0384 40.0-41.5' 01/09/89	5-C-1SB[f] BAFB-0385 41.5-43.0' 01/09/89
Percent Moisture	ASA#9	N/A	%	NS	NS	18.4	21.1	22.4	15.5	19.4	17

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-1SB BAFB-0386 50.0-51.5' 01/09/89	5-C-2SB BAFB-0387 0.0-1.5' 01/10/89	5-C-2SB BAFB-0388 10.0-11.5' 01/10/89	5-C-2SB BAFB-0389 20.0-21.5' 01/10/89	5-C-2SB BAFB-0390 30.0-31.5' 01/10/89	5-C-2SB BAFB-0391 40.0-41.5' 01/10/89
Percent Moisture	ASA#9	N/A	%	NS	NS	13.3	13.1	12.8	14.5	20.2	20
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	3.5	ND	ND	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.5-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-2SB BAFB-0392 50.0-51.5' 01/10/89	5-C-3SB BAFB-0393 0.0-1.5' 01/11/89	5-C-3SB BAFB-0394 10.0-11.5' 01/11/89	5-C-3SB BAFB-0395 20.0-21.5' 01/11/89	5-C-3SB BAFB-0396 30.0-31.5' 01/11/89	5-C-3SB[f] BAFB-0397 31.5-33.0' 01/11/89
Percent Moisture	ASA#9	N/A	%	NS	NS	9.5	17.3	15.2	21.1	13.1	22.1
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	16	ND	ND	ND	ND

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-3SB BAFB-0398 40.0-41.5' 01/11/89	5-C-3SB BAFB-0399 40.0-41.5' 01/11/89	5-C-4SB BAFB-0400 0.0-1.5' 01/12/89	5-C-4SB BAFB-0401 10.0-11.5' 01/12/89	5-C-4SB BAFB-0402 20.0-21.5' 01/12/89	5-C-4SB BAFB-0403 30.0-31.5' 01/12/89
Percent Moisture	ASA#9	N/A	%	NS	NS	17.8	18.8	12.8	20.8	22	16.5

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-4SB BAFB-0404 40.0-41.5' 01/12/89	5-C-4SB BAFB-0405 50.0-51.5' 01/12/89
Percent Moisture	ASA#9	N/A	%	NS	NS	12	16.4

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.5-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 5

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-1GW BAFB-0488 03/10/89	5-A-1GW BAFB-0489 03/13/89	5-C-1SW BAFB-0471 03/02/89	5-C-1SW[f] BAFB-0473 03/02/89	5-C-1SW[e] BAFB-0474 03/02/89	5-C-1SW[bn] BAFB-0475 03/02/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	165	161	105	105	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	21.3	21.0	13.0	13.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.29	7.43	7.39	7.55	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	56.4	72.8	NT	NT	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	68.8	88.8	NT	NT	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	182	174	102	NT	NT	NT
Chloride	E325.3	1.0	mg/l	250	250	10.9	9.9	ND	NT	NT	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.30	0.30	ND	NT	NT	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	10.2	9.8	1.3	NT	NT	NT
Sulfate	E375.4	1.0	mg/l	250	250	4.9	5.1	11.2	NT	NT	NT
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	ND	ND	0.20	0.30	0.10	NT
Calcium	SW6010	1.00	mg/l	NS	NS	10.7	10.1	23.1	NT	NT	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	5.90	5.39	ND	NT	NT	NT
Potassium	SW6010	1.00	mg/l	NS	NS	1.60	1.50	ND	NT	NT	NT
Sodium	SW6010	1.00	mg/l	NS	NS	18.6	15.1	5.68	NT	NT	NT
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0840	0.0220	0.889	NT	NT	NT

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
n: no analytes detected for analyses performed

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.5-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-2SW BAFB-0472 03/02/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	62
Temperature	E170.1	N/A	deg C	NS	NS	11.5
pH	E150.1	N/A	pH	5-9	NS	7.65
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	72.0
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	0.82
Sulfate	E375.4	1.0	mg/l	250	250	4.4
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	0.30
Calcium	SW6010	1.00	mg/l	NS	NS	17.0
Sodium	SW6010	1.00	mg/l	NS	NS	2.58
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.208

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.5-2

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 5

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	5-C-1GW BAFB-0626 09/06/89	5-A-1GW BAFB-0627 09/06/89	5-C-1SW BAFB-0650 09/18/89	5-C-2SW BAFB-0649 09/18/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	180	162	27	27
Temperature	E170.1	N/A	deg C	NS	NS	22.0	22.0	15.5	15.0
pH	E150.1	N/A	pH	5-9	NS	7.36	7.54	8.28	8.47
Alkalinity - Total	SM403	1.0	mg/l	20	NS	62.2	59.4	24.0	20.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	75.9	72.5	29.3	24.4
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	191	254	27.0	10.0
Chloride	E325.3	1.0	mg/l	250	250	12.8	9.5	ND	ND
Fluoride	E340.2	0.050	mg/l	2	1.4	0.18	0.020	ND	ND
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	12.7	11.4	0.31	0.35
Sulfate	E375.4	1.0	mg/l	250	250	8.0	6.0	1.4	1.4
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	ND	ND	0.16	2.2
Calcium	SW6010	1.00	mg/l	NS	NS	10.9	10.7	6.10	5.10
Magnesium	SW6010	1.00	mg/l	NS	NS	6.11	4.65	ND	ND
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.109	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	2.05	2.04	ND	ND
Sodium	SW6010	1.00	mg/l	NS	NS	18.3	15.7	1.31	ND
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	0.0700	0.0280	0.0700
Trichloroethene	SW8010	1	ug/l	5	5	66(60)	ND	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

Table 4.1.5-3
RANGES OF CONTAMINANTS DETECTED AT SITE 5

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SURFACE SOIL				
TFH-diesel	mg/kg	ND	940	4/5
TFH-gas	mg/kg	ND	230	2/5
SOIL BORINGS				
TFH-diesel	mg/kg	ND	16.0	2/24
SURFACE WATER				
TFH-diesel	mg/l	0.20	2.2	4/4
GROUNDWATER				
trichloroethene	ug/l	ND	66	1/4

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar leve's (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

No data corrections have been made based on method blank detections. Analytical data are believed to accurately represent site conditions at the time of sampling.

4.1.5.2 Sampling and Analytical Problems

4.1.5.2.1 Loss of Samples

There were no sample loss problems for Site 5 samples. The only omitted analyses were the alkalinity/carbonate/bicarbonate field analyses for the two surface runoff samples in the first semiannual sampling round. The omission of these analyses is not considered critical to the final evaluation of site conditions. The omitted analyses are generally used to evaluate natural water bodies and are not meaningful for the stormwater runoff samples.

4.1.5.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

None of the analytes detected are suspected of being false positive results.

Three soil replicate QC samples were collected at Site 5. The surface soil 5-C-5SS did not have results comparable to the replicate sample. The analyte RPD for TFH-diesel was 74 percent and TFH-gas was detected in the replicate, but not in the original sample. The other two replicate QC samples were collected in soil borings and did not detect contaminants.

One replicate water sample was taken at the first surface runoff sampling point (5-C-1SW), as were one equipment wash blank and one ambient condition (field) blank. Replicate results were very comparable, but TFH-diesel was detected in the equipment wash blank at 0.10 mg/l.

4.1.5.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 5 samples.

4.1.5.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.5.3 Significance of Findings

Surface Water

Surface water was sampled semiannually during rainfall from two locations in the drainage swale which carries surface

runoff from Site 5. This swale carries storm runoff and wash water from the apron to a culvert, which discharges at the West Drainage Ditch (Site 1). Water quality parameters measured in Site 5 surface water samples were at approximately the same levels as surface water samples from other streams on base. None of the standard water quality parameters for those samples indicate contamination of the surface water at Site 5. TFH-diesel was detected in all samples at 0.20 and 0.30 mg/l (0.30 mg/l in field replicate) in the first round and 0.16 and 2.2 mg/l in the second round. TFH-diesel was also detected in an equipment wash blank during the first round at 0.10 mg/l, but the second round detections confirm the presence of TFH-diesel in surface water at Site 5.

Soil

Sediment samples were collected at five locations in the drainage swale upstream of the storm drain inlet. A field replicate was collected at one location. Five of the six samples (including the field replicate) had detected TFH-diesel at concentrations ranging from 28 to 940 mg/kg. Three of the six had TFH-gas at concentrations ranging from 95 to 230 mg/kg. TFH-gas was detected in the field duplicate at 100 mg/kg but not in the corresponding sample. These detected TFHs could impact the environment through release of hydrocarbons to the ephemeral surface water.

Four soil borings were drilled at Site 5, three west of the SR-71 shelters and one background boring east of the shelters. Two of the borings west of the shelters had detected TFH-diesel in the surface samples at 3.5 and 16 mg/kg. TFH-diesel and -gas were not detected in any other soil samples on Site 5.

Groundwater

TCE was detected at 66 ug/l (60 ug/l in the second column) in the September 1989 groundwater sample of well 5-C-1 at Site 5. It is not known why TCE increased from not detected in the first sampling round at a LOQ of 1 ug/l to 66 ug/l in the second round. The EPA Drinking Water Standards MCL for TCE is 5 ug/l, as is the DHS action level. The EPA MCL goal is zero. The TCE levels detected in the second semiannual sample round at well 5-C-1 exceed both the EPA MCL and the DHS action level. All standard water quality parameters were at approximately the same levels in both wells and do not indicate the presence of contamination.

4.1.5.3.1 Zones of Contamination

Information collected during previous investigations and in this phase indicate that aircraft fuel that leaked from the

SR-71 aircraft has impacted the environment at Site 5 and downstream in the West Drainage Ditch (Site 1). The Phase II, Stage 1 study detected oil and grease at depths below the ground surface to 16.5 feet. Information collected in the Stage 2-1 study indicates that surface water at Site 5 contained TFH-diesel. The concentrations detected in the second semiannual round of surface water sampling (September 1989) may represent the highest concentrations that occur annually. This sampling was conducted during the first seasonal rainfall, when pavement runoff may contain the highest concentrations of spilled fuel and dirt as these are washed from the pavement surface.

The current Stage 2-1 study detected TFH-diesel and -gas only in the surface soil and surface sediment samples, though soil borings were drilled to depths of 50 feet. The soil area that had the greatest concentrations of hydrocarbons is within a 20-foot radius of the storm drainage inlet, to depths of at least 16.5 feet (based on Phase II Stage 1 analyses).

Groundwater sampled from the two monitoring wells at Site 5 was not contaminated with TFH, but did contain TCE in one sample.

4.1.5.3.2 Contaminant Migration

Contaminants migrate from Site 5 in the surface water and groundwater. It is probable that a portion of the contaminants detected at Site 1 originate from Site 5. However, the partial contribution of contaminants from Site 5 to the compounds detected in surface water, surface sediments, or groundwater at Site 1 cannot be accurately quantified at this time.

4.1.5.3.2.1 Potential to Move Off Site and Off Base

The potential for the contaminants detected at Site 5 to move both off site and off base is high. The storm drain inlet flows into an unnamed ephemeral stream which crosses the base boundary less than 6,000 feet from Site 5. The stream flows into Hutchinson Creek about 3 miles from the base boundary.

The groundwater in the area is moving to the southwest, and the detected TCE contamination in the groundwater will also move in this direction. The potential for this TCE to migrate off site is high.

4.1.5.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

The estimated peak velocity of the unnamed stream is 5 feet per second, based on observations made during storm flow conditions in the West Drainage Ditch (Site 1). At this estimated velocity, stream water will cross the base boundary approximately 20 minutes after leaving Site 5. The stream flows in a southwesterly direction.

Groundwater at Site 5 moves to the southwest, toward the groundwater depression west of the base. The estimated groundwater velocity is about 80 feet per year, based on the 72-hour pump test conducted at well 19-C-4.

4.1.5.3.2.3 Time of Travel to Receptors

Base personnel working in the Site 5 area are the primary potential human receptors at this site. These potential receptors may be exposed to the TFHs while they are in the area. This site is upstream from and contributes flow to Site 1, the West Drainage Ditch. The nearest receptor downstream of Site 1, if any, is not known. During a storm, surface water from Site 5 may reach Hutchinson Creek (west of the base) within 1 hour.

If contaminants pass into groundwater, users of base and domestic supply wells to the west of the site could be potential receptors. However, based on the estimated groundwater velocity presented in Section 4.1.5.1.2, it would take many years to reach nearby supply wells. However, contaminants may have been released at Site 5 for a long time.

4.1.5.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 5 because of the lack of well-defined parameters required for accurate modeling.

4.1.5.3.2.5 Expected Spatial and Temporal Variations in Concentration

TFH-diesel and -gas were observed only in surface soil samples collected from soil at the edge of the pavement in front of the SR-71 shelters. 5-C-1SS, collected north of the shelters, did not contain TFH. In samples from soil borings, only surface samples contained TFH, none were detected at depth.

Groundwater contamination (TCE) was detected in one well in the second of two (semiannual) sampling rounds. Based on the IRP sampling conducted, the TCE concentration in groundwater

is increasing at Site 5. Whether this is the result of TCE migration through soil at Site 5 or migration in groundwater from an upgradient source cannot be determined.

4.1.5.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1 activities.

4.1.6 DISCUSSION OF RESULTS FOR SITE 6: LANDFILL NO. 2

Site 6 (Landfill No. 2) occupies 56 acres in the southern sector of the base. Landfill No. 2 is located just south of 6th Street near its intersection with Earle Road. It was used primarily for refuse disposal from the early 1950s until 1980. Between 1967 and 1978, about 380 cubic yards of sludge from the photo wastewater treatment plant (Site 2) were disposed here (Engineering Science, 1984). Chemicals and petroleum were also disposed in reportedly small quantities in Landfill No. 2. It is now used to dispose of dirt, wood, and other inert construction and grounds maintenance debris. The landfill at Site 6 does not have an engineered liner system or leachate collection system.

Landfill No. 2 was in use after Landfill No. 1 (Site 13), and more is known about the operations. Aerial photographs (Beale AFB, 1987) clearly show an organized series of parallel, east-west trenches. Borings around the landfill confirmed the extent of the fill. Although estimates of the depth and extent of operations appear to be correct; original estimates of the amount of wastes deposited in the landfill at Site 6 appear too low. The amount of refuse deposited at Site 6 was originally estimated to be 45,000 cubic yards. Using operational criteria currently employed at Landfill No. 3 (15-foot-deep trenches covering 70 percent of the landfill surface area) and believed to be similar to past operations at Landfill No. 2, the total amount of refuse in Landfill No. 2 may be as much as 950,000 cubic yards.

During the Stage 2-1 study, five soil borings and one monitoring well were drilled and sampled at Site 6. Two existing wells were also sampled. Four of the borings were angled borings beneath backfilled landfill trenches. The remaining boring was a vertical background boring. The new monitoring well was installed on the upgradient (east) side of the site. Locations of these sampling points are illustrated in Figure 4.1.6-1.

4.1.6.1 Presentation of Results

4.1.6.1.1 Site Geology

Evaluation of local geology at Site 6 is based on drilling activities completed during the Stage 2-1 study and boreholes drilled for monitoring wells during the Phase II, Stage 1 investigation. There are three monitoring wells at Site 6. Two of these were drilled during Phase II, Stage 1.

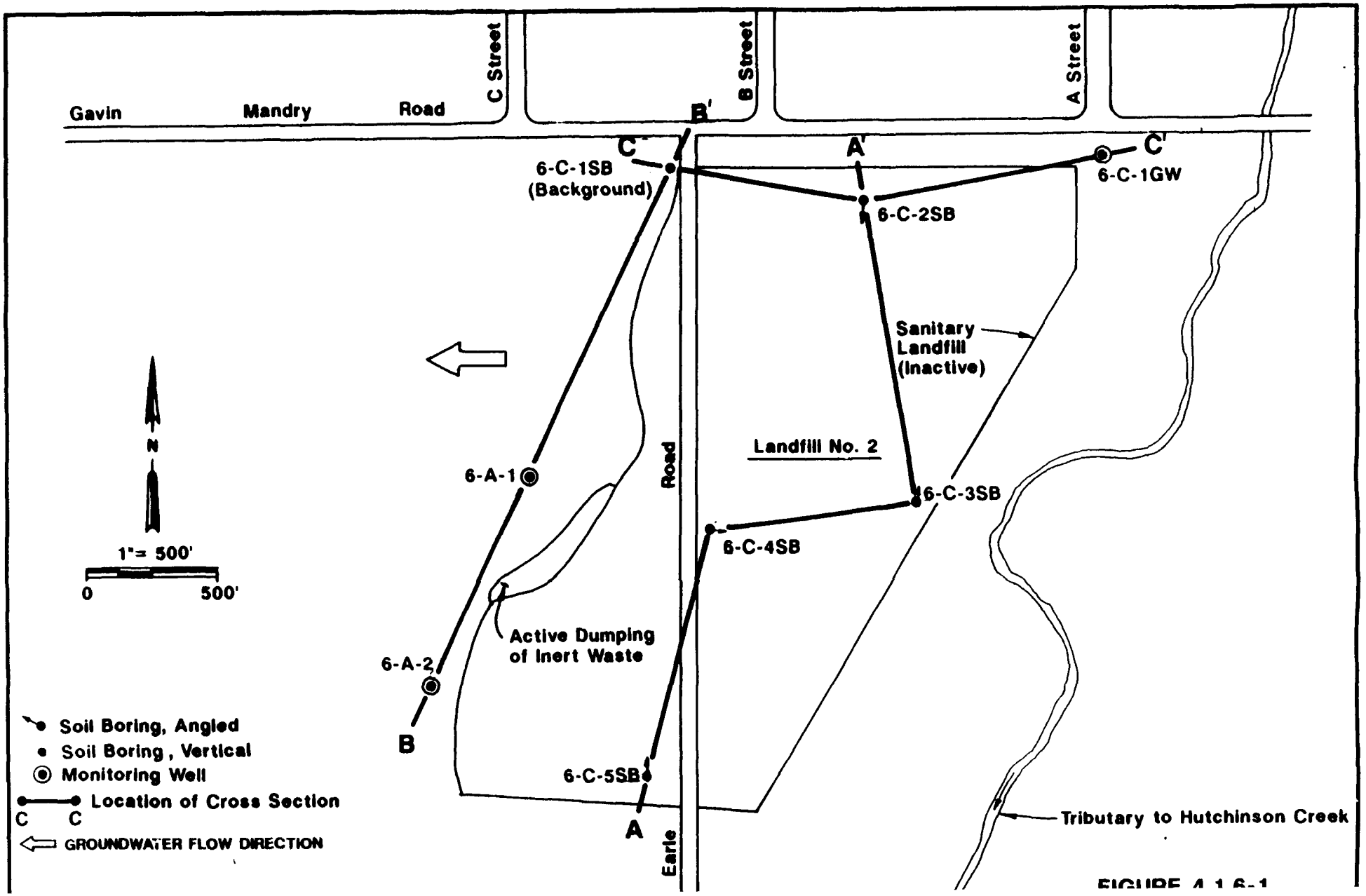
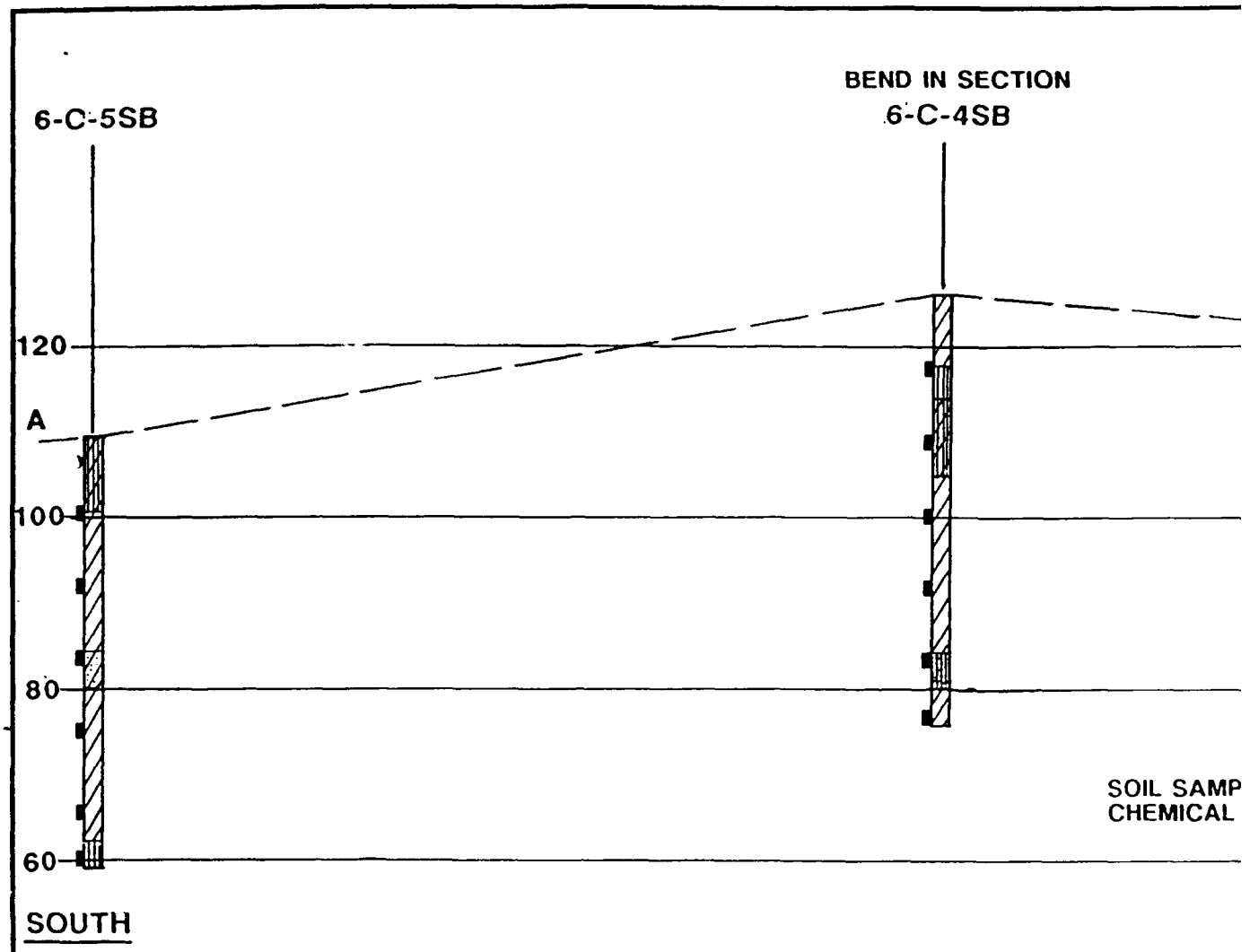

Gavin
Mandry
Road
C Street
B Street
A Street
B'
C'
A'
C'
6-C-1SB
(Background)
6-C-2SB
6-C-1GW
Sanitary
Landfill
(Inactive)
Landfill No. 2
Road
6-A-1
6-C-3SB
6-C-4SB
Active Dumping
of Inert Waste
6-A-2
B
6-C-5SB
A
Earle
Tributary to Hutchinson Creek
N
1"= 500'
0
500'
Soil Boring, Angled
Soil Boring, Vertical
Monitoring Well
Location of Cross Section
C C
GROUNDWATER FLOW DIRECTION

FIGURE 4.1.6-1

These wells are located west of the landfill (see Figure 4.1.6-1). A third well was drilled northeast of the landfill during the Stage 2-1 investigation. In addition, five boreholes were drilled and logged. Four of these were angled boreholes, drilled to total depths of about 59 feet (51 feet vertical depth). One was a vertical hole, drilled to a total depth of 51.5 feet. The location of all wells and boreholes is shown on Figure 4.1.6-1. Soil boring logs are provided in Appendix D.

Cross sections through the soil encountered in soil borings and monitoring wells in the IRP Phase II, Stage 1 and Stage 2-1 studies are located in Figure 4.1.6-1 and are shown in Figures 4.1.6-2 to 4.1.6-4. Investigations have confirmed that subsurface soils are composed of predominantly fine-grained alluvial sediments deposited on westward dipping bedrock. This is typical of valley sediments deposited at the base of the Sierra Nevada foothills. Although coarser sand and gravel beds were encountered in this and previous studies, these stream channel deposits are not as common as the finer-grained flood plain deposits that predominate. As with many of the near-surface alluvial deposits in the Central Valley, individual beds in the vadose zone at Site 6 generally may not be correlated between drilling locations. Some correlation may be made between wells 6-A-1 and 6-A-2, however, in the alluvial sequence which lies just beneath the water table. Both of these wells are screened in a thick sequence of predominantly coarse-grained materials. Well 6-A-1 contacted a silty sand at a depth of about 70 feet (30 feet NGVD), which became increasingly coarse-grained to the 90-foot total depth of the well (10 feet NGVD). Well 6-A-2 contacted sand at a depth of about 50 feet (49 feet NGVD), and remained in sands and clayey sands to its total depth of 95 feet (4 feet NGVD).

Well 6-C-1 encountered sandstone at a depth of 54 feet (54 feet NGVD), and remained in this unit to the bottom of the hole at a depth of 90 feet (18 feet NGVD). The sandstone surface appears to be sloping to the west since it was not contacted in either well 6-A-1 or 6-A-2. Apparently, the slope represents an erosional surface. Because of its dark color, the sandstone may belong to the volcanic rocks from the Sierra Nevada. This unit was mapped as outcropping on the ridge that is topographically uphill (east) from well 6-C-1 (Page, 1980).



LEGEND

- CLAY
- SILTY CLAY
- SILT
- SILTY SAND
- SANDY CLAY
- GRAVEL

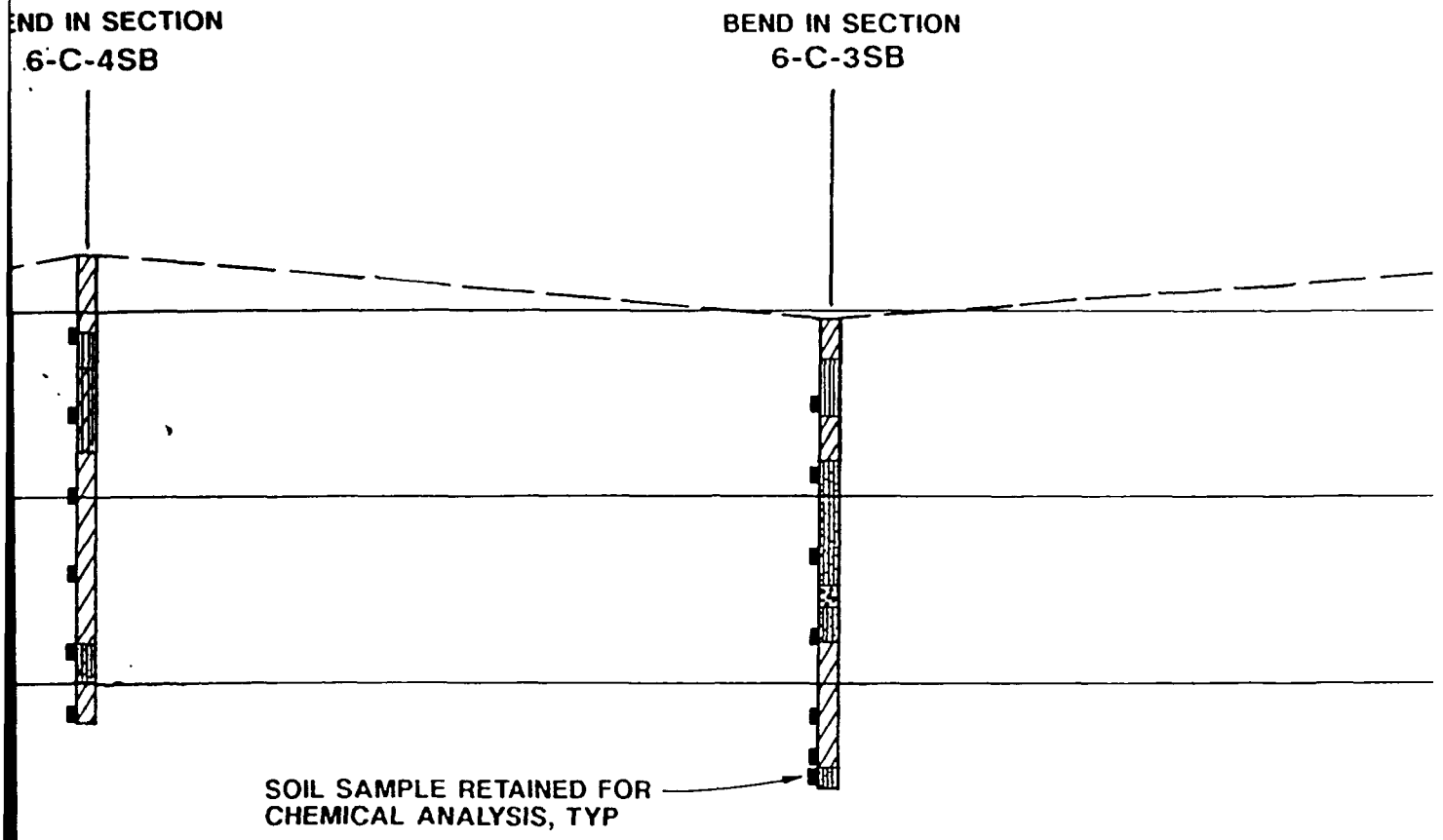
NOTE: DUE TO UNEQUAL SCALES AN

FOR SOIL BORING LOCATIONS

SCALE: 1"=200' HORIZ
1"=20' VERT

0 200'

VERTICAL SCALE 10 x



UE TO UNEQUAL SCALES ANGLED BORINGS ARE PLOTTED VERTICALLY.

OR SOIL BORING LOCATIONS SEE FIGURE 4.1.6-1

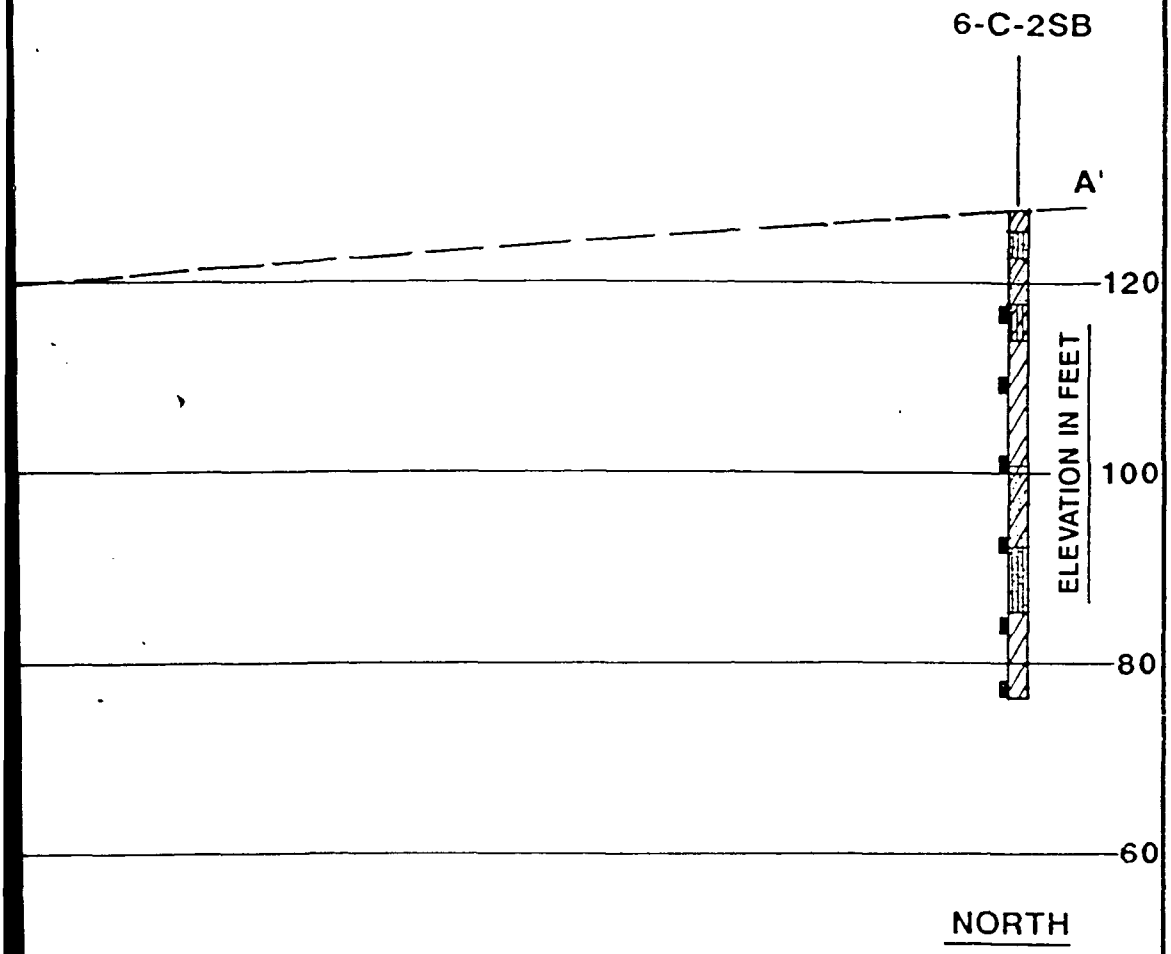
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0 200'

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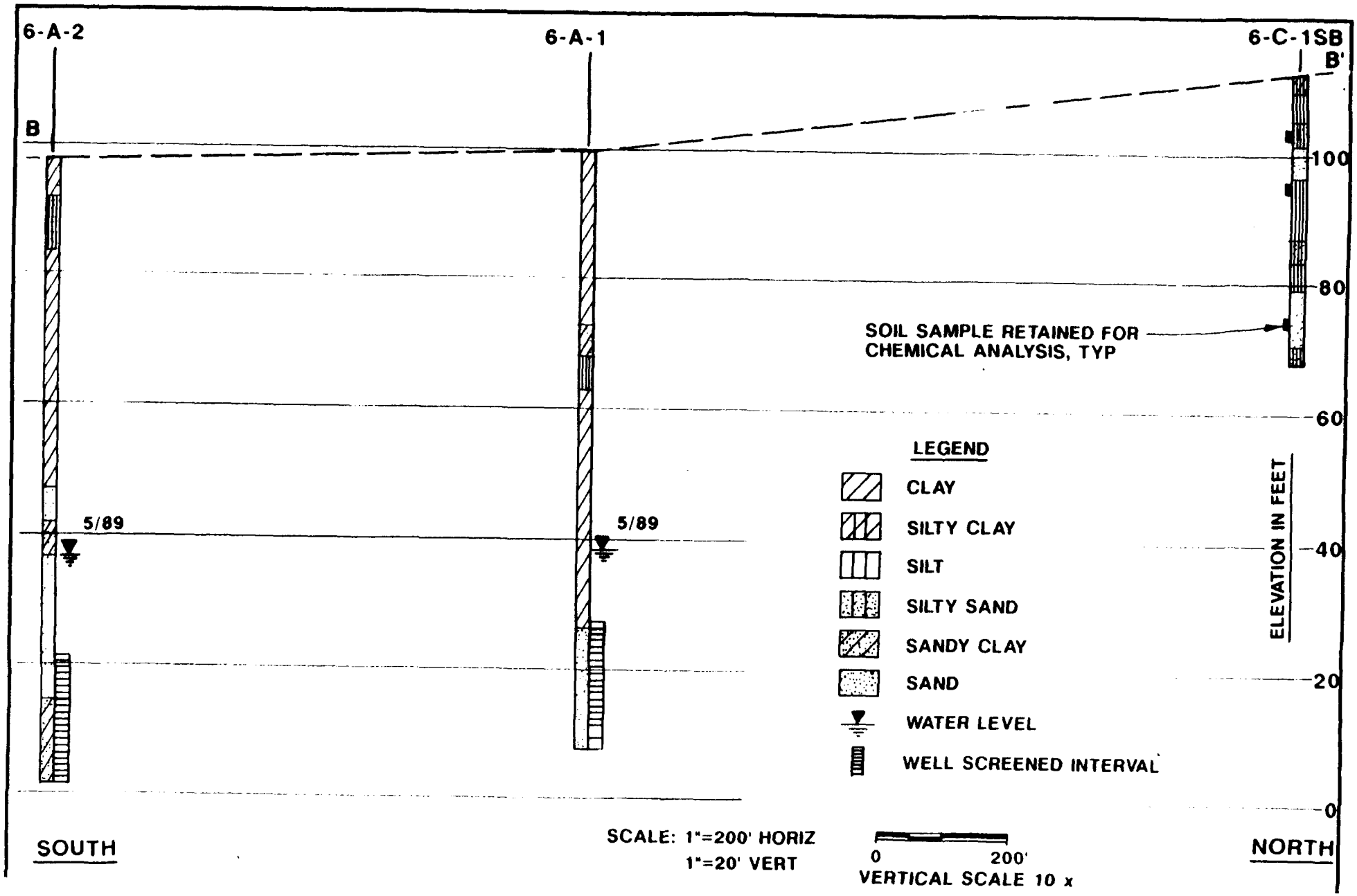
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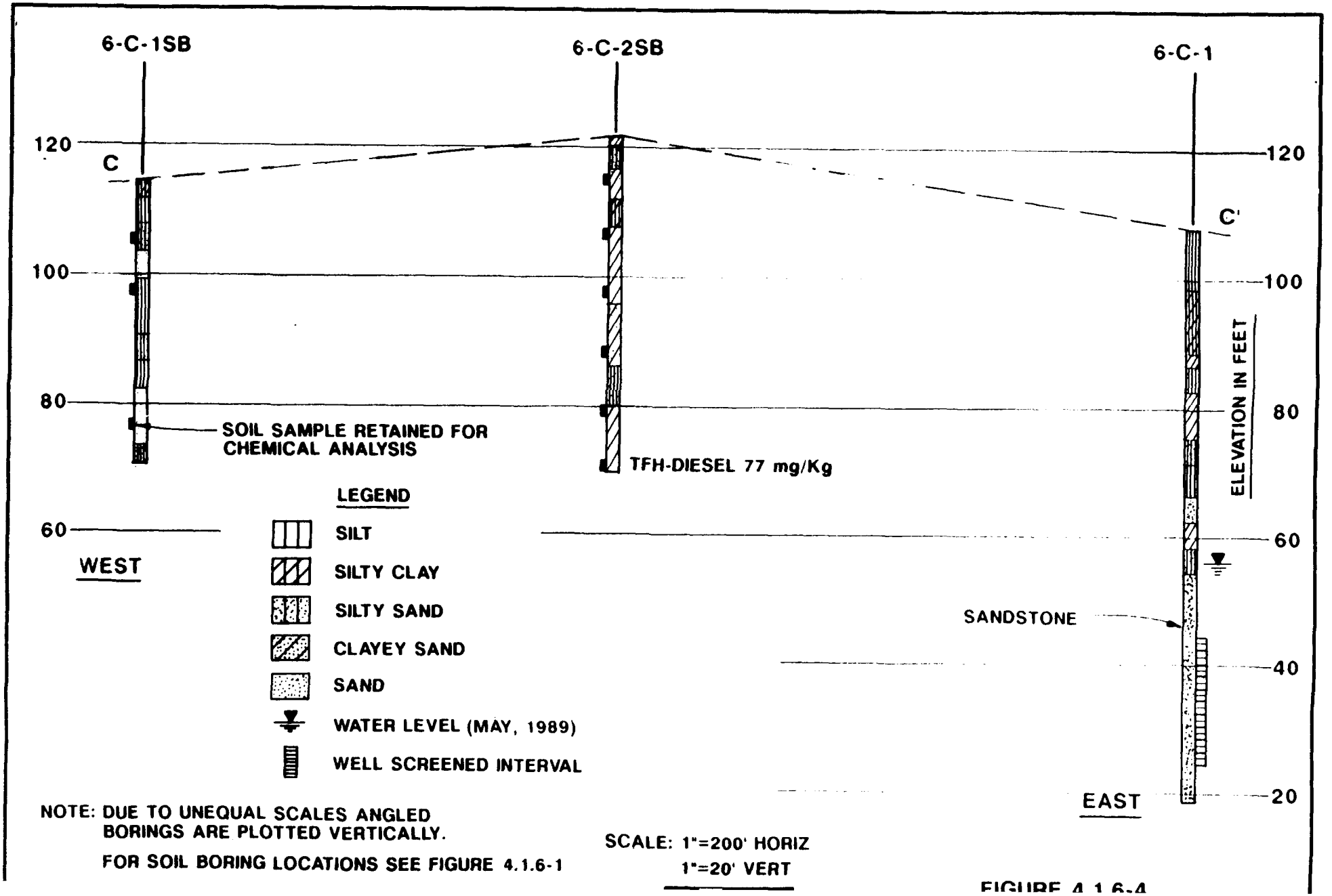


ALLY.

FIGURE 4.1.6-2
CROSS SECTION A-A', LANDFILL NO.2

CH2M HILL


6-A-2
6-A-1
6-C-1SB
B
B'
100
80
60
40
20
0
SOIL SAMPLE RETAINED FOR CHEMICAL ANALYSIS, TYP
5/89
5/89
LEGEND
CLAY
SILTY CLAY
SILT
SILTY SAND
SANDY CLAY
SAND
WATER LEVEL
WELL SCREENED INTERVAL
ELEVATION IN FEET
SOUTH
NORTH
SCALE: 1"=200' HORIZ
1"=20' VERT
0
200'
VERTICAL SCALE 10 x



NOTE: DUE TO UNEQUAL SCALES ANGLED BORINGS ARE PLOTTED VERTICALLY.

FOR SOIL BORING LOCATIONS SEE FIGURE 4.1.6-1

SCALE: 1"=200' HORIZ
1"=20' VERT

FIGURE 4.1.6-4

4.1.6.1.2 Site Hydrogeology

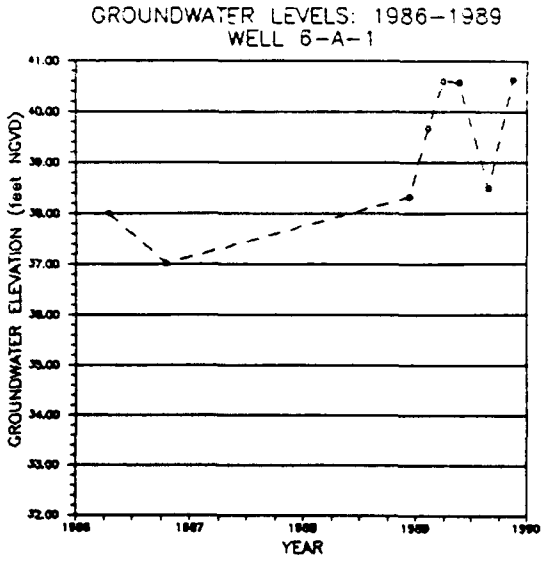
Near-surface groundwater in wells 6-A-1 and 6-A-2 appears to flow under mainly unconfined to semi-confined conditions in alluvial sediments. Well 6-A-1 is screened at a depth of 65-85 feet (14-34 feet NGVD), while 6-A-2 is screened at a depth of 73-93 feet (6-26 feet NGVD). The May 1989 water level in well 6-A-1 was at an elevation of 40.57 feet NGVD (see Table 4.1.6-1 and Figure 4.1.6-5). This level lies in a geologic unit described in the soil boring log as clay with increasing sand and silt. The water level in well 6-A-2 was 36.67 feet NGVD in May 1989, in a unit described as fine to medium sand and clay (AeroVironment, 1987).

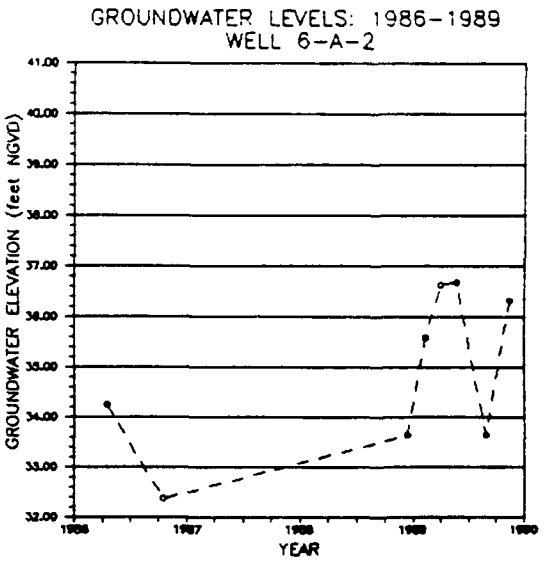
Table 4.1.6-1
GROUNDWATER ELEVATIONS: SITE 6
(FEET NGVD)

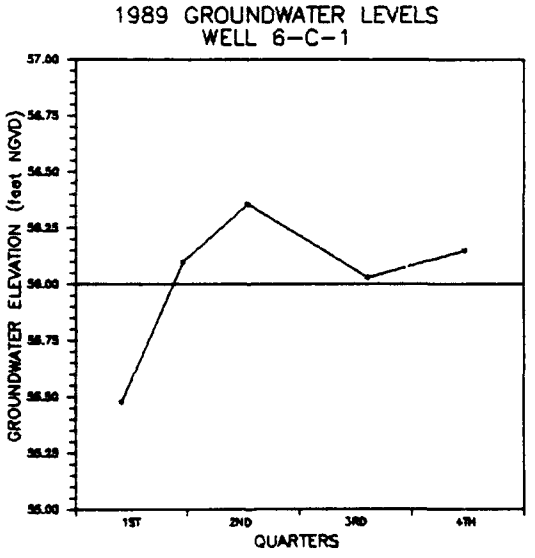
Well	Screened Interval	April 1986	October 1986	December 1988	February 1989	March 1989	May 1989	August 1989	November 1989
6-A-1	34 - 14	38.00	37.01	38.32	39.67	40.60	40.57	38.48	40.63
6-A-2	26 - 6	34.24	32.36	33.63	35.58	36.62	36.67	33.63	36.31
6-C-1	43 - 23	-	-	-	55.48	56.10	56.36	56.03	56.15

Upgradient monitoring well 6-C-1 was installed to evaluate background groundwater quality at Landfill No. 2. As described above, sandstone bedrock was encountered at a depth of 54 feet (54 feet NGVD) during drilling with sandstones continuing down to the total depth of 90 feet (18 feet NGVD). Moist samples were first encountered at a depth of 69 feet (39 feet NGVD). The only zone where groundwater was produced during drilling was from 75 to 77 feet in depth (33 to 31 feet NGVD) in friable sandstone. The well-cemented sandstone did not produce groundwater during drilling. The monitoring well was screened from 65 to 85 feet (43 to 23 feet NGVD) to capture groundwater from the producing zone. This zone may be confined at this location since the May 1989 static groundwater level measured 56.36 feet NGVD, which is more than 16 feet above the level where the first wet drill cuttings were encountered.

These wells indicate that two different hydrogeologic regimes are present at Landfill No. 2. In upgradient well 6-C-1, groundwater occurs in low permeability sandstone where groundwater moves mainly by fracture flow. The bedrock surface slopes down to the west so that groundwater in







NOTE: VARYING TIME SCALES

FIGURE 4.1.6-5
MONITORING WELL HYDROGRAPHS
SITE 6: LANDFILL NO. 2

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down-gradient wells on the west side of the landfill flows mainly through the higher permeability alluvial sequence that overlies the bedrock.

Table 4.1.6-1 contains groundwater level data collected between 1986 and 1989 from the monitoring wells at Site 6. Groundwater levels have risen slightly in downgradient wells at Landfill No. 2 from April 1986 to November 1989, rising 2.6 feet in monitoring well 6-A-1 and 2.1 feet in monitoring well 6-A-2 (Figure 4.1.6-5). The landfill is several miles east of the regional groundwater depression, which has also been rising in recent years. This small rise is consistent with the distance from the depression.

Groundwater elevations from May and March 1989 are plotted on Figure 4.1.6-6 and Plate 3; those from November 1989 are shown on Plate 4. The regional gradient west of Landfill No. 2 is approximately 0.007 foot per foot to the west northwest. The local groundwater gradient cannot be calculated with certainty because of the difference in completion-zone geology between the upgradient and downgradient wells.

The sandstone bedrock at the background monitoring well (6-C-1) at Landfill No. 2 has very low transmissivity and hydraulic conductivity. A 1.5-gpm pump test drew down more than 22 feet in an hour, giving an average transmissivity during the drawdown and recovery tests of 30 gallons per day per foot, or 4.0 square feet per day. The hydraulic conductivity was calculated to be 0.20 feet per day (7.1×10^{-5} cm/sec). The downgradient monitoring wells have higher transmissivities as they were successfully pumped at 7 to 8 gpm during sampling without pumping the monitoring wells dry. Plots of the aquifer tests and a discussion of the method of analysis is included in Appendix E.

An estimate of the groundwater flow velocity may be made using the results of the 72-hour multiple-well pump test conducted at Site 19, located about 4,000 feet north of Site 6 in a hydrogeologic setting similar to the unconsolidated sediments at Site 6. This test is discussed in more detail in Section 4.1.19.1.2. The average value of transmissivity obtained from the pumping well during this test was 1,700 square feet per day, while the average hydraulic conductivity was 28 feet per day (0.01 cm/sec). Using the gradient of 0.007 for the region, and an estimated effective transport porosity of 0.20, the approximate velocity of groundwater movement in the vicinity of Site 6 is about 1 foot per day, or 360 feet per year.

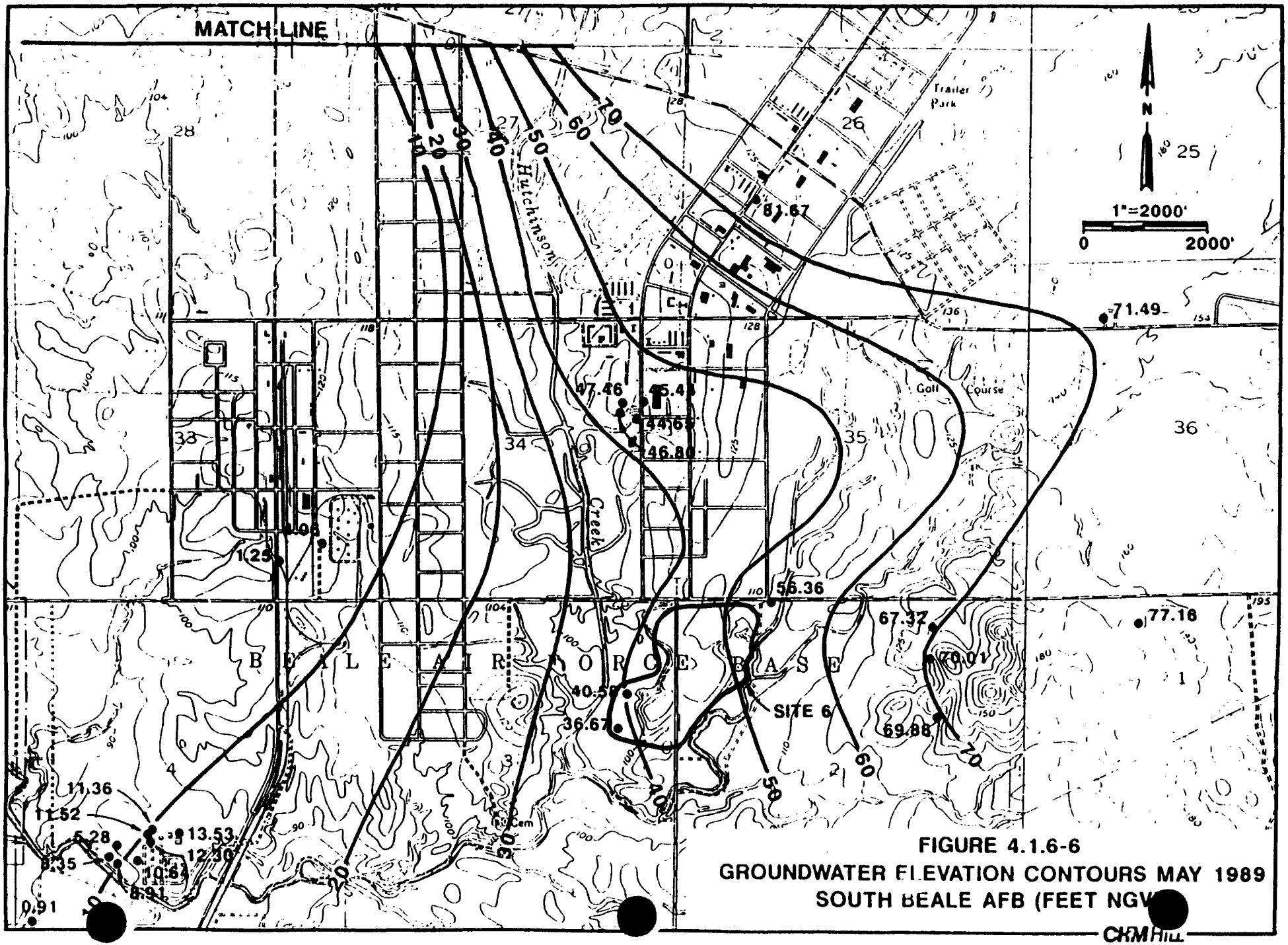


FIGURE 4.1.6-6
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGV

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4.1.6.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.5.1.4 and in Appendix A.

Soil

A total of 27 soil boring samples were collected at Site 6: three from a vertical background boring and 24 from the four angle borings under landfill trenches. These samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7470/7471), soil moisture (ASTM D2216), and TFH-diesel and -gas (California method).

TCE was detected in boring 6-C-4SB at 0.039 mg/kg in the 57.5-foot sample and was below the 0.007 mg/kg LOQ in the 17.5-foot sample (Figure 4.1.6-7). In boring 6-C-5SB, TCE and 1,1-DCE were tentatively identified below the LOQ of 0.031 mg/kg in the 17.5-foot sample and 0.029 mg/kg in the 27.5-foot sample. Trans-1,2-DCE was estimated in two samples in 6-C-3SB at levels below the LOQ. Toluene was detected in 24 of the 27 soil samples at up to 0.11 mg/kg.

Chlorobenzene was tentatively identified below the LOQ for three soil samples from 6-C-3SB and 6-C-5SB. The 17.5-foot soil sample in 6-C-3SB had 0.005 mg/kg with an LOQ of 0.006 mg/kg. The 17.5- and 27.5-foot samples from 6-C-5SB had 0.011 and 0.012 mg/kg detected chlorobenzene with LOQs of 0.031 and 0.029 mg/kg.

Semivolatile organic chemicals were detected in several soil samples at Site 6. 2-butanone was detected in four samples at up to 0.99 mg/kg. 4-methyl 2-pentanone was detected in three samples at up to 0.070 mg/kg. Bis(2-ethylhexyl) phthalate was estimated below the LOQ in eight samples at up to 0.37 mg/kg (which was below the LOQ). Di-n-butyl phthalate was detected in ten samples at up to 0.73 mg/kg.

ICP metals were detected in Site 6 soil samples at concentrations similar to background levels. Mercury was not detected in any sample. Cobalt was detected at 115 mg/kg in the 40-foot sample at background boring 6-C-1SB.

TFH-diesel was detected at 1.3 mg/kg and TFH-gas at 110 mg/kg at the 7.5-foot sample in 6-C-5SB. TFH-gas was found at 81 mg/kg in the 47.5-foot sample in 6-C-3SB and at 77 mg/kg at 57.5 feet in 6-C-2SB (Figure 4.1.6-7).

Groundwater and Surface Water

No groundwater contamination was detected in Phase II, Stage 1 sampling (AeroVironment, 1987).

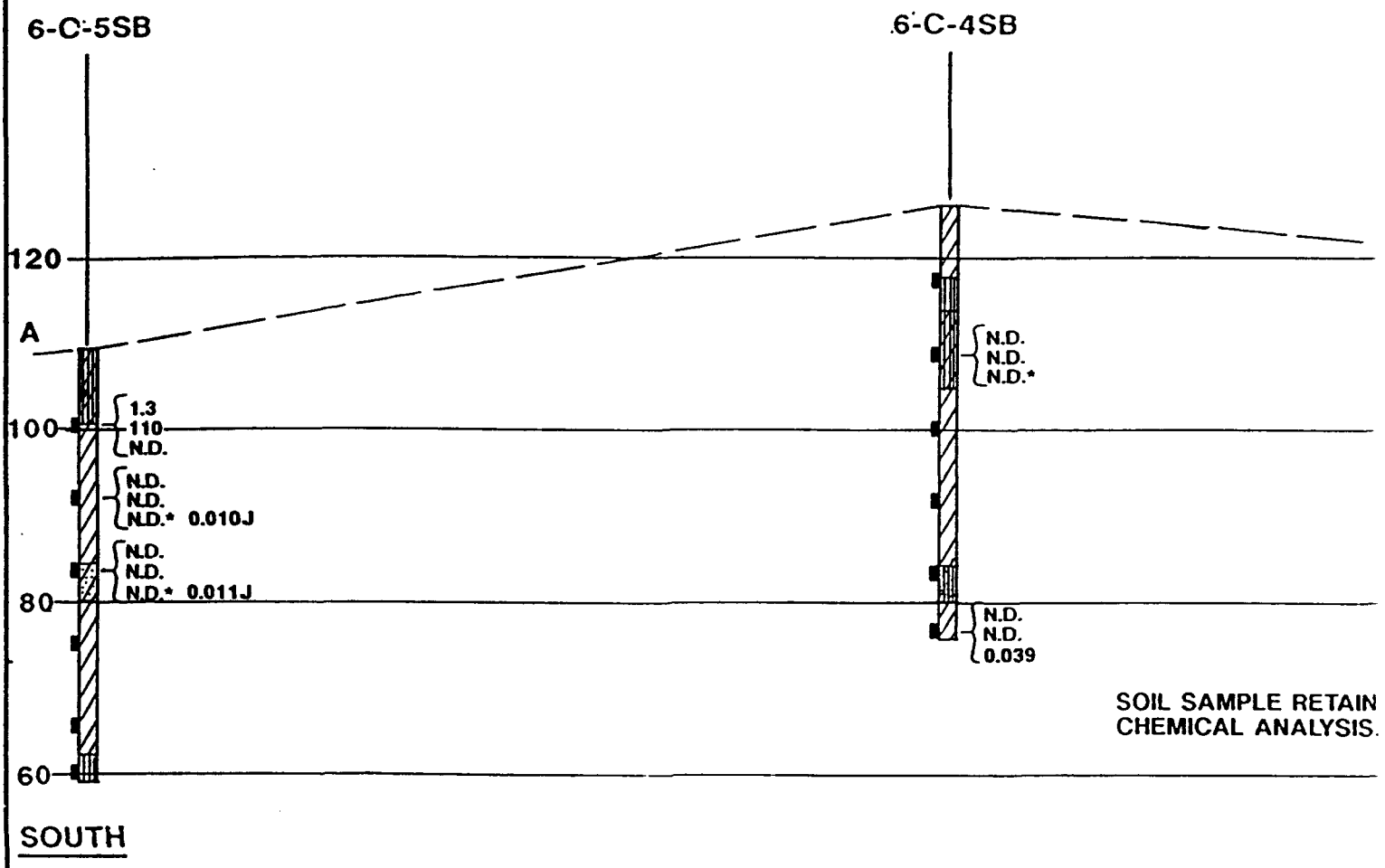
Through the four quarterly rounds of water sampling at Site 6, 12 groundwater samples and 4 surface water samples have been collected. Analyses performed for water samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), arsenic (7060), lead (7421), mercury (7470/7471), selenium (7740), water quality parameters, TFH-diesel and -gas (California method), and chemical oxygen demand (COD).

The only organic chemical detected in groundwater sampling through the third round of sampling at Site 6 was toluene. In the first quarterly sampling, toluene occurred only in background monitoring well 6-C-1 at 3 ug/l (2 ug/l in second column confirmation). This is considered to be a false positive result.

In the second quarterly sampling round (May 1989), toluene was detected in well 6-A-2 at 12 ug/l (1 ug/l in the second column confirmation); in well 6-A-1 at 1 ug/l (1 ug/l in the second column confirmation); and in well 6-C-1 at 1 ug/l (1 ug/l in the second column confirmation).

In the third round sampling, toluene was only detected in the downgradient wells: 1 ug/l (2 ug/l in the second column) in 6-A-1 and 9 ug/l (4 ug/l in the second column) in 6-A-2.

In the fourth quarterly sampling round toluene was only detected in downgradient well 6-A-2 at 2 ug/l (11 ug/l in the second column). Dichlorodifluoromethane (freon-12), a refrigerant and common laboratory contaminant, was detected in well 6-A-1 at 3 ug/l (1 ug/l in the second column). TFH-



LEGEND

- CLAY
- SILTY CLAY
- SILT
- SILTY SAND
- SANDY CLAY
- GRAVEL
- TFH-DIESEL, TFH-GAS, TCE

NOTE: DUE TO UNEQUAL SCALES ANGLED BORI

FOR SOIL BORING LOCATIONS SEE FIGUR

SCALE: 1"=200' HORIZ
1"=20' VERT

0 200'

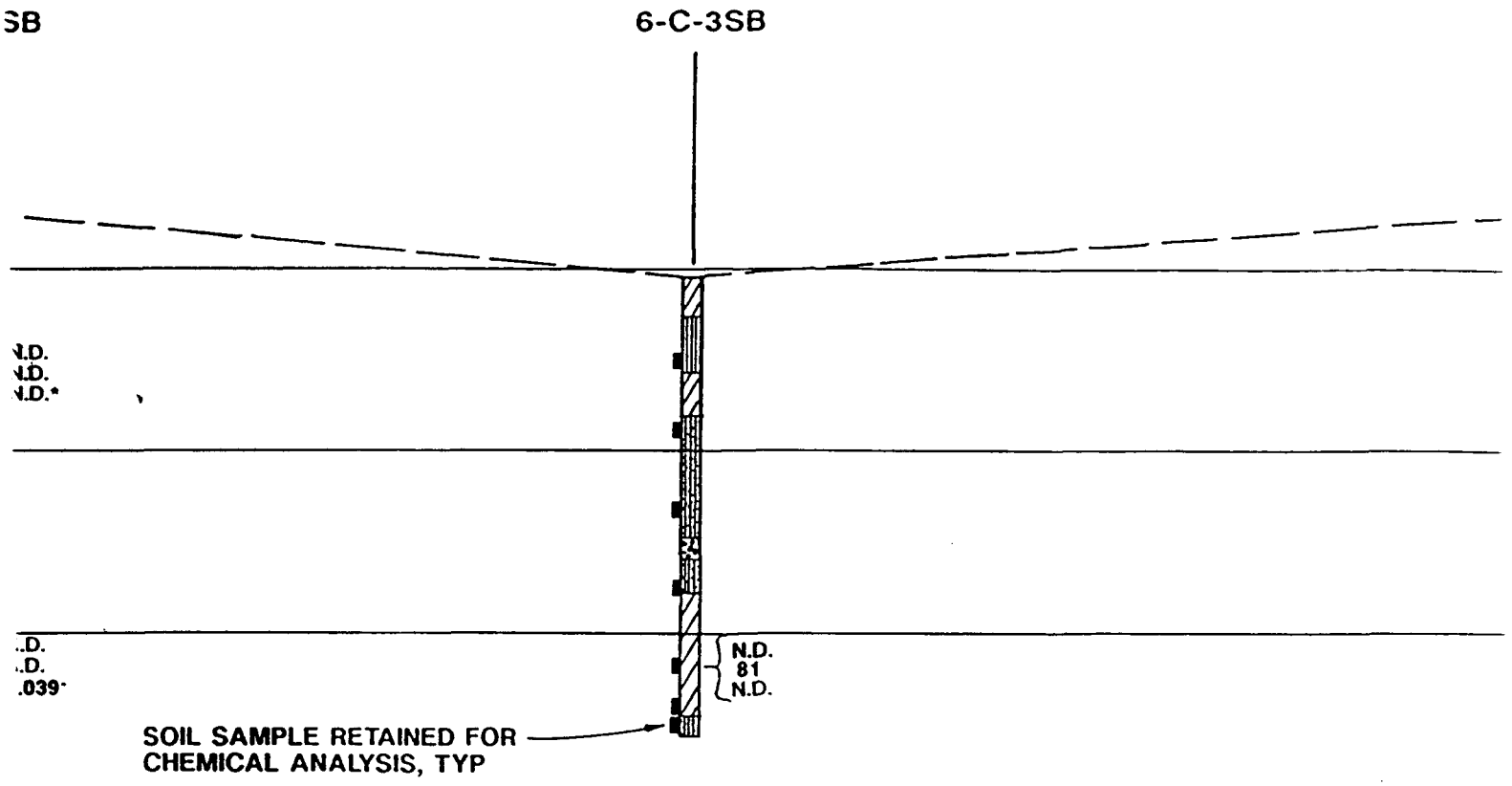
VERTICAL SCALE 10 x

ALL CONCENTRATIONS ARE IN mg/Kg

N.D. NOT DETECTED

J - N.D. * CONCENTRATION ESTIMATED BELOW LABORATORY L.O.Q.

CONCENTRATIONS SHOWN ONLY WHERE AN INDICATED ANALYTE WAS ESTIMATED OR DETECTED.



EQUAL SCALES ANGLED BORINGS ARE PLOTTED VERTICALLY.

·ORING LOCATIONS SEE FIGURE 4.1.6-1

=200' HORIZ
=20' VERT

200'

. SCALE 10 x

FIGURE 4
TFH AND TCE CONCE
CROSS SECTION A-

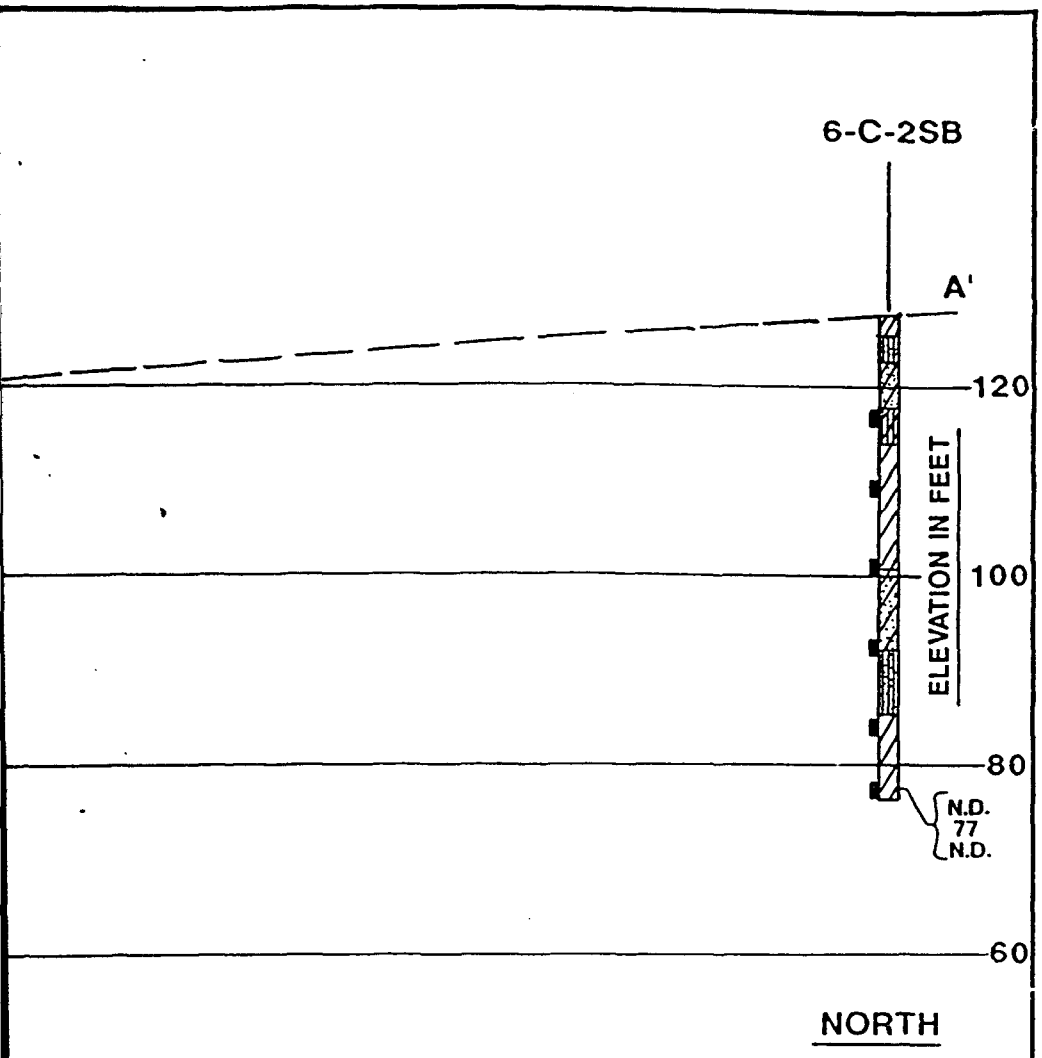


FIGURE 4.1.6-7
TFH AND TCE CONCENTRATIONS IN SOIL
CROSS SECTION A-A', LANDFILL NO. 2

CH2M HILL

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diesel was only detected in well 6-A-2 at 0.12 mg/l. Metals and water quality parameters were similar to earlier rounds except for manganese being detected in 6-A-1 at 0.037 mg/l.

Arsenic, mercury, lead, selenium, and TFH-gas were not detected in groundwater at Site 6. In the first groundwater sampling round, COD varied from below the 7 mg/l LOQ in 6-A-2 to 7.3 mg/l in 6-C-1 up to 8.0 mg/l in 6-A-1. However, COD was 9.9 mg/l in the equipment wash blank for 6-A-1. COD was not detected in any samples from the second, third, or fourth rounds.

Groundwater type varies at Landfill No. 2. Total dissolved solids in the first round were 284 and 236 mg/l at monitoring wells 6-C-1 and 6-A-2. However, TDS is much higher, 367 mg/l, in downgradient monitoring well 6-A-1, largely due to an anomalously high sulfate concentration of 115 mg/l (109 mg/l in a replicate sample). The sulfate concentration is over 85 mg/l, higher than in any of the other base monitoring wells, except well 2-R-3 which has a similar level. Background monitoring well 6-C-1, screened in sandstone, has a predominantly sodium bicarbonate water. Water from downgradient well 6-A-2 is bicarbonate with no dominant cations, and 6-A-1 is a calcium-magnesium sulfate type. Water type did not vary significantly in the second, third, and fourth sampling rounds. Sulfate remained high in 6-A-1 (131 mg/l in the second, 138 mg/l in the third, and 177 mg/l in the fourth round).

Nitrate plus nitrite (expressed as nitrate) in upgradient well 6-C-1 ranged from not detected in the first round to 0.80 mg/l in the second round to 2.2 mg/l in the third round and 0.35 mg/l in the fourth round, which is lower than any other well at Beale AFB. This lower nitrate may be due to recharge of fresh water from the tributary of Hutchinson Creek east of the well.

In each sampling round, one surface water sample (6-C-1SW) was taken from Hutchinson Creek immediately downstream of the Landfill No. 2 access road (Earle Road) bridge. In the first sampling round, toluene was detected at 2 ug/l (5 ug/l in second column) but was not detected in a replicate sample. The surface water was a calcium-magnesium bicarbonate type similar to groundwater at downgradient well 6-A-2 but with much lower TDS of 79 mg/l. A replicate sample had similar results.

Toluene was detected at 1 ug/l (2 ug/l in second column) in the second round surface water sampling. Nitrate was 0.42 mg/l and COD was 13.3 mg/l. TDS increased to 164 mg/l. Water type did not change.

Toluene was detected at 10 ug/l (3 ug/l in second column) in the third round surface water sampling. Nitrate was 0.49 mg/l and COD 25.8 mg/l, similar to the first round surface water results. TDS increased to 250 mg/l. Water type did not change.

Toluene was not detected in the fourth round surface water sampling. TCE was detected at 44 ug/l in the first column result but was not detected in a second or third column run for confirmation. Therefore, TCE is not believed to be present in the sample. TFH-diesel was detected at 0.070 mg/l. Nitrate was 0.53 mg/l and COD 18.5 mg/l. Manganese was detected at 0.0682 mg/l. Arsenic, mercury, lead, selenium, and TFH-gas were not detected in surface water at Site 6.

4.1.6.1.4 Analytical Results Table

Table 4.1.6-2 presents a summary of all detected analytes for Site 6. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.6-2 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.6.1.5 Discussion of Analytical Data

Contaminants were detected in some soil samples collected from beneath Site 6. With the exception of the probable false positive results for toluene and the single TFH-diesel detection in the fourth round surface water sample, no contaminants were detected above LOQs in either the groundwater or surface water samples. Table 4.1.6-3 presents the range of contaminants encountered for each of the media sampled (soil, groundwater, surface water), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections or surrogate spike recoveries.

TABLE 4.1.6-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 6

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-1SB BAFB-0087 10.0-11.5' 12/01/88	6-C-1SB BAFB-0088 20.0-21.5' 12/01/88	6-C-1SB BAFB-0089 40.0-41.5' 12/01/88	6-C-2SB BAFB-0177 7.5-9.0' 12/12/88	6-C-2SB BAFB-0178 17.5-19.0' 12/12/88	6-C-2SB BAFB-0179 27.5-29.0' 12/12/88
Percent Moisture	ASA#9	N/A	%	NS	NS	15.7	18.7	15	9.8	19.4	21.1
Aluminum	SW6010	20.0	mg/kg	NS	NS	16100	16000	10900	10800	20500	17400
Barium	SW6010	10.0	mg/kg	NS	10,000	269	185	40.9	143	244	112
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	ND	0.74	0.76
Calcium	SW6010	100	mg/kg	NS	NS	5110	6400	4940	3810	7790	5800
Chromium	SW6010	3.0	mg/kg	NS	500	32.7	37.5	37.2	37.3	47.4	37.0
Cobalt	SW6010	4.0	mg/kg	NS	8,000	22.5	20.9	115	21.1	28.3	22.8
Copper	SW6010	3.0	mg/kg	NS	2,500	60.3	73.1	40.4	44.2	58.8	51.3
Iron	SW6010	10.0	mg/kg	NS	NS	27000	31900	20700	29300	36400	38300
Magnesium	SW6010	100	mg/kg	NS	NS	6630	5820	5520	3810	8100	7290
Manganese	SW6010	1.5	mg/kg	NS	NS	816	1050	341	753	964	584
Nickel	SW6010	4.0	mg/kg	NS	2,000	29.9	22.1	22.4	20.0	36.7	25.3
Potassium	SW6010	200	mg/kg	NS	NS	427	ND	ND	ND	459	266
Sodium	SW6010	100	mg/kg	NS	NS	189	207	215	223	408	387
Vanadium	SW6010	4.0	mg/kg	NS	2,400	66.3	90.3	62.1	83.9	100	86.9
Zinc	SW6010	2.0	mg/kg	NS	5,000	65.0	68.8	52.6	43.8	71.5	66.8
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.15	0.14	0.027	0.037	0.035	0.061
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	0.11 B	1.5
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.99
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.070
Toluene	SW8240	0.005	mg/kg	NS	NS	0.090	0.041	0.016	0.003 J	0.002 J	0.016 J
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.002 J	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	1.3 B	2.0 B	1.9 B	1.8 B	2.1 B	2.0 B
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.24 J

NOTES: Results reported for detected analytes only.

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b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.6-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-2SB BAFB-0180 37.5-39.0' 12/12/88	6-C-2SB BAFB-0226 47.5-49.0' 12/12/88	6-C-2SB BAFB-0227 57.5-59.0' 12/12/88	6-C-3SB BAFB-0164 7.5-9.0' 12/08/88	6-C-3SB BAFB-0165 17.5-19.0' 12/08/88	6-C-3SB BAFB-0166 27.5-29.0' 12/08/88
Percent Moisture	ASA#9	N/A	%	NS	NS	13.3	12.1	19.4	12.4	17.7	18.3
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	ND	77	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	8990	7650	8810	14400	17400	9520
Barium	SW6010	10.0	mg/kg	NS	10,000	63.4	92.5	52.1	119	170	133
Calcium	SW6010	100	mg/kg	NS	NS	3480	3250	3460	2970	3850	2800
Chromium	SW6010	3.0	mg/kg	NS	500	18.5	26.6	14.9	4.4	14.6	7.2
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.5	14.8	5.5	21.7	10.6	8.6
Copper	SW6010	3.0	mg/kg	NS	2,500	43.1	39.0	31.5	41.2	14.6	14.7
Iron	SW6010	10.0	mg/kg	NS	NS	20600	23500	13500	30600	19400	12200
Magnesium	SW6010	100	mg/kg	NS	NS	3770	4060	3310	3220	3100	2480
Manganese	SW6010	1.5	mg/kg	NS	NS	453	544	230	930	558	517
Nickel	SW6010	4.0	mg/kg	NS	2,000	16.1	12.5	10.4	13.7	12.2	7.1
Potassium	SW6010	200	mg/kg	NS	NS	254	307	298	411	413	636
Sodium	SW6010	100	mg/kg	NS	NS	231	174	252	111	237	187
Vanadium	SW6010	4.0	mg/kg	NS	2,400	65.1	79.1	31.0	114	39.9	27.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	45.9	44.7	32.6	43.2	42.0	41.7
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.032	0.038	0.038	0.005 J	0.009 B	0.011 B
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	0.013 B	ND	0.018	0.016 B	0.024 B
trans-1,2-Dichloroethene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.005 J	0.005 J
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.006 J
2-Hexanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	0.006 J	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.004 J	ND	ND	0.021	0.049	0.083
Chlorobenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.005 J	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	2.0 B	1.7 B	1.9 B	ND	ND	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	0.54	0.73	0.26 J
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.078 J

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J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.6-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-3SB BAFB-0167 37.5-39.0' 12/08/88	6-C-3SB BAFB-0168 47.5-49.0' 12/08/88	6-C-3SB BAFB-0169 55.0-56.5' 12/08/88	6-C-3SB[f] BAFB-0170 57.5-59.0' 12/08/88	6-C-4SB BAFB-0228 6.5-8.0' 12/12/88	6-C-4SB BAFB-0229 16.5-18.0' 12/12/88
Percent Moisture	ASA#9	N/A	%	NS	NS	18.5	20.2	18.2	14.4	17	27.9
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	81	ND	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	11100	15300	13100	6960	13600	27200
Barium	SW6010	10.0	mg/kg	NS	10,000	133	575	428	114	159	241
Calcium	SW6010	100	mg/kg	NS	NS	2980	7520	6330	3760	4450	13200
Chromium	SW6010	3.0	mg/kg	NS	500	10.7	31.3	30.9	18.7	44.1	33.8
Cobalt	SW6010	4.0	mg/kg	NS	8,000	10.3	42.0	35.6	12.9	11.1	16.6
Copper	SW6010	3.0	mg/kg	NS	2,500	18.4	47.6	43.0	25.9	56.9	51.3
Iron	SW6010	10.0	mg/kg	NS	NS	14700	25200	25700	16400	35800	30200
Magnesium	SW6010	100	mg/kg	NS	NS	2430	6520	5110	3350	7140	7730
Manganese	SW6010	1.5	mg/kg	NS	NS	615	2430	2030	534	340	598
Nickel	SW6010	4.0	mg/kg	NS	2,000	9.3	25.2	27.8	11.7	24.6	35.4
Potassium	SW6010	200	mg/kg	NS	NS	577	802	1220	829	277	555
Sodium	SW6010	100	mg/kg	NS	NS	172	184	191	137	195	288
Vanadium	SW6010	4.0	mg/kg	NS	2,400	29.9	79.6	97.9	53.4	119	51.3
Zinc	SW6010	2.0	mg/kg	NS	5,000	41.2	49.7	45.1	34.6	63.5	83.8
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.007 B	0.005 BJ	0.005 J	0.005 J	0.029	0.042
Acetone	SW8240	0.010	mg/kg	NS	NS	0.022 B	0.096 B	0.015	0.016	ND	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	0.007 J	ND	0.009 J	ND	ND	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	ND	ND	ND	ND	0.002 J
Benzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.005 J
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.004 J
Toluene	SW8240	0.005	mg/kg	NS	NS	0.11	ND	0.062	0.046	0.020	0.058
Phenol	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	1.8 B	2.1 B
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.46	ND	0.21 J	0.48	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.080 J	ND	0.16 J	0.085 J	ND	0.24 J

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.6-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-4SB BAFB-0230 26.5-28.0' 12/13/88	6-C-4SB BAFB-0231 36.5-38.0' 12/13/88	6-C-4SB BAFB-0232 46.5-48.0' 12/13/88	6-C-4SB BAFB-0233 56.5-58.0' 12/13/88	6-C-5SB BAFB-0171 7.5-9.0' 12/09/88	6-C-5SB BAFB-0172 17.5-19.0' 12/09/88
Percent Moisture	ASA#9	N/A	%	NS	NS	22.7	20.3	13.5	45	20.3	21.3
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	ND	ND	ND	1.3	ND
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	ND	ND	ND	110	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	16300	11200	10800	20400	24500	23000
Barium	SW6010	10.0	mg/kg	NS	10,000	203	111	67.4	159	228	118
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	0.91	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	5760	4540	4600	9650	5560	6810
Chromium	SW6010	3.0	mg/kg	NS	500	40.6	21.3	23.8	11.1	48.6	41.4
Cobalt	SW6010	4.0	mg/kg	NS	8,000	20.7	17.6	12.7	11.1	22.6	25.4
Copper	SW6010	3.0	mg/kg	NS	2,500	60.2	41.8	36.1	29.1	52.9	63.2
Iron	SW6010	10.0	mg/kg	NS	NS	33600	24000	23200	11100	34300	40000
Magnesium	SW6010	100	mg/kg	NS	NS	8870	5180	4610	8040	6600	7670
Manganese	SW6010	1.5	mg/kg	NS	NS	1060	670	379	911	725	818
Nickel	SW6010	4.0	mg/kg	NS	2,000	36.9	20.1	16.2	13.8	34.9	32.4
Potassium	SW6010	200	mg/kg	NS	NS	375	ND	243	ND	552	839
Sodium	SW6010	100	mg/kg	NS	NS	219	184	185	275	272	215
Vanadium	SW6010	4.0	mg/kg	NS	2,400	89.9	48.6	69.4	20.0	67.3	111
Zinc	SW6010	2.0	mg/kg	NS	5,000	78.5	45.8	49.7	36.7	59.5	83.0
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.045	0.037	0.037	0.014	0.25 B	0.18 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.027	0.008 J	ND	0.096	0.15 B	0.030 BJ
1,1-Dichloroethene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.010 J
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	ND	ND	0.039	ND	0.010 J
Benzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.005 J	ND	0.012 J
Toluene	SW8240	0.005	mg/kg	NS	NS	0.058	0.023	0.006	0.073	0.22 J	0.017 J
Chlorobenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.011 J
Phenol	SW8270	0.33	mg/kg	NS	NS	2.1 B	2.1 B	1.8 B	2.2 B	2.1 B	2.0 B
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.53	0.44	0.52	0.31 J	ND	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	0.28 J	0.37 J

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.6-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-5SB BAFB-0173 27.5-29.0' 12/09/88	6-C-5SB BAFB-0174 37.5-39.0' 12/09/88	6-C-5SB BAFB-0175 47.5-49.0' 12/09/88	6-C-5SB BAFB-0176 57.5-59.0' 12/09/88
Percent Moisture	ASA#9	N/A	%	NS	NS	16.3	14.4	11.6	43.3
Aluminum	SW6010	20.0	mg/kg	NS	NS	19700	14000	13900	19000
Barium	SW6010	10.0	mg/kg	NS	10,000	131	161	106	236
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	0.88
Calcium	SW6010	100	mg/kg	NS	NS	6090	4210	6300	9860
Chromium	SW6010	3.0	mg/kg	NS	500	53.9	28.5	29.5	9.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	28.0	19.9	15.8	11.3
Copper	SW6010	3.0	mg/kg	NS	2,500	55.9	28.2	96.5	31.7
Iron	SW6010	10.0	mg/kg	NS	NS	39500	25100	26800	9450
Magnesium	SW6010	100	mg/kg	NS	NS	6000	3910	6070	7570
Manganese	SW6010	1.5	mg/kg	NS	NS	1040	875	620	1020
Nickel	SW6010	4.0	mg/kg	NS	2,000	27.0	18.7	17.0	15.3
Potassium	SW6010	200	mg/kg	NS	NS	765	ND	373	494
Sodium	SW6010	100	mg/kg	NS	NS	203	192	250	303
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	73.5	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	141	78.5	79.4	17.3
Zinc	SW6010	2.0	mg/kg	NS	5,000	68.2	41.6	89.9	36.0
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.19 B	0.15 B	0.19 B	0.25 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.032 BJ	0.059 B	0.071 B	0.096 B
1,1-Dichloroethene	SW8240	0.005	mg/kg	NS	NS	0.012 J	ND	ND	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	0.011 J	ND	ND	ND
Benzene	SW8240	0.005	mg/kg	NS	NS	0.013 J	ND	ND	ND
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.022 J
Toluene	SW8240	0.005	mg/kg	NS	NS	0.021 J	0.014 J	0.042	0.020 J
Chlorobenzene	SW8240	0.005	mg/kg	NS	NS	0.012 J	ND	ND	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	2.2 B	1.9 B	2.0 B	2.8 B
2-Chlorophenol	SW8270	0.33	mg/kg	NS	NS	ND	ND	0.20 J	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	0.33 J	ND

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.6-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 6

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-1GW BAFB-0504 03/22/89	6-A-1GW BAFB-0507 03/23/89	6-A-1GW^{R} BAFB-0532 04/20/89	6-A-1GW^{f} BAFB-0508 03/23/89	6-A-1GW^{Rf} BAFB-0533 04/20/89	6-A-1GW^{e} BAFB-0505 03/23/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	800	400	435	400	435	NT
Temperature	E170.1	N/A	deg C	NS	NS	22.0	19.0	20.0	19.0	20.0	NT
pH	E150.1	N/A	pH	5-9	NS	8.04	7.05	7.14	7.05	7.14	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	154.8	75.2	NT	70.8	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	188.9	91.7	NT	86.4	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	284	367	NT	371	NT	10.0
Chloride	E325.3	1.0	mg/l	250	250	34.2	29.5	NT	32.4	NT	ND
Fluoride	E340.2	0.050	mg/l	2	1.4	0.22	0.18	NT	0.17	NT	ND
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	ND	16.0	NT	16.0	NT	0.15
Sulfate	E375.4	1.0	mg/l	250	250	17.7	115	NT	109	NT	1.1
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	7.3	8.6	NT	9.0	NT	9.9
Calcium	SW6010	1.00	mg/l	NS	NS	28.8	43.5	NT	41.2	NT	ND
Iron	SW6010	0.100	mg/l	.3	.3	ND	0.116	NT	0.379	NT	ND
Magnesium	SW6010	1.00	mg/l	NS	NS	10.5	21.8	NT	20.6	NT	ND
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.0770	NT	0.0830	NT	ND
Potassium	SW6010	1.00	mg/l	NS	NS	2.30	1.90	NT	1.70	NT	ND
Sodium	SW6010	1.00	mg/l	NS	NS	54.4	26.4	NT	22.0	NT	ND
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	NT	ND	NT	0.0370
Toluene	SW8020	1	ug/l	14,300	100	3(2)	ND	NT	ND	NT	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	ND	NT	3 BJ	NT	2 BJ	ND
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	ND	NT	1 BJ	NT	1 BJ	ND
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	NT	4 BJ	NT	4 BJ	ND

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R: resample

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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.6-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-A-1GW[b] BAFB-0506 03/23/89	6-A-2GW BAFB-0509 03/23/89	6-C-1SW BAFB-0483 03/09/89	6-C-1SW[f] BAFB-0484 03/09/89	6-C-1SW[e] BAFB-0485 03/09/89	6-C-1SW[b] BAFB-0486 03/09/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	NT	170	88	85	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	NT	18.0	14.0	14.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	NT	8.01	7.22	7.09	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	NT	74.0	32.8	26.8	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	90.3	40.0	32.7	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	NT	236	79.0	83.0	8.0	NT
Chloride	E325.3	1.0	mg/l	250	250	NT	5.5	4.0	4.0	1.5	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	NT	0.22	ND	ND	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	NT	23.7	2.2	1.6	ND	NT
Sulfate	E375.4	1.0	mg/l	250	250	NT	7.5	5.3	5.1	ND	NT
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	NT	ND	18.5	20.8	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	NT	15.0	7.79	7.91	ND	NT
Iron	SW6010	0.100	mg/l	.3	.3	NT	ND	0.201	0.185	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	NT	6.74	4.93	5.01	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	NT	1.20	ND	ND	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	NT	15.3	4.79	4.93	ND	NT
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	2	ND	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.6-2

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 6

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-1GW BAFB-0549 05/25/89	6-A-1GW BAFB-0548 05/25/89	6-A-2GW BAFB-0547 05/24/89	6-C-1SW BAFB-0585 06/09/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	420	430	165	230
Temperature	E170.1	N/A	deg C	NS	NS	20.0	19.0	19.2	23.0
pH	E150.1	N/A	pH	5-9	NS	7.91	7.03	7.76	7.23
Alkalinity - Total	SM403	1.0	mg/l	20	NS	160.0	72.0	69.6	83.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	195.2	87.8	84.9	102.0
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	319	397	160	164
Chloride	E325.3	1.0	mg/l	250	250	38.8	25.9	5.4	28.1
Fluoride	E340.2	0.050	mg/l	2	1.4	0.18	0.14	0.17	0.16
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	0.70	17.5	23.3	0.42
Sulfate	E375.4	1.0	mg/l	250	250	23.1	131	11.7	2.3
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	ND	ND	ND	13.3
Calcium	SW6010	1.00	mg/l	NS	NS	27.4	43.2	12.7	16.3
Iron	SW6010	0.100	mg/l	.3	.3	ND	ND	ND	0.112
Magnesium	SW6010	1.00	mg/l	NS	NS	10.0	20.7	6.35	11.5
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.304	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.70	1.10	ND	ND
Sodium	SW6010	1.00	mg/l	NS	NS	49.7	23.5	15.3	16.4
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	ND	ND	6(19)
Trichlorofluoromethane	SW8010	1	ug/l	NS	3,400	ND	ND	ND	1
Toluene	SW8020	1	ug/l	14,300	100	1(1)	1(1)	12(1)	1(2)
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	5 J	5 J	6 J	6 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	20	4 J	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.6-2

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 6

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-1GW BAFB-0605 08/25/89	6-A-1GW BAFB-0606 08/28/89	6-A-2GW BAFB-0607 08/28/89	6-C-1SW BAFB-0608 08/28/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	412	432	162	463
Temperature	E170.1	N/A	deg C	NS	NS	20.2	19.0	20.5	21.0
pH	E150.1	N/A	pH	5-9	NS	7.99	6.86	7.40	7.55
Alkalinity - Total	SM403	1.0	mg/l	20	NS	160.0	66.4	62.8	74.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	195.2	81.0	76.6	90.8
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	263	397	215	250
Chloride	E325.3	1.0	mg/l	250	250	38.0	23.5	5.7	54.1
Fluoride	E340.2	0.050	mg/l	2	1.4	0.16	0.12	0.18	0.80
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	2.2	16.2	24.5	0.49
Sulfate	E375.4	1.0	mg/l	250	250	21.3	138	10.8	ND
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	ND	ND	ND	25.8
Calcium	SW6010	1.00	mg/l	NS	NS	29.1	44.6	11.6	22.9
Magnesium	SW6010	1.00	mg/l	NS	NS	10.9	22.0	6.76	16.0
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.0760	0.0310	0.0263
Potassium	SW6010	1.00	mg/l	NS	NS	1.40	ND	ND	1.77
Sodium	SW6010	1.00	mg/l	NS	NS	54.1	21.5	16.5	30.2
Toluene	SW8020	1	ug/l	14,300	100	ND	1(2)	9(4)	10(3)
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	7 BJ	7 BJ	6 BJ	6 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	8 J	ND	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.6-2

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 6

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	6-C-1GW BAFB-0696 11/18/89	6-A-1GW BAFB-0689 11/15/89	6-A-2GW BAFB-0688 11/15/89	6-C-1SW BAFB-0730 12/05/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	400	435	170	70
Temperature	E170.1	N/A	deg C	NS	NS	18.5	18.5	19.0	6.5
pH	E150.1	N/A	pH	5-9	NS	7.97	6.96	7.50	6.79
Alkalinity - Total	SM403	1.0	mg/l	20	NS	151.6	78.4	71.4	40.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	185.0	95.6	87.1	49.8
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	296	316	104	8.0
Chloride	E325.3	1.0	mg/l	250	250	35.5	34.2	2.9	6.6
Fluoride	E340.2	0.050	mg/l	2	1.4	0.20	0.15	0.20	ND
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	0.35	9.1	14.5	0.53
Sulfate	E375.4	1.0	mg/l	250	250	21.7	177	6.5	7.0
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	NT	ND	ND	18.5
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	ND	ND	0.12	0.070
Calcium	SW6010	1.00	mg/l	NS	NS	28.8	45.4	14.1	7.82
Iron	SW6010	0.100	mg/l	.3	.3	ND	ND	ND	0.101
Magnesium	SW6010	1.00	mg/l	NS	NS	10.0	21.4	6.58	4.38
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.0367	ND	0.0682
Potassium	SW6010	1.00	mg/l	NS	NS	1.26	ND	ND	1.17
Sodium	SW6010	1.00	mg/l	NS	NS	53.2	24.0	16.4	4.83
Dichlorodifluoromethane	SW8010	1	ug/l	NS	NS	ND	3(1)	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	ND	ND	ND	44(0)
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	2(11)	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 J	ND	ND	7 J
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	ND	ND	ND	6 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	8 J	ND	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Table 4.1.6-3
RANGES OF CONTAMINANTS DETECTED AT SITE 6

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SOIL BORINGS				
TFH-diesel	mg/kg	ND	1.3	1/27
TFH-gas	mg/kg	ND	110	3/27
toluene	mg/kg	ND	0.22	24/27
2-butanone	mg/kg	ND	0.99	4/27
4-methyl-2-pentanone	mg/kg	ND	0.070	3/27
chlorobenzene	mg/kg	ND	(0.012)	3/27
trans-1,2-dichloroethene	mg/kg	ND	(0.005)	2/27
1,1-dichloroethene	mg/kg	ND	(0.012)	2/27
trichloroethene	mg/kg	ND	(0.039)	4/27
bis(2-ethylhexyl) phthalate	mg/kg	ND	(0.37)	8/27
di-n-butyl phthalate	mg/kg	ND	0.73	10/27
GROUNDWATER				
toluene	ug/l	ND	12	7/12
TFH-diesel	mg/l	ND	0.12	1/12
SURFACE WATER				
toluene	ug/l	2	10	3/4
TFH-diesel	mg/l	ND	0.070	1/4

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the LOQ. These detections may represent laboratory "noise" and some of the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study, the LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.6.2 Sampling or Analytical Problems

4.1.6.2.1 Loss of Samples

There were no sample loss problems for Site 6 samples. One groundwater sample from well 6-A-1 in the first quarterly sampling round was resampled for semivolatile organic analysis due to a violation of holding times. Another first quarter groundwater sample (well 6-A-2) was not analyzed for semivolatile organics due to a laboratory handling problem. The omission of this analysis is not considered critical to the final evaluation of site conditions as the well was sampled in later rounds.

4.1.6.2.2 Likelihood That Positive Samples Were Contaminated in the Field or Laboratory

Soil and water samples collected at Site 6 contained several organic compounds that may be laboratory or field induced false positive results. Phenol was detected in most of the soil samples at concentrations of 1.3 mg/kg to 2.8 mg/kg. This has been traced to a factory-contaminated bottle of acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks that the induced contamination was 1.7 mg/kg.

Many of the soil samples collected also contained acetone and methylene chloride. These are common laboratory contaminants and were also found in some of the method blanks at similar concentrations.

In one first quarter groundwater sample (6-A-1), the semivolatile compounds bis-(2-ethylhexyl) phthalate, di-n-butyl phthalate, and n-nitrosodiphenylamine were estimated below the LOQ and were also found in the method blank at similar

levels. The second quarter surface water and third quarter groundwater and surface water samples had n-nitrosodiphenylamine detected below the LOQ and in the method blanks. Di-n-Butylphthalate was detected below the LOQ in the sample and the method blank in the fourth quarter sample from well 6-C-1.

Dichlorodifluoromethane (Freon 12) was detected at 3 ug/l (1 ug/l in the second column) in the fourth quarter sample from 6-A-1. This is a refrigerant which is a laboratory contaminant and is judged not to be from the groundwater.

Toluene was detected in all but three of the 27 soil samples, one of the three first round groundwater samples, and in the first round surface water sample. The maximum concentration in soils was 0.11 mg/kg. In the second quarter, toluene was detected in three groundwater samples and the surface water sample. In the third quarter, toluene was detected in two groundwater samples and the surface water sample. In the fourth quarter, toluene was only detected in one groundwater sample. The maximum concentration in groundwater was 12 ug/l (second round) and in surface water was 10 ug/l (third round). While toluene is not considered a common lab contaminant and was not detected in laboratory or field blanks at this site, the ubiquitous distribution makes the results suspect as positive detections.

During the collection of first quarter water samples, two ambient condition blanks (field blanks), and two equipment wash blanks were collected. All of these samples were free of contamination.

One soil replicate sample and two first quarter water replicate samples were also collected at Site 6. A comparison of results for the environmental samples versus the corresponding replicate samples shows that the analysis results are very similar. Some variability exists for metals in the soil samples, but this is expected since the two samples were not combined and homogenized in order to minimize loss of volatile compounds. The replicate sample of the first round surface water did not detect toluene, which was found in the corresponding environmental sample at 2 ug/l (5 ug/l in second column). This further supports the possibility that toluene is a false positive result.

4.1.6.2.3 Analytical Results Obtained Under Out-of-Control Conditions

Following the semivolatile analysis of the first quarter groundwater sample from well 6-A-1, it was noted that three of the six surrogate spike recoveries were below the acceptable percent recovery range, and one was above. All analytes were nondetectable in the sample. The surrogate recovery for volatile organic analysis of the fourth quarter sample from well 6-A-1 exceeded the allowable percent recovery by 2 percent. One of the six surrogate spike recoveries for the semivolatile organic analysis for well 6-C-1 was 1 percent below the acceptable range.

4.1.6.2.4 Corrective Actions Applied to Out-of-Control Events

The corrective action for the groundwater sample discussed above included the re-analysis of the sample. Although the re-analysis results were within acceptable recovery limits, the holding time for the sample had been violated. This sample (BAFB-0507) was resampled for the semivolatile fraction, re-analyzed, and reported in the data as sample BAFB-0532.

4.1.6.3 Significance of Findings

Soil

The soil sampling program at Site 6 involved collecting 27 samples from 5 borings. TFH-gas compounds were detected in two unrelated locations in angled borings: at 57.5 to 59 feet (actual vertical depth of 50 feet) in 6-C-2SB (77 mg/kg) and at 7.5 to 9 feet (7 feet vertically) in 6-C-5SB (110 mg/kg). TFH-diesel was detected at 1.3 mg/kg in the latter sample. However, since TFHs or associated organic compounds were not detected in the groundwater at Site 6, it cannot be concluded whether the detected TFHs are affecting the environment.

Aside from the probable false positive results for acetone, methylene chloride, toluene, phenol, and phthalates, several organics were detected in the soil samples from Site 6. Benzene, chlorobenzene, 4-methyl-2-pentanone, TCE, 2-butanone, trans-1,2-DCE, 1,1-DCE, 2-hexanone, total xylenes, and 2-chlorophenol, were all detected in samples from the angled borings drilled beneath the landfill at various locations and depths. Most of these compounds were found at or below

the LOQ. DHS TTLCs are not available for any of these compounds. These compounds were not detected in the background boring nor in the angled boring samples taken at approximately 7.5 to 9 feet (7 feet vertically) which would not be below the trenches. These compounds were most common in the 17.5- to 19- and 27.5- to 29-foot samples (16 and 24 feet vertically) which would be below the trenches. This suggests that contaminants have been released to the soil from the landfill, but at very low concentrations.

Groundwater

One background well (6-C-1) was constructed at Site 6. This well plus two existing wells were sampled during Stage 2-1. The background well encountered sandstone at a depth of 55 feet. Downgradient wells installed during previous studies (6-A-1 and 6-A-2) were completed in unconsolidated materials and did not encounter bedrock. Groundwater was encountered in the three wells at elevations ranging from 34 to 56 feet above NVGD. The large head difference across the site appears to be related to well completions in different geologic units.

Water levels have risen only slightly at this site, compared to previous and current data from IRP sites to the west of Site 6. This may be because Site 6 is sufficiently east of the regional groundwater depression to not be greatly influenced by the depression.

Aside from 3 ug/l of toluene found in the upgradient well in the first round, the confirmed toluene in downgradient wells in the second and third rounds, the single downgradient detection in the fourth round (probably false positive results), and the 0.12 mg/l TFH-diesel detected in the fourth quarter sample from 6-A-2, no organics were detected in the groundwater. General water quality parameters such as specific conductivity, alkalinity, and bicarbonate were higher at the background well than at the downgradient wells, another indication that they are completed in different geologic units. One exception is that sulfate was detected at 115, 131, 138, and 177 mg/l in four rounds at well 6-A-1. Although these are not particularly high concentrations, it is several times higher than in any other monitoring well on base except 2-R-3. The reason for this is unknown. The California DHS secondary MCL and EPA national ambient water quality criteria for sulfate are 250 mg/l. A primary DHS MCL is not available.

Surface Water

Surface water at Site 6 has the same general characteristics as the surface water sampled at Site 13, located downstream. Water quality parameters were generally measured at lower values than those in groundwater. Toluene was detected in the first three quarterly surface water samples but is probably a false positive result. The absence of confirmed contaminants in the surface water samples except for the single detection of TFH-diesel at 0.070 mg/l in the fourth quarter sample, plus the absence of a migration pathway between the landfill and the creek indicates that Site 6 is not significantly affecting the surface water on base.

4.1.6.3.1 Zones of Contamination

It is concluded that Site 6 may be contributing chlorinated organic compounds, BETX compounds, and TFH-diesel to the soils beneath the landfill, but the concentrations detected and the absence of these compounds in the groundwater sampled indicate that the effects, to date, are minimal in the vicinity of the two downgradient wells. However, there is no monitoring well downgradient of the northern half of the landfill and contaminants could be present there. The apparent zone of organic compound contamination at Site 6 appears to be limited to the upper 30 feet of soil. However, due to the dispersed sample locations in which TFH-diesel was detected and the occurrence in a total depth sample (50 feet vertically), the vertical extent of site related contaminants cannot be established from the information obtained during the Stage 2-1 study.

4.1.6.3.2 Contaminant Migration

Organic compounds are present in the soil beneath Site 6, however, these compounds are not migrating to groundwater in detectable quantities or are not detectable within the area of influence of the two downgradient wells except for the 0.12 mg/l TFH-diesel detected in the fourth round sample from 6-A-2. However, these two wells do not monitor the groundwater downgradient of the north half of the landfill. Another downgradient well will be required to evaluate groundwater contamination downgradient from the north half of the landfill. Considering the relatively low organic compound concentrations in the soil and the extensive clay deposits above the groundwater, the potential for detection of contaminants migrating to groundwater is considered low.

Surface water is located above groundwater levels and, therefore, it is unlikely that the landfill could affect surface water quality. Any infiltrating water will move vertically towards the groundwater.

4.1.6.3.2.1 Potential to Move Off Site and Off Base

Because of the low contaminant migration potential, the potential for contaminants to move from Site 6 off site or off base is very low.

4.1.6.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Any migration of the low concentrations detected in the soil above the groundwater would be downward, towards the groundwater. The rate of migration through the unsaturated zone cannot be accurately predicted based on the information available.

4.1.6.3.2.3 Time of Travel to Receptors

An accurate prediction of the travel time for contaminants in the unsaturated zone to potable water wells downgradient of the base is not possible or appropriate at this time. There were no detected contaminants in the groundwater at Site 6 at the time of sampling except for TFH-diesel in the fourth round. No potable water supply wells are within 1 mile of Site 6.

4.1.6.3.2.4 Applicability of Solute Transport Models

Since almost no contaminants have been detected in the groundwater at Site 6, solute transport models are not applicable.

4.1.6.3.2.5 Expected Spatial and Temporal Variations in Concentration

Concentrations in the soil at Site 6 are expected to vary spatially as a function of location relative to past landfilling activities and temporally as a function of depth. The low concentrations (at or below LOQs) detected at the four angled borings probably do not constitute a significant contaminant source which would be consistently detectable if migration to groundwater occurred.

Groundwater chemistry at Site 6 did not change significantly in the four sampling rounds. The anomalously high sulfate level in well 6-A-1 of 115 mg/l in the first round was similar, but increased slightly (131, 138, and 177 mg/l) in the second, third, and fourth rounds. Water type remained constant for each well.

In surface water, chemical characteristics may vary markedly over successive quarters. TDS changed from 79 to 164 to 250 to 178 mg/l in the four rounds for unknown reasons. COD went from 18.5 to 13.3 to 25.8 to 18.5 mg/l. Nitrate plus nitrate went from 2.2 to 0.42 to 0.49 to 0.53 mg/l.

4.1.6.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part Stage 2-1.

4.1.7 DISCUSSION OF RESULTS FOR SITE 7: ARMY BIOLOGICAL PRODUCTION AREA

As a result of previous investigations conducted at Site 7, AeroVironment concluded that no contaminants were identified. On this basis, it has been determined that no further IRP actions will be taken at this site. A Record of Decision has been prepared for Site 7 and is included in Appendix J of this report.

4.1.8 DISCUSSION OF RESULTS FOR SITE 8: J-57 TEST CELL

During previous investigations conducted at Site 8 (Aero-Vironment, 1987), contamination was identified in soils but not in the groundwater. The Air Force determined that no IRP activities would take place at this site during the Stage 2-1 Remedial Investigation. If it is determined that additional IRP actions are necessary, these actions will be included in future IRP tasks. If it is determined through risk assessment that no further action will be necessary, a Record of Decision will be prepared for the site.

4.1.9 DISCUSSION OF RESULTS FOR SITE 9: ENTOMOLOGY BUILDING 2560

Site 9 is an area adjacent to Building 2560, inside the fenced Civil Engineering Facility. From 1981 to 1987, rinsate and spillage from storing and mixing pesticides and herbicides and cleaning pesticide containers have been discharged onto this gravel area and allowed to evaporate or drain into the soil. Grass does not grow in a small area downhill from the gravel area.

During IRP Phase II, Stage 1 activities in 1986, soils were sampled in the area of the gravel basin. One borehole sample contained chlordane, but the base has stated that this pesticide has not been used on base. A concrete basin and berm designed to eliminate the release of contaminants to the soils has replaced the past practice of draining containers to the ground surface. The basin has a roof over it.

In an attempt to confirm results of the Phase II, Stage 1 study, one soil boring was drilled to a depth of 21.5 feet adjacent to the basin area. The soil encountered included silt and clay above sandy clay. Mercury and TFH-gas were encountered in samples from the boring.

4.1.9.1 Presentation of Results

This section presents the results of the field investigation conducted at Site 9. The discussion focuses on the geology and hydrogeology at the site and presents the results of chemical analyses performed on soil samples.

4.1.9.1.1 Site Geology

Evaluation of the geology at Site 9 is based on a borehole (9-C-1SB) drilled during the current Stage 2-1 investigation and on three boreholes (9-A-1SB, -2SB, and -3SB) drilled during the Phase II, Stage 1 investigation (AeroVironment, 1987). During the Stage 2-1 investigation, one vertical soil boring was drilled at the entomology building to a depth of 21.5 feet. During the Phase II, Stage 1 investigation, three boreholes were drilled to depths of between 8 and 13 feet. The locations of these boreholes are shown in Figure 4.1.9-1. The soil boring log for 9-C-1SB is provided in Appendix D.

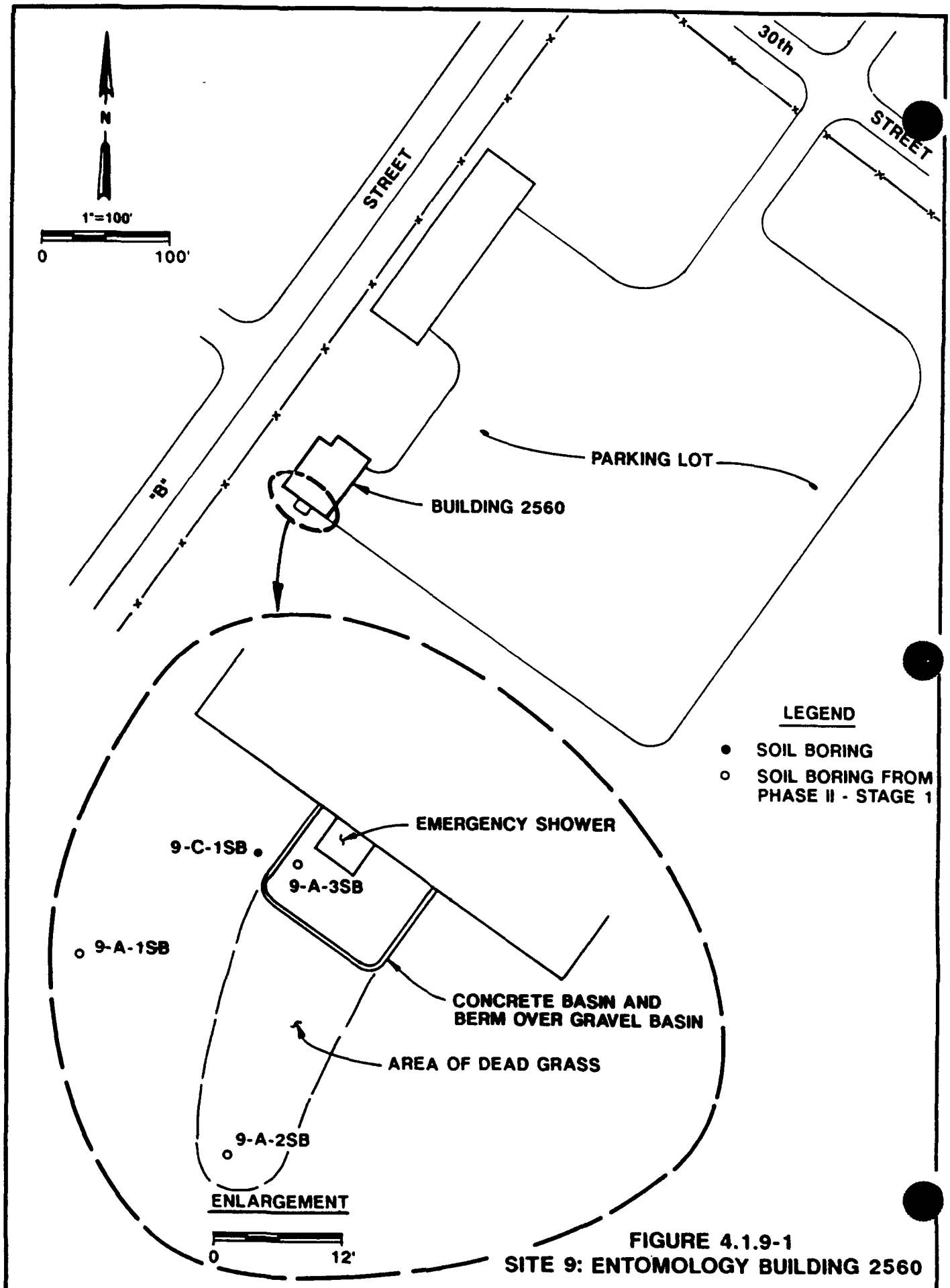


FIGURE 4.1.9-1
SITE 9: ENTOMOLOGY BUILDING 2560

CH2M HILL

The soil boring logs show that near-surface materials at Site 9 may be correlated among the boreholes. Each boring except 9-A-3SB encountered sandy silt at the surface, which continued to a depth of 3 to 5 feet. Borehole 9-A-3SB was drilled in the gravel area next to the building and penetrated fill material at the surface. Each boring then contacted a reddish-brown clay, which extended to a depth of about 13 feet. Borehole 9-C-1SB, which was the only hole to be drilled deeper than 13 feet, penetrated clayey sand from 13 feet to its total depth of 21.5 feet.

Soils at Site 9 constitute an alluvial sequence. At the surface, the deposits at Site 9 have been mapped as belonging to river deposits of Holocene age (Page, 1980). These are sand, silt, gravel, and minor clay deposited along stream channels and their flood plains. These sediments overlie the older Victor Formation deposits in the stratigraphic section at Beale AFB.

4.1.9.1.2 Site Hydrogeology

No monitoring wells are located at Site 9. Figure 4.1.9-2 shows groundwater elevation contours drawn from groundwater-level data collected from nearby wells in May 1989. Based on these data, groundwater beneath Site 9 is probably flowing toward the southwest.

4.1.9.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections and presentation of analytical results in figures and tables are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.9.1.4 and in Appendix A.

During the IRP Phase II, Stage 1 investigation (AeroVironment, 1987), three soil borings (9-A-1SB, -2SB, -3SB) were drilled at the Entomology Building (Figure 4.1.9-1). The only contamination detected in these borings was from boring 9-A-3SB within the diked pesticide mixing area. A chlordane concentration of 0.9 mg/kg was detected in the zero to 1.5-foot sample and 0.1 mg/kg (below the LOQ) in the 5- to 6.5-foot sample.

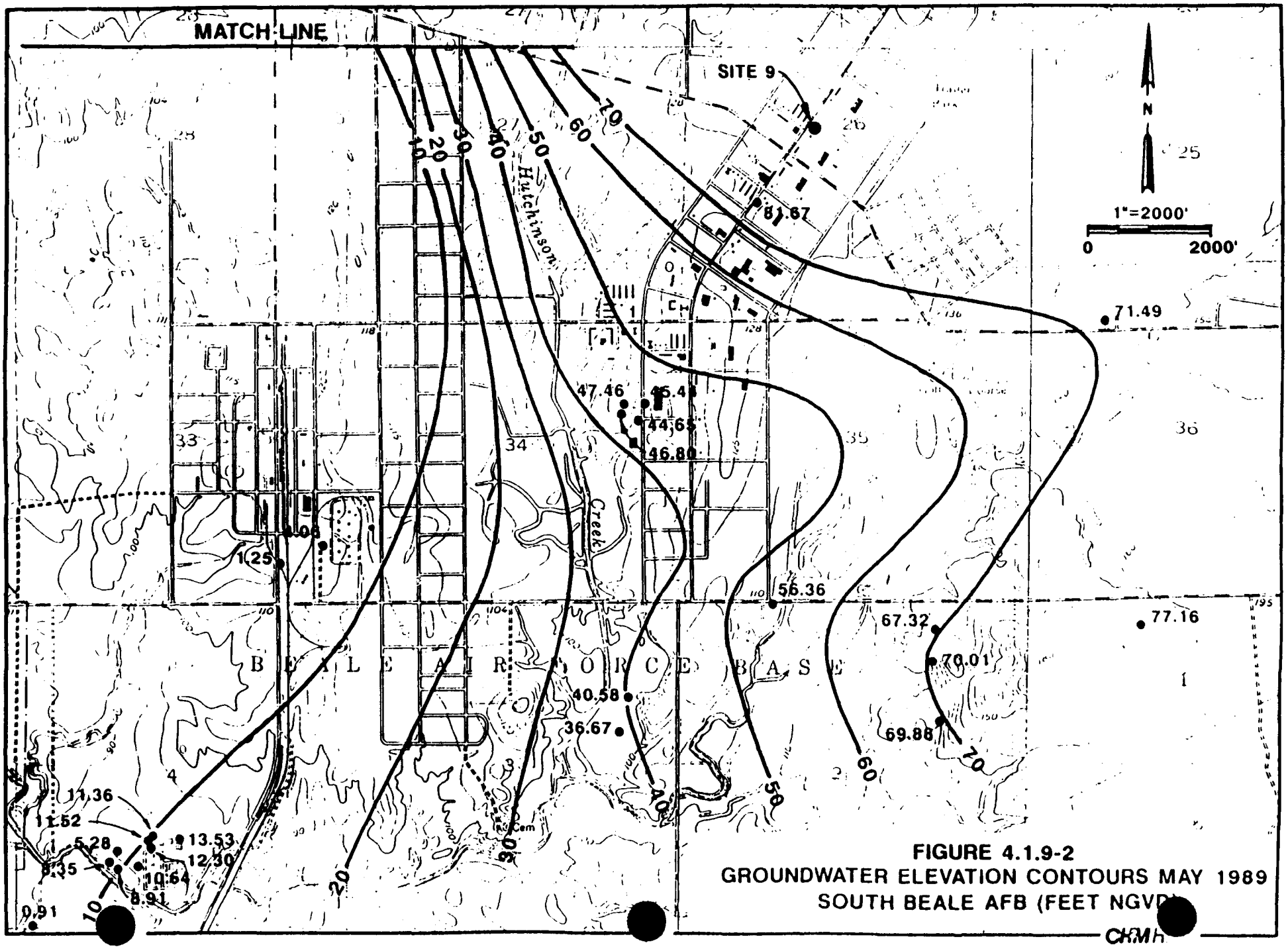


FIGURE 4.1.9-2
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGVD)

In Stage 2-1, five soil boring samples were collected at Site 9 (Figure 4.1.9-1) from one 21.5-foot vertical boring (9-C-1SB) next to the diked area bordering Entomology Building 2560 where pesticides are mixed. These soil boring samples were analyzed for volatile organics (8240), semi-volatile organics (8270), ICP metals (6010), mercury (7470/7471), soil moisture (ASTM D2216), TFH-diesel and -gas (California method), herbicides (8150) and pesticides and PCBs (8080).

In this investigation toluene was detected in boring 9-C-1SB at the surface (0.043 mg/kg), 5 feet (0.057 mg/kg), 10 feet (0.074 mg/kg), 15 feet (0.019 mg/kg), and 20 feet (0.030 mg/kg). Bis(2-ethylhexyl) phthalate was detected below the LOQ in all samples. ICP metals were similar to typical soils at Beale. Mercury was only detected in the surface sample (0.084 mg/kg). TFH-gas was detected at 5 feet (85 mg/kg), 10 feet (390 mg/kg), and 15 feet (62 mg/kg). No TFH-diesel, herbicides, pesticides, or PCBs were detected in any soil boring samples.

4.1.9.1.4 Analytical Results Table

Table 4.1.9-1 presents a summary of all detected analytes for Site 9. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.9-1 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of Applicable or Relevant and Appropriate Requirements (ARARs) is given in Appendix I.

4.1.9.1.5 Discussion of Analytical Data

The only contaminant detected and not potentially dismissed as false positives at Site 9 was TFH-gas, which was encountered in the soil boring samples from depths of 5 to 6.5 feet, 10 to 11.5 feet, and 15 to 16.5 feet and mercury, which was detected in the zero to 1.5 foot sample. No pesticides or herbicides were detected. Toluene, bis(2 ethylhexyl) phthalate, and di-n-butyl phthalate were detected but probably represent false positive results.

No data corrections have been made based on method blank detections.

TABLE 4.1.9-1

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 9

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	9-C-1SB BAFB-0204 0.0-1.5' 12/09/88	9-C-1SB^{nR} BAFB-0436 0.0-0.5' 01/25/89	9-C-1SB BAFB-0205 5.0-6.5' 12/09/88	9-C-1SB^{nR} BAFB-0437 5.0-5.5' 01/25/89	9-C-1SB BAFB-0206 10.0-11.5' 12/09/88	9-C-1SB^{nR} BAFB-0438 10.0-10.5' 01/25/89
Percent Moisture	ASA#9	N/A	%	NS	NS	4.8	NT	12.7	NT	21.4	NT
Mercury	SW7471	0.060	mg/kg	NS	20	0.084	NT	ND	NT	ND	NT
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	NT	85	NT	390	NT
Aluminum	SW6010	20.0	mg/kg	NS	NS	4600	NT	8990	NT	15900	NT
Barium	SW6010	10.0	mg/kg	NS	10,000	99.5	NT	149	NT	125	NT
Calcium	SW6010	100	mg/kg	NS	NS	2020	NT	2500	NT	5290	NT
Chromium	SW6010	3.0	mg/kg	NS	500	20.0	NT	36.1	NT	38.9	NT
Cobalt	SW6010	4.0	mg/kg	NS	8,000	5.7	NT	43.3	NT	24.2	NT
Copper	SW6010	3.0	mg/kg	NS	2,500	41.0	NT	55.0	NT	59.2	NT
Iron	SW6010	10.0	mg/kg	NS	NS	10300	NT	30800	NT	27400	NT
Magnesium	SW6010	100	mg/kg	NS	NS	2760	NT	4880	NT	8840	NT
Manganese	SW6010	1.5	mg/kg	NS	NS	254	NT	1580	NT	490	NT
Nickel	SW6010	4.0	mg/kg	NS	2,000	17.9	NT	22.9	NT	24.2	NT
Potassium	SW6010	200	mg/kg	NS	NS	693	NT	355	NT	471	NT
Sodium	SW6010	100	mg/kg	NS	NS	122	NT	132	NT	204	NT
Vanadium	SW6010	4.0	mg/kg	NS	2,400	23.5	NT	100	NT	48.9	NT
Zinc	SW6010	2.0	mg/kg	NS	5,000	53.2	NT	63.3	NT	76.6	NT
Acetone	SW8240	0.010	mg/kg	NS	NS	0.013	NT	0.031	NT	0.034	NT
Toluene	SW8240	0.005	mg/kg	NS	NS	0.043	NT	0.057	NT	0.074	NT
Phenol	SW8270	0.33	mg/kg	NS	NS	2.7 B	NT	3.0 B	NT	2.8 B	NT
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	NT	ND	NT	0.074 J	NT
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.22 J	NT	0.11 J	NT	0.24 J	NT

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
n: analyses performed to detect herbicides, no analytes detected
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.9-1 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	9-C-1SB[fnR] BAFB-0439 10.5-11.0' 01/25/89	9-C-1SB BAFB-0207 15.0-16.5' 12/09/88	9-C-1SB[nR] BAFB-0440 15.0-15.5' 01/25/89	9-C-1SB BAFB-0211 20.0-21.5' 12/09/88	9-C-1SB[nR] BAFB-0441 20.0-20.5' 01/25/89
Percent Moisture	ASA#9	N/A	%	NS	NS	NT	19.4	NT	23.1	NT
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	NT	62	NT	ND	NT
Aluminum	SW6010	20.0	mg/kg	NS	NS	NT	10100	NT	13300	NT
Barium	SW6010	10.0	mg/kg	NS	10,000	NT	61.8	NT	264	NT
Calcium	SW6010	100	mg/kg	NS	NS	NT	3150	NT	4920	NT
Chromium	SW6010	3.0	mg/kg	NS	500	NT	23.6	NT	35.9	NT
Cobalt	SW6010	4.0	mg/kg	NS	8,000	NT	11.5	NT	29.8	NT
Copper	SW6010	3.0	mg/kg	NS	2,500	NT	36.2	NT	57.1	NT
Iron	SW6010	10.0	mg/kg	NS	NS	NT	24100	NT	30200	NT
Magnesium	SW6010	100	mg/kg	NS	NS	NT	4890	NT	7610	NT
Manganese	SW6010	1.5	mg/kg	NS	NS	NT	329	NT	1340	NT
Nickel	SW6010	4.0	mg/kg	NS	2,000	NT	13.6	NT	23.4	NT
Potassium	SW6010	200	mg/kg	NS	NS	NT	372	NT	364	NT
Sodium	SW6010	100	mg/kg	NS	NS	NT	118	NT	174	NT
Vanadium	SW6010	4.0	mg/kg	NS	2,400	NT	66.5	NT	80.6	NT
Zinc	SW6010	2.0	mg/kg	NS	5,000	NT	60.9	NT	75.3	NT
Acetone	SW8240	0.010	mg/kg	NS	NS	NT	0.037	NT	ND	NT
2-Butanone	SW8240	0.010	mg/kg	NS	NS	NT	0.006 J	NT	ND	NT
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	0.019	NT	0.030	NT
Phenol	SW8270	0.33	mg/kg	NS	NS	NT	2.5 B	NT	2.6 B	NT
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	NT	0.14 J	NT	0.14 J	NT
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	NT	0.16 J	NT	0.20 J	NT

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
n: analyses performed to detect herbicides, no analytes detected
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Except for false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling.

4.1.9.2 Sampling and Analytical Problems

4.1.9.2.1 Loss of Samples

There were no sample loss problems for Site 9 samples. All five soil boring samples were resampled for herbicide analysis (8150) due to holding time violations.

All scheduled analyses were completed.

4.1.9.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil samples collected at Site 9 contained several organic compounds that were probably laboratory- or field-induced false positive results. Four of the five soil samples collected contained acetone. This is a common laboratory contaminant and, although not detected in the method blank, probably represents a false positive result.

Several soil samples contained the semivolatile compounds bis(2-ethylhexyl) phthalate and di-n-butyl phthalate. The phthalate compounds were commonly detected in samples and blanks from throughout the base and are probably false positive results.

Phenol was detected in all soil samples at concentrations ranging from 2.5 mg/kg to 3.0 mg/kg. This has been traced to a factory contaminated bottle of acetone used in the extraction process. The concentration of phenol in the affected samples was estimated to be 1.7 mg/kg based on laboratory blank analysis. The detected phenol concentrations are above this estimate, but within an associated range of uncertainty, and are believed to represent false positives.

Toluene was detected in all of the soil samples at low concentrations. This occurred for samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent and non-reproducibility in replicate samples taken at various sites suggest that it is a false positive result. For other sites on the base where soil replicate QC samples were taken, duplication of the toluene result was not good. This is indication that the toluene is probably not a true contaminant.

No soil replicate QC samples were collected at Site 9.

4.1.9.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 9 samples.

4.1.9.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.9.3 Significance of Findings

No pesticides or herbicides were detected in any of the soil samples in Stage 2-1. Mercury, not detected in background soil samples on the base, was detected in the surface sample at a concentration of 0.084 mg/kg. The mercury may be from pesticides mixed near the area. The DHS TTLC for mercury is 20 mg/kg.

TFH-gas were detected in samples from 5, 10, and 15 feet at concentrations from 62 to 390 mg/kg. The source of these organics at this facility is unknown.

In the Phase II, Stage 1 study, soil within the gravel area had detected concentrations of chlordane less than 1 mg/kg in two samples in one boring. The DHS TTLC for chlordane is 2.5 mg/kg. Stage 2-1 studies did not detect chlordane in the one boring outside the gravel area.

4.1.9.3.1 Zones of Contamination

Soil between 5 and 15 feet BGS is contaminated with TFH-gas. The extent of this contamination is apparently limited to this depth interval at this location since it was not detected above or below. The lateral extent is not known, but the small scale and infrequent mixing operations at this site make widespread contamination of TFH-gas doubtful.

4.1.9.3.2 Contaminant Migration

Contamination is not expected to migrate from Site 9.

4.1.9.3.2.1 Potential to Move Off Site and Off Base

The potential for contamination to move off the site or off the base is very low.

4.1.9.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Contamination probably has not affected groundwater at Site 9, based on contaminant concentrations in 9-C-1SB.

4.1.9.3.2.3 Time of Travel to Receptors

Other than base personnel performing pest control, there are no obvious potential human receptors.

4.1.9.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 9 because no groundwater studies were conducted at this site and contaminants probably have not reached groundwater.

4.1.9.3.2.5 Expected Spatial and Temporal Variations in Concentration

Spatial and temporal variations, if any, are not apparent from the sampling which has been conducted to date.

4.1.9.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.10 DISCUSSION OF RESULTS FOR SITE 10: J-58 TEST CELL

During previous investigations conducted at Site 10 (Aero-Vironment, 1987), contamination was identified in soils but not in the groundwater. The Air Force determined that no IRP activities would take place at this site during the Stage 2-1 Remedial Investigation. If it is determined that additional IRP actions are necessary, these actions will be included in future IRP tasks. If it is determined that no further action will be necessary, a Record of Decision will be prepared for the site.

4.1.11 DISCUSSION OF RESULTS FOR SITE 11: AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA

For the past 25 years, aircraft ground support vehicles have been operated from a paved area adjacent to the Aircraft Ground Equipment (AGE) maintenance shop at Building 1225. These vehicles have been known to leak oil and hydraulic fluids. Maintenance activities may have included using solvents or degreasers. A drainage ditch behind Building 1225 has shown evidence of staining, likely from fuel- and oil-contaminated runoff. Some of the stained soils were removed in 1984, but some discoloration is still visible.

In the Phase II, Stage 1 study, one monitoring well was installed and four soil borings and seven soil hand auger locations were sampled and analyzed. During the Stage 2-1 study, three borings were drilled near the edge of the pavement. The existing well was sampled semiannually for a year.

4.1.11.1 Presentation of Results

This section presents the results of the field investigation conducted at Site 11. The discussion focuses on the geology and hydrogeology at the site and presents the results of chemical analyses performed on soil and groundwater samples.

4.1.11.1.1 Site Geology

Evaluation of the geology and hydrogeology at Site 11 is based on three shallow boreholes drilled during the current Stage 2-1 investigation and on a monitoring well drilled during the Phase II, Stage 1 investigation (AeroVironment, 1987). During the Stage 2-1 investigation, three vertical soil borings that ranged in depth from 8 to 12 feet were drilled at the AGE maintenance area. During the Phase II, Stage 1 investigation a monitoring well was drilled to a depth of 140 feet and screened across the water table. The locations of the boreholes and monitoring well are shown in Figure 4.1.11-1. Soil boring logs are provided in Appendix D.

The soil boring logs show that near-surface materials at Site 11 consist of fine-grained silts and clays. However, at a depth of about 8 feet in boreholes 11-C-1SB and 11-C-2SB and at a depth of about 9 feet in borehole 11-C-3SB and well 11-A-1, the drill bit entered a gravel and sand unit with cobbles. In the Phase II, Stage 1 investigation, this gravel zone was encountered from 10.5 to 12.5 feet in boring 11-A-4SB, from 11.5 to 13 feet in 11-A-3SB, and was

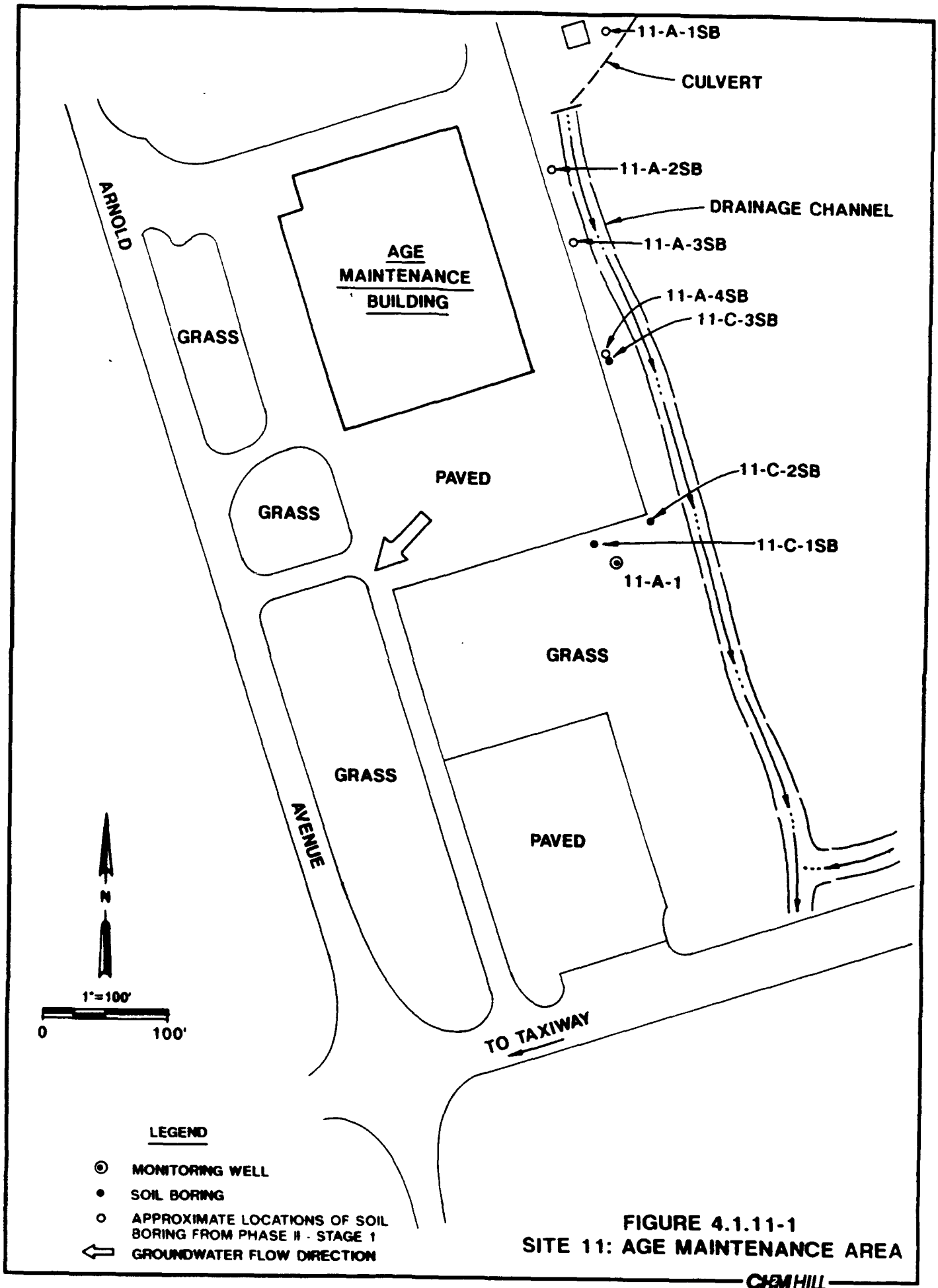


FIGURE 4.1.11-1
SITE 11: AGE MAINTENANCE AREA

CH2M HILL

not encountered in the 16.5-foot boring 11-A-2SB (AeroVironment, 1987). According to the well borehole log, the sands continued for the entire length of the hole, varying between silty sand and sand with gravel (AeroVironment, 1987). This thick sequence of sands was also found in other boreholes in the flightline area, Sites 1, 3, 4, 5, and 21.

Surface soils at Site 11 have been mapped as belonging to the Laguna Formation (Page, 1980). This formation is of Pleistocene and Pliocene age and consists of an alluvial sequence of silt, sand, clay, and unsorted gravel. The Laguna Formation overlies the volcanic rocks from the Sierra Nevada in the stratigraphic section at Beale AFB. Although this unit outcrops about 1 mile west of Site 11, the log of well 11-A-1 gave no indication of contacting volcanic materials.

4.1.11.1.2 Site Hydrogeology

The first saturated permeable zone in well 11-A-1 that produced water during drilling occurred at a depth of about 130 feet BGS (-6 feet NGVD) in gravel and pebbles with coarse sand. After completion of the well, the depth to water remained at about 130 feet BGS (-6 feet NGVD). The vadose zone above the aquifer is composed of sand units nearly to the ground surface, as described above. Therefore the aquifer is unconfined at Site 11. No impermeable basal unit was contacted in the borehole through its total depth of 140 feet.

Groundwater levels in well 11-A-1 between April 1986 and November 1989 are summarized in Table 4.1.11-1 and in Figure 4.1.11-2. This table shows that the groundwater level in this well has risen over 13 feet during this period. This rise is part of a regional water level rise comparable to that observed in other shallow monitoring wells in the vicinity (e.g., wells at Sites 3, 4, and 5) and is presumably due to a reduction in the regional groundwater depression centered to the west of the base. The water level rose about 3.6 feet between December 1988 and November 1989 and showed no seasonal fluctuations.

Table 4.1.11-1
GROUNDWATER ELEVATIONS: SITE 11

Well	Screened Interval	April 1986	Oct. 1986	Dec. 1988	March 1989	May 1989	Aug. 1989	Nov. 1989
11-A-1	8 to -12	-3.86	-1.68	5.79	7.07	7.58	8.76	9.40

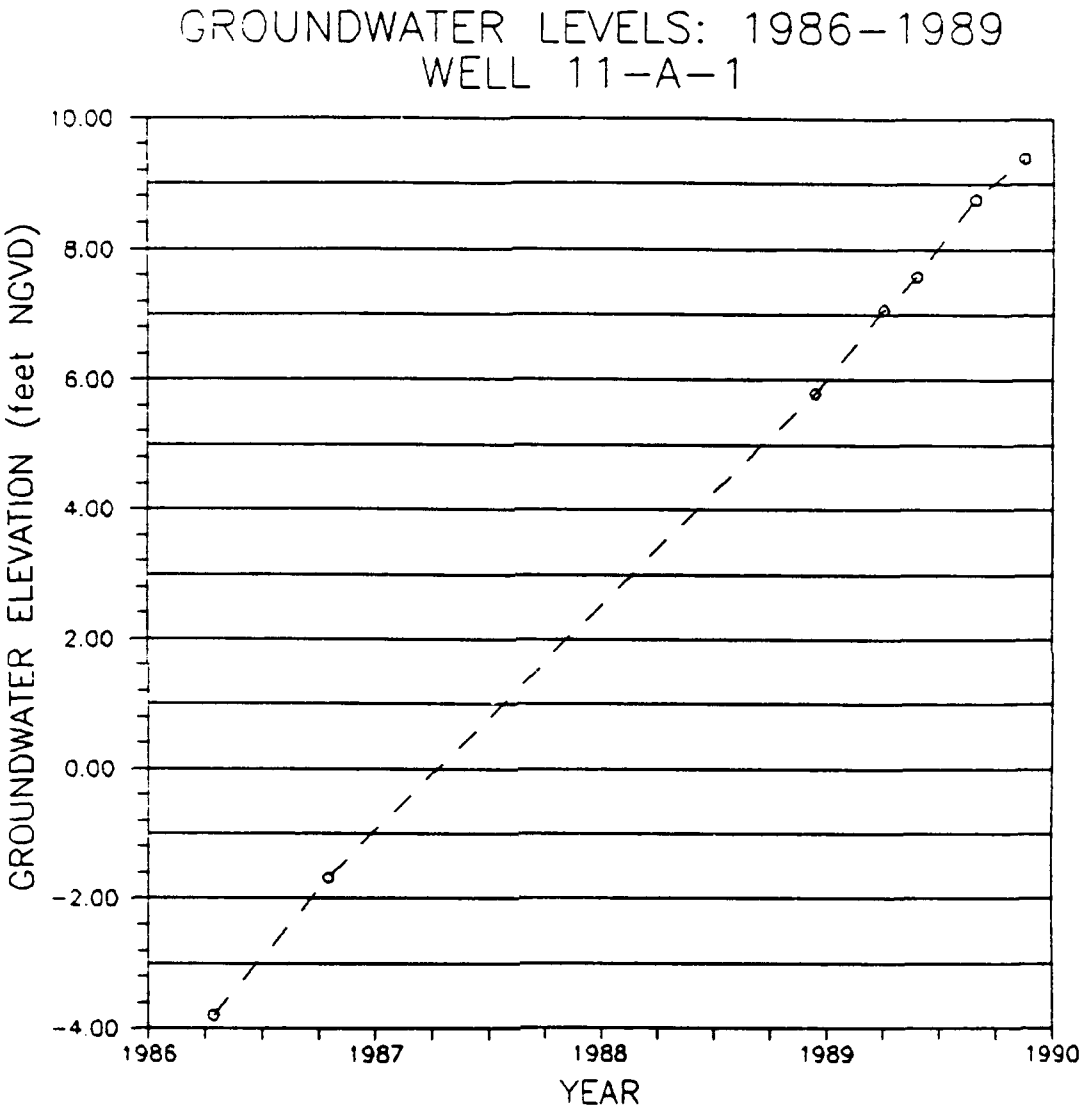


FIGURE 4.1.11-2
MONITORING WELL HYDROGRAPH
SITE 11: AGE MAINTENANCE AREA

CH2M HILL

Contours of groundwater levels taken in May 1989 from monitoring wells screened across the water table in the flightline area of Beale AFB are plotted in Figure 4.1.11-3. Groundwater levels taken across Beale AFB in March and November 1989 are plotted in Plates 3 and 4. Groundwater contours drawn on these levels show that groundwater flows toward the southwest in the vicinity of Site 11. The gradient increases to the east of well 11-A-1, from about 0.002 to about 0.02. This change may be due to a change in hydrogeologic regimes from unconsolidated sediments of the Central Valley to consolidated rocks of the foothills of the Sierra Nevada. Aquifer parameters in the immediate vicinity of Site 11 are unknown because no tests were performed on existing well 11-A-1 during the Stage 2-1 investigation.

4.1.11.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.11.1.4. and in Appendix A.

Soil

Six soil boring samples were collected at Site 11 (Figure 4.1.11-1) from three shallow soil borings. These borings were planned to be drilled to a 10-foot depth, but the auger rigs were unable to sample at 10 feet due to a gravel layer. These soil boring samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), soil moisture (ASTM D2216), and TFH-diesel and -gas (California method).

During the IRP Phase II, Stage 1 investigation (AeroVironment, 1987), three soil borings 11-A-2SB, -3SB, and -4SB were drilled along the edge of the pavement parallel to and northeast of the AGE maintenance building (Figure 4.1.11-1). Oil and grease were detected in the surface soil samples at 7,000, 3,900, and 1,500 mg/kg, going from a northwest to a southeast direction. No contamination was detected in the 6-foot samples.

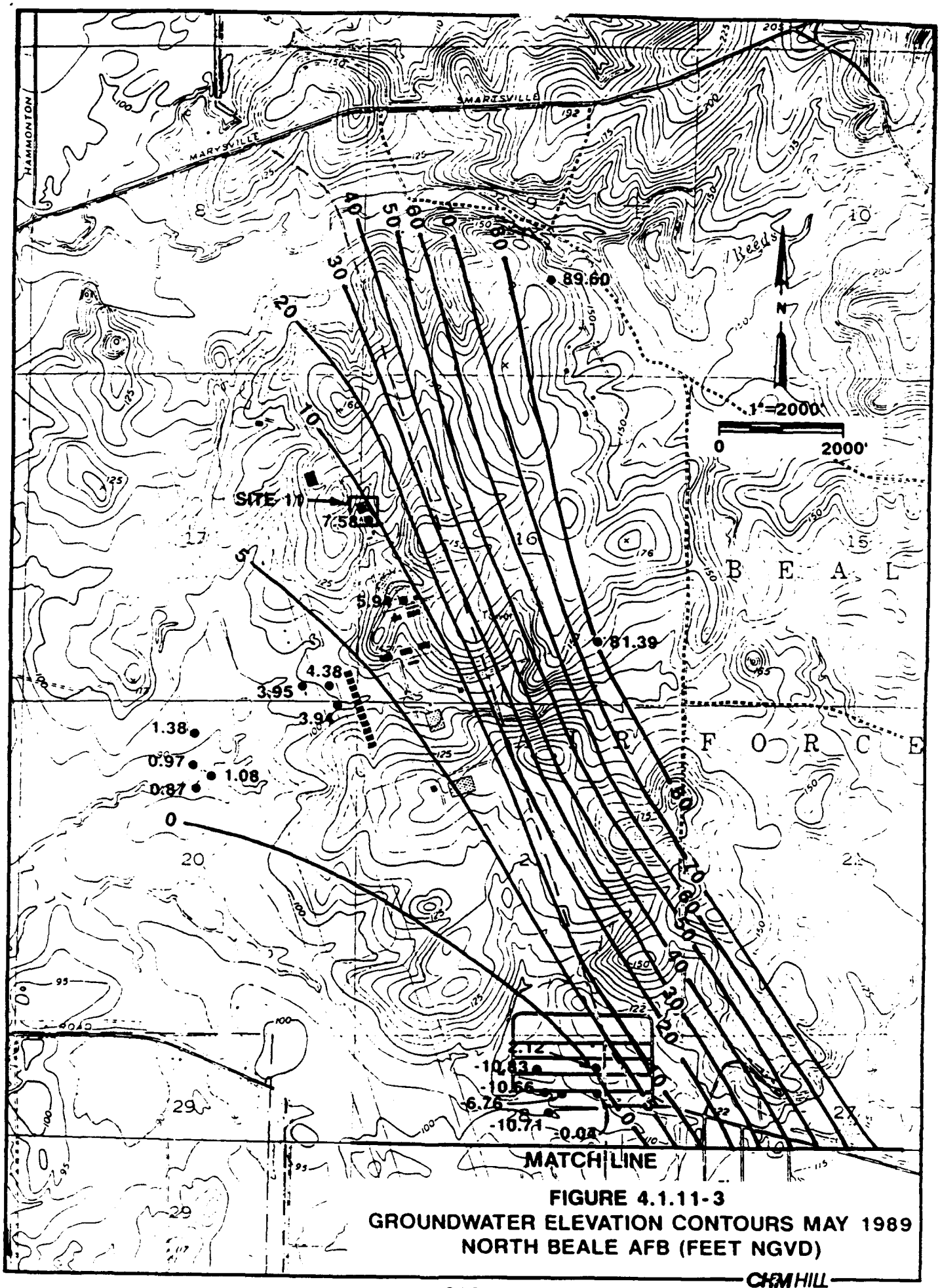


FIGURE 4.1.11-3
GROUNDWATER ELEVATION CONTOURS MAY 1989
NORTH BEALE AFB (FEET NGVD)

CH2M HILL

During the current investigation, toluene was detected in the soil boring samples at 0.017 to 0.14 mg/kg. 2-butanone was detected in the 6-foot sample at boring 11-C-2SB at 0.095 mg/kg and tentatively detected below the LOQ in two other samples. TCE was detected in the surface sample at boring 11-C-3SB at 0.014 mg/kg and carbon disulfide at 0.006 mg/kg (the LOQ).

Bis(2-ethylhexyl) phthalate was detected at 0.65 mg/kg in the surface sample at boring 11-C-3SB. Bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, and n-nitrosodiphenylamine were detected in several samples below the LOQ. Lead was detected at 119 mg/kg and cadmium at 4.7 mg/kg in the surface sample at boring 11-C-3SB. Barium was detected at 1,040 mg/kg in the 5- to 6.5-foot sample in 11-C-1SB and 445 mg/kg in the surface field replicate sample 11-C-3SB. Beryllium was detected at 0.78 mg/kg in the 6- to 7.5-foot sample in 11-C-2SB and 0.85 mg/kg in the 1.5- to 3.0-foot sample in 11-C-3SB. Other metals were at levels similar to background soil values at Beale AFB. TFH-gas was detected at 32 mg/kg in the surface sample in boring 11-C-2SB. TFH-diesel was detected at 84 mg/kg in the surface sample in boring 11-C-3SB.

Groundwater

During the Phase II, Stage 1 investigation of groundwater (AeroVironment, 1987), TCE was detected in well 11-A-1 at 0.4 ug/l in the April 1986, sampling rounds and was not detected in the October 1986, sampling round.

Through the two semiannual rounds of water sampling at Site 11 (April and August 1989), two groundwater and one field replicate samples were collected from monitoring well 11-A-1. Analyses performed for the groundwater samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), water quality parameters, (various methods) and TFH-diesel and -gas (California method).

During the first semiannual sampling round of this investigation, toluene was detected at 1 ug/l (2 ug/l in second column) in the groundwater sample from well 11-A-1. Purgeable halocarbons, TFH-diesel, and TFH-gas were not detected in groundwater at Site 11 and TDS were 167 mg/l. Major anions and cation concentrations at this well are generally similar to other sites near the flightline. Nitrite plus nitrate (expressed as nitrate) was 8.1 mg/l. Sulfate was lower than at most sites at Beale at 6.8 mg/l.

During the second semiannual sampling round, purgeable halocarbons, purgeable aromatics, TFH-diesel and -gas were not detected in groundwater sampled at Site 11. TDS were 242 mg/l in the sample and 203 mg/l in the field replicate. Major anions and cations were again generally similar to other wells in the flightline area. Iron was detected at 0.128 mg/l in the original sample and was not detected in the field replicate. Groundwater at Site 11 is a sodium bicarbonate type.

4.1.11.1.4 Analytical Results Table

Table 4.1.11-2 presents a summary of all detected analytes for Site 11. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.11-2 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.11.1.5 Discussion of Analytical Data

With the exception of probable false positive results, contaminants in the form of TCE and lead were detected in only one sample at Site 11. TFH-diesel and -gas were detected in one separate sample each. Contaminants were not detected in the groundwater. Table 4.1.11-3 presents the range of contaminants encountered for each of the media sampled (soil borings and groundwater), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the LOQ. These detections may represent laboratory "noise," and some of the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study the LOQ is

TABLE 4.1.11-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 11

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	11-C-1SB BAFB-0212 0.0-1.5' 12/09/88	11-C-1SB BAFB-0213 5.0-6.5' 12/09/88	11-C-2SB BAFB-0280 0.0-1.5' 12/16/88	11-C-2SB BAFB-0281 6.0-7.5' 12/16/88	11-C-3SB BAFB-0406 0.0-1.5' 01/13/89	11-C-3SB[R] BAFB-0541 0.0-1.5' 05/03/89
Percent Moisture	ASA#9	N/A	%	NS	NS	10.9	17.6	15.9	23.5	16.9	NT
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	ND	ND	ND	84	NT
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	ND	32	ND	ND	NT
Aluminum	SW6010	20.0	mg/kg	NS	NS	8930	17500	10700	29000	7560	NT
Barium	SW6010	10.0	mg/kg	NS	10,000	134	1040	118	371	241	NT
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	0.78	ND	NT
Cadmium	SW6010	1.0	mg/kg	NS	100	ND	ND	ND	ND	4.7	NT
Calcium	SW6010	100	mg/kg	NS	NS	2040	4250	2680	4690	2740	NT
Chromium	SW6010	3.0	mg/kg	NS	500	39.7	32.0	22.6	30.3	30.8	NT
Cobalt	SW6010	4.0	mg/kg	NS	8,000	8.5	10.9	8.3	13.1	7.8	NT
Copper	SW6010	3.0	mg/kg	NS	2,500	53.4	45.4	15.5	27.8	45.4	NT
Iron	SW6010	10.0	mg/kg	NS	NS	18400	28200	18100	26500	14400	NT
Lead	SW6010	20.0	mg/kg	NS	1,000	ND	ND	ND	ND	119	NT
Magnesium	SW6010	100	mg/kg	NS	NS	2220	4380	2320	3220	2640	NT
Manganese	SW6010	1.5	mg/kg	NS	NS	268	351	219	612	196	NT
Nickel	SW6010	4.0	mg/kg	NS	2,000	16.8	24.5	8.8	24.8	13.2	NT
Potassium	SW6010	200	mg/kg	NS	NS	617	643	ND	ND	ND	NT
Sodium	SW6010	100	mg/kg	NS	NS	199	483	290	484	236	NT
Vanadium	SW6010	4.0	mg/kg	NS	2,400	50.3	71.2	57.0	77.8	47.9	NT
Zinc	SW6010	2.0	mg/kg	NS	5,000	64.0	82.9	28.8	40.0	89.0	NT
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.053	NT
Acetone	SW8240	0.010	mg/kg	NS	NS	0.036	0.025	0.008 J	0.025	0.053	NT
Carbon Disulfide	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.006 J	NT
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.095	0.012 J	NT
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	ND	ND	ND	0.014	NT
Toluene	SW8240	0.005	mg/kg	NS	NS	0.047	0.030	0.056	0.063	0.14	NT
N-Nitrosodimethylamine	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	NT	0.063 J
Phenol	SW8270	0.33	mg/kg	NS	NS	2.1 B	2.3 B	ND	ND	NT	ND
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	0.048 J	ND	ND	ND	NT	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.081 BJ	1.0 B	ND	0.18 J	NT	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.22 BJ	0.33 BJ	0.087 BJ	0.16 BJ	NT	0.65

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.11-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	11-C-3SB[f] BAFB-0416 1.5-3.0' 01/13/89	11-C-3SB[Rf] BAFB-0542 1.5-3.0' 05/03/89	11-C-3SB BAFB-0417 5.0-6.5' 01/13/89	11-C-3SB[R] BAFB-0543 5.0-6.5' 05/03/89
Percent Moisture	ASA#9	N/A	%	NS	NS	17.7	NT	22.8	NT
Aluminum	SW6010	20.0	mg/kg	NS	NS	11200	NT	15000	NT
Barium	SW6010	10.0	mg/kg	NS	10,000	445	NT	312	NT
Beryllium	SW6010	0.50	mg/kg	NS	75	0.85	NT	0.65	NT
Calcium	SW6010	100	mg/kg	NS	NS	3520	NT	4020	NT
Chromium	SW6010	3.0	mg/kg	NS	500	19.4	NT	19.4	NT
Cobalt	SW6010	4.0	mg/kg	NS	8,000	8.3	NT	11.0	NT
Copper	SW6010	3.0	mg/kg	NS	2,500	18.2	NT	25.9	NT
Iron	SW6010	10.0	mg/kg	NS	NS	17600	NT	26800	NT
Magnesium	SW6010	100	mg/kg	NS	NS	4000	NT	3960	NT
Manganese	SW6010	1.5	mg/kg	NS	NS	173	NT	484	NT
Nickel	SW6010	4.0	mg/kg	NS	2,000	14.6	NT	16.8	NT
Potassium	SW6010	200	mg/kg	NS	NS	ND	NT	583	NT
Sodium	SW6010	100	mg/kg	NS	NS	433	NT	539	NT
Thallium	SW6010	50.0	mg/kg	NS	700	ND	NT	110	NT
Vanadium	SW6010	4.0	mg/kg	NS	2,400	63.5	NT	83.3	NT
Zinc	SW6010	2.0	mg/kg	NS	5,000	32.9	NT	50.6	NT
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.050 B	NT	0.009 B	NT
Acetone	SW8240	0.010	mg/kg	NS	NS	0.35 B	NT	0.035 B	NT
Carbon Disulfide	SW8240	0.005	mg/kg	NS	NS	0.007 B	NT	ND	NT
2-Butanone	SW8240	0.010	mg/kg	NS	NS	0.027 B	NT	0.012 J	NT
Toluene	SW8240	0.005	mg/kg	NS	NS	0.017	NT	0.065	NT
N-Nitrosodimethylamine	SW8270	0.33	mg/kg	NS	NS	NT	0.077 J	NT	0.093 J
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	NT	0.14 J	NT	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.11-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 11

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	11-A-1GW BAFB-0526 04/04/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	200
Temperature	E170.1	N/A	deg C	NS	NS	22.0
pH	E150.1	N/A	pH	5-9	NS	7.64
Alkalinity - Total	SM403	1.0	mg/l	20	NS	84.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	102.5
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	167
Chloride	E325.3	1.0	mg/l	250	250	11.4
Fluoride	E340.2	0.050	mg/l	2	1.4	0.37
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	8.1
Sulfate	E375.4	1.0	mg/l	250	250	6.8
Calcium	SW6010	1.00	mg/l	NS	NS	11.1
Magnesium	SW6010	1.00	mg/l	NS	NS	4.28
Potassium	SW6010	1.00	mg/l	NS	NS	1.00
Sodium	SW6010	1.00	mg/l	NS	NS	27.9
Toluene	SW8020	1	ug/l	14,300	100	1(2)

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.11-2

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 11

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	11-A-1GW BAFB-0620 08/31/89	11-A-1GW[f] BAFB-0621 08/31/89	11-A-1GW[e] BAFB-0619 08/31/89	11-A-1GW[b] BAFB-0618 08/31/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	200	200	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	22.0	22.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.83	7.83	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	74.0	77.2	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	90.3	94.2	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	242	203	22.0	NT
Chloride	E325.3	1.0	mg/l	250	250	12.2	10.8	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.25	0.27	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	10.1	10.1	1.2	NT
Sulfate	E375.4	1.0	mg/l	250	250	21.1	11.4	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	12.2	12.2	ND	NT
Iron	SW6010	0.100	mg/l	.3	.3	0.128	ND	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	4.70	4.72	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	27.3	27.1	ND	NT
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	ND	730(1200)	850(1300)
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	ND	1(1)
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	5 BJ	7 BJ	5 BJ	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	ND	60	NT

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Table 4.1.11-3
RANGES OF CONTAMINANTS DETECTED AT SITE 11

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SOIL BORINGS				
TPH-diesel	mg/kg	ND	84	1/6
TPH-gas	mg/kg	ND	32	1/6
lead	mg/kg	ND	119	1/6
toluene	mg/kg	0.017	0.14	6/6
2-butanone	mg/kg	ND	0.095	3/6
bis(2-ethylhexyl) phthalate	mg/kg	ND	0.65	1/6
n-nitrosodiphenylamine	mg/kg	ND	(0.093)	3/6
GROUNDWATER				
toluene	ug/l	ND	1.0	1/2

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.11.2 Sampling and Analytical Problems

4.1.11.2.1 Loss of Samples

There were no sample loss problems for Site 11 samples. Three soil samples were resampled for semivolatile organic analysis (8270) due to missed holding times. One of these original samples had a soil replicate QC sample taken at the same location. Semivolatile organic analysis was not conducted for the replicate sample because the original sample was not analyzed. When the resample was collected, a new replicate was also collected.

4.1.11.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil samples collected at Site 11 contained several organic compounds that may be laboratory- or field-induced false positive results. All of the soil samples collected contained acetone, and two of the samples contained methylene chloride. These are common laboratory contaminants.

Several soil samples contained the semivolatile compounds bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, and n-nitrosodiphenylamine. Bis(2-ethylhexyl) phthalate and di-n-butyl phthalate were also detected in the method blank at similar concentrations. The phthalate compounds were commonly detected in samples and blanks from throughout the base and are probably false positive results.

Phenol was detected in two soil samples from boring 11-C-1SB at 2.1 and 2.3 mg/kg. This has been traced to a factory-contaminated bottle of acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks that the induced contamination was 1.7 mg/kg.

Toluene was detected in all of the soil samples at low concentrations. This also occurred for other soil samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent suggests that it is a false positive result.

One soil replicate QC sample was collected at Site 11. Although the results for metals were for the most part comparable, concentrations of organic compounds were not

reproduced. The volatile compound 2-butanone had an RPD of 75 percent. This may be explained because the original sample was collected from the ground surface to 1.5 feet, while the replicate sample was collected on the next push of the sampler from 1.5 to 3.0 feet. Volatile compounds were at much lower concentrations in the surface sample than in the deeper QC sample. Volatilization may have occurred from the near-surface soils leading to lower concentrations and high RPDs.

Conversely, TFH-diesel and lead were detected in the original sample but not in the replicate. Lead probably entered the soils and was attenuated within the first 1.5 feet. The difference for TFH-diesel is not known.

In the second semiannual sampling at well 11-A-1, methylene chloride was not detected in the normal environmental sample or the replicate sample. However, methylene chloride was detected in both the ambient condition blank (850 ug/l, 1,300 ug/l in second column) and the equipment wash blank (730 ug/l, 1,200 ug/l in second column). This has been traced to contaminated Type 1 organic free water which occurred in a number of blanks during that sampling round. In each case, the normal environmental sample did not contain methylene chloride but the blanks did. Toluene was detected in the ambient condition blank but not the sample, field replicate, or equipment wash blank. N-nitrosodiphenylamine was detected below the LOQ in both the sample and the associated method blank.

4.1.11.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 11 samples.

4.1.11.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.11.3 Significance of Findings

Soil

Three soil borings were drilled at Site 11 near the edge of the pavement at the AGE maintenance building. All borings encountered a gravel layer at approximately 10 feet and could not be sampled. Surface samples from two of the

borings contained TFH. The surface sample from 11-C-3SB contained 84 mg/kg TFH-diesel and 0.014 mg/kg of TCE. The surface sample from 11-C-2SB had 32 mg/kg TFH-gas. Aluminum, barium, beryllium, cadmium, and lead were also detected at levels above averaged ranges from background borings, but were all below respective DHS TTLCs.

Groundwater

Based on Stage 2-1 information, groundwater at Site 11 does not appear to be contaminated in the vicinity of well 11-A-1. However, groundwater may not have been completely characterized as the single well is not placed downgradient of most of the site. The well at Site 11 had standard water quality parameters such as specific conductivity, pH, alkalinity, bicarbonate, and TDS similar to other wells near the flightline at Beale AFB. Other than calcium, potassium, magnesium, iron, and sodium, no other metals were detected in the groundwater.

4.1.11.3.1 Zones of Contamination

The only zone contaminated at Site 11 is the soil adjacent to the pavement to depths of less than 5 feet, based on samples collected during the two IRP investigation stages. Contamination believed to represent actual conditions was not detected in samples below the surface samples. In boring 11-C-3SB no contamination was detected in a replicate sample from 1.5 to 3.0 feet.

Groundwater at Site 11, based on samples collected from well 11-A-1, is not contaminated.

4.1.11.3.2 Contaminant Migration

Contaminants are not expected to migrate from Site 11. Evidence from two independent investigations indicate that contamination is limited to the surface soil. Groundwater, other than the April 1986 sample (0.4 ug/l TCE), or subsurface soils evidently have not been affected.

4.1.11.3.2.1 Potential to Move Off Site and Off Base

The potential for contamination from Site 11 to move off the site or off the base is minimal because contaminants have apparently not reached groundwater in detectable quantities.

4.1.11.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Groundwater in the monitoring well at Site 11 has had no detected contaminants in sampling conducted in the two semi-annual rounds of the Stage 2-1 study. Based on this, the section on migration is not applicable to Site 11.

4.1.11.3.2.3 Time of Travel to Receptors

Other than personnel involved in equipment maintenance, there are no human receptors. If contaminants should migrate into groundwater at detectable levels, water wells to the west of base could be affected.

4.1.11.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 11 because no contaminants have been detected in the groundwater.

4.1.11.3.2.5 Expected Spatial and Temporal Variations in Concentration

No spatial or temporal variations in concentration were observed in the groundwater at Site 11 during Stage 2-1.

4.1.11.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.12 DISCUSSION OF RESULTS FOR SITE 12: ENTOMOLOGY BUILDING 440

As a result of previous investigations conducted at Site 12 AeroVironment concluded that no contaminants were identified. On this basis, it has been determined that no further IRP actions will be taken at this site. A Record of Decision has been prepared for Site 12 and is included in Appendix J of this report.

4.1.13 DISCUSSION OF RESULTS FOR SITE 13: LANDFILL NO. 1

Site 13 was believed to be a trench and fill landfill operation which operated in the 1940s into the 1950s. At least part of the time Landfill No. 1 was in operation, it was a burn dump. The waste type is unknown, but is assumed to have consisted of general domestic refuse. The exact location and orientation of landfill trenches was largely unknown, except where subsidence had occurred. The Stage 2-1 study, through a geophysical investigation, completed in association with Site 20, and materials encountered during drilling, confirmed that landfill trenches did exist and were apparently not in an organized, parallel order as they are at Sites 6 and 15 (Landfills No. 2 and No. 3). The landfill at Site 13 did not have an engineered liner, cover, or leachate collection system. Wells drilled around the approximate perimeter of the landfill did not encounter buried waste materials. Therefore, the landfill boundaries probably fall within an area defined by these boreholes.

During the Stage 2-1 study, five soil borings were drilled at Site 13; one vertical boring at a background location, and four angled borings drilled under landfill trenches to determine soil pore fluid characteristics. Soil contamination was detected in samples from angled boring 13-C-2SB, located in the northwest corner of the landfill.

Six monitoring wells were constructed to supplement the two existing wells. Four rounds of sampling data from the wells and one surface water sample location at Site 13 are discussed below along with data from sampling off base in the third and fourth rounds.

4.1.13.1 Presentation of Results

The following section presents the results of the field investigation at Site 13. The discussion focuses on the geology and hydrogeology at the site, and presents the results of chemical analyses performed on samples of groundwater, surface water, and soil.

4.1.13.1.1 Site Geology

Evaluation of the geology at Site 13 (Landfill 1) is based on boreholes and wells drilled during the current Stage 2-1 investigation, and on wells installed during the Phase II, Stage 1 investigation. During the current investigation, four angled borings were drilled to a depth of 60 feet

(52 feet beneath the ground surface), and one vertical boring was drilled to a depth of 50 feet. In addition, six new monitoring wells were constructed. Five of these were screened across the first permeable zone in which groundwater was encountered. One additional well was constructed as a paired well, adjacent to a shallow well but screened in a deeper interval. During the previous Phase II, Stage 1 investigation, two shallow monitoring wells were constructed. The location of these wells and boreholes is shown on Figure 4.1.13-1. Soil boring logs are provided in Appendix D.

Cross-sections through the soil encountered in soil borings and monitoring wells in the IRP Phase II, Stage 1 and IRP Stage 2-1 studies are located in Figure 4.1.13-1 and are shown in Figures 4.1.13-2, 4.1.13-3, and 4.1.13-4. A key to lithologic symbols is given in Appendix D. The soil encountered in soil borings and monitoring wells at Landfill No. 1 was predominantly fine grained, with low permeability.

These soils constitute an alluvial sequence and are predominantly fine-grained overbank deposits with occasional discontinuous sand and gravel channel deposits forming permeable zones. This sequence is typical of valley sediments deposited at the base of the Sierra Nevada foothills. Although coarser sand and gravel beds were encountered in this and previous studies, these stream channel deposits are not as common as the much finer-grained overbank and flood plain deposits that predominate.

As with many of the near-surface alluvial deposits in the Central Valley, individual beds may generally not be correlated between drilling locations unless they are very close together. The meandering stream depositional environment does not result in laterally extensive deposits but rather produces relatively thin, narrow deposits. Channel deposits of coarse-grained materials, which may be very narrow in cross section, may be continuous for long distances in the direction of stream flow. These channel deposits may serve as migration pathways for contaminants. Because the alluvial materials are extremely heterogeneous, the aquifer hydraulic properties are also heterogeneous.

Near-surface deposits at Site 13 have been mapped as Quaternary river deposits by the Geological Survey (Page, 1980). These materials are the recent channel and flood plain deposits from Hutchinson Creek, which flows along the western boundary of the landfill. Non-volcanic continental alluvium

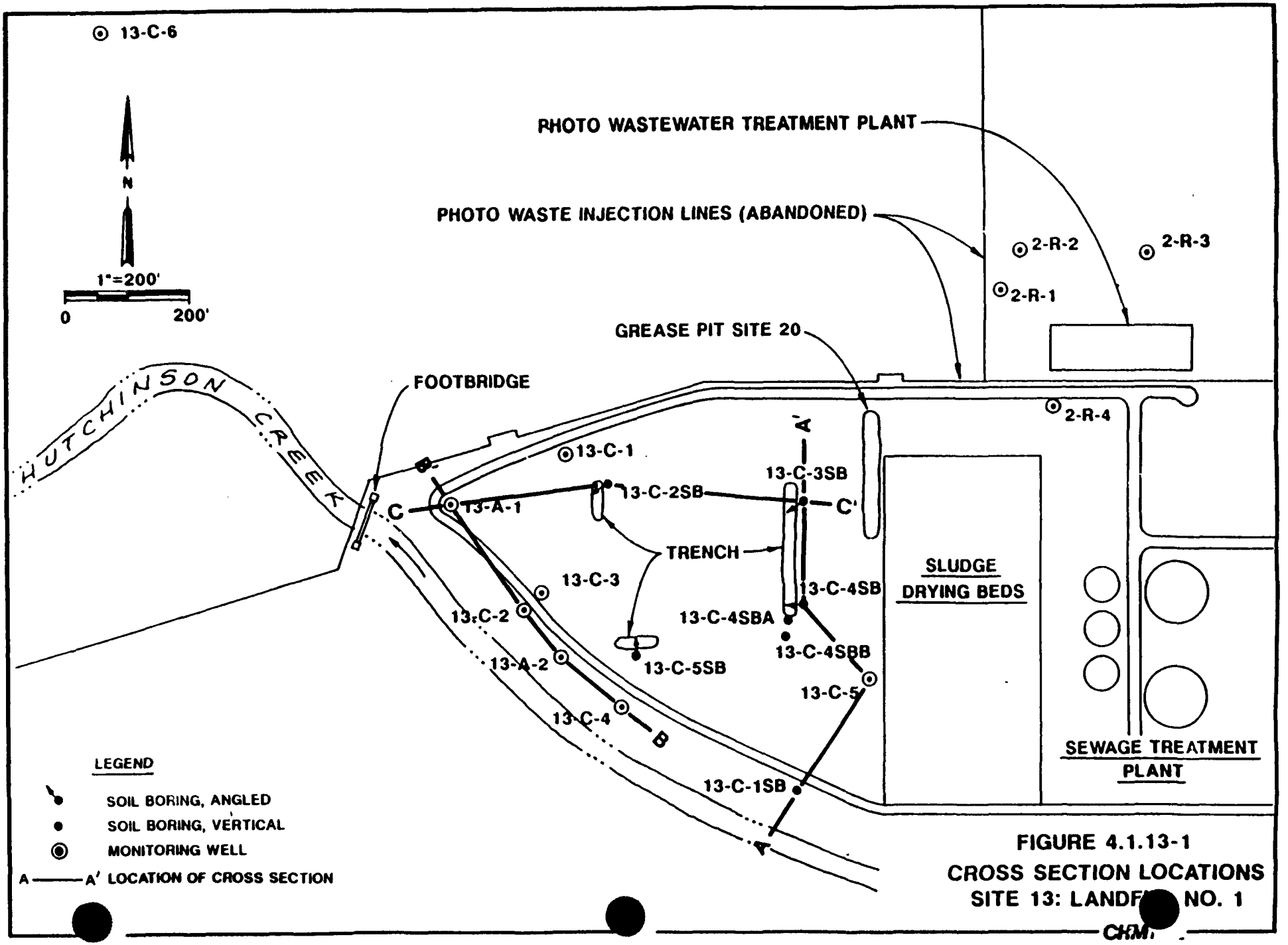


FIGURE 4.1.13-1
CROSS SECTION LOCATIONS
SITE 13: LANDF[illegible] NO. 1

CHM

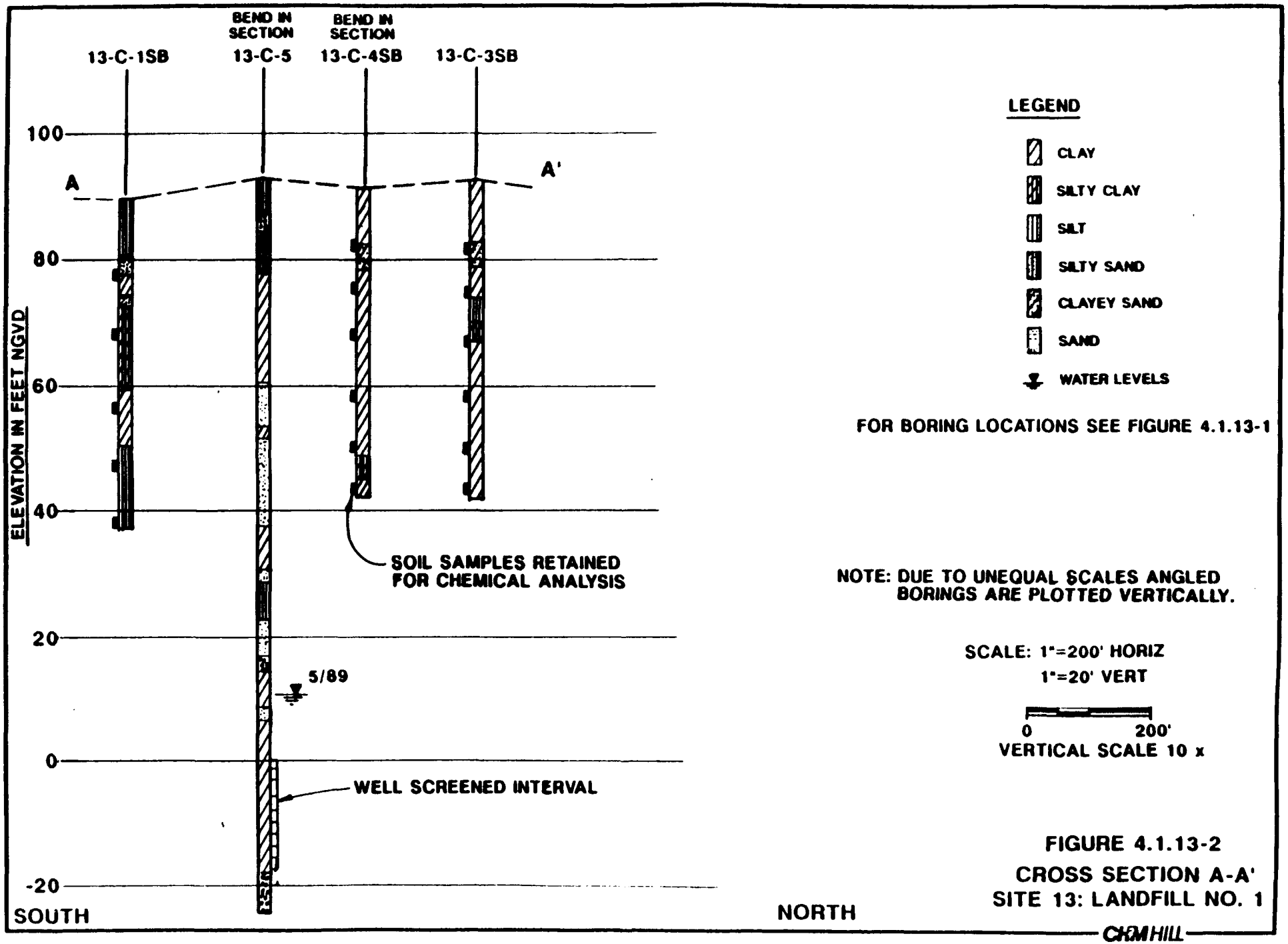
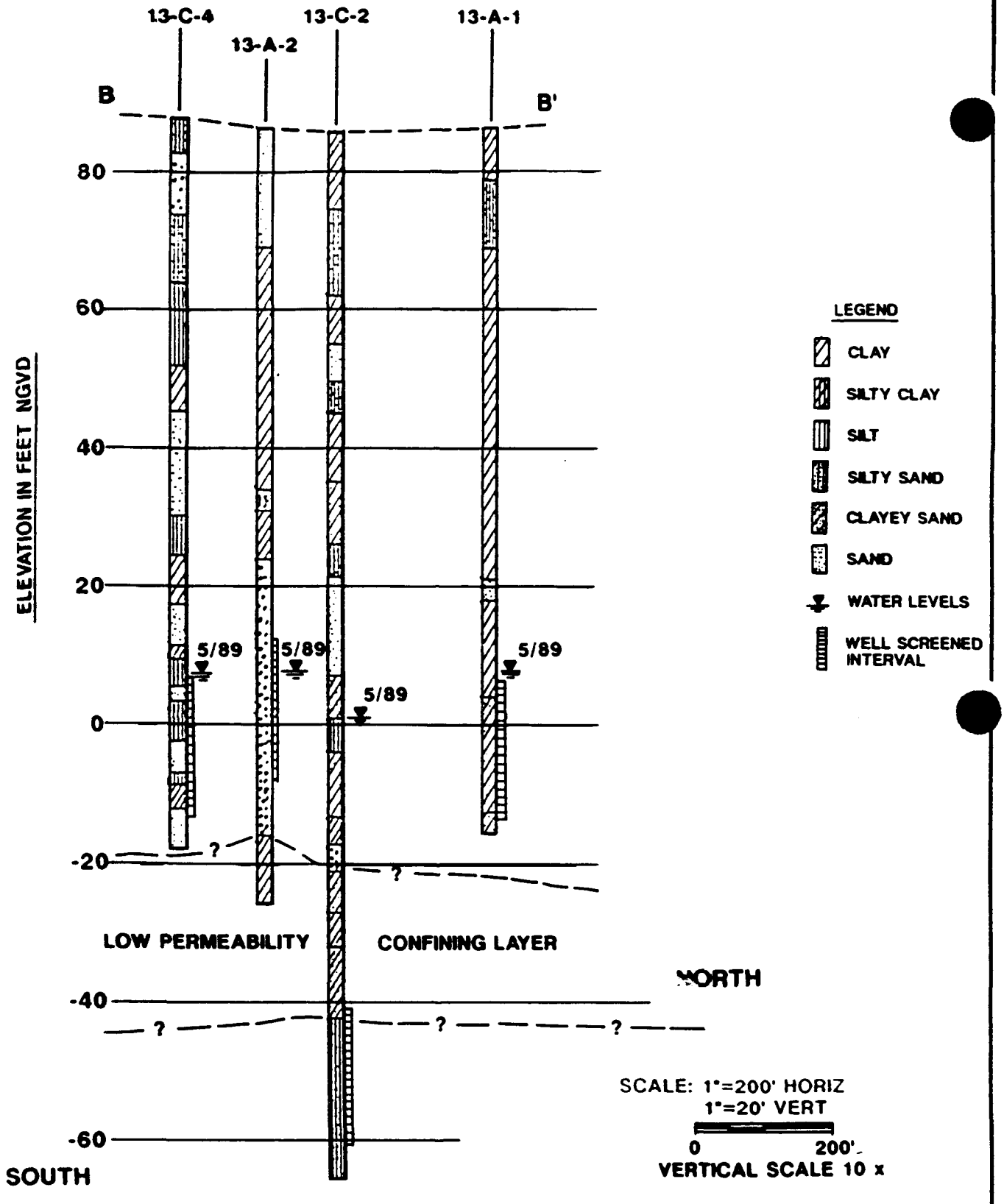


FIGURE 4.1.13-2
CROSS SECTION A-A'
SITE 13: LANDFILL NO. 1

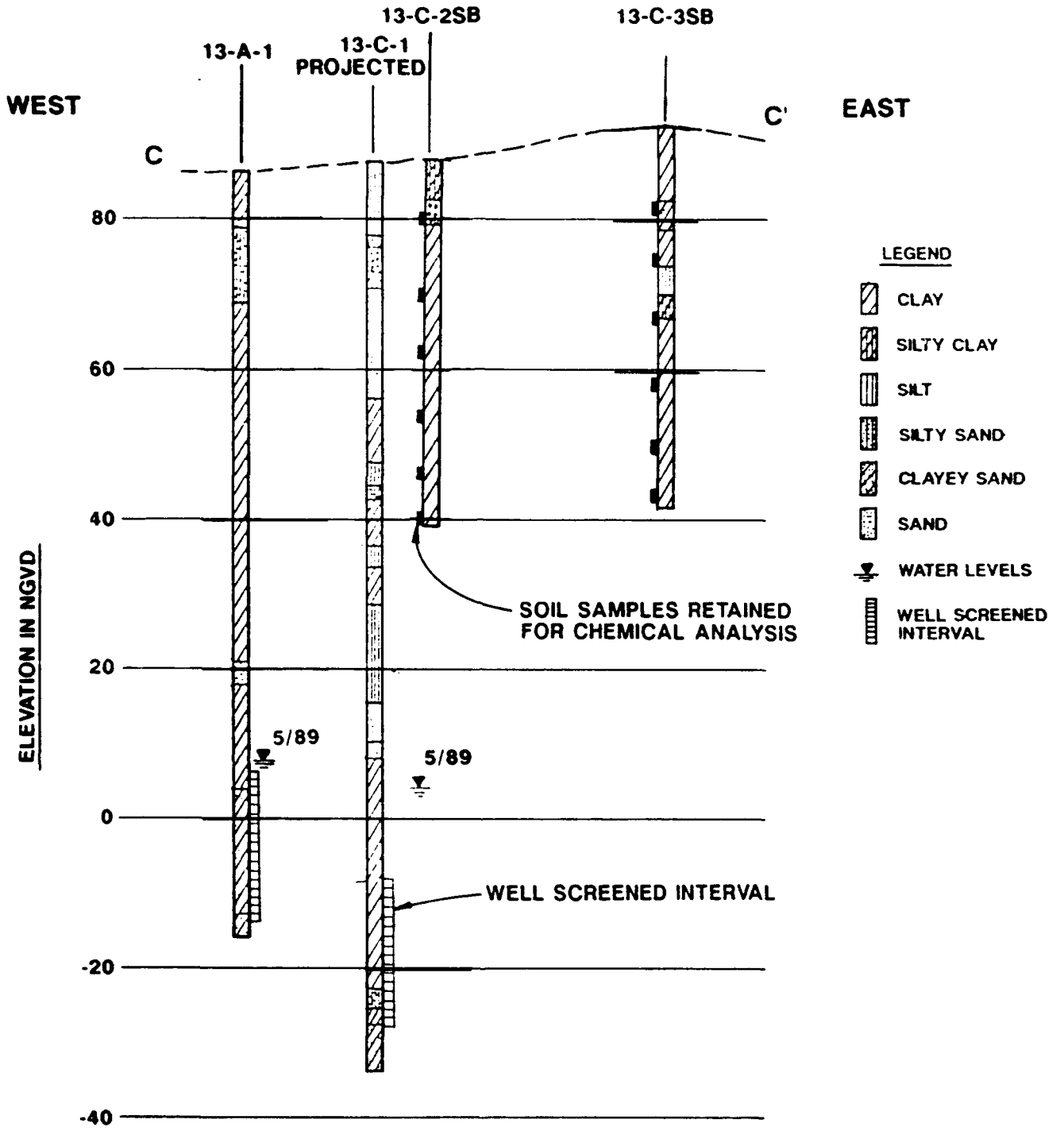
CH2MHILL



FOR SOIL BORING LOCATIONS SEE FIGURE 4.1.13-1

FIGURE 4.1.13-3
CROSS SECTION B-B'
SITE 13: LANDFILL NO. 1

CH2M HILL



NOTE: DUE TO UNEQUAL SCALES ANGLED BORINGS ARE PLOTTED VERTICALLY.

SCALE: 1"=200' HORIZ
1"=20' VERT

0 200'
VERTICAL SCALE 10 x

FIGURE 4.1.13-4
CROSS SECTION C-C'
SITE 13: LANDFILL NO. 1

CH2M HILL

was encountered to the total depth of all boreholes. Presumably, these deposits belong to the Victor and/or Laguna Formations.

4.1.13.1.2 Site Hydrogeology

The first saturated permeable zone occurs from approximately 80 to 105 feet below grade (10 to -15 feet NGVD). The shallow monitoring wells were completed so the uppermost permeable water-bearing zone encountered during drilling would be screened as noted on the cross sections. Monitoring well 13-A-2 is screened largely in a sand unit. The other shallow wells encountered the first permeable zone below a saturated low permeability silt or clay layer. Regionally, the groundwater system appears to be unconfined. At individual wells, fine-grained sediments and screen placement affect water levels and make comparisons difficult.

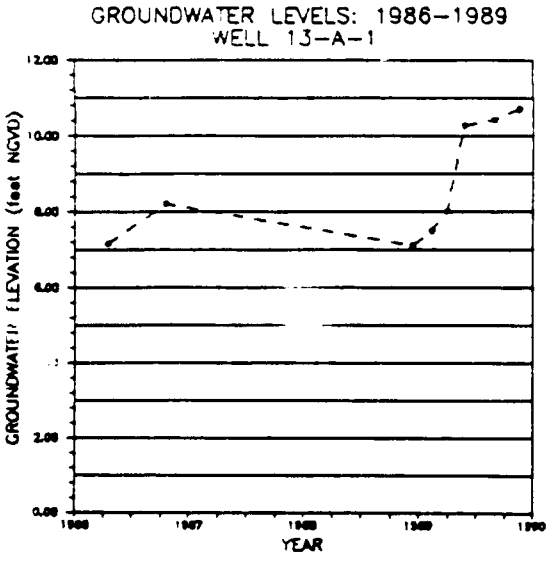
Well 13-C-2 was constructed adjacent to 13-C-3 in the second, or next-to-uppermost, permeable zone encountered during drilling. A 20-foot-thick confining layer from 106 to 126 feet in depth (-20 to -40 NGVD) composed of low permeability lean clays and sandy clays, separates the uppermost permeable zone from the next lower permeable zone in the vicinity of this well. Wells screened above this zone did not respond to pumping below the zone, and vice versa, in pump tests. Well 13-C-2 is screened in silty sands and gravels in the second permeable zone at a depth of 125 to 145 feet below grade (-39 to -59 feet NGVD).

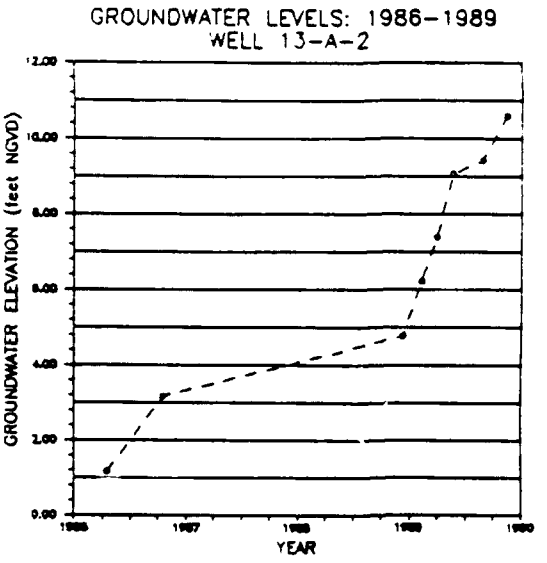
Groundwater levels in the monitoring wells near Landfill No. 1 (Sites 13 and 2) measured between April 1986 and November 1989 are summarized in Table 4.1.13-1 and Figures 4.1.13-5 and 4.1.13-6. Groundwater elevations taken from monitoring wells throughout Beale AFB in March and November 1989 are plotted on Plates 3 and 4. Groundwater elevations at Landfill No. 1 are given in Figure 4.1.13-7; those in the south part of Beale AFB in May 1989 are contoured in Figure 4.1.13-8. These figures show that the groundwater gradient in the uppermost saturated permeable zone in the vicinity of Landfill No. 1 is approximately 0.007 foot per foot to the northwest.

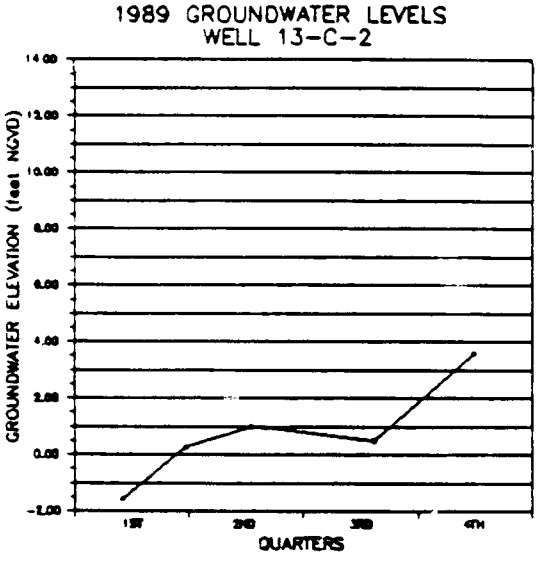
A large groundwater depression west of Beale AFB controls groundwater gradients in the western part of the base. Several off base wells northwest of Landfill No. 1 are measured semiannually by the California Department of Water Resources (DWR). Water levels in these wells dropped steadily from

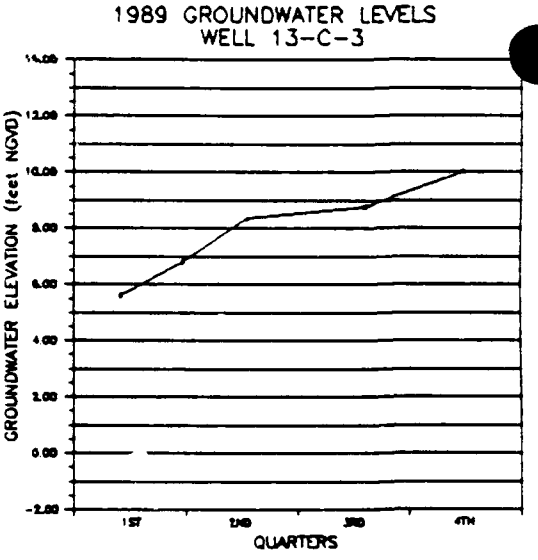
Table 4.1.13-1
GROUNDWATER ELEVATIONS: SITES 13 AND 2
(FEET NGVD)

Well	Screened Interval	April 1986	Oct. 1986	Dec. 1988	Feb. 1989	March 1989	May 1989	Aug. 1989	Nov. 1989
2-A-1	-9 to -29	-16.22	-15.57	-6.67	-1.93	0.40	0.91	-0.08	3.96
2-C-1	-62 to -82	--	--	--	-2.43	-0.48	-1.32	-1.8	2.60
2-R-1	13 to -7	5.71	--	7.68	8.83	9.65	11.36	12.31	13.25
2-R-2	17 to -3	7.05	9.05	8.70	9.03	9.82	11.52	12.48	13.38
2-R-3	15 to 5	10.44	12.27	10.71	11.21	11.85	13.53	14.57	15.36
2-R-4	14 to -6	7.83	9.62	8.86	9.62	10.50	12.30	13.23	14.11
13-A-1	8 to -12	7.15	8.20	7.10	7.49	8.01	10.27	10.42	10.71
13-A-2	14 to -6	1.15	3.16	4.77	6.21	7.38	9.06	9.43	10.60
13-C-1	-7 to -27	--	--	--	2.90	3.78	5.28	6.16	7.87
13-C-2	-39 to -59	--	--	--	-1.57	0.26	1.00	0.49	3.59
13-C-3	1 to -19	--	--	--	5.61	6.81	8.35	8.77	10.03
13-C-4	8 to -12	--	--	--	6.14	7.3[illegible]	8.91	9.29	10.51
13-C-5	0 to -20	--	--	--	7.77	8.93	10.64	11.25	12.35
13-C-6	4 to -16	--	--	--	--	--	--	--	0.76





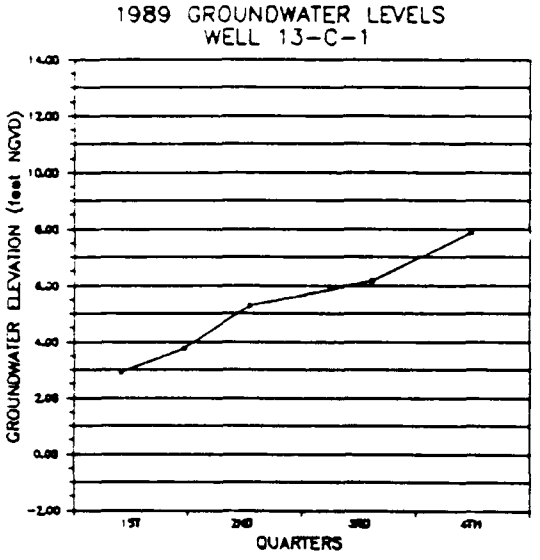


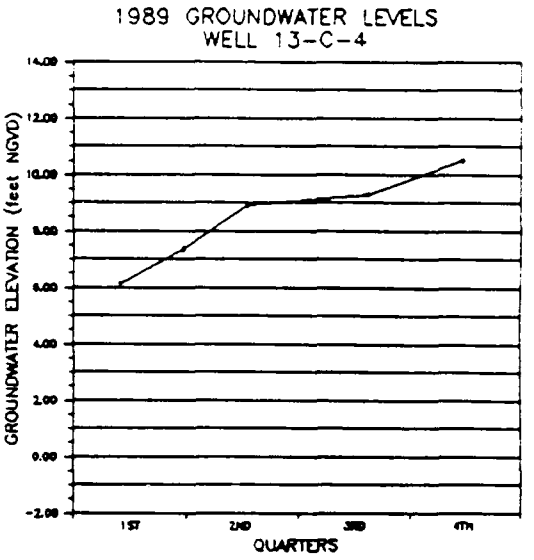


NOTE: VARING TIME SCALES

FIGURE 4.1.13-5
MONITORING WELL HYDROGRAPHS
SITE 13: LANDFILL NO. 1

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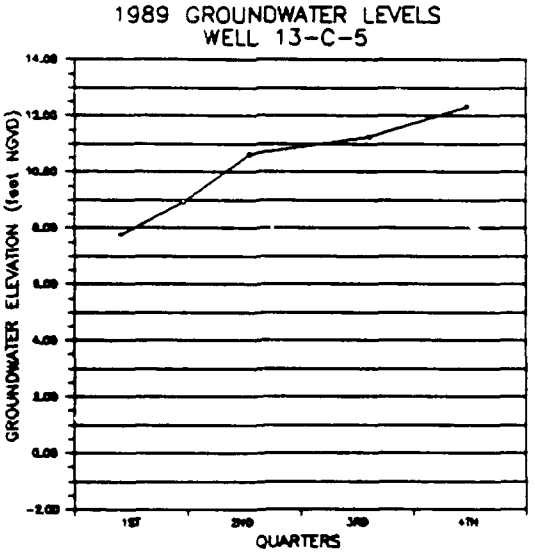


FIGURE 4.1.13- 6
MONITORING WELL HYDROGRAPHS
SITE 13: LANDFILL NO. 1

CH2M HILL

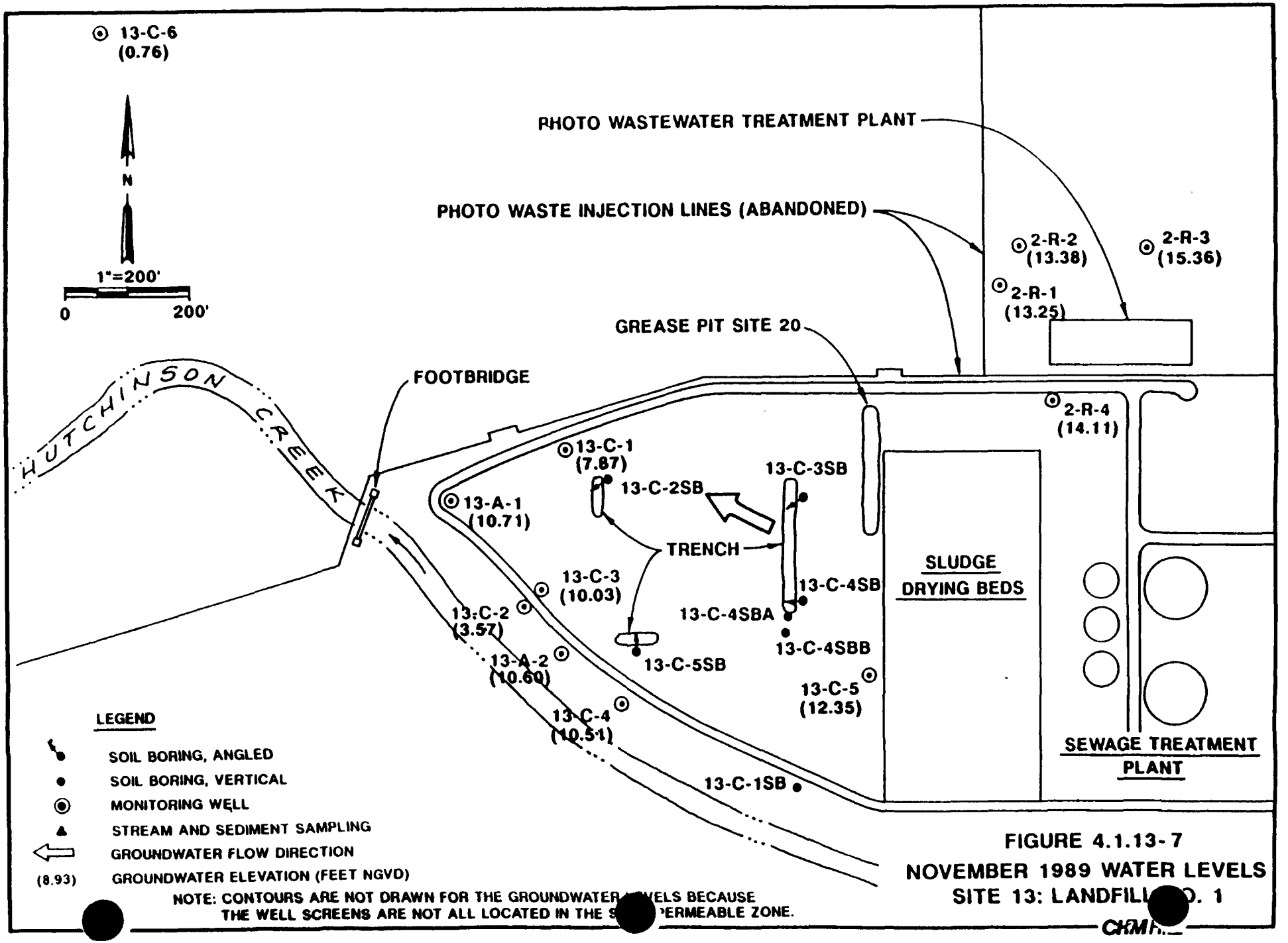


FIGURE 4.1.13-7
NOVEMBER 1989 WATER LEVELS
SITE 13: LANDFILL NO. 1

CHM

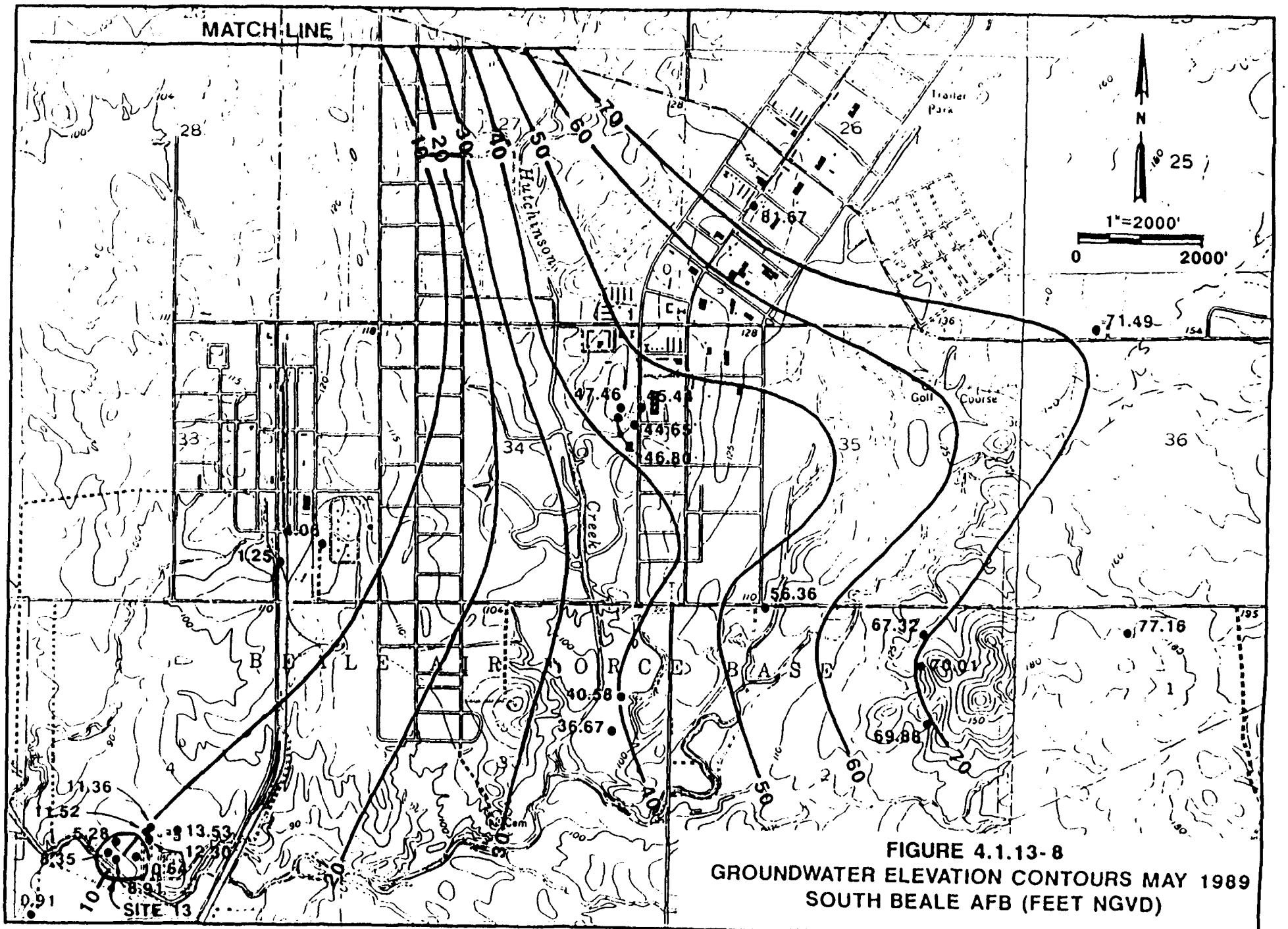


FIGURE 4.1.13-8
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGVD)

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the 1940s until 1981. From 1981 through 1987, the last year data were available, water levels have typically risen 20 feet or more in those wells. As described in Section 4.1.2.1.2, since 1984 water levels have risen 30 feet in the deep monitoring well (364 feet) located near the injection wells in Site 2 about 600 feet west of Site 13.

Groundwater levels in monitoring wells screened in the uppermost permeable zone in the western part of Beale AFB have risen 3 to 20 feet above the 1986 levels measured by Aero-Vironment (Table 4.1.13-1). The most plausible explanation for this is a reduction in agricultural pumping, or an increase in recharge west of the base, or a combination, resulting in the rise in water levels observed by DWR for wells northwest of Landfill No. 1.

At Landfill No. 1, groundwater levels in monitoring well 13-A-2 rose 9.5 feet from April 1986 to November 1989, while the groundwater level in monitoring well 13-A-1 rose 3.6 feet. During pump testing of all the new monitoring wells at Site 13, the groundwater level in monitoring well 13-A-1 did not change when nearby monitoring wells were pumped for 4 to 12 hours. Well 13-A-1 also has anomalously high groundwater levels compared with nearby wells.

The groundwater levels in the four monitoring wells (2-R-1, -2, -3, and -4) installed by Radian at the PWTP (Site 2) northeast of Landfill No. 1 had relatively small groundwater level changes between 1986 and 1989, typically rising 4.9 to 7.5 feet (Table 4.1.13-1). Groundwater levels in the paired monitoring wells 13-C-2 and 13-C-3 indicate a downward vertical gradient between the first and second permeable zones at Site 13. The May 1989 groundwater level in shallow monitoring well 13-C-3 was 8.35 feet NGVD; in the paired deep monitoring well 13-C-2 it was 1.00 feet NVGD, 7.35 feet below that in 13-C-3. This demonstrates a 7.35-foot head difference across the 20-foot-thick, low-permeability lean clay and clayey sand that acts as a localized aquitard between the two permeable zones. A downward gradient implies that Site 13 lies in a groundwater recharge zone. This is consistent with Site 13's location within the groundwater depression described above.

During pump testing of the new monitoring wells at Landfill No. 1, the groundwater level in the deep monitoring well, 13-C-2, did not change in response to 4 to 12 hours of pumping in shallow monitoring wells 13-C-1, -3, -4, or -5. None of the shallow monitoring wells exhibited groundwater level changes in response to 4 hours of pumping in deep monitoring

well 13-C-2. These observations imply that fine-grained sediments have delayed the vertical response at Site 13 near this well. However, the effectiveness of these fine-grained sediments in restricting downward migration of groundwater across the site is unknown.

Aquifer parameters were derived according to the Cooper-Jacob method from the water level drawdown and recovery data generated during the pump tests of the new monitoring wells at Site 13. A summary of calculated aquifer properties is given in Table 4.1.13-2. Plots of the data and a discussion of testing methodology are provided in Appendix E. Calculated aquifer properties are summarized. Transmissivities (T) ranged from 230 to 1,200 square feet per day with an average value of 580 square feet per day. Hydraulic conductivity (K) was estimated by dividing the transmissivity (T) by the saturated screened thickness (b) of the well. Hydraulic conductivity ranged from 11 to 74 feet per day with an average value of 32 feet per day (1.1×10^{-2} cm/sec). Storativity values are in the range expected for confined aquifers (Freeze and Cherry, 1979). However, because of the complexity of the groundwater system, values for aquifer parameters should be regarded as estimates.

Linear groundwater velocity can be roughly estimated using Darcy's Law. For Site 13, a representative value of the hydraulic conductivity may be assumed to be about 28 feet per day, as determined in the 72-hour test in well 19-C-4. The regional groundwater gradient in the vicinity of Landfill No. 1 is 0.007 feet per foot. The estimated effective transport porosity for the permeable sediments, through which groundwater will flow preferentially, is assumed to be about 20 percent (0.20). Using these values gives a groundwater velocity of about 1.0 feet per day, or 360 feet per year.

4.1.13.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.13.1.4 and in Appendix A.

Table 4.1.13-2
SITE 13: SUMMARY OF PUMP TEST RESULTS
(Cooper-Jacob)

Date	Observation Well	Pumping Well	Type of Test	Length of Test (hr)	Transmissivity T (ft^2/d)	Aquifer Thickness b (ft)	Hydraulic Conductivity K (ft/d)	Storativity S
2/89	13-C-1	13-C-3	Drawdown	12	780	20.0	39	4.7×10^{-4}
2/89	13-C-1	13-C-1	Drawdown	1.7	270	20.0	13.5	--
2/89	13-C-1	13-C-1	Recovery	1.7	230	20.0	11	--
2/89	13-C-2	13-C-2	Drawdown	6	380	20.0	19	--
2/89	13-C-2	13-C-2	Recovery	6	440	20.0	22	--
2/89	13-C-3	13-C-3	Drawdown	12	390	20.0	19	--
2/89	13-C-3	13-C-3	Recovery	12	450	20.0	23	--
2/89	13-C-4	13-C-3	Drawdown	4	250	19.0	13	--
2/89	13-C-4	13-C-3	Recovery	4	390	19.0	21	--
2/89	13-C-4	13-C-3	Drawdown	12	990	18.8	53	5.1×10^{-4}
2/89	13-C-5	13-C-3	Drawdown	4	380	20.0	19	--
2/89	13-C-5	13-C-3	Recovery	4	380	20.0	19	--
2/89	13-C-5	13-C-3	Drawdown	12	1,100	20.0	57	5.9×10^{-4}
9/89	13-C-6	13-C-6	Drawdown	4	78	15.9	4.9	--
9/89	13-C-6	13-C-6	Recovery	4	280	15.9	18	--
2/89	13-A-2	13-C-4	Drawdown	4	1,100	15.0	74	9.1×10^{-4}
2/89	13-A-2	13-C-4	Recovery	4	1,200	15.0	63	--
2/89	13-A-2	13-C-3	Drawdown	12	570	14.6	39	9.6×10^{-4}
2/89	13-A-2	13-C-3	Recovery	12	540	14.6	37	--

Notes: Assume b = saturated thickness of screen.

Soil

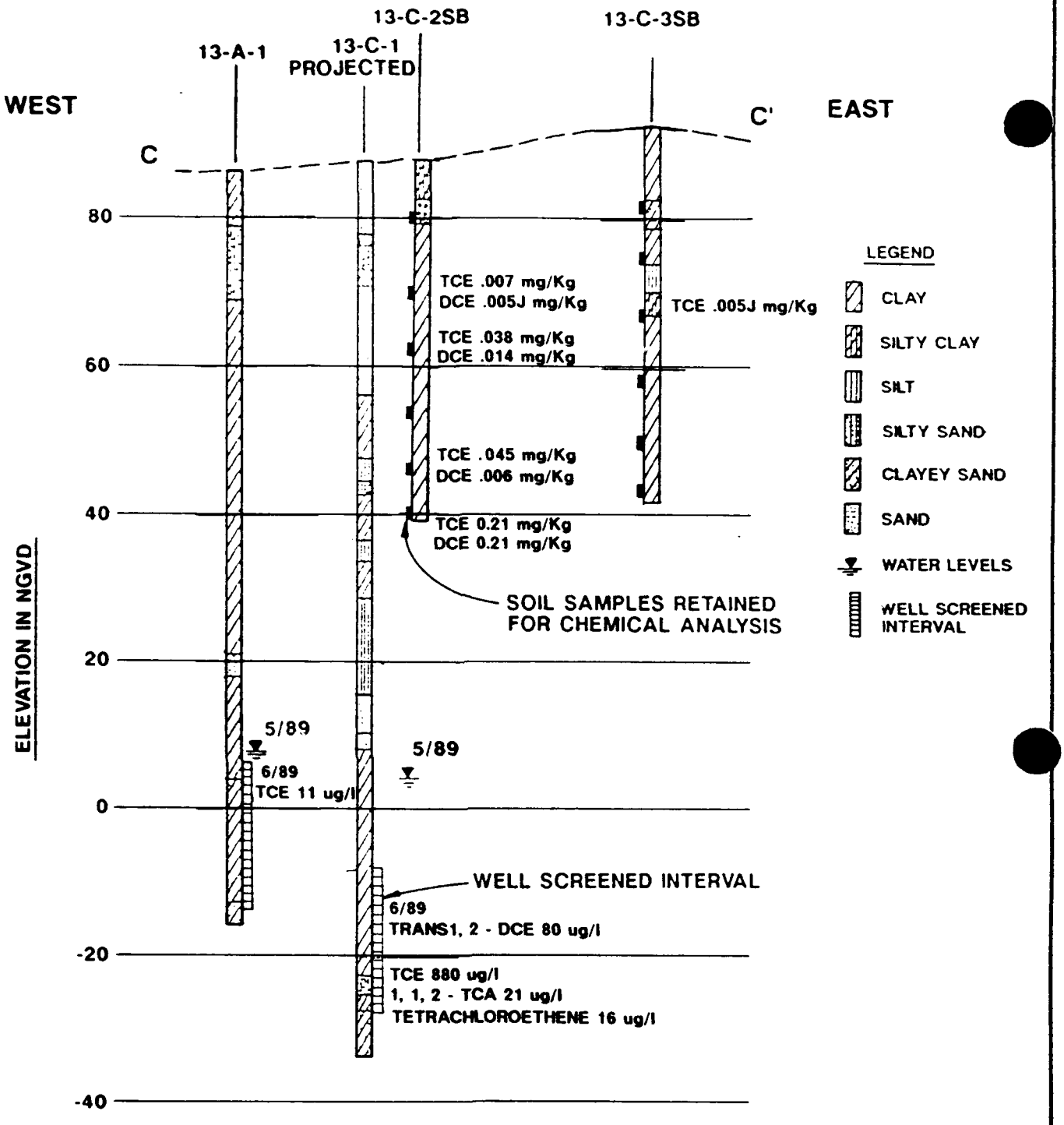
A total of 29 soil boring samples were collected at Site 13: 5 from a vertical background boring and 24 from the four angle borings under landfill trenches. These samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7470/7471), soil moisture (ASTM D2216), and TFH-diesel and -gas (California method).

TCE and trans-1,2-DCE were detected in boring 13-C-2SB (Figure 4.1.13-9). TCE was detected in samples from depths of 18, 28, 48, and 58 feet (actual vertical depths equal 16, 24, 42, and 50 feet) at 0.007, 0.038, 0.045, and 0.21 mg/kg. Trans-1,2-DCE was detected at the same depths at 0.005 (below LOQ), 0.014, 0.006, and 0.21 mg/kg. 1,1,2 trichloroethane was detected at 0.009 mg/kg at 48 feet (42 feet vertically) and 0.062 mg/kg at 58 feet (50 feet vertically). The 58-foot sample also had tetrachloroethane estimated below the LOQ, and chloroform at 0.006 mg/kg. In the 48-foot sample from boring 13-C-3SB TCE was detected below the LOQ. Chloroform was detected at 0.006 mg/kg at 38 feet and below the LOQ at 28 feet. Toluene was detected in 25 of 29 soil samples at up to 0.065 mg/kg.

Semivolatile organic chemicals were detected in several soil samples at Site 13. Bis(2-ethylhexyl) phthalate was detected in five samples at up to 0.21 mg/kg. Di-n-butyl phthalate was detected in 16 samples at up to 5.4 mg/kg. Butyl benzyl phthalate was detected in one sample at 0.54 mg/kg. ICP metals were detected in Site 13 soil samples at concentrations generally similar to background levels. Twelve of the 24 soil samples from angled borings contained from one to three metals at concentrations greater than two standard deviations above the mean average ICP metal values for background soil borings at Beale AFB. These metals were aluminum, barium, calcium, iron, magnesium, manganese, nickel, and potassium. Mercury was detected at boring 13-C-3SB at 0.24 mg/kg at 8 feet (7 feet actual vertically) and 0.11 mg/kg at 18 feet (16 feet actual vertically). TFH-gas was found at 30 mg/kg at 28 feet (24 feet actual vertically) in 13-C-5SB.

Groundwater

During the IRP Phase II, Stage 1 investigation (AeroVironment, 1987) TCE was detected at downgradient monitoring wells 13-A-1 and 13-A-2 in the April and October 1986 sampling rounds. TCE was detected at 13-A-1 at 0.4 ug/l in the



NOTE: DUE TO UNEQUAL SCALES ANGLED BORINGS ARE PLOTTED VERTICALLY.

SCALE: 1"=200' HORIZ
1"=20' VERT

0 200'
VERTICAL SCALE 10 x

FIGURE 4.1.13-9

TCE AND DCE CONCENTRATIONS IN SOIL AND GROUNDWATER CROSS SECTION C-C' SITE 13: LANDFILL NO. 1

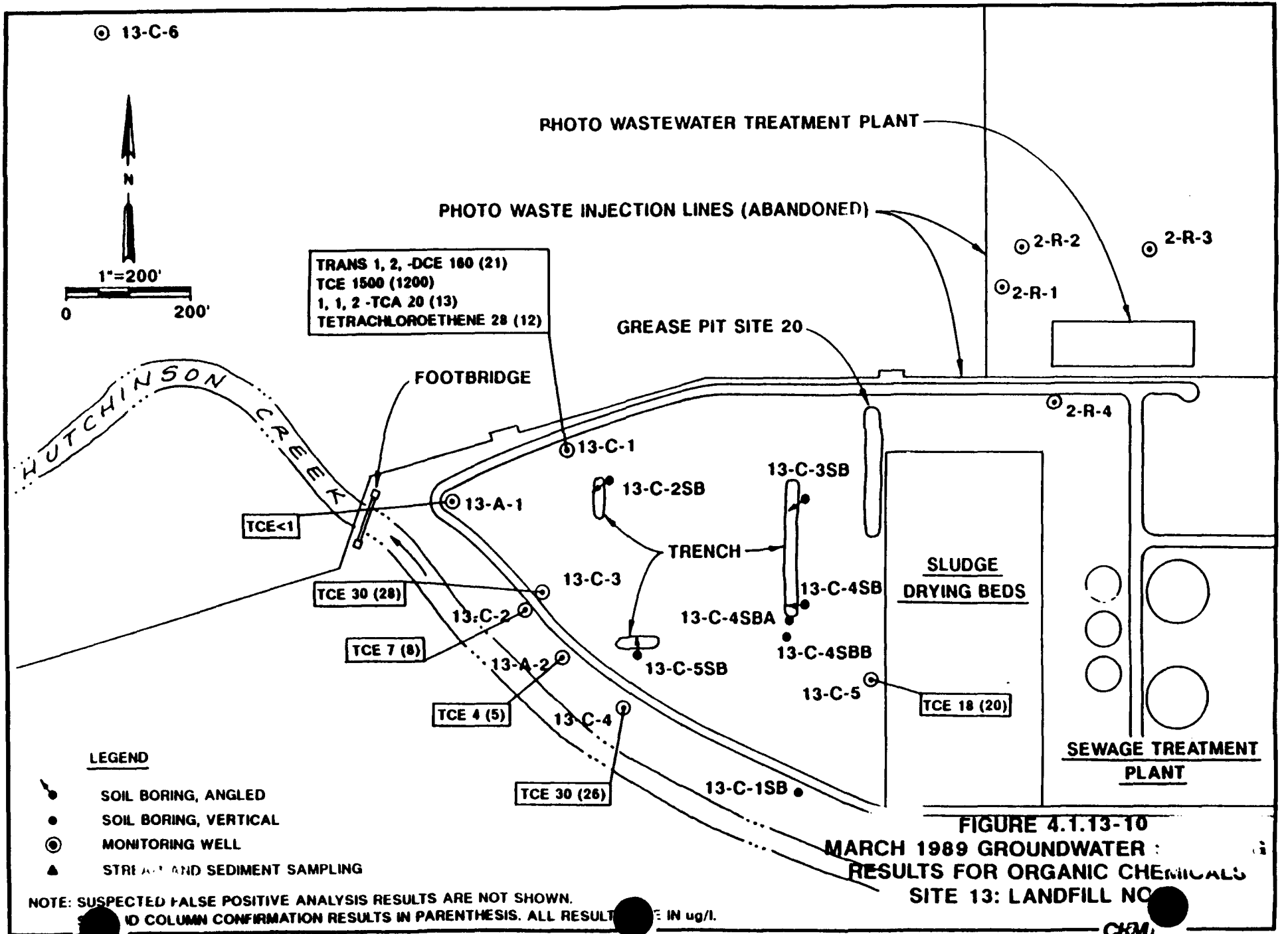
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first round and 28 ug/l in the second. TCE was detected at 13-A-2 at 106 ug/l in the first round and 0.4 ug/l in the 13-A-2 in the second round. Trans-1,2-DCE was detected in 13-A-2 at 3.8 and 0.5 ug/l in the first and second rounds. Barium ranged from less than 0.050 mg/l to 0.100 mg/l. Silver was detected only in the first round in 13-A-1 at 0.040 mg/l. The pesticide 2,4-D was detected at 0.09 ug/l in 13-A-1 and 13-A-2 in the second round.

Through the four quarterly rounds of water sampling at Site 13, 35 groundwater samples and 4 surface water samples were collected. Analyses performed for water samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), arsenic (7060), lead (7421), mercury (7470/7471), selenium (7740), water quality parameters, TFH-diesel and -gas (California method), and COD.

Results from the first quarterly sampling round (February and March, 1989) of the Stage 2-1 investigation (Figure 4.1.13-10) indicate the highest level of contamination was in monitoring well 13-C-1 on the northwest edge of Landfill No. 1, located approximately 80 feet downgradient from boring 13-C-2SB, in which TCE was detected as discussed above. In the first sampling round TCE was present at 1,500 ug/l (1,200 ug/l in second column). Trans-1,2-DCE was detected at 160 ug/l (21 ug/l in second column). 1,1,2-Tetrachloroethane (TCA) was detected at 20 ug/l (13 ug/l in second column). Tetrachloroethane was detected at 28 ug/l (12 ug/l in second column) and chloroform was detected at 2 ug/l (2 ug/l in second column).

TCE was detected in samples collected from other monitoring wells at Landfill No. 1 at much lower levels than found at 13-C-1. It was detected in 13-C-3 at 30 ug/l (28 ug/l in second column), in 13-C-4 at 30 ug/l (26 ug/l in second column), and in 13-C-5 at 18 ug/l (20 ug/l in second column). Well 13-A-2 had 4 ug/l with 5 ug/l in the second column confirmation. Second column confirmation data were within the acceptable RPD range of 25 percent. Groundwater samples collected from monitoring well 13-A-1 did not have detectable TCE. At deep monitoring well 13-C-2, TCE was detected at 7 ug/l in the first column and in second column confirmation at 8 ug/l. Trans-1,2 DCE, 1,1,2-TCA, chloroform, and tetrachloroethane were not detected in samples from these monitoring wells at Landfill No. 1 in the first sampling round.



NOTE: SUSPECTED FALSE POSITIVE ANALYSIS RESULTS ARE NOT SHOWN.
[redacted]D COLUMN CONFIRMATION RESULTS IN PARENTHESIS. ALL RESULT[redacted]E IN ug/l.

FIGURE 4.1.13-10
MARCH 1989 GROUNDWATER [redacted]
RESULTS FOR ORGANIC CHEMICALS
SITE 13: LANDFILL NO[redacted]

CRM[redacted]

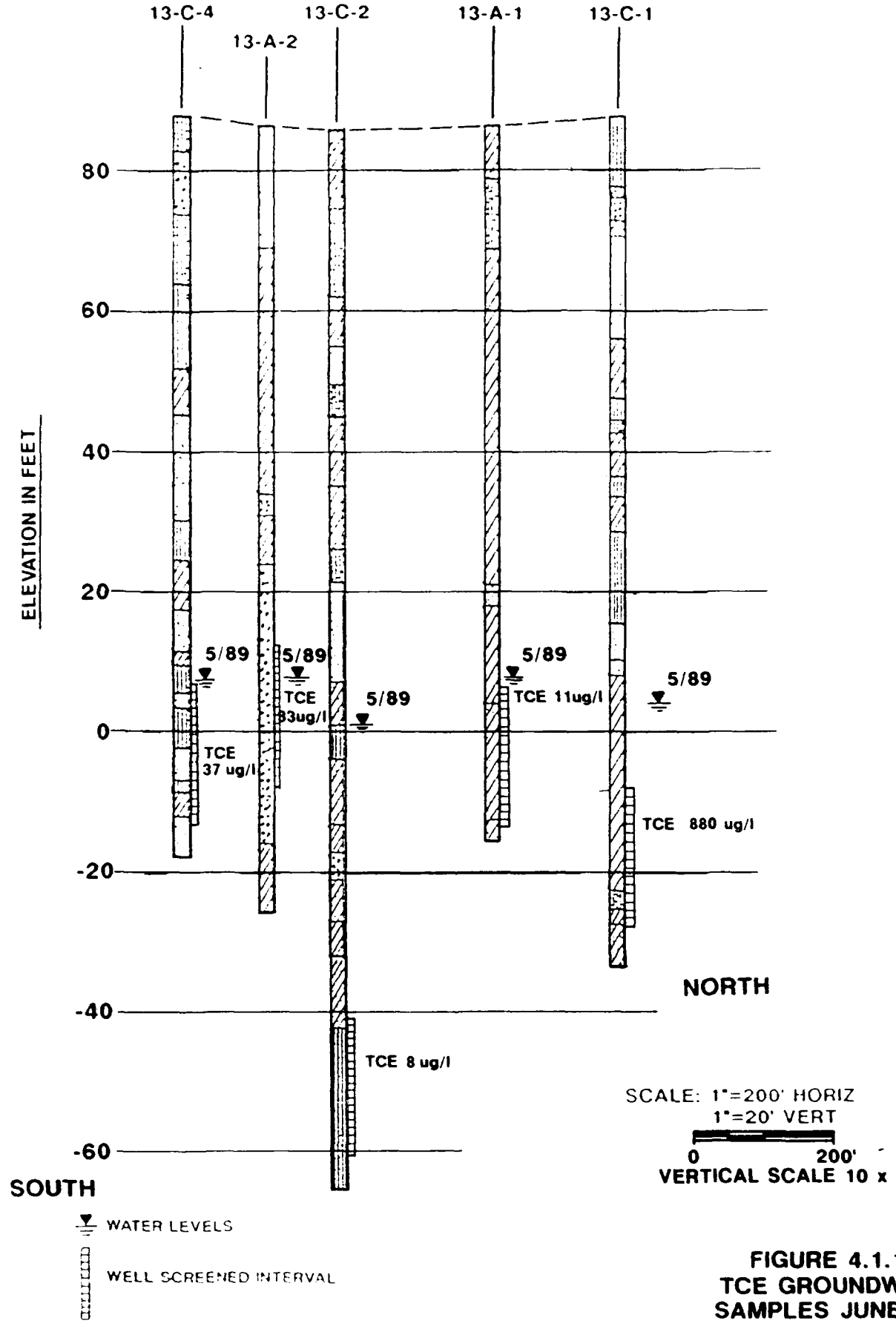
Toluene was detected in monitoring well 13-C-4 at 11 ug/l (15 ug/l in second column confirmation). The RPD is 31 percent, which is outside the acceptable RPD of 14 percent. detected in any groundwater samples at an LOQ of 0.10 ug/l. Mercury was detected in monitoring well 13-C-5, at 0.0008 mg/l, just above the LOQ of 0.0005 mg/l. Barium was not detected in any groundwater samples at an LOQ of 0.10 ug/l.

Results from the second quarterly sampling round in June 1989 (Figures 4.1.13-11 and 4.1.13-12) also indicate the highest level of contamination in well 13-C-1. TCE was detected at 880 ug/l in the original sample (800 ug/l in second column) and 1,000 ug/l in a field replicate (830 ug/l in second column). Trans-1,2,-DCE was detected at 80 ug/l (20 ug/l in second column) in the original sample and 94 mg/l (13 ug/l in the second column) in a field replicate. Tetrachloroethene was detected at 16 ug/l, 1,1,2-trichloroethane at 21 ug/l, and chloroform at 1 ug/l in both the original and replicate samples. For tetrachloroethene, the second column result in the original was 2 ug/l and in the field replicate 5 ug/l; for 1,1,2-trichloroethane 15 and 17 ug/l and for chloroform 1 ug/l and 1 ug/l.

In the second round, TCE was detected in all other Landfill No. 1 monitoring wells, including 13-A-1, at much lower levels than 13-C-1 (Figure 4.1.13-12). Concentration variations are plotted on cross section B-B' in Figure 4.1.13-11. TCE was present in deep monitoring well 13-C-2 (8 ug/l, 10 ug/l in second column), and shallow wells 13-C-3 (69 ug/l, 62 ug/l in second column), 13-C-4 (37 ug/l, 28 ug/l in second column), 13-C-5 (12 ug/l, 14 ug/l in second column), 13-A-1 (11 ug/l, 11 ug/l in second column), and 13-A-2 (33 ug/l, 36 ug/l in second cclumn). Tetrachloroethene was detected in well 13-C-3 (2 ug/l, 2 ug/l in second column). The RPDs for these samples are within acceptable ranges. No mercury, arsenic, lead or selenium was detected at Landfill No. 1 in the second sampling round.

General water quality parameters in the second round were generally similar to those in the first quarter sampling, although TDS (594 mg/l) and chloride (129 mg/l) were higher in 13-A-1. Manganese was detected only in background well 13-C-5 at 0.456 mg/l.

Results from the third quarter sampling round in September 1989 (Figure 4.1.13-13) also indicated the highest level of contamination in well 13-C-1. This sample was first screened using the 8010 analysis on the gas chromatograph, which was normally used for second column confirmations. TCE was detected at 620 ug/l. Trans-1,2,-DCE was detected at



FOR SOIL BORING LOCATIONS SEE FIGURE 4.1.13-1

FIGURE 4.1.13-11
TCE GROUNDWATER SAMPLES JUNE 1989
CROSS SECTION B-B'
SITE 13: LANDFILL NO. 1

CH2MHILL

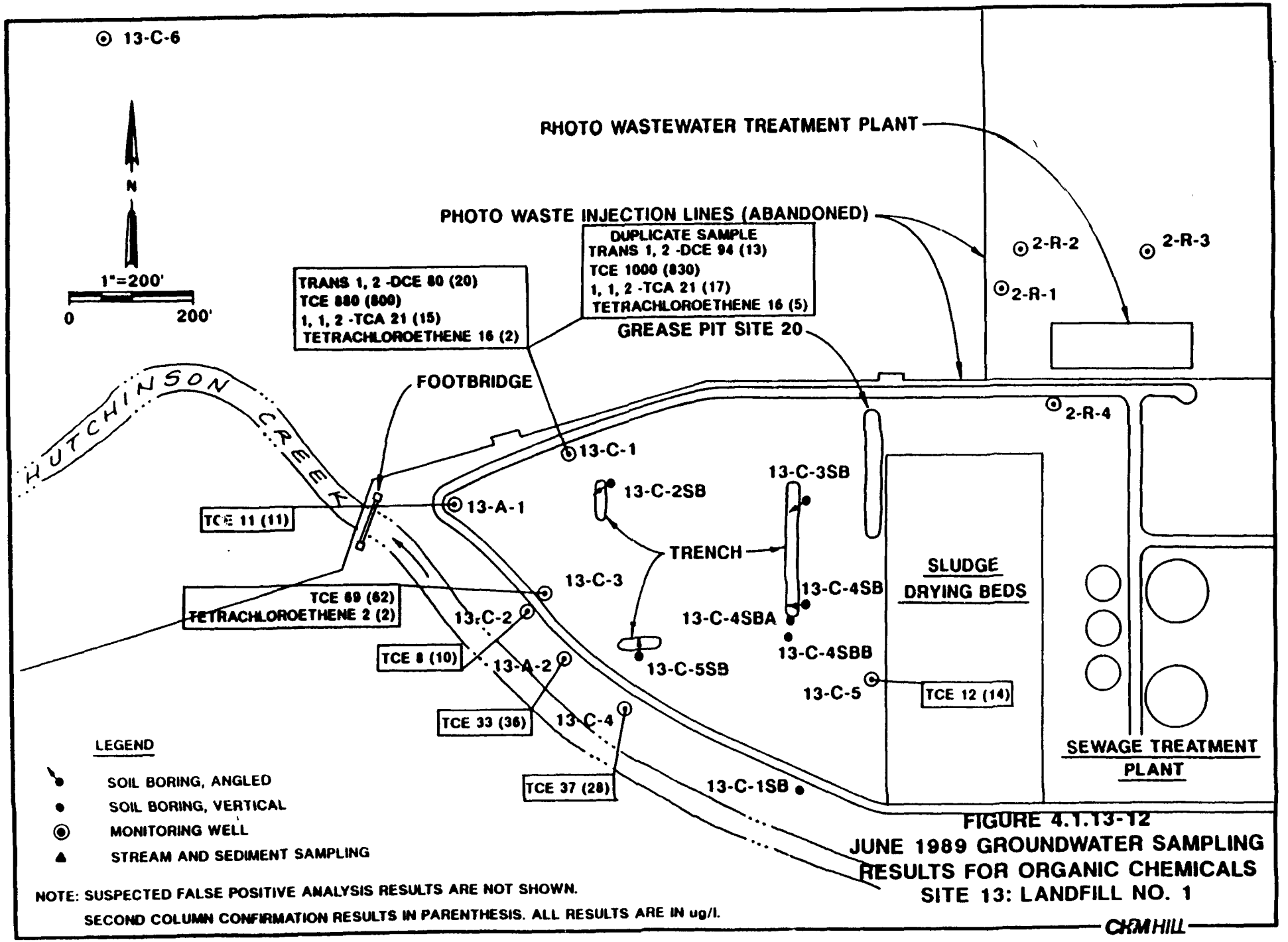


FIGURE 4.1.13-12
JUNE 1989 GROUNDWATER SAMPLING RESULTS FOR ORGANIC CHEMICALS
SITE 13: LANDFILL NO. 1

CH2M HILL

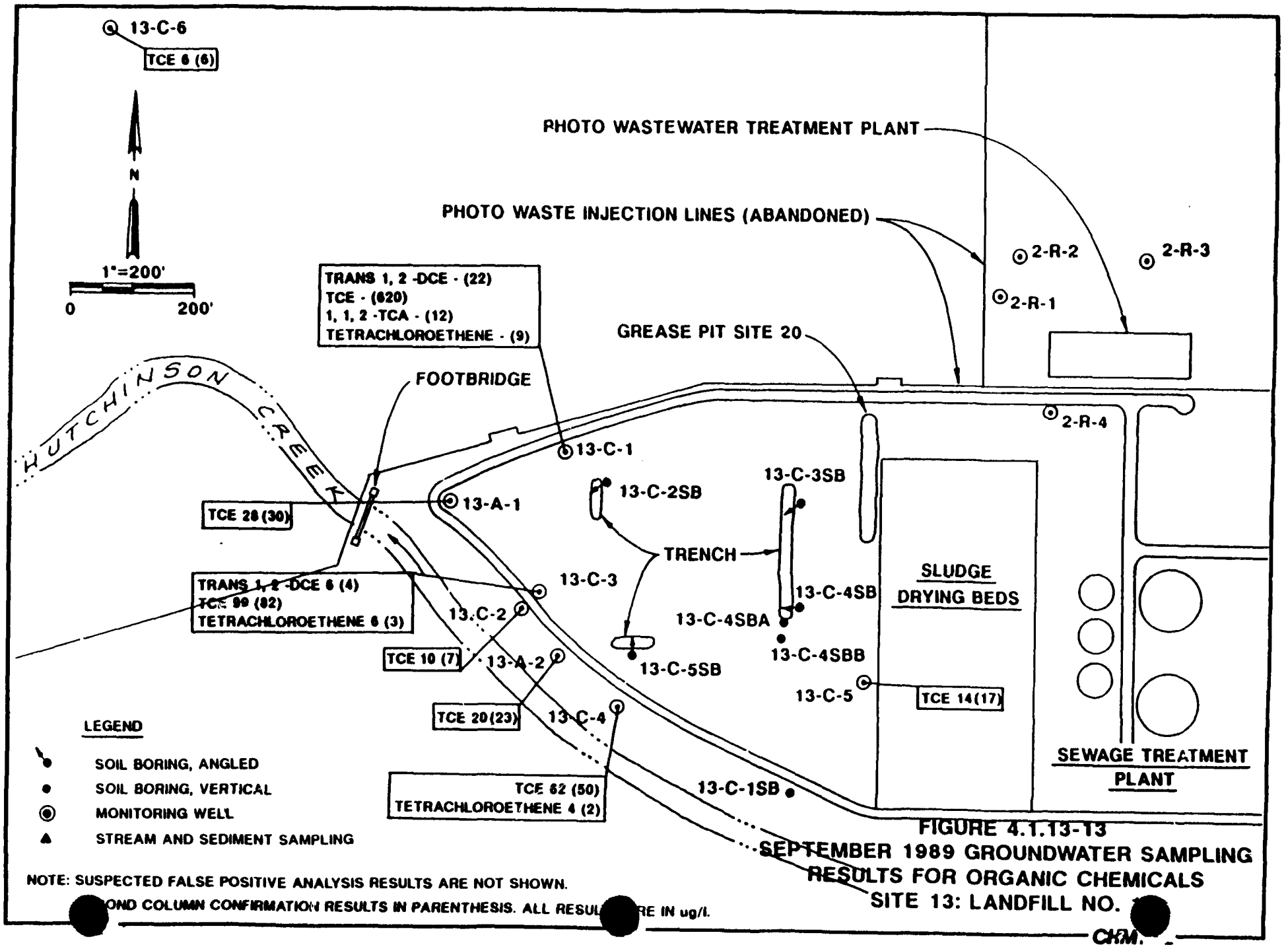


FIGURE 4.1.13-13
SEPTEMBER 1989 GROUNDWATER SAMPLING
RESULTS FOR ORGANIC CHEMICALS
SITE 13: LANDFILL NO.

CHM

22 ug/l. Tetrachloroethene was detected at 9 ug/l, 1,1,2-trichloroethane at 12 ug/l, and chloroform at 1 ug/l. The sample was then run in the gas chromatograph normally used for first column data. In successive analyses run at 100 to 1 dilution, 10 to 1 dilution and with no dilution, no organic compounds were detected. The reason for this is not known but may have been a sample handling problem. A letter from the chemist responsible for the analyses is included in Appendix A.

During third quarter sampling, TCE was again detected in all other Landfill No. 1 monitoring wells at much lower levels than 13-C-1. TCE was present in deep monitoring well 13-C-2 (10 ug/l, 7 ug/l in second column), and shallow wells 13-C-3 (99 ug/l, 82 ug/l in second column), 13-C-4 (62 ug/l, 50 ug/l in second column), 13-C-5 (14 ug/l, 17 ug/l in second column), 13-C-6 (6 ug/l, 6 ug/l in second column), 13-A-1 (28 ug/l, 30 ug/l in second column), and 13-A-2 (20 ug/l, 23 ug/l in second column). The presence of 6 ug/l TCE in the new downgradient monitoring well 13-C-6 indicates that TCE has spread downgradient at least 1,000 feet northwest from Landfill No. 1. No mercury, arsenic, lead, or selenium was detected in the third sampling round.

General water quality parameters were similar to those in the first and second rounds. Manganese was detected at 0.436 mg/l in well 13-C-5.

An off base private water supply well was sampled for purgeable halocarbons (8010) analysis for the first time during the third quarterly water sampling round. It is located west of the base boundary about 2,200 feet northwest of Site 13 (Figure 4.1.13-14). This private well was sampled from two locations. The first sample (OB-C-3) was taken from a 5-inch diameter agricultural spigot near the well head located in front of the caretaker's cottage which had 2 ug/l TCE. The second sample (OB-C-4) from the well was taken from an outside faucet in back of the caretaker's cottage which also had 7 ug/l TCE. No other volatile organic compounds were detected in either sample. These offbase samples are included in Table 4.1.13-3 in Section 4.1.13.1.4.

TCE was detected in all wells at Site 13 in the fourth quarter sampling round and the levels were generally similar to the third round (Figure 4.1.13-15). Well 13-C-1 again had the highest level with 550 ug/l (540 ug/l in the second column). Trans-1,2-DCE was detected at 14 ug/l (92 ug/l in the second column), 1,1,2-Trichloroethane at 10 ug/l (19 ug/l in the second column), and tetrachloroethene at

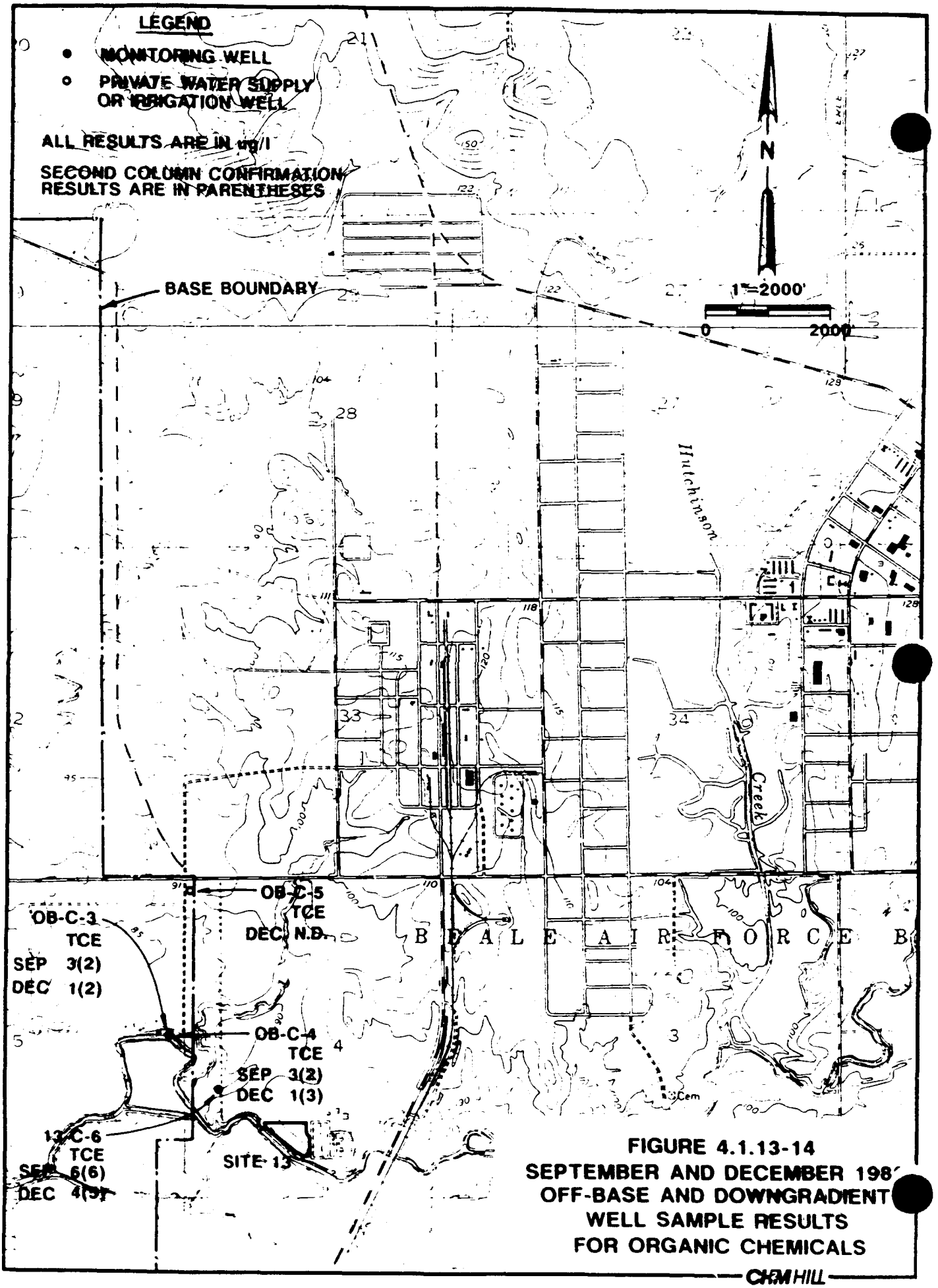
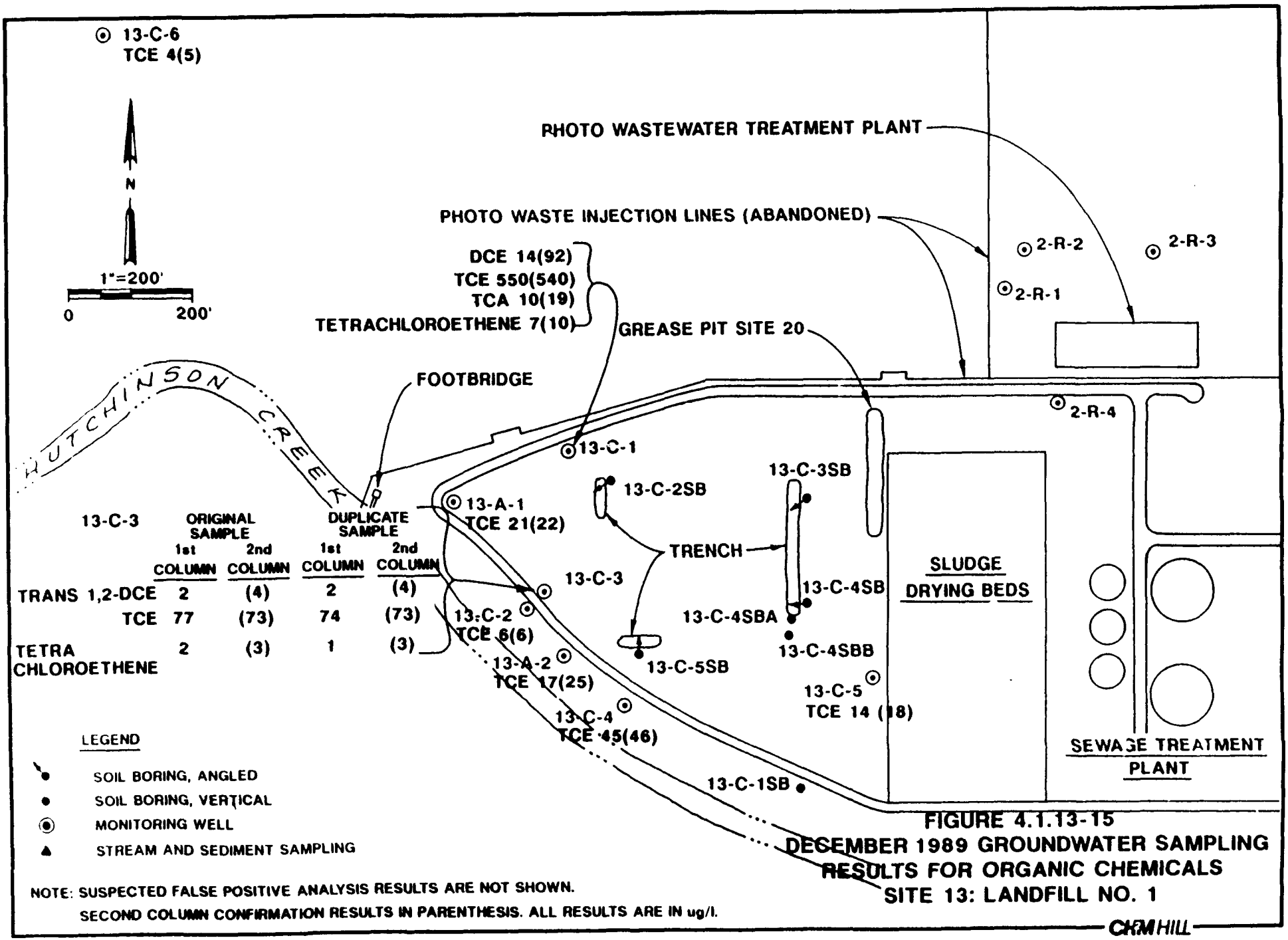


FIGURE 4.1.13-14
SEPTEMBER AND DECEMBER 198
OFF-BASE AND DOWNGRADIENT
WELL SAMPLE RESULTS
FOR ORGANIC CHEMICALS

CH2MHILL



NOTE: SUSPECTED FALSE POSITIVE ANALYSIS RESULTS ARE NOT SHOWN.
SECOND COLUMN CONFIRMATION RESULTS IN PARENTHESIS. ALL RESULTS ARE IN ug/l.

FIGURE 4.1.13-15
DECEMBER 1989 GROUNDWATER SAMPLING RESULTS FOR ORGANIC CHEMICALS
SITE 13: LANDFILL NO. 1

CH2M HILL

7 ug/l (10 ug/l in the second column). Similar compounds were detected at lower levels in the original and duplicate samples from well 13-C-3. TCE was detected at 77 ug/l (73 ug/l in the second column) in the original and 74 ug/l (73 ug/l in the second column) in the duplicate. Trans-1,2-DCE was detected at 2 ug/l (4 ug/l in the second column) in the original and the same levels in the duplicate. Tetrachloroethene was detected at 2 ug/l (3 ug/l in the second column) in the original and 1 ug/l (3 ug/l in the second column) in the duplicate.

TCE was also detected at 21 ug/l (22 ug/l in the second column) in 13-A-1, at 17 ug/l (25 ug/l in the second column) in well 13-A-2, 45 ug/l (46 ug/l in the second column) in 13-C-4, 14 ug/l (18 ug/l in the second column) in background well 13-C-5, 6 ug/l (6 ug/l in the second column) in deep well 13-C-2, and 4 ug/l (5 ug/l in the second column) in the downgradient well 13-C-6.

Manganese was detected at well 13-C-5 at 0.278 mg/l and at well 13-C-6 at 0.0183 mg/l. Water quality parameters were similar to previous rounds.

The off-base well at Deep Violet Farms was sampled again in the fourth quarter (Figure 4.1.13-14). Sample OB-C-3 had 1 ug/l TCE (2 ug/l in the second column) and OB-C-4 had 1 ug/l TCE (3 ug/l in the second column). Another well located about 2,300 feet north of Deep Violet Farms was sampled for 8010 analyses (OB-C-5) and had no detected compounds.

Through the four sampling rounds at Landfill No. 1, total dissolved solids (TDS) in groundwater ranged from 146 to 594 mg/l. Groundwater is a calcium-magnesium bicarbonate type. Nitrite plus nitrate (expressed as nitrate) ranged from 5 to 33.2 mg/l. Chemical oxygen demand (COD) was below the 7 mg/l LOQ.

Surface Water

Surface water and bottom sediments (0-0.5 foot) in Hutchinson Creek adjacent to Landfill No. 1 were sampled in four locations in November 1985 by AeroVironment (Figure 4.1.13-16). The surface water sampling was repeated in April 1986 (AeroVironment, 1987). Low levels of the organochlorine pesticides gamma-BHC (Lindane), Aldrin, and the chlorophenoxy herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) were detected in the surface water samples. Lindane was detected in all but one sample from both sampling rounds

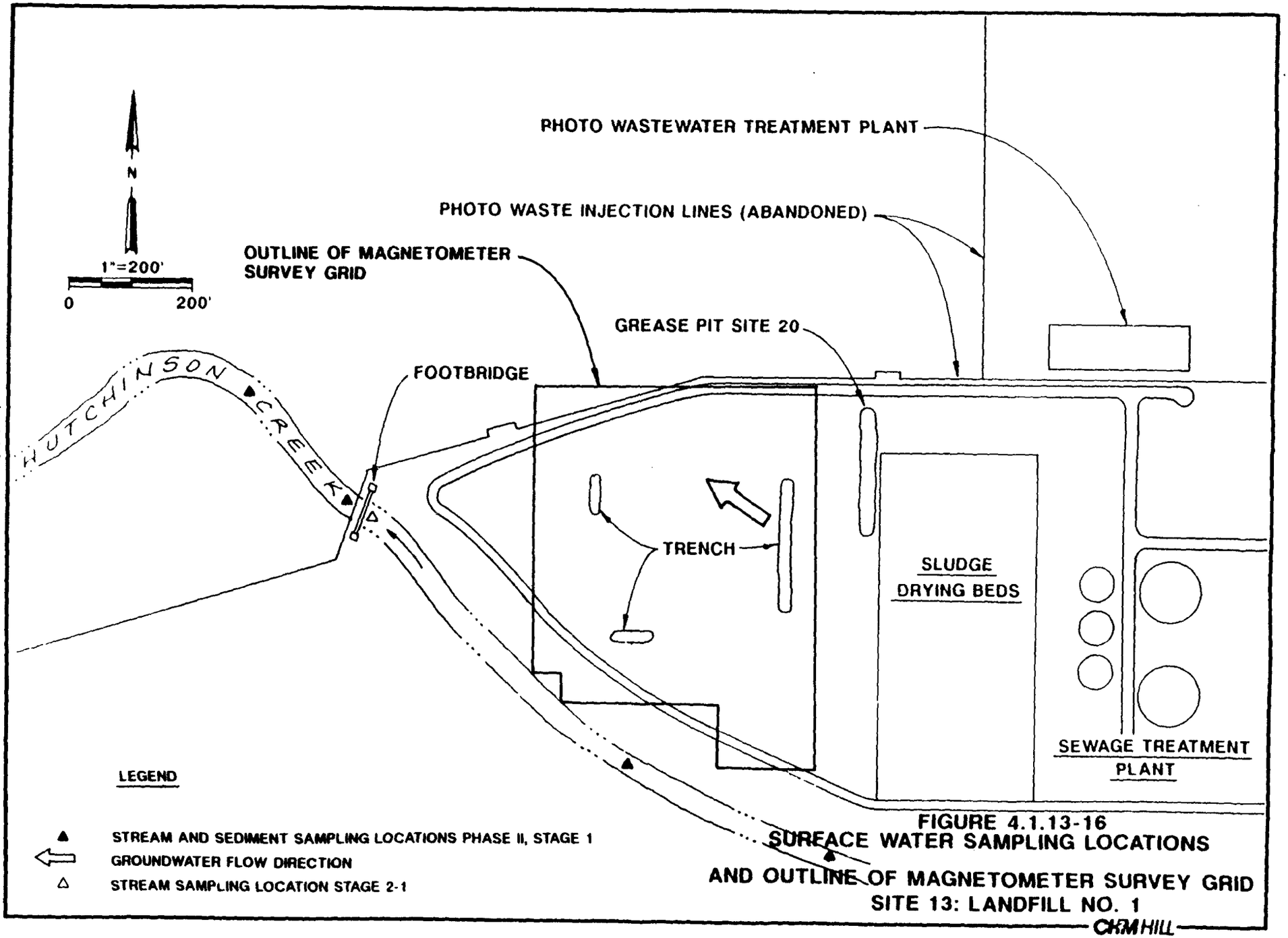


FIGURE 4.1.13-16
SURFACE WATER SAMPLING LOCATIONS
AND OUTLINE OF MAGNETOMETER SURVEY GRID
SITE 13: LANDFILL NO. 1
CH2M HILL

(0.04-0.11 ug/l). Aldrin was detected in all of the second round samples at concentration near the method detection limit and well below the LOQ. No Aldrin was detected during the first round. 2,4-D was detected in three samples below the LOQ.

The first quarterly surface water sample collected as part of the current Stage 2-1 activities was taken below the foot bridge across Hutchinson Creek in February 1989. No volatile or semivolatile organic compounds were detected. Lead was detected at the 0.005 mg/l LOQ. TDS was 169 mg/l. The surface water cations were of no dominant type with 50 percent bicarbonate anions. Nitrate was 12.6 mg/l. COD was 19.7 mg/l, similar to the 18.5 mg/l detected upstream at Landfill 2.

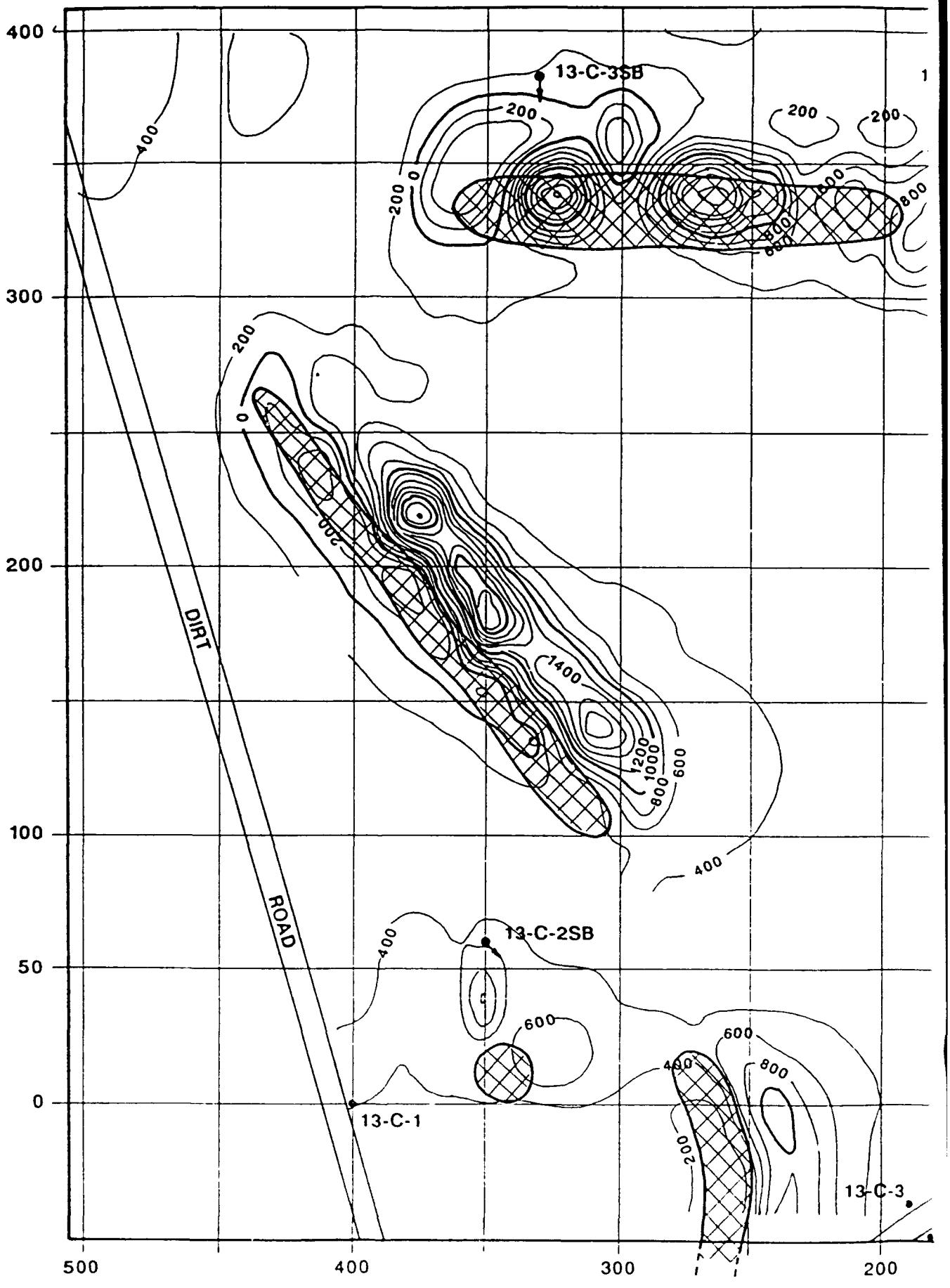
The second round sampling included a replicate sample. Nitrate increased to 74.0 mg/l (66 mg/l in replicate). COD increased to 56.3 mg/l (63.6 mg/l in replicate), higher than the 13.3 mg/l detected upstream at Landfill No. 2. TDS increased to 427 mg/l (418 in the replicate). No lead or volatile or semivolatile organic compounds were detected.

In the third round sample, nitrate dropped to 36.9 mg/l. COD was not detected at Site 13 but was 25.8 mg/l upstream at Site 6. TDS was 398 mg/l. Again, no lead or volatile or semivolatile organic compounds were detected.

A replicate surface water sample was taken in the fourth round. Nitrate increased to 75.8 mg/l (66.9 in the replicate). COD was 44.5 mg/l (41.2 in the replicate), higher than the 18.5 mg/l upstream at Site 6. TDS was 415 mg/l (352 in the replicate). Lead was detected in the replicate sample at 0.0417 mg/l, but was not detected in the original sample. No volatile or semivolatile organic compounds were detected. Arsenic, mercury, selenium, and total fuel hydrocarbons -gas and -diesel were not detected in surface water at Site 13. Surface water was a sodium-magnesium bicarbonate type in the first round, and sodium chloride in the second and third rounds and sodium chloride bicarbonate in the fourth round.

Geophysics

A geophysical investigation (magnetometer survey) was conducted in the vicinity of the grease pit (Site 20), adjacent to Landfill No. 1, to determine the locations of backfilled trenches. The outline of the magnetometer survey grid is given in Figure 4.1.13-16. Figure 4.1.13-17 shows the area


400
300
200
100
50
0
500
400
300
200
13-C-3SB
13-C-2SB
13-C-1
13-C-3
DIRT
ROAD
200
400
600
800
1000
1200
1400

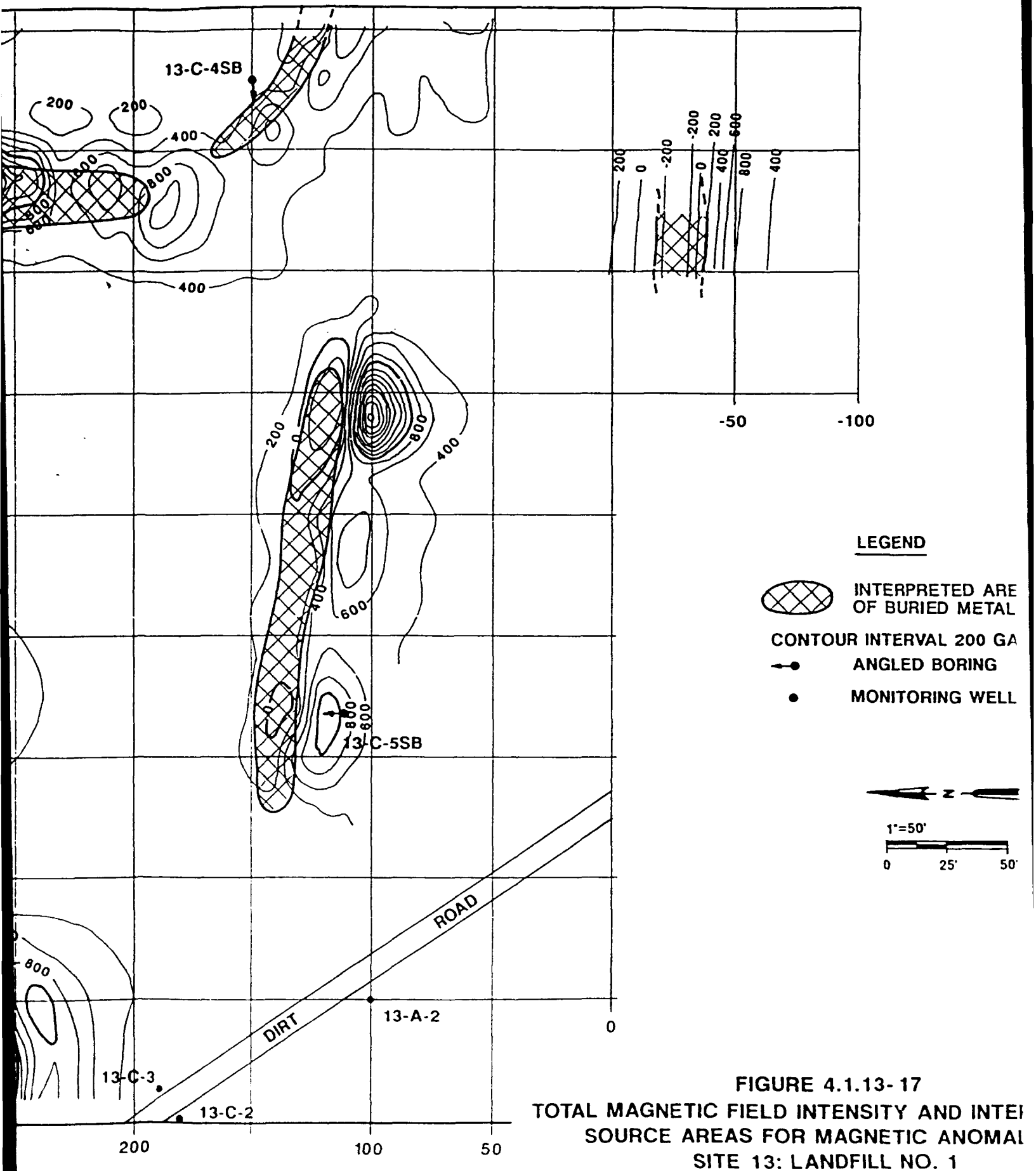
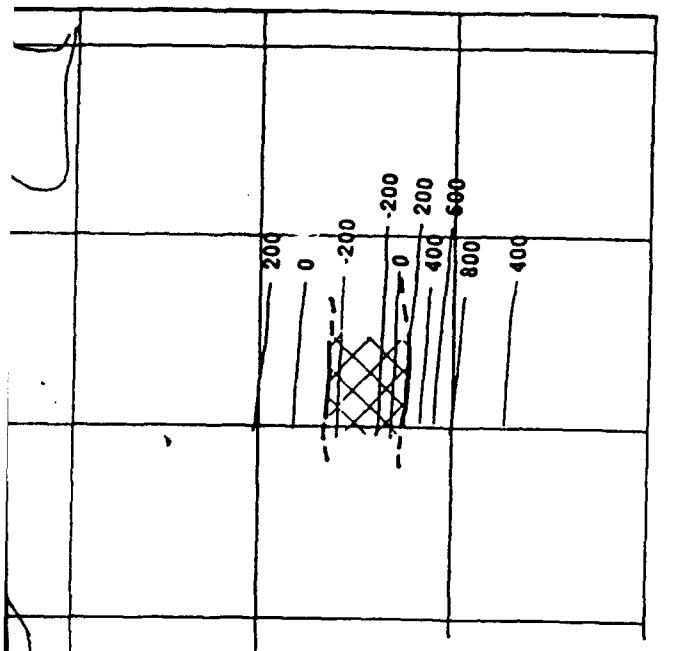


FIGURE 4.1.13-17
TOTAL MAGNETIC FIELD INTENSITY AND INTEI
SOURCE AREAS FOR MAGNETIC ANOMAI
SITE 13: LANDFILL NO. 1



-50

-100

0

50

LEGEND

INTERPRETED AREAS OF BURIED METAL

CONTOUR INTERVAL 200 GAMMAS

ANGLED BORING

MONITORING WELL

N

1"=50'

0 25' 50'

FIGURE 4.1.13-17
TOTAL MAGNETIC FIELD INTENSITY AND INTERPRETED SOURCE AREAS FOR MAGNETIC ANOMALIES
SITE 13: LANDFILL NO. 1

interpreted from a magnetic field survey to have buried metal. Geophysical scan lines are presented in Appendix H. The magnetic source areas were generally associated with shallow depressions.

Seven areas of buried metal were delineated. Three of these were not fully covered with the magnetometer because the scope of work limited the geophysical investigation in the vicinity of Site 20 (and, therefore, Landfill No. 1) to one day. Time did not permit full delineation of the landfill trenches.

4.1.13.1.4 Analytical Results Table

Table 4.1.13-3 presents a summary of all detected analytes for Site 13. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.13-3 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.13.1.5 Discussion of Analytical Data

Contaminants were detected in both soil and groundwater samples collected at Site 13. With the exception of lead, which was detected at the LOQ, no contaminants were detected in the surface water sample. Table 4.1.13-4 presents the range of contaminants encountered for each of the media sampled (soil, groundwater, surface water), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections or surrogate spike recoveries.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the limit of quantification. These detections may represent laboratory "noise" and the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study the

TABLE 4.1.13-3

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 13

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-1SB BAFB-0106 10.0-11.5' 12/06/88	13-C-1SB BAFB-0107 20.0-21.5' 12/06/88	13-C-1SB BAFB-0108 30.0-31.5' 12/06/88	13-C-1SB BAFB-0111 40.0-41.5' 12/07/88	13-C-1SB BAFB-0113 51.0-52.5' 12/07/88	13-C-2SB BAFB-0252 7.5-9.0' 12/15/88
Percent Moisture	ASA#9	N/A	%	NS	NS	7.0	26.5	27.8	19.8	17.5	9.2
Aluminum	SW6010	20.0	mg/kg	NS	NS	5030	16600	17300	11900	14100	17100
Barium	SW6010	10.0	mg/kg	NS	10,000	46.5	190	141	72.3	393	122
Calcium	SW6010	100	mg/kg	NS	NS	2580	10400	5140	4390	4880	5040
Chromium	SW6010	3.0	mg/kg	NS	50	16.1 B	50.9 B	29.9 B	27.8 B	37.2 B	32.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	7.1	33.5	13.9	18.7	23.0	18.7
Copper	SW6010	3.0	mg/kg	NS	2,500	26.3	62.9	37.3	44.1	40.5	45.7
Iron	SW6010	10.0	mg/kg	NS	NS	11800 B	26800 B	24500 B	26700 B	27600 B	28400
Magnesium	SW6010	100	mg/kg	NS	NS	2160	10100	6570	5560	5670	5340
Manganese	SW6010	1.5	mg/kg	NS	NS	420	1210	579	633	2040	759
Nickel	SW6010	4.0	mg/kg	NS	2,000	10.8	50.1	30.9	21.2	28.0	19.8
Potassium	SW6010	200	mg/kg	NS	NS	ND	1050	1040	474	424	363
Sodium	SW6010	100	mg/kg	NS	NS	145	174	248	182	190	287
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	ND	ND	ND	68.9
Vanadium	SW6010	4.0	mg/kg	NS	2,400	39.6	60.8	51.1	79.8	86.1	80.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	26.5	81.0	64.4	52.5 B	53.1 B	53.3
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.029 B	0.042 B	0.040 B	0.020 B	0.022 B	0.004 BJ
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.081	0.063	0.018 B
Toluene	SW8240	0.005	mg/kg	NS	NS	0.048	0.065	0.039	0.026	0.030	0.004 J
Phenanthrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	0.057 J	ND	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.29 J	0.68 B	0.65 B	0.31 J	0.15 J	0.26 J
Fluoranthene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	0.065 J	ND	ND
Pyrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	0.057 J	ND	ND
bis(2 ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.035 J	0.065 J	ND	0.11 J	0.42	0.091 BJ

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-2SB[R] BAFB-0424 7.5-8.0' 01/23/89	13-C-2SB BAFB-0254 17.5-19.0' 12/15/88	13-C-2SB[R] BAFB-0426 17.5-18.0' 01/23/89	13-C-2SB BAFB-0255 27.5-29.0' 12/15/88	13-C-2SB[R] BAFB-0427 27.5-28.0' 01/23/89	13-C-2SB[fR] BAFB-0428 28.0-28.5' 01/23/89
Percent Moisture	ASA#9	N/A	%	NS	NS	10.9	19.6	22.1	21.0	20.4	13.6
Aluminum	SW6010	20.0	mg/kg	NS	NS	NT	13100	NT	21500	NT	NT
Barium	SW6010	10.0	mg/kg	NS	10,000	NT	144	NT	325	NT	NT
Calcium	SW6010	100	mg/kg	NS	NS	NT	4470	NT	4040	NT	NT
Chromium	SW6010	3.0	mg/kg	NS	500	NT	36.6	NT	40.8	NT	NT
Cobalt	SW6010	4.0	mg/kg	NS	8,000	NT	28.7	NT	24.1	NT	NT
Copper	SW6010	3.0	mg/kg	NS	2,500	NT	60.7	NT	43.2	NT	NT
Iron	SW6010	10.0	mg/kg	NS	NS	NT	36200	NT	31500	NT	NT
Magnesium	SW6010	100	mg/kg	NS	NS	NT	6770	NT	5440	NT	NT
Manganese	SW6010	1.5	mg/kg	NS	NS	NT	1360	NT	1970	NT	NT
Nickel	SW6010	4.0	mg/kg	NS	2,000	NT	28.7	NT	43.9	NT	NT
Potassium	SW6010	200	mg/kg	NS	NS	NT	398	NT	823	NT	NT
Sodium	SW6010	100	mg/kg	NS	NS	NT	353	NT	335	NT	NT
Thallium	SW6010	50.0	mg/kg	NS	700	NT	ND	NT	63.3	NT	NT
Vanadium	SW6010	4.0	mg/kg	NS	2,400	NT	116	NT	77.8	NT	NT
Zinc	SW6010	2.0	mg/kg	NS	5,000	NT	66.2	NT	64.2	NT	NT
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	NT	0.009 B	NT	0.009 B	NT	NT
Acetone	SW8240	0.010	mg/kg	NS	NS	NT	0.027 B	NT	0.037 B	NT	NT
trans-1,2-Dichloroethene	SW8240	0.005	mg/kg	NS	NS	NT	0.005 J	NT	0.014	NT	NT
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	NT	0.007	NT	0.038	NT	NT
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	0.021	NT	0.028	NT	NT
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	NT	0.41	NT	ND	NT	NT
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	NT	0.29 BJ	NT	ND	NT	NT

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-2SB BAFB-0256 37.5-39.0' 12/15/88	13-C-2SB[R] BAFB-0429 37.5-38.0' 01/23/89	13-C-2SB BAFB-0257 47.5-49.0' 12/15/88	13-C-2SB[R] BAFB-0430 47.5-48.0' 01/23/89	13-C-2SB BAFB-0258 57.5-59.0' 12/16/88	13-C-3SB BAFB-0246 7.5-9.0' 12/14/88
Percent Moisture	ASA#9	N/A	%	NS	NS	17.0	23.3	15.4	21.6	18.2	8.5
Mercury	SW7471	0.060	mg/kg	NS	20	NT	ND	NT	ND	NT	0.24
Aluminum	SW6010	20.0	mg/kg	NS	NS	15200	NT	12300	NT	11100	8190
Barium	SW6010	10.0	mg/kg	NS	10,000	98.2	NT	210	NT	133	214
Calcium	SW6010	100	mg/kg	NS	NS	3720	NT	4440	NT	4130	3130
Chromium	SW6010	3.0	mg/kg	NS	500	27.7	NT	27.7	NT	35.9	37.0
Cobalt	SW6010	4.0	mg/kg	NS	8,000	13.3	NT	30.3	NT	18.3	42.2
Copper	SW6010	3.0	mg/kg	NS	2,500	32.7	NT	39.5	NT	37.0	37.7
Iron	SW6010	10.0	mg/kg	NS	NS	26300	NT	26100	NT	25900	26600
Magnesium	SW6010	100	mg/kg	NS	NS	4750	NT	5390	NT	6100	2460
Manganese	SW6010	1.5	mg/kg	NS	NS	658	NT	1310	NT	804	1700
Nickel	SW6010	4.0	mg/kg	NS	2,000	24.5	NT	22.5	NT	23.2	18.6
Potassium	SW6010	200	mg/kg	NS	NS	988	NT	508	NT	477	251
Sodium	SW6010	100	mg/kg	NS	NS	323	NT	195	NT	167	116
Thallium	SW6010	50.0	mg/kg	NS	700	74.1	NT	ND	NT	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	64.6	NT	70.7	NT	86.7	89.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	59.4	NT	52.6	NT	55.3	40.2
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.010 B	NT	0.008 B	NT	0.007	0.048 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.014 B	NT	ND	NT	0.024 B	0.005 BJ
trans-1,2-Dichloroethene	SW8240	0.005	mg/kg	NS	NS	ND	NT	0.006	NT	0.21	ND
Chloroform	SW8240	0.005	mg/kg	NS	NS	ND	NT	ND	NT	0.006	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	NT	0.045	NT	0.21	ND
1,1,2-Trichloroethane	SW8240	0.005	mg/kg	NS	NS	ND	NT	0.009	NT	0.062	ND
Tetrachloroethene	SW8240	0.005	mg/kg	NS	NS	ND	NT	ND	NT	0.004 J	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	NT	ND	NT	0.042	0.020
Phenol	SW8270	0.33	mg/kg	NS	NS	ND	NT	ND	NT	ND	0.83 B
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.29 J	NT	1.5	NT	0.24 BJ	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	NT	0.24 BJ	NT	ND	0.23 BJ

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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-3SB BAFB-0247 17.5-19.0' 12/14/88	13-C-3SB BAFB-0248 27.5-29.0' 12/15/88	13-C-3SB[R] BAFB-0431 27.5-28.0' 01/24/89	13-C-3SB BAFB-0249 37.5-39.0' 12/15/88	13-C-3SB[R] BAFB-0432 37.5-38.0' 01/24/89	13-C-3SB[fR] BAFB-0433 38.0-38.5' 01/24/89
Percent Moisture	ASA#9	N/A	%	NS	NS	21.2	20.9	22.5	20.6	26.8	22.3
Mercury	SW7471	0.060	mg/kg	NS	20	0.11	NT	ND	NT	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	18000	18700	NT	13700	NT	NT
Barium	SW6010	10.0	mg/kg	NS	10,000	84.3	308	NT	85.3	NT	NT
Calcium	SW6010	100	mg/kg	NS	NS	6570	6170	NT	3940	NT	NT
Chromium	SW6010	3.0	mg/kg	NS	500	52.2	52.3	NT	28.6	NT	NT
Cobalt	SW6010	4.0	mg/kg	NS	8,000	20.3	26.6	NT	12.5	NT	NT
Copper	SW6010	3.0	mg/kg	NS	2,500	61.9	63.3	NT	33.8	NT	NT
Iron	SW6010	10.0	mg/kg	NS	NS	38700	38900	NT	26400	NT	NT
Magnesium	SW6010	100	mg/kg	NS	NS	8350	9890	NT	4740	NT	NT
Manganese	SW6010	1.5	mg/kg	NS	NS	514	1740	NT	451	NT	NT
Nickel	SW6010	4.0	mg/kg	NS	2,000	27.7	42.6	NT	25.2	NT	NT
Potassium	SW6010	200	mg/kg	NS	NS	444	ND	NT	668	NT	NT
Sodium	SW6010	100	mg/kg	NS	NS	226	221	NT	315	NT	NT
Vanadium	SW6010	4.0	mg/kg	NS	2,400	101	104	NT	60.1	NT	NT
Zinc	SW6010	2.0	mg/kg	NS	5,000	74.0	75.7	NT	55.9	NT	NT
Chloromethane	SW8240	0.010	mg/kg	NS	NS	ND	0.008 J	NT	ND	NT	NT
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.062 B	0.004 J	NT	0.004 J	NT	NT
Acetone	SW8240	0.010	mg/kg	NS	NS	0.008 BJ	0.021 B	NT	0.016 B	NT	NT
Chloroform	SW8240	0.005	mg/kg	NS	NS	ND	0.005 J	NT	0.006	NT	NT
Toluene	SW8240	0.005	mg/kg	NS	NS	0.005 J	0.030	NT	0.031	NT	NT
Phenol	SW8270	0.33	mg/kg	NS	NS	0.86 B	ND	NT	ND	NT	NT
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.42	NT	0.91	NT	NT
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.30 BJ	0.18 BJ	NT	ND	NT	NT

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f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-3SB BAFB-0250 47.5-49.0' 12/15/88	13-C-3SB[R] BAFB-0434 47.5-48.0' 01/25/89	13-C-3SB BAFB-0251 57.5-59.0' 12/15/88	13-C-3SB[R] BAFB-0435 57.5-58.0' 01/25/89	13-C-4SB BAFB-0303 7.5-9.0' 01/04/89	13-C-4SB BAFB-0305 17.5-19.0' 01/04/89
Percent Moisture	ASA#9	N/A	%	NS	NS	15.4	21.7	23.3	19.2	17.5	19.8
Aluminum	SW6010	20.0	mg/kg	NS	NS	19500	NT	22900	NT	15600	13700
Barium	SW6010	10.0	mg/kg	NS	10,000	180	NT	88.0	NT	246	78.1
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	NT	0.65	NT	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	5650	NT	7420	NT	4020	5170
Chromium	SW6010	3.0	mg/kg	NS	500	49.8	NT	40.2	NT	29.0	38.5
Cobalt	SW6010	4.0	mg/kg	NS	8,000	21.3	NT	16.9	NT	15.8	21.2
Copper	SW6010	3.0	mg/kg	NS	2,500	54.6	NT	59.3	NT	39.2	55.5
Iron	SW6010	10.0	mg/kg	NS	NS	37600	NT	35700	NT	26400	32900
Magnesium	SW6010	100	mg/kg	NS	NS	7200	NT	9230	NT	6580	7380
Manganese	SW6010	1.5	mg/kg	NS	NS	923	NT	596	NT	515	526
Nickel	SW6010	4.0	mg/kg	NS	2,000	26.6	NT	28.0	NT	34.1	23.7
Potassium	SW6010	200	mg/kg	NS	NS	615	NT	756	NT	521	449
Sodium	SW6010	100	mg/kg	NS	NS	235	NT	279	NT	342	284
Vanadium	SW6010	4.0	mg/kg	NS	2,400	103	NT	63.2	NT	67.3	106
Zinc	SW6010	2.0	mg/kg	NS	5,000	65.0	NT	90.5	NT	52.8	66.5
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.006 B	NT	0.007 B	NT	0.067	0.091
Acetone	SW8240	0.010	mg/kg	NS	NS	0.022 B	NT	0.044 B	NT	ND	0.019
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	NT	0.014 B	NT	ND	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	0.005 J	NT	ND	NT	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.021	NT	0.008	NT	ND	0.001 J
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.71	NT	0.27 J	NT	0.11 BJ	0.25 BJ
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.21 J	NT	0.21 BJ	NT	0.11 BJ	0.12 BJ

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R: resample
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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-4SB BAFB-0306 27.5-29.0' 01/04/89	13-C-4SB BAFB-0307 37.5-39.0' 01/04/89	13-C-4SB BAFB-0309 47.5-49.0' 01/04/89	13-C-4SB BAFB-0310 57.5-59.0' 01/04/89	13-C-5SB BAFB-0259 7.5-9.0' 12/16/88	13-C-5SB BAFB-0287 17.5-19.0' 12/16/88
Percent Moisture	ASA#9	N/A	%	NS	NS	23.7	22.7	22.4	20.7	10.5	21
Aluminum	SW6010	20.0	mg/kg	NS	NS	20200	28500	15100	19300	5850	7060
Barium	SW6010	10.0	mg/kg	NS	10,000	204	131	183	107	72.4	45.3
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	0.77	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	6280	5960	5720	5130	1830	3380
Chromium	SW6010	3.0	mg/kg	NS	500	49.5	35.2	49.1	35.1	22.3	20.3
Cobalt	SW6010	4.0	mg/kg	NS	8,000	28.7	15.5	26.4	16.4	14.5	7.1
Copper	SW6010	3.0	mg/kg	NS	2,500	70.5	63.3	75.4	47.4	24.5	29.6
Iron	SW6010	10.0	mg/kg	NS	NS	39400	38000	36100	31500	15200	18100
Magnesium	SW6010	100	mg/kg	NS	NS	11400	7630	10200	6000	2670	3490
Manganese	SW6010	1.5	mg/kg	NS	NS	1040	485	948	620	532	213
Nickel	SW6010	4.0	mg/kg	NS	2,000	44.4	36.4	30.4	21.4	12.3	12.0
Potassium	SW6010	200	mg/kg	NS	NS	590	1220	567	454	ND	291
Sodium	SW6010	100	mg/kg	NS	NS	275	502	211	198	191	211
Thallium	SW6010	50.0	mg/kg	NS	700	ND	104	ND	69.1	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	90.6	77.6	121	76.0	56.8	65.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	82.3	88.7	85.2	62.5	23.9	42.3
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.073	0.10	0.026	0.026	ND	0.005 J
Acetone	SW8240	0.010	mg/kg	NS	NS	0.013	0.014	0.009 J	0.006 J	0.009 J	0.014 B
Toluene	SW8240	0.005	mg/kg	NS	NS	0.003 J	0.003 J	0.021	0.003 J	0.007	0.034
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.31 BJ	0.25 BJ	0.75 B	0.58 B	0.13 J	0.43
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.13 BJ	0.12 BJ	0.12 BJ	0.11 BJ	0.099 BJ	0.15 BJ

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-5SB BAFB-0288 27.5-29.0' 12/16/88	13-C-5SB BAFB-0289 37.5-39.0' 12/16/88	13-C-5SB BAFB-0290 47.5-49.0' 12/19/88	13-C-5SB[R] BAFB-0534 47.0-48.5' 05/02/89	13-C-5SB BAFB-0291 57.5-59.0' 12/19/88
Percent Moisture	ASA#9	N/A	%	NS	NS	18.7	23.3	25.8	NT	18.1
TPH-Gas	TPH-GA	50	mg/kg	NS	NS	30	ND	ND	NT	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	14400	11600	17800	NT	12600
Barium	SW6010	10.0	mg/kg	NS	10,000	161	108	117	NT	436
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	NT	0.73
Calcium	SW6010	100	mg/kg	NS	NS	4020	2950	4270	NT	4520
Chromium	SW6010	3.0	mg/kg	NS	500	35.9	14.3	25.6	NT	44.2
Cobalt	SW6010	4.0	mg/kg	NS	8,000	17.2	9.6	17.5	NT	51.8
Copper	SW6010	3.0	mg/kg	NS	2,500	36.4	22.2	40.3	NT	54.0
Iron	SW6010	10.0	mg/kg	NS	NS	27300	16900	25300	NT	32500
Magnesium	SW6010	100	mg/kg	NS	NS	5830	3340	6190	NT	7520
Manganese	SW6010	1.5	mg/kg	NS	NS	881	481	613	NT	2030
Nickel	SW6010	4.0	mg/kg	NS	2,000	29.8	20.9	30.6	NT	36.8
Potassium	SW6010	200	mg/kg	NS	NS	910	1280	633	NT	525
Sodium	SW6010	100	mg/kg	NS	NS	264	322	288	NT	192
Vanadium	SW6010	4.0	mg/kg	NS	2,400	60.5	43.5	49.2	NT	139
Zinc	SW6010	2.0	mg/kg	NS	5,000	72.8	49.3	57.8	NT	69.6
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	ND	ND	NT	NT	0.006
Acetone	SW8240	0.010	mg/kg	NS	NS	0.014	0.014	NT	NT	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	0.008 J	NT	NT	ND
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	ND	NT	NT	0.006
Toluene	SW8240	0.005	mg/kg	NS	NS	0.062	0.053	NT	NT	0.034
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.23 J	NT	ND	5.4
Butylbenzylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	NT	ND	0.54
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.18 BJ	NT	0.063 J	0.57 B

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 13

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-1GW BAFB-0467 02/28/89	13-C-2GW BAFB-0501 03/21/89	13-C-2GW^{R} BAFB-0529 04/19/89	13-C-3GW BAFB-0500 03/20/89	13-C-4GW BAFB-0459 02/13/89	13-C-5GW BAFB-0470 03/01/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	413	438	309	540	370	420
Temperature	E170.1	N/A	deg C	NS	NS	16.5	18.5	20.0	18.9	19.0	18.0
pH	E150.1	N/A	pH	5-9	NS	6.78	7.15	7.07	6.97	6.72	6.88
Alkalinity - Total	SM403	1.0	mg/l	20	NS	106.8	97.6	NT	141.2	137.0	128.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	130.3	119.1	NT	172.3	167.1	156.6
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	353	265	NT	318	313	365
Chloride	E325.3	1.0	mg/l	250	250	49.0	31.5	NT	50.5	34.6	46.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.15	0.26	NT	0.22	0.14	0.14
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	25.5	22.9	NT	6.8	12.9	25.2
Sulfate	E375.4	1.0	mg/l	250	250	20.8	13.8	NT	15.6	11.6	27.3
Mercury	SW7471	0.0050	mg/l	.002	.002	ND	ND	NT	ND	ND	0.00080
Calcium	SW6010	1.00	mg/l	NS	NS	36.3	26.9	NT	34.6	29.9	39.9
Magnesium	SW6010	1.00	mg/l	NS	NS	24.7	18.4	NT	24.2	21.2	27.1
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	NT	ND	ND	0.0220
Potassium	SW6010	1.00	mg/l	NS	NS	ND	ND	NT	ND	1.00	1.20
Sodium	SW6010	1.00	mg/l	NS	NS	14.9	12.9	NT	15.9	15.4	15.8
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0360	ND	NT	0.0360	0.138	ND
trans-1,2,-Dichloroethene	SW8010	1	ug/l	NS	NS	160(21)	ND	NT	ND	ND	ND
Chloroform	SW8010	1	ug/l	NS	100	2(2)	ND	NT	ND	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	1500(1200)	7	NT	30(28)	30(26)	18(20)
1,1,2-Trichloroethane	SW8010	1	ug/l	NS	32	20(13)	ND	NT	ND	ND	ND
Tetrachloroethene	SW8010	1	ug/l	2000	5	28(12)	ND	NT	ND	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	NT	ND	11(15)	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	ND	NT	3 BJ	NT	ND	ND
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	NT	3 BJ	NT	8 BJ	ND

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a: Values represent most stringent standard, criteria or action level. See Appendix I.

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TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-A-1GW BAFB-0503 03/22/89	13-A-1GW[R] BAFB-0531 04/20/89	13-A-2GW BAFB-0502 03/22/89	13-A-2GW[R] BAFB-0530 04/18/89	13-C-1SW BAFB-0461 02/13/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	600	525	470	389	170
Temperature	E170.1	N/A	deg C	NS	NS	19.1	20.0	19.5	20.5	17.0
pH	E150.1	N/A	pH	5-9	NS	7.00	7 [illegible]	7.17	6.97	7.85
Alkalinity - Total	SM403	1.0	mg/l	20	NS	143.2	NT	104.2	NT	54.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	174.7	NT	127.1	NT	65.9
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	349	NT	288	NT	169
Chloride	E325.3	1.0	mg/l	250	250	63.5	NT	48.5	NT	21.4
Fluoride	E340.2	0.050	mg/l	2	1.4	0.20	NT	0.23	NT	0.16
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	8.8	NT	5.0	NT	12.6
Sulfate	E375.4	1.0	mg/l	250	250	11.5	NT	14.2	NT	15.4
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	ND	NT	ND	NT	19.7
Lead	SW7421	0.0050	mg/l	.05	.05	ND	NT	ND	NT	0.0050
Calcium	SW6010	1.00	mg/l	NS	NS	42.3	NT	31.7	NT	12.3
Iron	SW6010	0.100	mg/l	.3	.3	ND	NT	ND	NT	0.161
Magnesium	SW6010	1.00	mg/l	NS	NS	28.3	NT	21.9	NT	8.04
Potassium	SW6010	1.00	mg/l	NS	NS	1.20	NT	ND	NT	3.20
Sodium	SW6010	1.00	mg/l	NS	NS	16.7	NT	14.7	NT	21.1
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0290	NT	0.0230	NT	0.0290
Trichloroethene	SW8010	1	ug/l	5	5	ND	NT	4(5)	NT	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	NT	1 BJ	NT	3 BJ	ND
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	NT	ND	NT	4 BJ	ND
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	NT	1 J	NT	4 J	6 BJ

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 13

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-1GW BAFB-0568 06/02/89	13-C-1GW[f] BAFB-0570 06/02/89	13-C-1GW[c] BAFB-0567 06/02/89	13-C-1GW[b] BAFB-0569 06/02/89	13-C-2GW BAFB-0562 06/01/89	13-C-3GW BAFB-0564 06/01/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	390	390	NT	NT	313	409
Temperature	E170.1	N/A	deg C	NS	NS	19.5	19.5	NT	NT	19.0	19.5
pH	E150.1	N/A	pH	5-9	NS	7.04	7.04	NT	NT	7.08	6.78
Alkalinity - Total	SM403	1.0	mg/l	20	NS	115.4	115.2	NT	NT	330.8	139.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	140.8	140.5	NT	NT	403.6	170.6
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	408	458	10.0	NT	320	393
Chloride	E325.3	1.0	mg/l	250	250	61.2	61.7	ND	NT	31.3	51.7
Fluoride	E340.2	0.050	mg/l	2	1.4	0.13	0.13	ND	NT	0.19	0.13
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	31.5	33.2	0.37	NT	24.5	7.5
Sulfate	E375.4	1.0	mg/l	250	250	40.5	38.8	ND	NT	14.4	18.1
Calcium	SW6010	1.00	mg/l	NS	NS	38.2	36.6	ND	NT	25.7	34.7
Magnesium	SW6010	1.00	mg/l	NS	NS	26.6	25.5	ND	NT	17.5	23.7
Potassium	SW6010	1.00	mg/l	NS	NS	1.10	1.10	ND	NT	ND	1.40
Sodium	SW6010	1.00	mg/l	NS	NS	15.9	15.4	ND	NT	13.2	16.5
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	ND	NT	0.0310	ND
trans-1,2,-Dichloroethene	SW8010	1	ug/l	NS	NS	80(20)	94(13)	ND	ND	ND	4
Chloroform	SW8010	1	ug/l	NS	100	1(1)	1(1)	3(2)	3(4)	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	880(800)	1000(830)	ND	ND	8(10)	69(62)
1,1,2-Trichloroethane	SW8010	1	ug/l	NS	32	21(15)	21(17)	ND	ND	ND	ND
Tetrachloroethene	SW8010	1	ug/l	2000	5	16(2)	16(15)	ND	ND	ND	2(2)
Toluene	SW8020	1	ug/l	14,300	100	20	4	2(1)	2(3)	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	ND	6 BJ	7 BJ	NT	5 J	5 J
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	ND	12	NT	7 J	4 J

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-4GW BAFB-0561 06/01/89	13-C-5GW BAFB-0566 06/02/89	13-A-1GW BAFB-0563 06/01/89	13-A-2GW BAFB-0565 06/01/89	13-C-1SW BAFB-0590 06/12/89	13-C-1SW[f] BAFB-0591 06/12/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	357	400	710	338	650	650
Temperature	E170.1	N/A	deg C	NS	NS	19.5	19.0	19.0	19.0	29.0	29.0
pH	E150.1	N/A	pH	5-9	NS	6.97	6.97	7.20	7.01	8.66	8.66
Alkalinity - Total	SM403	1.0	mg/l	20	NS	148.2	149.2	169.6	126.0	59.2	66.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	180.8	182.0	206.9	153.7	72.2	80.5
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	344	514	594	366	427	418
Chloride	E325.3	1.0	mg/l	250	250	34.8	48.5	129	41.8	71.8	70.8
Fluoride	E340.2	0.050	mg/l	2	1.4	0.12	0.090	0.11	0.14	0.17	0.18
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	10.9	26.7	7.2	6.1	74.0	66.0
Sulfate	E375.4	1.0	mg/l	250	250	12.6	71.0	7.6	30.9	48.7	50.4
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	ND	ND	ND	ND	56.3	63.6
Calcium	SW6010	1.00	mg/l	NS	NS	29.9	34.7	58.9	31.1	22.0	22.8
Iron	SW6010	0.100	mg/l	.3	.3	ND	ND	ND	ND	0.113	0.147
Magnesium	SW6010	1.00	mg/l	NS	NS	20.5	21.7	38.9	20.9	12.0	12.4
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.456	ND	ND	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.10	1.30	1.50	1.70	10.6	11.3
Sodium	SW6010	1.00	mg/l	NS	NS	14.5	47.9	21.1	16.8	70.1	72.3
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	ND	ND	0.0610	0.0380
Trichloroethene	SW8010	1	ug/l	5	5	37(28)	12(14)	11(11)	33(36)	ND	ND
1,1,2,2-Tetrachloroethane	SW8010	1	ug/l	NS	1	1	ND	ND	ND	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	ND	ND	ND	2	1	ND
1,2-Dichlorobenzene	SW8270	10	ug/l	620	130	ND	ND	ND	ND	3 J	4 J
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	5 J	5 BJ	5 J	4 J	8 BJ	7 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	ND	5 J	9 J	ND	2 J

NOTES: Results reported for detected analytes only.

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ND: analyte not detected.
NS: No standard criteria or action level currently exists.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

(): values listed in () are 2nd column confirmation values.

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-1SW[c] BAFB-0592 06/12/89	13-C-1SW[b] BAFB-0593 06/12/89
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	0.51	NT
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	9.0	NT
Methylene chloride	SW8010	5	ug/l	NS	NS	130(110)	170(160)
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 BJ	NT
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	3 J	NT

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 13

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-1GW BAFB-0665 09/21/89	13-C-2GW BAFB-0664 09/21/89	13-C-3GW BAFB-0663 09/20/89	13-C-4GW BAFB-0659 09/19/89	13-C-5GW BAFB-0657 09/19/89	13-C-6GW BAFB-0662 09/20/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	440	310	415	350	446	140
Temperature	E170.1	N/A	deg C	NS	NS	19.8	19.0	19.0	19.0	19.0	19.9
pH	E150.1	N/A	pH	5-9	NS	7.02	7.10	7.09	7.05	7.17	7.33
Alkalinity - Total	SM403	1.0	mg/l	20	NS	114.8	102.0	139.0	138.0	141.0	73.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	140.1	124.4	169.6	168.4	172.0	89.8
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	545	387	385	354	417	146
Chloride	E325.3	1.0	mg/l	250	250	65.0	33.0	60.0	35.0	46.0	4.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.13	0.19	0.16	0.13	0.12	0.26
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	31.3	23.6	8.6	12.0	26.2	5.3
Sulfate	E375.4	1.0	mg/l	250	250	26.0	14.0	15.0	13.0	37.0	3.5
Calcium	SW6010	1.00	mg/l	NS	NS	39.0	25.3	36.9	31.2	37.6	10.3
Iron	SW6010	0.100	mg/l	.3	.3	ND	ND	0.159	ND	ND	ND
Magnesium	SW6010	1.00	mg/l	NS	NS	27.0	17.2	25.0	21.3	23.5	7.03
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	ND	ND	0.436	0.0150
Potassium	SW6010	1.00	mg/l	NS	NS	ND	ND	ND	ND	ND	1.00
Sodium	SW6010	1.00	mg/l	NS	NS	15.6	12.5	16.4	14.6	26.4	10.7
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	ND	ND	ND	0.0210
trans-1,2,-Dichloroethene	SW8010	1	ug/l	NS	NS	ND	ND	6(4)	ND	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	ND	10(7)	99(82)	62(50)	14(17)	6(6)
Tetrachloroethene	SW8010	1	ug/l	2000	5	ND	ND	6(3)	4(2)	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	ND	2(0)	1(0)	ND	ND	ND
Diethylphthalate	SW8270	10	ug/l	NS	NS	ND	ND	ND	11	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	ND	6 J	7 J	ND	6 J	6 J
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	ND	ND	ND	ND	9 BJ

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.13 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-A-1GW BAFB-0661 09/20/89	13-A-2GW BAFB-0660 09/20/89	13-C-1SW BAFB-0666 09/21/89	OB-C-3GW BAFB-0672 09/26/89	OB-C-3GW[b] BAFB-0674 09/26/89	OB-C-4GW BAFB-0673 09/26/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	510	320	432	NT	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	18.0	17.8	24.0	NT	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.08	7.22	6.94	NT	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	173.6	119.6	72.0	NT	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	211.8	145.9	87.8	NT	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	485	326	398	NT	NT	NT
Chloride	E325.3	1.0	mg/l	250	250	97.0	35.0	60.0	NT	NT	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.11	0.14	0.29	NT	NT	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	8.1	8.6	36.9	NT	NT	NT
Sulfate	E375.4	1.0	mg/l	250	250	8.9	17.0	26.0	NT	NT	NT
Calcium	SW6010	1.00	mg/l	NS	NS	49.7	29.0	20.2	NT	NT	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	32.7	19.2	10.0	NT	NT	NT
Potassium	SW6010	1.00	mg/l	NS	NS	ND	ND	7.40	NT	NT	NT
Sodium	SW6010	1.00	mg/l	NS	NS	19.0	14.4	48.1	NT	NT	NT
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	ND	ND	ND	16(18)	ND
Trichloroethene	SW8010	1	ug/l	5	5	28(30)	20(23)	ND	3(2)	ND	3(2)
Tetrachloroethene	SW8010	1	ug/l	2000	5	3(1)	2	ND	ND	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	ND	1	ND	NT	NT	NT
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 J	ND	ND	NT	NT	NT

NOTES: Results reported for detected analytes only.
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ND: analyte not detected.
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B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 13

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-1GW BAFB-0681 11/13/89	13-C-2GW BAFB-0687 11/15/89	13-C-3GW BAFB-0683 11/14/89	13-C-3GW[f] BAFB-0684 11/14/89	13-C-3GW[f] BAFB-0685 11/14/89	13-C-3GW[b] BAFB-0686 11/14/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	450	296	406	406	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	18.5	18.0	17.0	17.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.21	7.24	7.04	7.04	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	NT	100.4	130.2	135.6	8.2	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	122.5	158.8	165.4	10.0	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	389	146	190	241	18.0	NT
Chloride	E325.3	1.0	mg/l	250	250	63.5	28.0	56.5	56.7	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.15	0.20	0.17	0.17	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	22.9	16.0	11.0	11.0	ND	NT
Sulfate	E375.4	1.0	mg/l	250	250	27.3	14.8	16.8	17.4	ND	NT
Barium	SW6010	0.100	mg/l	NS	NS	0.128	ND	ND	ND	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	42.1	27.5	38.1	39.0	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	27.9	17.8	25.1	25.7	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	16.8	13.2	16.8	17.3	ND	NT
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0293	ND	ND	ND	ND	NT
trans-1,2,-Dichloroethene	SW8010	1	ug/l	NS	NS	14(92)	ND	2(4)	2(4)	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	550(540)	6(6)	77(73)	74(73)	ND	ND
1,1,2-Trichloroethane	SW8010	1	ug/l	NS	32	10(19)	ND	ND	ND	ND	ND
Tetrachloroethene	SW8010	1	ug/l	2000	5	7(10)	ND	2(3)	1(3)	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	9(0)	3(0)	2(0)	10(1)	1(0)	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	8 BJ	ND	8 BJ	9 BJ	8 BJ	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	10 B	ND	ND	7 BJ	14 B	NT

NOTES: Results reported for detected analytes only.
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J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix 1.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	13-C-4GW BAFB-0703 11/21/89	13-C-5GW BAFB-0709 11/27/89	13-C-6GW BAFB-0680 11/13/89	13-A-1GW BAFB-0682 11/14/89	13-A-2GW BAFB-0702 11/20/89	OB-C-3GW BAFB-0737 12/11/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	342	425	143	530	345	177
Temperature	E170.1	N/A	deg C	NS	NS	17.5	18.5	19.5	17.5	19.0	18.0
pH	E150.1	N/A	pH	5-9	NS	7.19	7.18	7.37	7.26	7.29	7.10
Alkalinity - Total	SM403	1.0	mg/l	20	NS	NT	124.4	NT	174.2	83.8	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	151.8	NT	212.5	102.2	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	338	366	166	354	278	NT
Chloride	E325.3	1.0	mg/l	250	250	35.1	44.2	112	87.0	37.4	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.17	0.13	0.28	0.14	0.16	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	9.1	27.9	3.9	6.7	3.3	NT
Sulfate	E375.4	1.0	mg/l	250	250	11.9	24.1	3.9	9.3	14.5	NT
Barium	SW6010	0.100	mg/l	NS	NS	ND	ND	0.103	ND	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	30.7	38.7	11.4	52.0	29.7	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	20.8	24.2	7.28	32.7	19.5	NT
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.278	0.0183	ND	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	15.1	18.3	11.7	18.9	14.9	NT
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	0.0404	ND	ND	NT
Trichloroethene	SW8010	1	ug/l	5	5	45(46)	14(18)	4(5)	21(22)	17(25)	1(2)
Diethylphthalate	SW8270	10	ug/l	NS	NS	7 BJ	5 BJ	ND	ND	7 BJ	NT
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	9 BJ	9 BJ	11 B	10 B	8 BJ	NT
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	7 BJ	10 B	ND	ND	6 BJ	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	ND	11 B	ND	16	NT

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.13-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	OB-C-4GW BAFB-0738 12/11/89	OB-C-5GW BAFB-0741 12/12/89	13-C-1SW BAFB-0726 12/04/89	13-C-1SW[f] BAFB-0727 12/04/89	13-C-1SW[e] BAFB-0728 12/04/89	13-C-1SW[b] BAFB-0729 12/04/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	171	294	409	409	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	17.0	19.5	15.0	15.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.19	7.10	6.81	6.81	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	NT	NT	69.8	168.5	31.5	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	NT	85.2	205.6	38.4	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	NT	NT	415	352	12.0	NT
Chloride	E325.3	1.0	mg/l	250	250	NT	NT	62.8	65.7	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	NT	NT	0.26	0.31	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	NT	NT	75.8	66.9	0.40	NT
Sulfate	E375.4	1.0	mg/l	250	250	NT	NT	26.9	20.2	ND	NT
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	NT	NT	44.5	41.2	ND	NT
Lead	SW7421	0.0050	mg/l	.05	.05	NT	NT	ND	0.0417	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	NT	NT	23.4	24.0	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	NT	NT	11.0	11.2	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	NT	NT	8.38	8.54	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	NT	NT	52.6	54.2	ND	NT
Zinc	SW6010	0.0200	mg/l	0.110	0.012	NT	NT	0.0416	0.0296	ND	NT
Trichloroethene	SW8010	1	ug/l	5	5	1(3)	ND	ND	ND	ND	ND
Diethylphthalate	SW8270	10	ug/l	NS	NS	NT	NT	ND	ND	7 J	NT
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	NT	NT	9 BJ	ND	11 B	NT
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	NT	NT	7 BJ	5 BJ	15 B	NT

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Table 4.1.13-4
RANGES OF CONTAMINANTS DETECTED AT SITE 13

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SOIL BORINGS				
mercury	mg/kg	ND	0.24	2/29
TFH-gas	mg/kg	ND	30	1/29
toluene	mg/kg	ND	0.065	25/29
trans-1,2-dichloroethene	mg/kg	ND	0.21	4/29
trichloroethene	mg/kg	ND	0.21	6/29
1,1,2-trichloroethane	mg/kg	ND	0.062	2/29
chloroform	mg/kg	ND	0.006	3/29
bis(2-ethylhexyl) phthalate	mg/kg	ND	0.21	2/29
di-n-butyl phthalate	mg/kg	ND	5.4	11/29
butyl benzyl phthalate	mg/kg	ND	0.54	1/29
GROUNDWATER				
mercury	mg/l	ND	0.00080	1/30
trans-1,2-dichloroethene	ug/l	ND	160	7/35
1,1,2-trichloroethane	ug/l	ND	20	6/35
tetrachloroethene	ug/l	ND	28	11/35
trichloroethene	ug/l	ND	1500	33/35
chloroform	ug/l	ND	3	3/35
toluene	ug/l	ND	20	9/35
bis(2-ethylhexyl) phthalate	ug/l	ND	4	5/30

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.13.2 Sampling and Analytical Problems

4.1.13.2.1 Loss of Samples

There were no sample loss problems for Site 13 samples. A total of nine soil samples were resampled for mercury and percent moisture analysis due to violations of holding times. In addition, five soil samples missed holding times for mercury but were not resampled. Other scheduled analyses which were not completed due to laboratory handling problems were one soil sample for volatile organics (8240), one soil sample for TFH-diesel, and one groundwater sample for semivolatile organics (8270). The omission of these analyses is not considered critical to the final evaluation of site conditions for the following reasons:

- Four of the missing mercury analyses were from soil boring 13-C-5SB which had no evidence of positive contamination by other analytes within the same samples.

- The other missing mercury analysis was from soil boring 13-C-2SB, at a depth of 57.5-59.0 feet (51 feet vertically). This was the most highly contaminated soil sample collected at Site 13 (volatile organics). Other samples in the boring were also contaminated with volatile organics but did not contain detectable mercury.

- The missing TFH-diesel analysis was from soil boring 13-C-2SB, at a depth of 7.5-9.0 feet (7 feet vertically). That sample did not contain TFH-gas nor quantifiable levels of organic compounds. Additionally, no TFH-diesel was found in any of the 28 soil samples analyzed for TFH-diesel.

- The missing volatile organic analysis was from soil boring 13-C-5SB, from a depth of 47.5-49.0 feet (42 feet vertically). Volatile organic analyses were obtained for the samples above and below the missing sample.

- The missing semivolatile organic analysis was from well 13-C-3. The well will be resampled during

the three subsequent rounds of water sampling. No semivolatile organic compounds, other than bis(2-ethylhexyl) phthalate, were detected in the other groundwater samples.

4.1.13.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil and water samples collected at Site 13 contained several organic compounds that were probably laboratory or field induced false positive results. Many of the soil samples collected contained acetone and methylene chloride. These are common laboratory contaminants and were also found in some of the method blanks at similar concentrations.

Several soil and first round groundwater samples contained the semivolatile compounds bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, and n-nitrosodiphenylamine, which were also detected in the method blank. Bis(2-ethylhexyl) phthalate was also tentatively identified in the first round surface water sample and the associated method blank at similar concentrations.

In the second round groundwater sample from well 13-C-1, n-nitrosodiphenylamine was estimated below the LOQ in the field replicate sample, the equipment wash blank, and the method blank but not in the original normal environmental sample. For groundwater sample 13-C-5, n-nitrosodiphenylamine was estimated below the LOQ in both the sample and the associated method blank. For 13-C-1SW, n-nitrosodiphenylamine was estimated below the LOQ in the method blank, the original surface water sample, the field replicate, and the equipment wash blank. For 13-C-2 and 13-C-3 in the second round, n-nitrosodiphenylamine and bis(2-ethylhexyl) phthalate were detected below the LOQ in both the sample and the associated method blank. In the third round, groundwater sample 13-C-6 bis(2-ethylhexyl) phthalate was estimated below the LOQ in both the sample and the associated method blank.

In the second quarter, surface water sample 13-C-1SW methylene chloride was detected by 8010 analysis and confirmed in the second column confirmation for both the ambient condition blank and equipment wash blank, but was not detected in the original sample or in the field replicate. The ambient condition blank for the third quarter off base sample also contained methylene chloride when the original sample did not. This occurred a number of times in the second and

third sampling rounds and is believed to be due to contaminated Type 1 organic free water used for the blanks.

In the fourth quarter N-nitrosodiphenylamine and Di-n-Butylphthalate were detected below the LOQ in both the sample and the associated method blank in groundwater samples 13-A-2, 13-C-3 (field replicate), 13-C-4, and surface water sample 13-C-1. N-nitrosodiphenylamine was detected below the LOQ and in the associated method blank for 13-C-1, 13-C-3, and 13-C-5. It was detected in the method blank and at the LOQ in 13-A-1 and in the blank for 13-C-6. Di-N-Butylphthalate was detected below the LOQ in both the sample and the associated method blank in 13-A-2 and 13-C-4. Bis(2-Ethylhexyl) Phthalate was detected in the replicate sample and the associated method blank for 13-C-3 and the equipment wash blank for 13-C-3.

Toluene was detected in most of the soil samples. This occurred for samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent suggests that it is a false positive result. For soil replicate QC samples from other sites on base in which toluene was detected, duplication of the toluene result generally was not good. This is another indication that the toluene is probably not a true contaminant present at the site.

Chromium and iron, among other metals, were detected in all soil samples. For 5 of the 29 soil samples, chromium and iron were also detected in the associated method blank. This does not mean, however, that chromium and iron should be considered false positive results for these samples. They are naturally occurring metals which are consistently found in soil samples at higher concentrations than detected in the blank.

4.1.13.2.3 Analytical Results Obtained Under Out-of-Control Conditions

Third quarter off base well samples OB-C-3 and -4 both exceeded the allowable surrogate spike percent recovery range of 70 to 130 percent for 8010 analyses on the first column.

The 8020 analysis trifluorotoluene surrogate spike for the 13-C-2 sample and 13-C-3 ambient condition blank was 135 percent which is outside the acceptable range of 70 to 130 percent surrogate spike recovery. The 8270 semivolatile organics analysis for surface water sample 13-C-1 had

several surrogate spike recoveries below the acceptable range: Nitrobenzene-d5 was 28 percent (below the 35 to 144 percent range), 2-Fluorobiphenyl was 42 percent (below the 43 to 116 percent range), and 2-Fluorophenol was 19 percent (below the 21 to 100 percent range).

4.1.13.2.4 Corrective Actions Applied to Out-of-Control Events

The third quarter off base samples were also run using the second column, giving surrogate spike recoveries of 94 percent in each case and TCE concentrations of 2 ug/l, which are used in this report.

4.1.13.3 Significance of Findings

Soil

Soil sampled at Site 13 contained TFH-gas components in one sample. The TFH-gas was detected in the 28-foot sample from 13-C-5SB at 30 mg/kg, with an LOQ of 25 mg/kg. Because TFH-gas was detected at only one location, and because the analysis for volatile organics did not detect any common gasoline components (other than the probable false positive toluene), this result may not represent real contamination. The LUFT cleanup standard computed for TFH-gas at this sample location is 100 mg/kg.

Soil sampled from 13-C-2SB contained TCE and/or trans-1,2-DCE in samples from 18 feet, 28 feet, 48 feet, and 58 feet (actual vertical depths of 16, 24, 42, and 50 feet). Chloroform and 1,1,2-trichloroethane were also detected in the 58-foot sample (50 feet vertically). Concentrations for these four compounds ranged from the LOQ (0.006 mg/kg) to 0.21 mg/kg for both DCE and TCE at 58 feet (50 feet vertically). The DHS TTLC for TCE is 2,040 mg/kg. DHS TTLC values are not available for the other organic compounds.

Several other volatile and semivolatile organic compounds were detected in boring 13-C-2SB as well as other borings, including the background boring. These included acetone, methylene chloride, toluene, and two phthalate compounds. Acetone and methylene chloride are common laboratory contaminants and were detected in laboratory blanks. The phthalates were detected generally at or below the detection limit and bis(2-ethylhexyl) phthalate was detected in the lab blanks.

Organic compounds were detected in other borings at various locations. Aside from the probable false positive results discussed above, chloromethane, chloroform, TCE, and 2-butanone were detected in boring 13-C-3SB (northeast area), and TCE was reported at the detection limit in one sample from boring 13-C-5SB (southern area). All of these compounds were detected at or below the detection limit, and/or were detected in the lab blank. Therefore, the only boring with definite contamination (TCE and trans-1,2-DCE) is the boring in the northwest area of the landfill (13-C-2SB).

Metals detected in the soil, other than mercury, are those that may commonly occur in sediments, and no trends were observed that would indicate the presence of contamination by metals leaching from the landfill. This is to be expected because the predominant clays at Site 13 would tend to attenuate metals in solution. Mercury was detected in two samples (7 and 16 feet vertically) from 13-C-3SB at 0.24 and 0.11 mg/kg. The TTLC for mercury is 20 mg/kg. No metals were detected at levels greater than their respective California DHS TTLCs.

Groundwater

Groundwater encountered during installation of Stage 2-1 wells at Site 13 indicated that the uppermost permeable zone generally occurred under confined conditions. Water levels rose in the finished wells above the level where saturated soils were first encountered during drilling. The groundwater potentiometric surface at Site 13 is at an elevation of approximately 5 to 10 feet above NVGD, indicating that water levels have risen substantially over the past 3 years. Despite this rise, there was a vertical head difference of approximately 6 feet (downward) across a 20-foot-thick clay bed located between the first and second uppermost permeable zones.

For all eight wells sampled at Site 13 during the four quarter sampling rounds, general water quality parameters such as specific conductivity, total dissolved solids, alkalinity, and pH were similar and did not indicate the presence of contamination. Other than calcium, potassium, magnesium, manganese, sodium, and zinc, no metals were detected in the groundwater, except for the upgradient well 13-C-5. There mercury was detected at 0.0008 mg/l in the first round, slightly above the LOQ of 0.0005 mg/l. Mercury was not detected in later rounds. The DHS primary MCL for mercury is 0.002 mg/l. Manganese was detected in well 13-C-5 in all

four sampling rounds and was above the secondary MCL of 0.05 mg/l in the second, third, and fourth rounds.

Groundwater at Site 13 contains chlorinated organic solvents. TCE, trans-1,2-DCE, 1,1,2-trichloroethane (1,1,2-TCA) and tetrachloroethene were detected in all four sampling rounds at well 13-C-1. This well is located near the northwest edge of the landfill near soil boring 13-C-2SB which had TCE detected in soil samples. The concentration of TCE dropped consistently in quarterly samples from 1,500 to 880 to 620 to 550 ug/l while the other chemicals showed no distinct trend in well 13-C-1. TCE was detected in all wells at Site 13 including deep well 13-C-2 and background well 13-C-5 during all four sampling rounds, with the exception of 13-A-1 in the first round. Organic chemical concentrations increased in successive rounds in wells 13-A-1, 13-C-3, and 13-C-4 while 13-A-2, deep well 13-C-2, and background well 13-C-5 showed no distinct pattern. The EPA drinking water standards MCL of 5 ug/l for TCE was exceeded in all wells sampled at Site 13 in the second and third sampling rounds. The presence of TCE at downgradient well 13-C-6 at 6 ug/l in the third quarter and 4 ug/l in the fourth quarter indicates that organic chemicals may have traveled down gradient from Landfill No. 1 at least as far as well 13-C-6. TCE was also detected at 2 ug/l in the third quarter sample and 1 ug/l in the fourth quarter sample from an off base well 2,200 feet northwest of Site 13.

Trans 1,2-DCE was detected in all four rounds at 13-C-1 at similar concentrations based on the second column confirmation data. However, the only other time it was detected was in the second round at 13-C-3 at 6 ug/l and the fourth round at 2 ug/l. No MCL is available for trans 1,2-DCE. 1,1,2-TCA was detected in all four rounds at 13-C-1 at similar levels, all of which are below the EPA drinking water standards MCL of 32 ug/l. 1,1,2-TCA was not detected in other wells at Site 13.

Tetrachloroethene was detected in all four rounds at 13-C-1 at similar levels, all of which exceeded the EPA drinking water standards MCL of 5 ug/l. In the second and fourth rounds, tetrachloroethene was also detected in 13-C-3 below the MCL and in the third round at 13-C-3 above the MCL and in 13-C-4 below the MCL.

Surface Water

Surface water sampled at Site 13 generally has the same characteristics as the surface water sampled at Site 6

(upstream). Surface water sampled adjacent to Site 13 was free of organic contaminants. The general water quality parameters of specific conductivity, alkalinity, bicarbonate, total dissolved solids, and chloride all had lower values than did the groundwater samples, which is a pattern typical of surface water samples from Beale AFB. Nitrate increased dramatically from 12.6 in the first round to 74.0 mg/l in the second, above the EPA primary drinking water standard MCL of 45 mg/l for nitrate, dropped below the MCL to 36.9 mg/l in the third round, and rose to 75.8 mg/l in the fourth round. COD in round one was measured at 19.7 mg/l, rose to 56.3 mg/l in the second round, dropped below the 7.0 mg/l LOQ in the third, and rose to 44.5 mg/l in the fourth round. There is no MCL for COD. Iron was detected in the surface water in the first and second rounds, but not in the groundwater. The only other metal in the surface water besides calcium, potassium, magnesium, sodium, and zinc was lead, which was found in the first round at the LOQ of 0.005 mg/l and in the field replicate sample in the fourth round at 0.0417 mg/l. The DHS MCL for lead is 0.050 mg/l. The EPA MCL goal is 0.020 mg/l.

Geophysics

A geophysical investigation was conducted on the eastern side of Site 13 to determine if other trenches existed. Seven areas of buried metal were delineated, as illustrated in Figure 4.1.13-16. The ground surface was irregular with depressions indicative of previous excavation and backfilling. Often waste disposal areas were associated with these depressions.

4.1.13.3.1 Zones of Contamination

It is concluded that Site 13 is affecting the environment in the form of chlorinated volatile organic compounds. Soil has been affected in the northwestern area of the site. TCE and 1,2-DCE were detected in the 58-foot sample (50 feet vertically, deepest in the boring) in 13-C-2SB, so the lower extent of the soil contamination cannot be determined. Groundwater in the same area (well 13-C-1) has been contaminated with the same compounds plus 1,1,2-TCA and tetrachloroethene. TCE was also detected at much lower concentrations, but above the EPA MCL, in all other wells at Site 13, including the up-gradient well, deep well 13-C-2, and the new well 13-C-6 about 1,000 feet downgradient of the landfill. The well at the off base farm, about 2,200 feet downgradient of Site 13, had 2 ug/l TCE in the third round and 1 ug/l in the fourth. Neither the extent nor source of

groundwater contamination have been fully determined in the Site 13 area.

4.1.13.3.2 Contaminant Migration

Groundwater at Site 13 is flowing to the northwest and appears to have a downward potential flow. Contaminants detected in the groundwater at Site 13 will migrate in this direction.

Hutchinson Creek is probably a "losing stream." Therefore, water quality in the creek may not be affected by contaminants from the landfill unless those contaminants move laterally through the unsaturated zone soil or are transported into the creek by surface runoff. Movement of percolating water in the vadose zone is normally vertical; lateral movement is not expected in the vadose zone at Site 13.

4.1.13.3.2.1 Potential to Move Off Site and Off Base

Groundwater samples containing 6 ug/l of TCE were taken in the third quarter and with 4 mg/l TCE in the fourth quarter from downgradient monitoring well 13-C-6 located 1,000 feet northwest of well 13-C-1 and about 500 feet east of the base boundary. This indicates that TCE may have migrated to within 500 feet from the base boundary at concentrations exceeding MCLs. Groundwater in the vicinity of Site 13 has an estimated rate of flow of about 360 feet per year as noted below. Therefore, it is likely that groundwater containing TCE will move or has moved downgradient towards the base boundary. Samples taken during the third and fourth quarters from a farm well about 2,200 feet northwest of Site 13 contained 2 and 1 ug/l TCE, respectively, although the continuity of the plume can only be inferred based on the available data.

4.1.13.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Linear groundwater velocity can be approximated using the equation $v = Ki/n$, where v = average linear groundwater velocity, K = hydraulic conductivity, i = groundwater gradient, and n = effective porosity. For Site 13, a representative value of the hydraulic conductivity can be derived using an average hydraulic conductivity of 28 feet per day as determined in the 72-hour pump test conducted in well 19-C-4. The regional groundwater gradient (i) in the vicinity of Site 13, taken from Plate 3, is $i = 0.007$ foot per

foot to the northwest. The estimated effective porosity for permeable sediments, through which groundwater will flow preferentially, is 20 percent (0.20). Using these values gives:

$$v = Ki/n = (28 \text{ ft/day} \times 0.007/0.20) = 0.98 \text{ ft/day},$$

or for an estimated yearly velocity of:

$$0.98 \text{ ft/day} \times 365 \text{ days/yr} = 360 \text{ ft/yr}$$

The gradient, and thus rate of flow, may steepen nearer the agricultural wells west of the base with a resulting increase in groundwater velocity.

4.1.13.3.2.3 Time of Travel to Receptors

The nearest potential downgradient receptor is the farm 2,200 feet northwest of Site 13. Using only the average linear groundwater velocity, the estimated travel time for groundwater from Site 13 to the residence is approximately 6 years. However, many factors affect contaminant transport in groundwater, and most of these factors are not well defined in this project. Some of these factors act to shorten and some to lengthen the travel time of a contaminant in groundwater. Since it is not known when contaminants entered the groundwater at Site 13, estimates cannot be made of how far migration has progressed or where the leading edge of the plume is located.

4.1.13.3.2.4 Applicability of Solute Transport Models

A solute transport program could not effectively model Site 13 due to the nonhomogeneous soil deposits typical of Beale AFB.

4.1.13.3.2.5 Expected Spatial and Temporal Variations in Concentration

Based on observations through the four rounds of Stage 2-1 sampling, the spatial variation in TCE groundwater contamination has not changed significantly. TCE has also been detected at two additional downgradient sampling points (13-C-6 and the off-base farm), although the continuity of the plume between these points can only be inferred. Since the source of TCE contamination has not been identified, accurate estimates of temporal variations cannot be made.

4.1.13.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.14 DISCUSSION OF RESULTS FOR SITE 14: TRANSFORMER DRAINAGE PIT

During previous investigations conducted at Site 14 (Aero-Vironment, 1987), contamination was identified in 2 of 12 soil samples. Groundwater was not sampled at this site. The Air Force determined that no IRP activities would take place at this site during the Stage 2-1 Remedial Investigation. If it is determined that additional IRP actions are necessary, these actions will be included in future IRP tasks. If it is determined through risk assessment that no further action will be necessary, a Record of Decision will be prepared for the site.

4.1.15 DISCUSSION OF RESULTS FOR SITE 15: LANDFILL NO. 3

Site 15 is a currently active and permitted Class III landfill. Approximately 35 acres have been used to date, although 184 acres have been allocated for eventual use. The trench and fill method of operation is used to bury refuse. Trenches are oriented east-west, and the disposal area boundaries are well defined. The landfill at Site 15 does not have an engineered liner system or leachate collection system.

Landfill No. 3 has an ultimate capacity of 3.8 million cubic yards. Approximately 63,000 cubic yards of compacted domestic garbage and refuse have been accepted annually since 1980. Total waste in the landfill is currently estimated to be 630,000 cubic yards with a remaining capacity of approximately 3.2 million cubic yards. This gives a 40- to 45-year life expectancy for Landfill No. 3, allowing for increasing annual waste volumes.

Trenches used for waste disposal are about 35 feet wide, 15 feet deep, and 300 feet long. A minimum 6-inch compacted soil lift is placed over the waste material at the close of each operating day. No waste is exposed, and the cover is graded to prevent erosion and to keep water from ponding. A diversion ditch has been graded on the uphill side of the trenches to prevent surface water from running into the open pits.

One vertical background and four angled soil borings were drilled at Site 15 during the Stage 2-1 study. The four existing monitoring wells were sampled quarterly. Soil gas samples were collected from vapor wells constructed both above a capped landfill trench and adjacent to the landfill.

No organic compounds were found in the groundwater samples except the single detection of TFH-diesel at 0.090 mg/l in the fourth quarter sample from well 15-A-4. Arsenic was detected in the first quarter at the 0.005 mg/l LOQ in two samples and at 0.006 mg/l in a third quarter sample. No surface water samples were collected at Site 15.

The soil gas sample from the backfilled trench contained organic compounds, 16 percent methane and 2 percent oxygen. The OVA analysis of air pumped from the four adjacent vapor wells did not detect any vapor concentrations considered different from potential naturally occurring soil vapors.

4.1.15.1 Presentation of Results

The following section presents field investigation results at Site 15. The discussion focuses on the geology and hydrogeology at the site and presents the results of chemical analyses performed on groundwater and soil samples.

4.1.15.1.1 Site Geology

Evaluation of the geology at Site 15 (Landfill No. 3) is based on boreholes drilled during the current Stage 2-1 investigation, and on wells installed during the previous Phase II, Stage 1 investigation. During the current investigation, four angle borings were drilled to a nominal 60-foot depth (52 feet beneath the ground surface), and one vertical background boring was drilled to a 50-foot depth. During the previous Phase II, Stage 1 investigation, four monitoring wells were constructed.

The well and borehole locations are shown in Figure 4.1.15-1. Soil boring logs are provided in Appendix D. Cross-sections through the soil borings and monitoring wells are located in Figure 4.1.15-1 and are shown in Figures 4.1.15-2, 4.1.15-3, and 4.1.15-4.

Near-surface materials at Site 15 appear to be predominantly fine-grained. However, at greater depth these give way to mainly coarse-grained materials. Below an elevation of about 100 feet NVGD on the western and northern side of the landfill, and 80 feet NVGD on the eastern side, the borings contacted sands and gravels to their total depth. Well 15-A-4 encountered a consolidated shale at a depth of 95 feet (45 feet NGVD). The other wells were all identified as being completed in unconsolidated materials (AeroVironment, 1987). However, the subangular gravels and shale fragments identified in well 15-A-3 at a depth of 87 feet (48 feet NGVD) may have originated from the top of the consolidated materials. Wells 15-A-3 and 15-A-4 were found to have low yields during sampling. In addition, well 6-C-1, the easternmost well at Site 6 about 1,500 feet west of Site 15, is completed in consolidated materials.

Surface soils at Site 15 are mapped as belonging to the Redding-Corning gravely loams, formed in alluvium from mixed sources (SCS, 1985). These surfaces are associated with the Laguna Formation and were so mapped in the vicinity of Site 15 by the U.S. Geological Survey (Page, 1980). Volcanic fragments described below 80 feet NGVD in well 15-A-1 and dark gray shale at 42 feet NGVD in well 15-A-4 may signify contact with volcanic rock from the Sierra Nevada, the geologic unit that lies under the Laguna Formation in the stratigraphic section at Beale AFB.

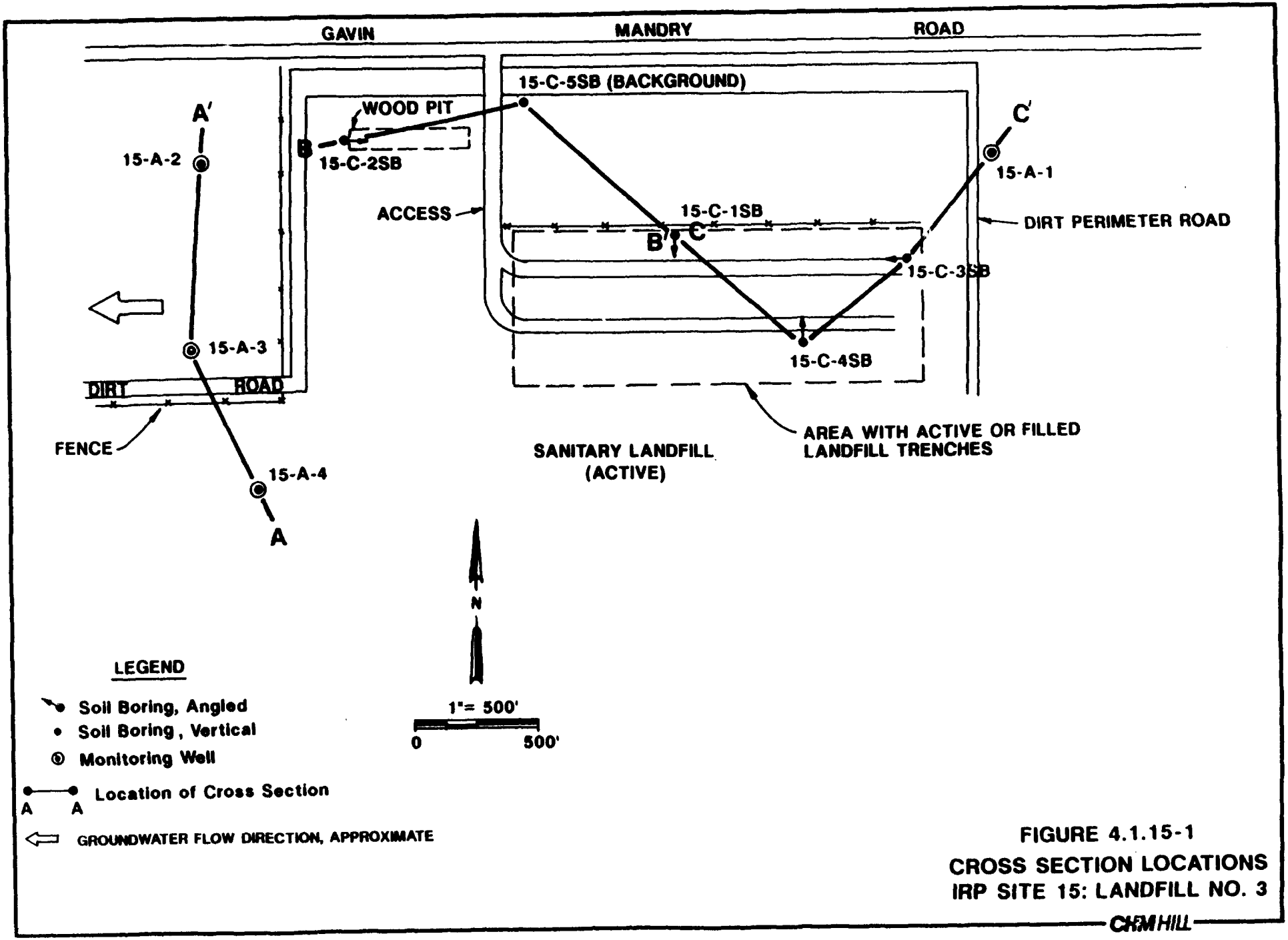
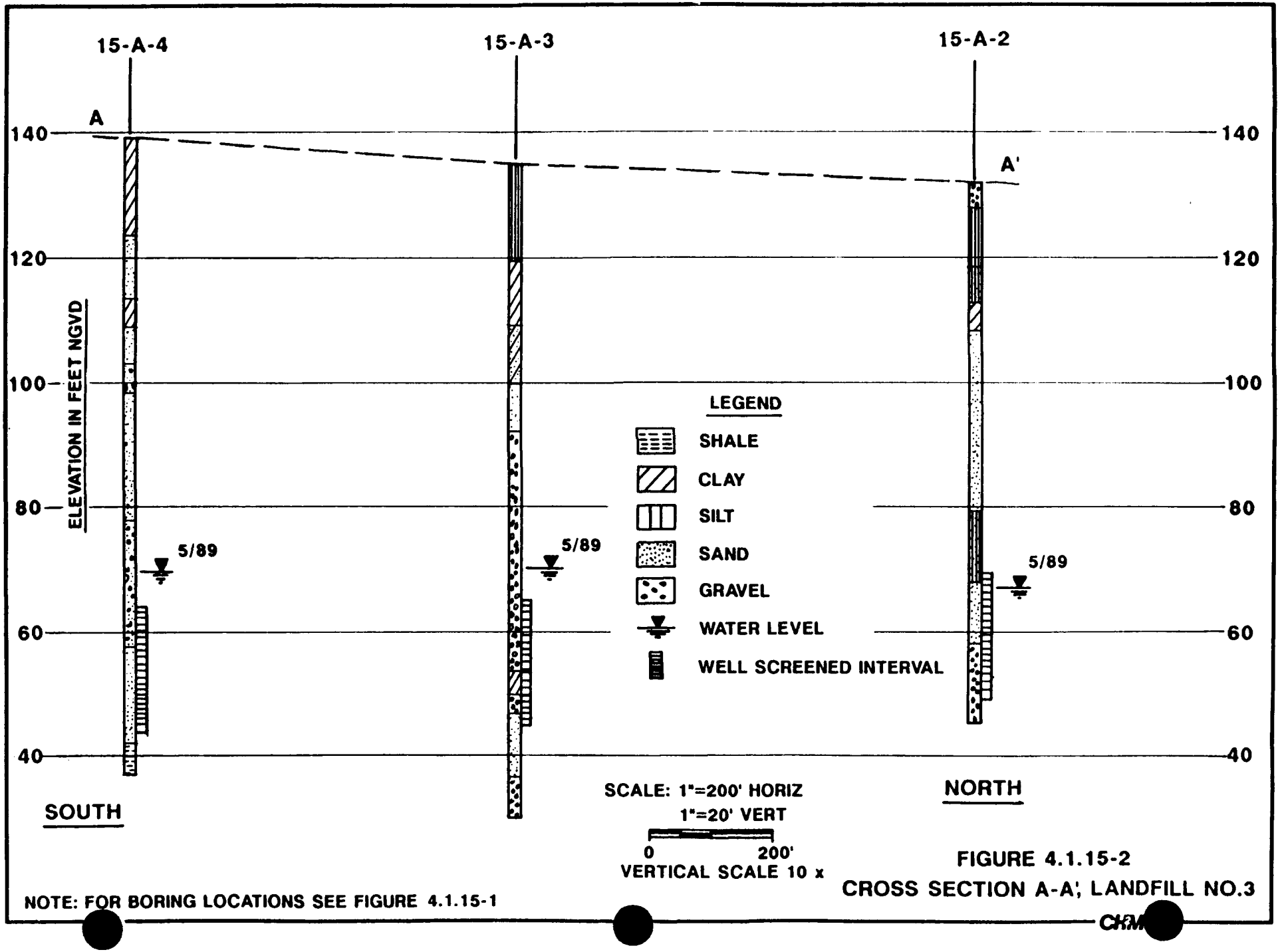


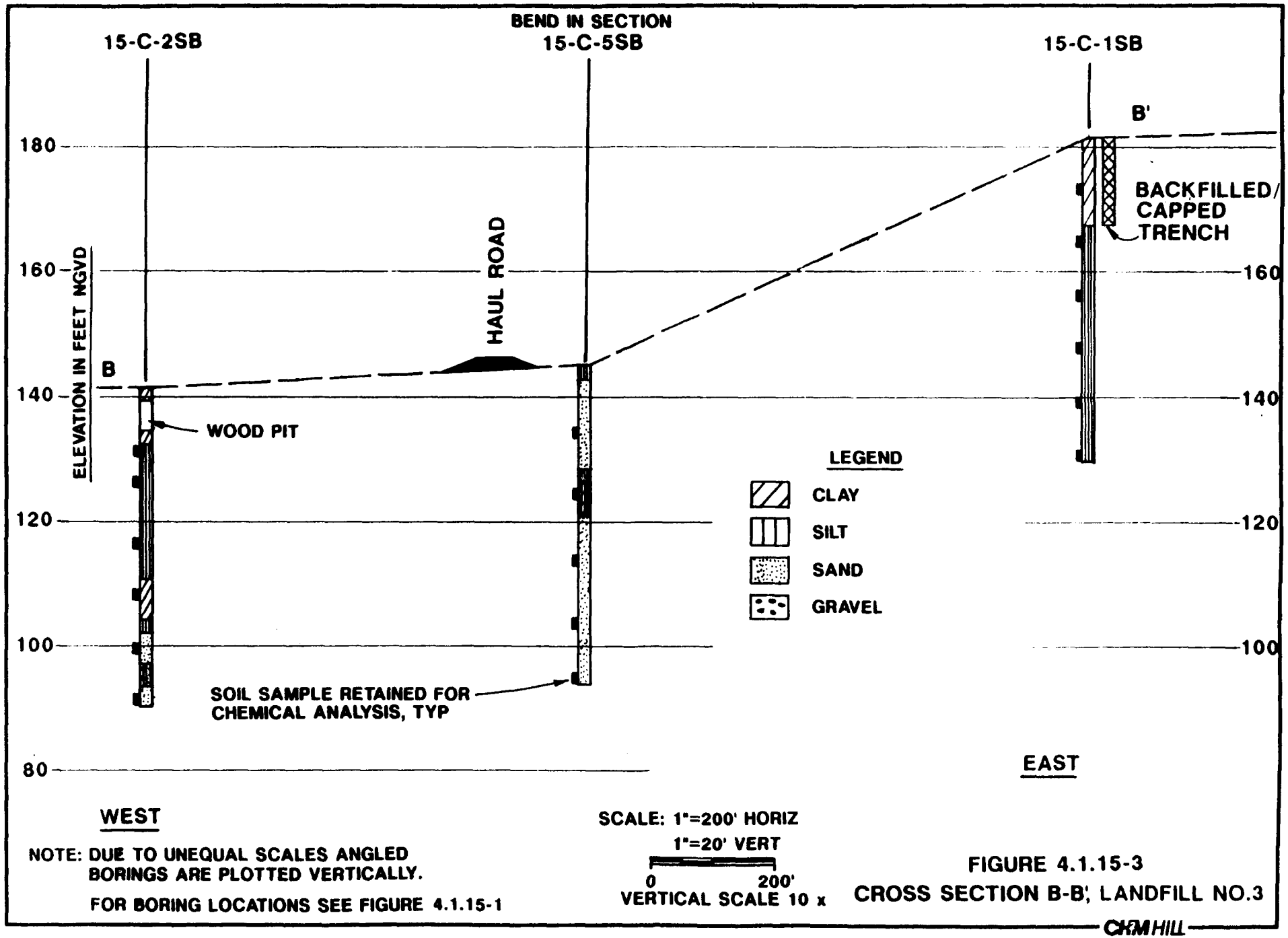
FIGURE 4.1.15-1
CROSS SECTION LOCATIONS
IRP SITE 15: LANDFILL NO. 3

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NOTE: FOR BORING LOCATIONS SEE FIGURE 4.1.15-1

FIGURE 4.1.15-2
CROSS SECTION A-A', LANDFILL NO.3

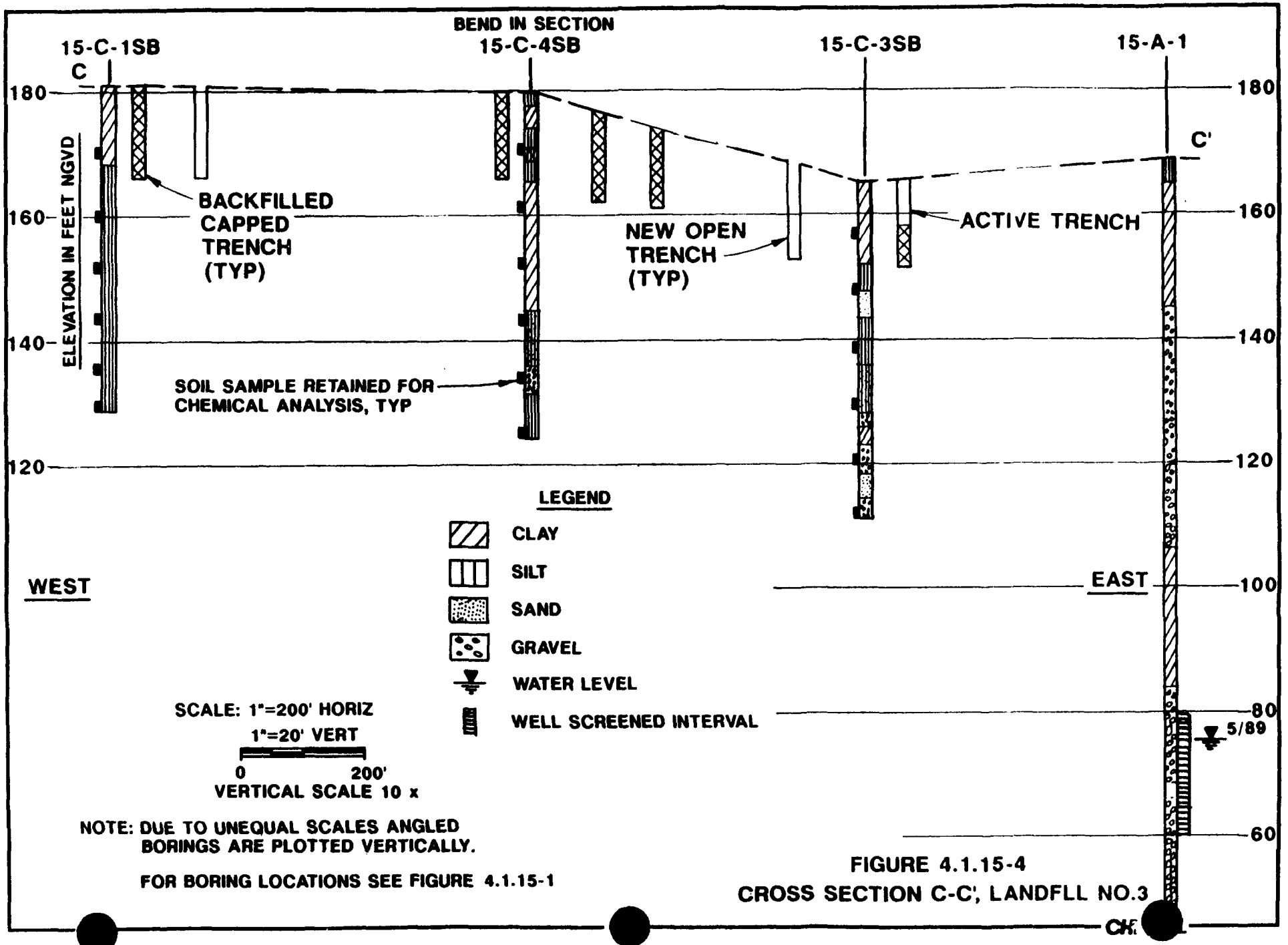


NOTE: DUE TO UNEQUAL SCALES ANGLED BORINGS ARE PLOTTED VERTICALLY.

FOR BORING LOCATIONS SEE FIGURE 4.1.15-1

FIGURE 4.1.15-3
CROSS SECTION B-B', LANDFILL NO.3

CH2M HILL



NOTE: DUE TO UNEQUAL SCALES ANGLED BORINGS ARE PLOTTED VERTICALLY.

FOR BORING LOCATIONS SEE FIGURE 4.1.15-1

FIGURE 4.1.15-4
CROSS SECTION C-C', LANDFLL NO.3

4.1.15.1.2 Site Hydrogeology

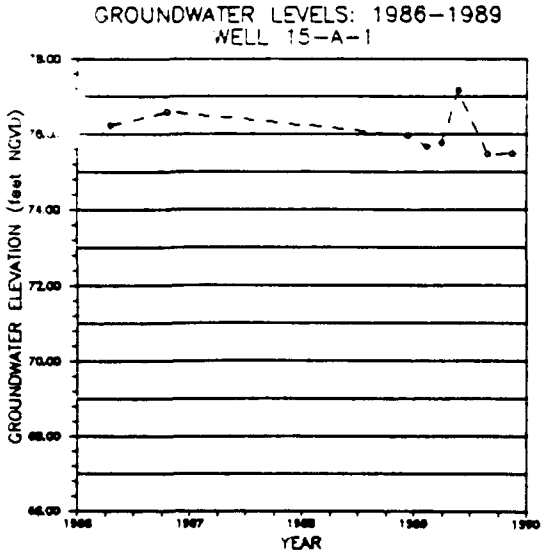
Groundwater at Site 15 appears to be unconfined. All the wells are described as being screened in sands and gravels, including well 15-A-4, which is screened above a shale unit. Wells 15-A-1 and 15-A-2 are screened across the water table. Water levels in wells 15-A-3 and 15-A-4 lie slightly above the screened intervals in sands and gravels.

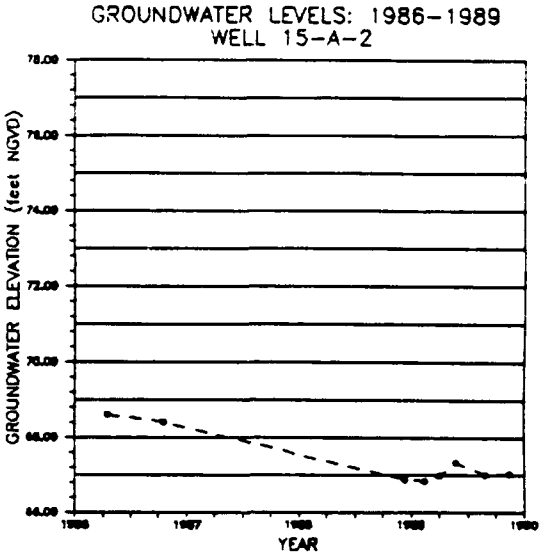
Groundwater levels at the monitoring wells near Landfill No. 3 were measured between April 1986 and November 1989 (Table 4.1.15-1 and Figure 4.1.15-5). May 1989 groundwater elevation contours in the southern part of Beale AFB are plotted on Figure 4.1.15-6 while regional contours are plotted on Plates 3 and 4. The average groundwater gradient at Landfill No. 3 in March 1989 was approximately 0.003 foot per foot to the west. However, downgradient from Site 15 the regional gradient is about 0.007. Groundwater levels in 1986 and 1989 are consistently lower in downgradient monitoring well 15-A-2 than in downgradient wells 15-A-4 and 15-A-3.

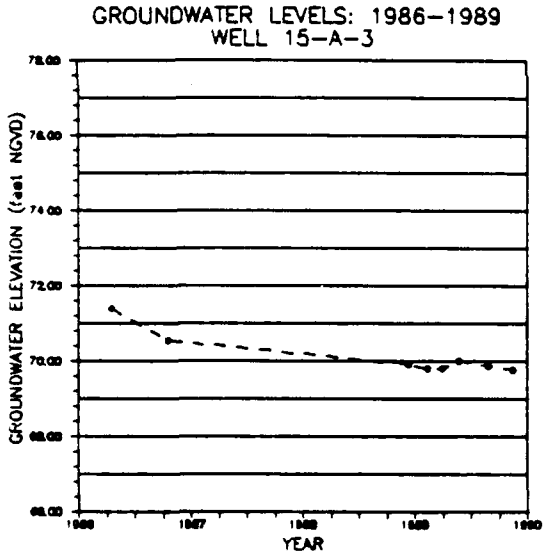
Table 4.1.15-1
GROUNDWATER ELEVATIONS: SITE 15
(FEET NGVD)

Well	Screened Interval	April 1986	Oct. 1986	Dec. 1988	Feb. 1989	March 1989	May 1989	Aug. 1989	Nov. 1989
15-A-1	81 to 61	76.23	76.58	75.96	75.67	75.77	77.16	75.47	75.48
15-A-2	71 to 51	68.60	68.40	66.86	66.82	66.97	67.32	67.00	67.02
15-A-3	65 to 45	71.40	70.55	69.92	69.81	69.82	70.01	69.88	69.78
15-A-4	64 to 44	72.60	70.68	69.89	69.74	69.70	69.88	69.93	69.82

Groundwater levels have remained stable or fallen slightly at Landfill No. 3 between April 1986 and November 1989. The fall in groundwater levels indicates that Landfill No. 3 is outside the immediate influence of the recovering groundwater depression to the west of Beale AFB. The hydrographs presented in Figure 4.1.15-5 are typical of wells located in the eastern part of Beale AFB.







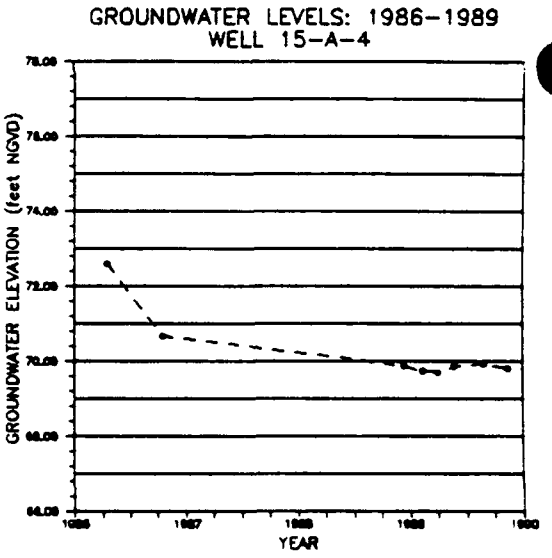


FIGURE 4.1.15-5
MONITORING WELL HYDROGRAPHS
SITE 15: LANDFILL NO. 3

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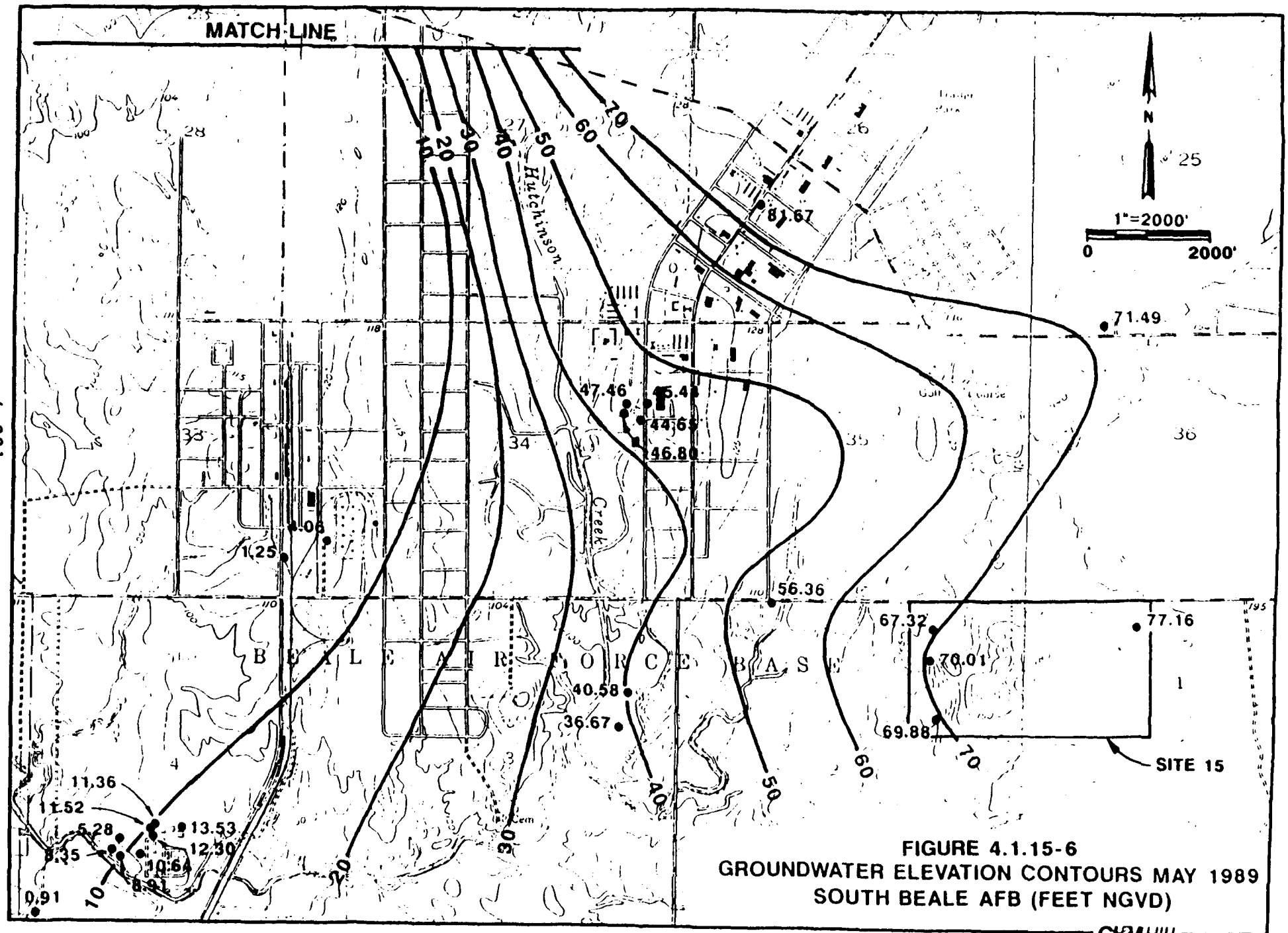


FIGURE 4.1.15-6
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGVD)

CH2M HILL

No aquifer testing was performed at Site 15. However, a 72-hour multiple well pump test was conducted at Site 19 located 7,000 feet northwest of Site 15. Site 19 is in a hydrogeologic setting and in sediments similar to those downgradient from Site 15. Plots of the pump test data and a discussion of aquifer testing methodology are provided in Appendix E. The average value of transmissivity derived from the 72-hour drawdown and recovery data from pumping well 19-C-4 was 1,700 square feet per day, while the average value of hydraulic conductivity was 28 feet per day (0.01 cm/sec). An estimate of average linear groundwater velocity can be made by substitution into Darcy's Law. Using the average value of hydraulic conductivity of 28 feet per day, the regional hydraulic gradient of 0.007, and an estimated effective transport porosity of 0.20, the groundwater velocity is about 0.98 foot per day or 360 feet per year.

4.1.15.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.15.1.4 and in Appendix A.

Soil

A total of 29 soil boring samples were collected at Site 15: 5 from a vertical background boring and 24 from the 4 angle borings under landfill trenches. These samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7470/7471), soil moisture (ASTM D2216), and TFH-diesel and -gas (California method).

Toluene was detected in 26 of the 29 soil samples at up to 0.32 mg/kg. No other volatile organic compounds were detected.

Semivolatile organic chemicals detected in soil samples at Site 15 were below the LOQ. Bis(2-ethylhexyl) phthalate was detected in six samples at up to 0.32 mg/kg. Di-n-butyl phthalate was detected in eight samples at up to 0.34 mg/kg. N-nitrosodiphenylamine was detected in three samples at up to 0.057 mg/kg.

ICP metals were detected in soils at Site 15 at concentrations similar to background levels. Mercury was not detected in any sample. The following metals were detected in only one sample at greater than two standard deviations higher than background levels: barium, iron, manganese, magnesium, sodium, and zinc. Iron was detected in two samples at more than two standard deviations above background. In boring 15-C-3SB, TFH-gas was detected at 120 mg/kg at 18 feet (16 feet vertically), TFH-diesel at 30 mg/kg at 28 feet (24 feet vertically), and TFH-gas at 77 mg/kg at 38 feet (32 feet vertically). TFH-gas was found at 69 mg/kg at 30 feet in background boring 15-C-5SB.

Groundwater

No groundwater contamination was detected in the April, and October 1986 sampling rounds of the Phase II, Stage 1 investigation (AeroVironment, 1987).

Through four quarterly rounds of water sampling at Site 15, 16 groundwater samples have been collected. Analyses performed for water samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), arsenic (7060), lead (7421), mercury (7470/7471), selenium (7740), water quality parameters, TFH-diesel and -gas (California method), and COD.

No organic chemicals were detected in the first three quarters of groundwater sampling at Site 15. Arsenic was detected at the LOQ of 0.005 ug/l in downgradient wells 15-A-3 and 15-A-4 in the first sampling round. However, arsenic was not detected in the second or fourth quarterly sampling and was only detected in 15-A-4 at 0.006 mg/l in the third quarter. TFH-diesel was only detected in the fourth quarter in well 15-A-4 at 0.090 mg/l. Mercury, lead, selenium, and TFH-gas were not detected in groundwater at Site 15. COD was detected only in the 15-A-1 third round sample at 7.4 mg/l.

Groundwater is a sodium bicarbonate to sodium-magnesium bicarbonate type at Landfill No. 3. Total dissolved solids ranged from 198 to 252 mg/l in the first three sampling rounds. Groundwater quality parameters did not change significantly in the second, third, and fourth sampling rounds.

Surface Water

No surface water was sampled at Landfill No. 3. The nearest surface stream is a tributary to Hutchinson Creek, approximately 1,500 feet to the west. It was sampled at Site 6.

Landfill Gas

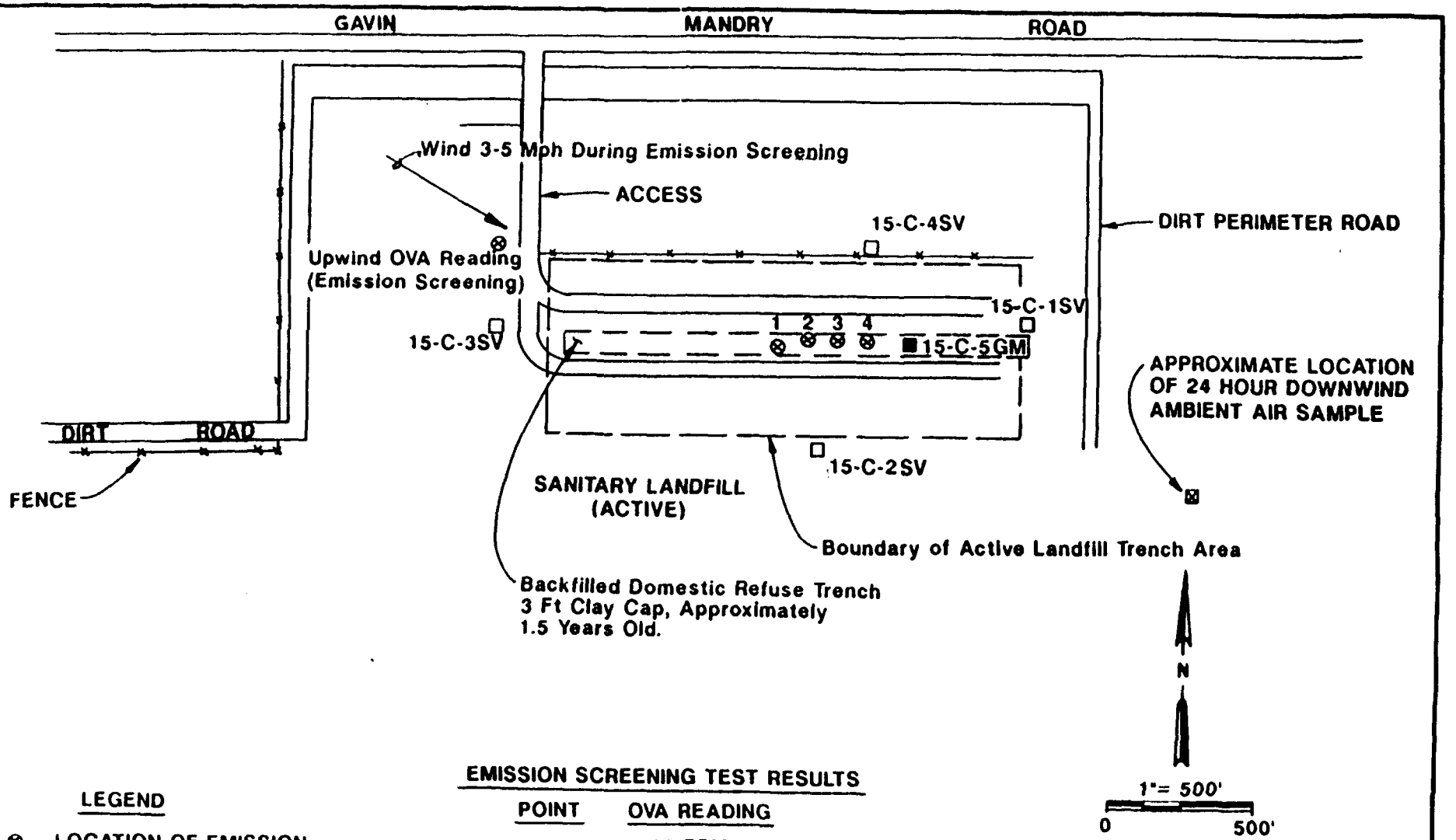
Landfill gas monitoring was completed at Site 15 in compliance with the California Air Resources Board Testing Guidelines for Active Solid Waste Disposal Sites (CARB, 1987).

Landfill emission screening was performed with an OVA calibrated to methane. The background concentration upwind of the landfill was measured at 8 ppm. During the screening walkover of the center acre of Landfill No. 3, four OVA readings above 50 ppm, the CARB screening guideline, were observed with the probe held within 3 inches of the surface. Concentrations of 100, 80, 70, and 60 ppmv were measured. Figure 4.1.15-7 shows the locations and magnitudes of the readings.

A ten-liter air sample from the landfill gas well was analyzed for fixed gases and the compounds listed in Attachment 1 of the California Air Resources Board Testing Guidelines for Active Solid Waste Disposal Sites. Table 4.1.15-2 provides a complete list of the detected Attachment 1 compounds and the fixed gases. Compounds detected were dichloromethane (4,500 ppbv), 1,1,1-trichloromethane (68 ppbv), 1,2-dichloroethane (100 ppbv), trichloroethene (880 ppbv), and tetrachlorethane (830 ppbv). Methane concentration was 16.16 percent and oxygen 1.78 percent by volume.

A 24-hour, 30-liter air sample was taken downwind of the landfill and analyzed (Table 4.1.15-3). The following chemicals were detected: dichloromethane (3.0 ppbv), 1,2-dichloroethane (1.1 ppbv), benzene (2.4 ppbv), carbon tetrachloride (0.22 ppbv), trichloroethene (2.5 ppbv), and tetrachloroethane (0.84 ppbv).

Each of the four soil vapor wells located along the perimeter of Landfill No. 3 (Figure 4.1.15-7) was monitored with an OVA while being purged. The purging continued until a stable OVA reading was reached (Table 4.1.15-4) in accordance with CARB monitoring guidelines. The OVA readings ranged from 7.0 to 26.0 ppm.



LEGEND

- ⊗ LOCATION OF EMISSION SCREENING TESTS
- □ SOIL VAPOR WELL
- ■ LANDFILL GAS MONITORING WELL

EMISSION SCREENING TEST RESULTS

POINT	OVA READING
1	60 PPM
2	100 PPM
3	80 PPM
4	70 PPM
UPWIND	8 PPM

FIGURE 4.1.15-7
AIR SAMPLING LOCATIONS
SITE 15: LANDFILL NO. 3

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Table 4.1.15-2
LANDFILL GAS RESULTS

ATTACHMENT 1 COMPOUNDS DETECTED

Compound	Concentration (ppbv)	Concentration (mg/m^3)	Minimum Detection Limit (ppbv)
Dichloromethane	4,500	16,000	60
1,1,1-Trichloroethane	68	380	10
1,2-Dichloroethane	100	410	20
Trichloroethene	880	4,800	10
Tetrachloroethene	830	5,700	10

FIXED GAS

Component	Sample Concentration Percent by Volume
Nitrogen	52.1
Oxygen	1.78
Methane	16.16
Carbon monoxide	≤0.05
Carbon dioxide	8.6
Hydrogen	0.63

Note: ppbv = parts per billion by volume

Table 4.1.15-3
AMBIENT AIR RESULTS

ATTACHMENT 1 COMPOUNDS

Compound	Concentration (ppbv)	Concentration (mg/m^3)	Minimum Detection Limit (ppbv)
Dichloromethane	3.0	11.0	1.00
1,2-Dichloroethane	1.1	4.5	0.20
Benzene	2.4	7.8	2.00
Carbon Tetrachloride	0.22	1.4	0.20
Trichloroethene	2.5	14.0	0.60
Tetrachloroethene	0.84	5.8	0.20

FIXED GAS

Component	Sample Concentration Percent by Volume
Nitrogen	78.0
Oxygen	20.92
Hydrogen	1.13

Note: ppbv = parts per billion by volume

Table 4.1.15-4
GAS MIGRATION TESTING RESULTS

Date	Soil Vapor Well Number	Total Depth (ft)	Stabilized OVA Reading (ppm)
05/11/89	15-C-1SV	8	13.0
05/11/89	15-C-2SV	8	7.5
05/11/89	15-C-3SV	8	7.0
05/11/89	15-C-4SV	8	26.0

4.1.15.1.4 Analytical Results Table

Table 4.1.15-5 presents a summary of all detected analytes for Site 15 excluding the results for the two air samples. Soil and groundwater analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.15-5 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.15.1.5 Discussion of Analytical Data

Contaminants were detected in some soil samples collected beneath Site 15. Most of these contaminants were either reported at concentrations below the LOQ or are suspected false positives. With the exception of arsenic, which was detected at the 0.005 mg/l LOQ or at 0.006 mg/l and the single detection of TFH-diesel at 0.090 mg/l in the fourth round sample at 15-A-4, no contaminants were detected in the groundwater. Contaminants were also detected in the landfill gas sample and, at much lower concentrations, in the ambient air sample. Table 4.1.15-6 presents the range of contaminants encountered for each of the media sampled (soil, groundwater, air), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections or surrogate spike recoveries.

TABLE 4.1.15-5

BEALE AFB: SOIL DATA 1968/1989

ANALYTICAL RESULTS TABLE FOR SITE 15

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-C-1SB BAFB-0139 10.0-11.0' 12/01/88	15-C-1SB BAFB-0140 21.0-22.5' 12/01/88	15-C-1SB BAFB-0141 30.0-31.0' 12/01/88	15-C-1SB BAFB-0142 40.0-41.5' 12/01/88	15-C-1SB BAFB-0143 50.0-51.0' 12/02/88	15-C-1SB BAFB-0184 60.0-61.2' 12/02/88
Percent Moisture	ASA#9	N/A	%	NS	NS	13.4	18.4	27.1	27.3	21.6	19.7
Aluminum	SW6010	20.0	mg/kg	NS	NS	15500	16800	23000	20100	18200	26000
Barium	SW6010	10.0	mg/kg	NS	10,000	115	63.2	103	110	83.4	73.8
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	0.69	ND	0.62
Calcium	SW6010	100	mg/kg	NS	NS	5540	6050	5540	5870	6240	6800
Chromium	SW6010	3.0	mg/kg	NS	500	32.7	38.1	28.0	34.3	37.1	54.0
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.5	18.4	16.5	24.8	23.0	23.7
Copper	SW6010	3.0	mg/kg	NS	2,500	52.7	49.3	49.0	71.9	68.9	66.7
Iron	SW6010	10.0	mg/kg	NS	NS	31900	37300	32000	35400	37400	47400
Magnesium	SW6010	100	mg/kg	NS	NS	6280	7820	6450	9570	9390	8000
Manganese	SW6010	1.5	mg/kg	NS	NS	382	721	601	869	719	772
Nickel	SW6010	4.0	mg/kg	NS	2,000	19.6	32.0	24.7	29.8	27.6	33.4
Potassium	SW6010	200	mg/kg	NS	NS	ND	392	658	509	485	760
Sodium	SW6010	100	mg/kg	NS	NS	232	294	516	432	393	467
Thallium	SW6010	50.0	mg/kg	NS	700	ND	65.4	89.4	68.2	ND	106
Vanadium	SW6010	4.0	mg/kg	NS	2,400	99.2	103	69.7	97.0	73.0	139
Zinc	SW6010	2.0	mg/kg	NS	5,000	53.3	68.8	73.7	93.0	81.6	91.7
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.023	0.074	0.099	0.028	0.024 J	0.058
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	0.29	0.23
1,1,1-Trichloroethane	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.004 J	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.039	0.072	0.19	0.12	ND	0.020
Phenol	SW8270	0.33	mg/kg	NS	NS	1.5 B	2.0 B	2.2 B	2.2 B	0.097 BJ	ND
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	ND	ND	0.23 BJ	ND	ND	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	0.34 J	0.19 J

NOTES: Results reported for detected analytes only.

NT: analyte not tested

ND: analyte not detected.

NS: No standard criteria or action level currently exists.

(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank

J: estimated value, below quantification limit

b: field blank (ambient condition blank)

e: equipment wash blank

f: field replicate

R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-C-1SB[f] BAFB-0185 62.4-63.1' 12/02/88	15-C-2SB BAFB-0151 11.5-13.0' 12/06/88	15-C-2SB BAFB-0152 17.5-19.5' 12/06/88	15-C-2SB BAFB-0153 27.5-29.0' 12/06/88	15-C-2SB BAFB-0154 37.5-39.0' 12/06/88	15-C-2SB BAFB-0155 47.5-49.0' 12/07/88
Percent Moisture	ASA#9	N/A	%	NS	NS	17.8	18.2	19.8	15.8	22.7	22.2
Aluminum	SW6010	20.0	mg/kg	NS	NS	26200	17800	20400	10200	15300	14900
Barium	SW6010	10.0	mg/kg	NS	10,000	68.1	137	126	120	765	123
Beryllium	SW6010	0.50	mg/kg	NS	75	0.61	ND	ND	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	6530	6630	6660	4520	6270	5120
Chromium	SW6010	3.0	mg/kg	NS	500	51.9	44.6 B	50.1 B	20.2 B	37.4 B	6.8 B
Cobalt	SW6010	4.0	mg/kg	NS	8,000	23.1	20.8	22.4	21.4	31.8	7.2
Copper	SW6010	3.0	mg/kg	NS	2,500	68.6	50.1	71.8	36.3	70.6	21.9
Iron	SW6010	10.0	mg/kg	NS	NS	48400	35700 B	41900 B	23800 B	32200 B	15400 B
Magnesium	SW6010	100	mg/kg	NS	NS	7860	7080	8380	5370	7220	2540
Manganese	SW6010	1.5	mg/kg	NS	NS	790	787	895	829	3310	537
Nickel	SW6010	4.0	mg/kg	NS	2,000	31.8	30.3	31.4	17.8	33.9	7.7
Potassium	SW6010	200	mg/kg	NS	NS	1080	ND	299	249	763	ND
Sodium	SW6010	100	mg/kg	NS	NS	371	180	190	137	168	518
Thallium	SW6010	50.0	mg/kg	NS	700	108	62.5	ND	ND	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	167	98.4	131	61.4	127	24.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	85.2	62.5 B	78.8	47.9	64.7	42.5 B
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.10 J	0.034	0.013	0.011	0.019	0.015
Acetone	SW8240	0.010	mg/kg	NS	NS	0.75	0.017 B	0.063	0.047	ND	0.035
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	0.32	0.022	0.008	0.022	0.022
Phenol	SW8270	0.33	mg/kg	NS	NS	0.12 BJ	ND	ND	ND	ND	ND
Acenaphthene	SW8270	0.33	mg/kg	NS	NS	ND	0.046 J	ND	ND	ND	ND
Fluorene	SW8270	0.33	mg/kg	NS	NS	ND	0.068 J	ND	ND	ND	ND
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	ND	0.043 J	ND	ND	ND	ND
Anthracene	SW8270	0.33	mg/kg	NS	NS	ND	0.11 J	ND	ND	ND	ND
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.18 J	0.61 B	0.42 B	0.13 BJ	0.38 BJ	0.14 BJ
Fluoranthene	SW8270	0.33	mg/kg	NS	NS	ND	0.23 J	ND	ND	ND	ND
Pyrene	SW8270	0.33	mg/kg	NS	NS	ND	0.17 J	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.057 J	0.060 J	0.10 J	ND	0.050 J
Chrysene	SW8270	0.33	mg/kg	NS	NS	ND	0.054 J	ND	ND	ND	ND
Benzo(k)fluoranthene	SW8270	0.33	mg/kg	NS	NS	ND	0.043 J	ND	ND	ND	ND
Benzo(a)pyrene	SW8270	0.33	mg/kg	NS	NS	ND	0.046 J	ND	ND	ND	ND

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a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-C-2SB BAFB-0156 57.5-59.0' 12/07/88	15-C-3SB BAFB-0145 7.5-9.0' 12/05/88	15-C-3SB BAFB-0146 17.5-19.0' 12/05/88	15-C-3SB BAFB-0147 27.5-29.0' 12/05/88	15-C-3SB BAFB-0148 37.5-39.0' 12/05/88	15-C-3SB BAFB-0149 47.5-49.0' 12/05/88
Percent Moisture	ASA#9	N/A	%	NS	NS	14.1	14.6	10.4	27.8	17.1	11
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	ND	ND	30	ND	ND
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	ND	ND	120	ND	77	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	8670	8950	10500	27400	12500	10800
Barium	SW6010	10.0	mg/kg	NS	10,000	86.5	119	116	173	55.5	51.1
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	0.59	ND	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	4090	2470	3480	6540	5160	4090
Chromium	SW6010	3.0	mg/kg	NS	500	14.0 B	19.9	26.1	62.6	41.4	25.6
Cobalt	SW6010	4.0	mg/kg	NS	8,000	4.9	6.4	19.0	41.3	14.5	13.5
Copper	SW6010	3.0	mg/kg	NS	2,500	17.5	40.6	46.8	79.4	46.3	47.3
Iron	SW6010	10.0	mg/kg	NS	NS	11600 B	23300	29000	54200	28600	32700
Magnesium	SW6010	100	mg/kg	NS	NS	1620	5810	5890	9970	528)	5100
Manganese	SW6010	1.5	mg/kg	NS	NS	343	130	735	1690	573	489
Nickel	SW6010	4.0	mg/kg	NS	2,000	9.8	14.1	19.0	44.7	24.7	13.5
Potassium	SW6010	200	mg/kg	NS	NS	ND	433	ND	485	302	315
Sodium	SW6010	100	mg/kg	NS	NS	558	183	219	504	328	335
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	61.6	107	67.6	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	18.6	72.0	87.8	143	70.1	72.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	31.8 B	51.3	58.7	96.1	52.8	54.5
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.014 B	0.028	0.030	0.025	0.044	0.057
Acetone	SW8240	0.010	mg/kg	NS	NS	0.037 B	ND	ND	0.11	0.061	0.086
Toluene	SW8240	0.005	mg/kg	NS	NS	0.021	0.11	0.022	0.011	0.004 J	0.003 J
N-nitrosodiphenylamine	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	0.057 J	0.051 J
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.083 J	0.28 J	0.12 J	0.37 BJ	0.29 BJ	0.12 BJ
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.045 J	0.085 J	ND	0.32 J	0.087 J	0.11 J

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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-C-3SB BAFB-0150 57.5-59.0' 12/05/88	15-C-4SB BAFB-0157 7.5-9.0' 12/07/88	15-C-4SB[f] BAFB-0158 9.0-10.5' 12/07/88	15-C-4SB BAFB-0159 17.5-19.0' 12/07/88	15-C-4SB BAFB-0160 27.5-29.0' 12/07/88	15-C-4SB BAFB-0161 37.5-39.0' 12/07/88
Percent Moisture	ASA#9	N/A	%	NS	NS	10.0	20	21.9	15.5	19.2	10.2
Aluminum	SW6010	20.0	mg/kg	NS	NS	10000	14800	18700	10500	13100	11000
Barium	SW6010	10.0	mg/kg	NS	10,000	46.9	218	152	67.1	69.1	25.5
Calcium	SW6010	100	mg/kg	NS	NS	4760	5340	5690	4070	4260	4910
Chromium	SW6010	3.0	mg/kg	NS	500	33.7	37.4 B	51.3 B	29.9 B	35.6 B	22.3
Cobalt	SW6010	4.0	mg/kg	NS	8,000	10.0	21.3	17.9	16.6	18.6	10.1
Copper	SW6010	3.0	mg/kg	NS	2,500	38.0	59.8	61.5	49.5	45.8	42.7
Iron	SW6010	10.0	mg/kg	NS	NS	25700	26000 B	30500 B	28300 B	23800 B	25600
Magnesium	SW6010	100	mg/kg	NS	NS	3630	7910	7700	6080	6340	4930
Manganese	SW6010	1.5	mg/kg	NS	NS	397	1030	592	646	507	298
Nickel	SW6010	4.0	mg/kg	NS	2,000	18.9	30.4	39.1	29.0	28.0	12.2
Potassium	SW6010	200	mg/kg	NS	NS	256	363	397	284	408	345
Sodium	SW6010	100	mg/kg	NS	NS	293	188	229	159	191	180
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	ND	ND	ND	65.9
Vanadium	SW6010	4.0	mg/kg	NS	2,400	76.9	59.5	52.0	93.7	70.8	87.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	38.8	78.3 B	73.8 B	56.7 B	56.6 B	50.6
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.010	0.023 B	0.005 BJ	0.013 B	0.014 B	0.004 J
Acetone	SW8240	0.010	mg/kg	NS	NS	0.033	0.036 B	0.026 B	1.1 B	0.40 B	0.017
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.008 J	ND	ND	ND
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.003 J	ND	0.001 J	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.003 J	0.038	0.023	0.007	0.007	0.004 J
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.29 BJ	ND	ND	ND	ND	0.085 J
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.18 J	ND	ND	ND	ND	ND

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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-C-4SB BAFB-0162 47.5-49.0' 12/08/88	15-C-4SB BAFB-0163 57.5-59.0' 12/08/88	15-C-5SB BAFB-0082 10.0-11.5' 11/30/88	15-C-5SB BAFB-0083 20.0-21.5' 11/30/88	15-C-5SB BAFB-0084 30.0-30.7' 11/30/88	15-C-5SB BAFB-0085 40.0-41.0' 11/30/88
Percent Moisture	ASA#9	N/A	%	NS	NS	13.8	19.1	11.7	16.4	12.9	16.5
TPH-Gas	TPH-GA	50	mg/kg	NS	NS	ND	ND	ND	ND	69	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	8670	9800	9940	17900	9450	17500
Barium	SW6010	10.0	mg/kg	NS	10,000	48.4	168	48.6	136	34.1	133
Calcium	SW6010	100	mg/kg	NS	NS	3490	3830	4860	6240	4640	4560
Chromium	SW6010	3.0	mg/kg	NS	500	27.4	26.8	25.3	40.1	19.5	14.4
Cobalt	SW6010	4.0	mg/kg	NS	8,000	17.4	29.9	12.5	29.2	11.5	21.6
Copper	SW6010	3.0	mg/kg	NS	2,500	39.2	43.3	34.2	64.1	33.8	24.0
Iron	SW6010	10.0	mg/kg	NS	NS	22900	25600	24200	38200	22800	26700
Magnesium	SW6010	100	mg/kg	NS	NS	6360	6280	4750	7690	4550	3370
Manganese	SW6010	1.5	mg/kg	NS	NS	553	1510	447	1180	375	565
Nickel	SW6010	4.0	mg/kg	NS	2,000	17.4	23.5	12.5	29.1	11.5	20.4
Potassium	SW6010	200	mg/kg	NS	NS	452	791	288	437	274	334
Sodium	SW6010	100	mg/kg	NS	NS	161	168	163	227	204	234
Vanadium	SW6010	4.0	mg/kg	NS	2,400	76.2	72.4	70.8	102	67.6	58.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	51.2	59.5	59.5 B	70.1 B	40.5 B	52.2 B
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.073	0.084	0.023 B	0.040 B	0.011 B	0.024 B
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.037 B	0.58 B	0.008 B	0.19 B
Toluene	SW8240	0.005	mg/kg	NS	NS	0.020	0.043	0.012 B	0.017 J	ND	0.047 B
Phenol	SW8270	0.33	mg/kg	NS	NS	ND	ND	1.4 B	1.8 B	2.0 B	1.6 B

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* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-C-5SB BAFB-0086 50.0-51.5' 11/30/88
Percent Moisture	ASA#9	N/A	%	NS	NS	16.3
Aluminum	SW6010	20.0	mg/kg	NS	NS	12500
Barium	SW6010	10.0	mg/kg	NS	10,000	92.0
Calcium	SW6010	100	mg/kg	NS	NS	3870
Chromium	SW6010	3.0	mg/kg	NS	500	9.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	10.6
Copper	SW6010	3.0	mg/kg	NS	2,500	21.5
Iron	SW6010	10.0	mg/kg	NS	NS	22300
Magnesium	SW6010	100	mg/kg	NS	NS	2840
Manganese	SW6010	1.5	mg/kg	NS	NS	477
Nickel	SW6010	4.0	mg/kg	NS	2,000	13.1
Potassium	SW6010	200	mg/kg	NS	NS	335
Sodium	SW6010	100	mg/kg	NS	NS	385
Thallium	SW6010	50.0	mg/kg	NS	700	68.5
Vanadium	SW6010	4.0	mg/kg	NS	2,400	42.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	47.7 B
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.015 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.11 B
Toluene	SW8240	0.005	mg/kg	NS	NS	0.027 B
Phenol	SW8270	0.33	mg/kg	NS	NS	2.0 B

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a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 15

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-A-1GW BAFB-0515 03/30/89	15-A-2GW BAFB-0514 03/30/89	15-A-3GW BAFB-0512 03/30/89	15-A-4GW BAFB-0510 03/29/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	285	252	210	220
Temperature	E170.1	N/A	deg C	NS	NS	19.5	20.8	19.2	19.0
pH	E150.1	N/A	pH	5-9	NS	7.84	7.65	8.10	8.12
Alkalinity - Total	SM403	1.0	mg/l	20	NS	102.0	92.2	95.0	80.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	124.4	112.5	115.9	97.6
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	232	221	198	208
Chloride	E325.3	1.0	mg/l	250	250	23.3	18.2	15.0	10.2
Fluoride	E340.2	0.050	mg/l	2	1.4	0.34	0.31	0.37	0.36
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	12.0	5.3	8.0	6.8
Sulfate	E375.4	1.0	mg/l	250	250	18.1	16.7	5.7	4.9
Arsenic	SW7060	0.0050	mg/l	.05	.05	ND	ND	0.0050	0.0050
Calcium	SW6010	1.00	mg/l	NS	NS	16.6	24.4	16.6	16.1
Magnesium	SW6010	1.00	mg/l	NS	NS	5.29	8.60	5.52	4.90
Potassium	SW6010	1.00	mg/l	NS	NS	1.20	1.30	1.70	1.70
Sodium	SW6010	1.00	mg/l	NS	NS	41.2	20.7	23.6	26.6
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	0.0320	ND

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R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 15

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-A-1GW BAFB-0553 05/26/89	15-A-2GW BAFB-0550 05/25/89	15-A-3GW BAFB-0551 05/26/89	15-A-4GW BAFB-0552 05/26/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	295	255	222	227
Temperature	E170.1	N/A	deg C	NS	NS	21.0	20.5	20.5	20.5
pH	E150.1	N/A	pH	5-9	NS	7.69	7.50	8.73	9.33
Alkalinity - Total	SM403	1.0	mg/l	20	NS	94.4	96.0	92.0	94.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	115.2	117.1	112.2	115.7
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	244	232	205	208
Chloride	E325.3	1.0	mg/l	250	250	23.4	17.7	13.9	9.9
Fluoride	E340.2	0.050	mg/l	2	1.4	0.26	0.23	0.29	0.31
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	12.5	5.0	8.5	8.1
Sulfate	E375.4	1.0	mg/l	250	250	22.0	19.6	8.1	8.1
Calcium	SW6010	1.00	mg/l	NS	NS	16.0	23.1	13.8	14.0
Magnesium	SW6010	1.00	mg/l	NS	NS	4.98	7.79	4.49	4.01
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.0240	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	ND	1.30	2.40	2.30
Sodium	SW6010	1.00	mg/l	NS	NS	37.5	18.0	22.8	25.0
Toluene	SW8020	1	ug/l	14,300	100	1(1)	1(0)	1(0)	2(0)
1,4-Dichlorobenzene	SW8020	1	ug/l	75	75	ND	ND	90	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	5 J	5 J	5 J	5 J
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	6 J	5 J	3 J

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f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 15

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-A-1GW BAFB-0609 08/29/89	15-1-2GW BAFB-0612 08/29/89	15-A-2GW[f] BAFB-0613 08/29/89	15-A-2GW[e] BAFB-0611 08/29/89	15-A-2GW[b] BAFB-0610 08/29/89	15-A-3GW BAFB-0615 08/30/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	288	260	260	NT	NT	210
Temperature	E170.1	N/A	deg C	NS	NS	20.5	21.0	21.0	NT	NT	21.0
pH	E150.1	N/A	pH	5-9	NS	8.05	7.98	7.98	NT	NT	8.34
Alkalinity - Total	SM403	1.0	mg/l	20	NS	100.0	94.0	100.4	NT	NT	83.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	122.0	114.7	122.5	NT	NT	101.7
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	249	252	251	24.0	NT	213
Chloride	E325.3	1.0	mg/l	250	250	23.5	15.7	16.8	ND	NT	13.4
Fluoride	E340.2	0.050	mg/l	2	1.4	0.23	0.24	0.24	0.060	NT	0.27
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	14.2	5.7	4.1	0.93	NT	9.0
Sulfate	E375.4	1.0	mg/l	250	250	20.3	17.8	17.3	ND	NT	5.6
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	7.4	ND	ND	ND	NT	ND
Calcium	SW6010	1.00	mg/l	NS	NS	17.2	23.4	24.7	ND	NT	15.2
Magnesium	SW6010	1.00	mg/l	NS	NS	5.53	9.14	8.69	ND	NT	5.30
Potassium	SW6010	1.00	mg/l	NS	NS	ND	1.15	ND	ND	NT	1.64
Sodium	SW6010	1.00	mg/l	NS	NS	41.9	21.5	20.3	ND	NT	25.9
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	ND	ND	140(150)	140(150)	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 BJ	7 BJ	6 BJ	6 BJ	NT	5 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	7 J	8 J	8 J	23	NT	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.15-5 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-A-4GW BAFB-0614 08/30/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	215
Temperature	E170.1	N/A	deg C	NS	NS	21.0
pH	E150.1	N/A	pH	5-9	NS	8.83
Alkalinity - Total	SM403	1.0	mg/l	20	NS	97.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	118.8
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	226
Chloride	E325.3	1.0	mg/l	250	250	13.4
Fluoride	E340.2	0.050	mg/l	2	1.4	0.29
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	7.2
Sulfate	E375.4	1.0	mg/l	250	250	10.3
Arsenic	SW7060	0.0050	mg/l	.05	.05	0.0060
Calcium	SW6010	1.00	mg/l	NS	NS	15.8
Magnesium	SW6010	1.00	mg/l	NS	NS	5.10
Potassium	SW6010	1.00	mg/l	NS	NS	2.00
Sodium	SW6010	1.00	mg/l	NS	NS	27.4

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.15-5

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 15

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	15-A-1GW BAFB-0695 11/18/89	15-A-2GW BAFB-0694 11/18/89	15-A-3GW BAFB-0697 11/19/89	15-A-4GW BAFB-0700 11/20/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	289	250	215	200
Temperature	E170.1	N/A	deg C	NS	NS	20.5	19.0	21.0	19.0
pH	E150.1	N/A	pH	5-9	NS	8.06	7.80	8.50	8.69
Alkalinity - Total	SM403	1.0	mg/l	20	NS	97.6	93.2	94.8	96.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	119.1	113.7	115.7	118.1
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	232	242	189	178
Chloride	E325.3	1.0	mg/l	250	250	22.9	17.0	13.1	9.6
Fluoride	E340.2	0.050	mg/l	2	1.4	0.29	0.24	0.32	0.32
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	10.5	4.4	8.2	2.4
Sulfate	E375.4	1.0	mg/l	250	250	15.8	17.4	3.3	4.8
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	ND	ND	ND	0.090
Calcium	SW6010	1.00	mg/l	NS	NS	17.4	26.1	14.7	14.9
Magnesium	SW6010	1.00	mg/l	NS	NS	5.40	8.67	4.90	4.75
Molybdenum	SW6010	0.0400	mg/l	NS	NS	0.0400	ND	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.11	1.33	1.91	1.96
Sodium	SW6010	1.00	mg/l	NS	NS	41.2	20.6	25.8	27.0
Toluene	SW8020	1	ug/l	14,300	100	1(1)	ND	ND	2(1)
Diethylphthalate	SW8270	10	ug/l	NS	NS	ND	ND	ND	12 B
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	7 J	ND	8 J	10 B
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	ND	ND	ND	9 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	9 J	5 J	9 J	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

Table 4.1.15-6
RANGES OF CONTAMINANTS DETECTED AT SITE 15

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SOIL BORINGS				
TPH-diesel	mg/kg	ND	30	1/29
TPH-gas	mg/kg	ND	120	3/29
toluene	mg/kg	ND	0.32	26/29
bis(2-ethylhexyl) phthalate	mg/kg	ND	(0.32)	6/29
di-n-butyl phthalate	mg/kg	ND	(0.34)	8/29
n-nitrosodiphenylamine	mg/kg	ND	(0.057)	3/29
GROUNDWATER				
arsenic	mg/l	ND	0.006	3/16
TPH-diesel	mg/l	ND	0.090	1/16
LANDFILL GAS				
dichloromethane	ppbv	4500	4500	1/1
1,1,1-trichloroethane	ppbv	68	68	1/1
1,2-dichloroethane	ppbv	100	100	1/1
trichloroethene	ppbv	880	880	1/1
tetrachloroethene	ppbv	830	830	1/1
AMBIENT AIR				
dichloromethane	ppbv	3.0	3.0	1/1
1,2-dichloroethane	ppbv	1.1	1.1	1/1
benzene	ppbv	2.4	2.4	1/1
carbon tetrachloride	ppbv	0.22	0.22	1/1
trichloroethene	ppbv	2.5	2.5	1/1
tetrachloroethene	ppbv	0.84	0.84	1/1

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the LOQ. These detections may represent laboratory "noise," and some analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study, the LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.15.2 Sampling and Analytical Problems

4.1.15.2.1 Loss of Samples

There were no sample loss problems for Site 15 samples. Additionally, there were no holding time violations that required resampling and no scheduled analyses were missed.

4.1.15.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil and water samples collected at Site 15 contained several organic compounds that were probably laboratory- or field-induced false positive results. Phenol was detected in 11 of the soil samples at concentrations of 0.097 mg/kg to 2.2 mg/kg. This has been traced to a factory-contaminated bottle of acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks that the induced contamination was 1.7 mg/kg.

Many of the soil samples collected also contained acetone and methylene chloride. These are common laboratory contaminants and were also found in some of the method blanks at similar levels.

In several of the soil samples, the semivolatile compounds di-n-butyl phthalate, and n-nitrosodiphenylamine were estimated below the LOQ and were also found in some of the method blanks at similar levels.

Toluene was detected in all but 3 of the 29 soil samples. The maximum concentration was 0.32 mg/kg, with most of the detected concentrations below 0.12 mg/kg. Toluene is not considered a common lab contaminant but was detected in at least one associated laboratory blank. The ubiquitous distribution makes the results suspect as positive detections.

One group of semivolatile organic compounds was detected in a sample from soil boring 15-C-2SB, at a depth of 11.5 to 13.0 feet (10 to 11 feet vertically). Although this may represent positive contamination, all of the compounds were tentatively identified at concentrations below the LOQ.

Two soil replicate samples were collected at Site 15. A comparison of results for the environmental samples versus the corresponding replicate samples shows that the analysis results are very similar. Some variability exists for metals in the soil samples, but this is expected because the two samples were not combined and homogenized in order to minimize loss of volatile compounds.

Arsenic was detected at the LOQ (0.005 mg/l) in wells 15-A-3 and 4 in the first quarterly sampling. It was not detected in the method blank. Arsenic was not detected in the second or fourth rounds but was detected in the third round in well 15-A-4 at 0.006 mg/l.

In the third quarterly sampling at well 15-A-2, methylene chloride was not detected in the normal environmental sample or the replicate sample. However, methylene chloride was detected in both the ambient condition blank and the equipment wash blank. This has been traced to contaminated Type 1 organic free water which occurred in a number of blanks during the third sampling round. In each case, the normal environmental sample did not contain methylene chloride but the blanks did.

N-nitrosodiphenylamine was estimated below the LOQ in both the water sample and method blank for wells 15-A-1, 15-A-2, and 15-A-3 and also in the replicate and equipment wash blank for 15-A-2 in the third quarterly sampling round. Di-N-Butylphthalate was detected below the LOQ in both the sample and the associated method blank for 15-A-4.

4.1.15.2.3 Analytical Results Obtained under Out-of-Control Conditions

In the third quarterly sample of well 15-A-4 the phenol-d5 surrogate spike for 8270 analysis exceeded allowable percent recovery limits by 16 percent. No chemicals were detected in the analysis.

In the fourth quarter 8270 analyses of groundwater samples, the following surrogate spike recoveries were below their acceptable ranges: Nitrobenzene-D5 was 33 percent in 15-A-1 and 15 percent in 15-A-3 (below the 35 to 114 percent

range), 2-Fluorobipnenyl was 40 percent in 15-A-1, 39 percent in 15-A-2, and 22 percent in 15-A-3 (below the 43 to 116 percent range).

4.1.15.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.15.3 Significance of Findings

Soil

In the four angled borings and one background boring drilled at Site 15, no organic compounds were detected above the LOQ in soil samples except for those compounds considered to be false positives. The only potential contaminants quantified were TFH-diesel and -gas. TFH-diesel was detected at 30m g/kg in the 28-foot sample (24 feet vertically) from boring 15-C-3SB. TFH-gas was detected at 120 and 77 mg/kg in the 18- and 38-foot samples (16 and 33 feet vertically) from 15-C-3SB and at 69 mg/kg in the 30-foot sample from 15-C-5SB (background boring). The LUFT cleanup standards computed for these specific sample locations are 1,000 mg/kg for TFH-diesel, and 100 mg/kg for TFH-gas. TFH-gas detected at 18 feet in 15-C-3SB at 120 mg/kg is the only case which exceeds these standards.

A suite of 10 semivolatile organics was tentatively identified below the LOQ in the 12-foot sample (10 feet vertically) from 15-C-2SB. These organic compounds may have migrated into the soil from materials in the wood pit.

Aluminum, barium, beryllium, chromium, magnesium, and sodium were detected at levels greater than two standard deviations above the averaged background soil boring values. All detections were at levels below the respective DHS TTLC values.

Groundwater

Wells installed at Site 15 were all completed during previous investigations. The sandstone observed at the Site 6 background well (6-C-1, 2,800 feet to the west of the three western Site 15 wells) was not logged in any of these Site 15 wells. Although consolidated materials (shale in 15-A-4) were specifically identified in only one well log, it is possible that the subangular gravel described near each hole bottom was actually the beginning of consolidated formations. This is supported by the low well yields at Site 15.

General water quality parameters were at approximately the same levels in all the wells at Site 15 and do not indicate the presence of contamination. No organic compounds were detected in the groundwater at Site 15 except the single detection of TFH-diesel at 0.090 mg/l in the fourth round at 15-A-4. Arsenic was found at the 0.005 mg/l LOQ in samples from wells 15-A-3 and 15-A-4 in the first round, and at 0.006 mg/l in 15-A-4 in the third round. It is most likely that the arsenic, if present, is naturally occurring in the groundwater, as arsenic was not detected in the soil borings. The DHS primary MCL for arsenic is 0.050 mg/l.

Surface Water

Surface water is not present near Site 15 and was not sampled.

Air

An OVA was used to screen landfill gas concentrations above the soil cap at four locations in the approximate center of the landfilled area, with the highest concentration being 100 ppm. Screening measurements in soil vapor wells installed around the landfill at four locations indicated organic vapors at levels of 7.0, 7.5, 13.0, and 26.0 ppmv, with the highest concentration measured at the northern side of the landfill. Two soil vapor concentrations exceeded the background (upwind) ambient air concentration of 8 ppm. Local variations in natural soil vapor could account for the concentrations measured.

The landfill gas sample collected from the landfill gas monitoring well installed into the landfill contained dichloromethane, 1,1,1-trichloroethane, 1,2-dichloroethane, trichloroethene, and tetrachlorethane at concentrations ranging from 68 ppbv (380 ug/cubic meter) for 1,1,1-trichloroethane, to 4,500 ppbv (16,000 ug/cubic meter) for dichloromethane. The fixed gas analysis for hydrogen, nitrogen, oxygen, methane, carbon monoxide, and carbon dioxide accounted for only 79.2 percent of the sample volume.

The downwind, 24-hour ambient air sample (Table 4.1.15-3) contained four of the five compounds detected in the landfill gas sample (4.5 to 14 ug/cubic meter), with 1,1,1-trichloroethane being the only one of the five compounds not detected. In addition to these four compounds, the ambient air sample also contained benzene and carbon tetrachloride (7.8 and 1.4 ug/cubic meter, respectively), which were not found in the landfill gas sample.

It is concluded that Site 15 is generating landfill gas in the form of methane, carbon dioxide, and chlorinated volatile organics. Oxygen concentration in the landfill gas monitoring well is less than 2 percent, indicating that as the refuse materials degrade, oxygen is being depleted and anaerobic conditions may prevail in the future. Although four of the five compounds detected in the landfill gas sample were also detected in the downwind ambient air sample, it cannot be concluded that the sole source of these compounds is Landfill No. 3. Benzene and carbon tetrachloride were also detected in the ambient air sample but not in the landfill gas. The source of these compounds is unknown.

4.1.15.3.1 Zones of Contamination

On the basis of soil borings drilled at Site 15 during Stage 2-1, the only signs of soil contamination detected were the semivolatile organic compounds tentatively detected below the LOQ in 15-C-2SB and the isolated detections of TFH-diesel and -gas.

Based on groundwater sampling conducted during two stages of IRP work, no indications of contamination have been detected in the groundwater except the single detection of TFH-diesel at 0.090 mg/l in the fourth round at 15-A-4.

4.1.15.3.2 Contaminant Migration

Contaminant migration is not expected in soil or groundwater at Site 15. Evidence from the Stage 2-1 study indicates no significant contamination in groundwater at Site 15.

Although four of the five compounds detected in the landfill gas sample were also detected in the downwind ambient air sample, it cannot be concluded that the sole source of these compounds is Site 15. Based on the emission screening, there does seem to be some leakage from the landfill soil cover; however, the quantity of gas escaping is unknown. The combined concentration of gases detected in the downwind sample is less than 1 percent of the background organic vapor concentration measured upwind of the landfill. If the Attachment 1 gases detected downwind are from the landfill, they appear to contribute very little to the total organic vapor concentrations.

4.1.15.3.2.1 Potential to Move Off Site and Off Base

Measurable contaminant migration is not expected from Site 15. No significant contamination has been detected in the groundwater.

4.1.15.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

No contaminants were detected in the groundwater samples collected at Site 15 monitoring wells in the IRP Phase II, Stage 1 or Stage 2-1 studies except the single detection of TFH-diesel at 0.090 mg/l in the fourth round at 15-A-4. Since the landfill is an active facility, groundwater monitoring should continue at the site. The presence of TFH-diesel in 15-A-4 needs to be evaluated with future sampling. Should contaminants migrate from the landfill into the groundwater they would move with groundwater generally to the west.

4.1.15.3.2.3 Time of Travel to Receptors

Significant contaminant migration is not expected from Site 15 based on information from the IRP studies.

4.1.15.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable because no significant contaminants were detected in the groundwater wells at Site 15.

4.1.15.3.2.5 Expected Spatial and Temporal Variations in Concentration

Based on present conditions, spatial or temporal variations are not expected in concentrations from Site 15 apart from groundwater at well 15-A-4 which needs to be sampled to evaluate TFH-diesel variations in the future.

4.1.15.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.16 DISCUSSION OF RESULTS FOR SITE 16: EXPLOSIVE ORDNANCE DISPOSAL AREA

The Explosive Ordnance Disposal (EOD) area is in a remote area off a series of dirt roads in the northern sector of Beale AFB, 600 feet west of Upper Blackwelder Lake. The EOD area consists of two bunkers for burning ordnance and a trench that measures approximately 70 feet long by 15 feet wide by 10 feet deep. Unused ordnance (active munitions, explosives, flares, and pyrotechnics) from military bases around Sacramento are detonated in the bunkers or in the open field.

Diesel fuel and an underlying/overlying layer of wood are used to burn the smaller ordnance. No residual fuel remains after the fire burns itself out. After burning, remains are inspected and unburned ammunition is removed. The burned portion of the ordnance, primarily metal casings, is then disposed in the trench.

During precipitation, the disposal trench fills with water. The standing water provides a hydraulic head which could help move any contaminants in the trench toward groundwater.

During IRP Stage 2-1 activities three surface soil samples were collected with a hand auger from the bottom of the scrap metal trench (Figure 4.1.16-1). A vertical background boring and two angled borings beneath the disposal trench were scheduled to be drilled to depths of 50 feet. Three attempts were made to drill the background boring (16-C-3SB) east (uphill) of the trench. Each attempt met refusal on bedrock at a 5- to 6-foot depth below ground surface. Field reconnaissance revealed several bedrock exposures at Site 16. Rock is exposed in the sides and bottom of the disposal trench. The scheduled angled borings were not drilled. No soil samples were collected from borings at Site 16.

One monitoring well was constructed and sampled at Site 16 during the Stage 2-1 study.

A magnetic geophysical investigation was conducted in the vicinity of the trench at Site 16 to determine whether other buried scrap metal trenches were present.

4.1.16.1 Presentation of Results

The following section presents the results of the field investigation conducted at Site 16. The discussion focuses

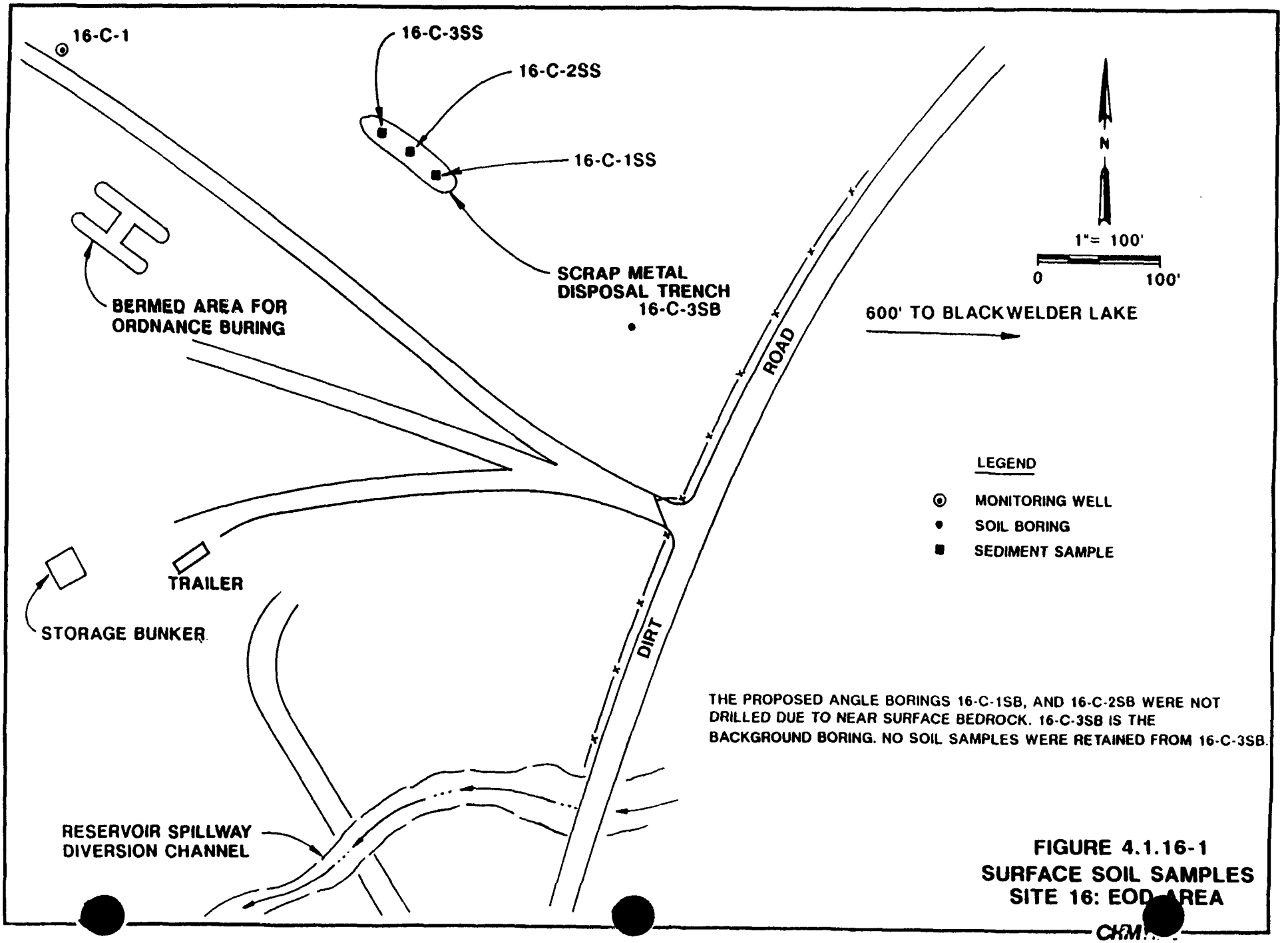


FIGURE 4.1.16-1
SURFACE SOIL SAMPLES
SITE 16: EOD AREA

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on the geology and hydrogeology at the site, and presents the results of chemical analyses performed on soil and groundwater samples and the results of the geophysical examination of the area.

4.1.16.1.1 Site Geology

Evaluation of the geology and hydrogeology at Site 16 is based on one shallow borehole and on a monitoring well drilled during the current Stage 2-1 investigation. Although surface soil samples were collected during the previous Phase II, Stage 1 investigation, no drilling was accomplished at that time (AeroVironment, 1987). During the current investigation, one vertical background boring and two angled borings beneath the disposal trench were scheduled to be drilled. Three attempts were made with a hollow-stem auger to drill the background boring east (uphill) of the trench. Each attempt met refusal on bedrock at a depth below ground surface of 5 to 6 feet. Field reconnaissance revealed bedrock outcrops near the top of hills northeast and south of the disposal trench. Rock is exposed in the sides and bottom of the disposal trench. Because the bedrock was so near the surface, the scheduled angled borings were not drilled. The locations of the borehole and monitoring well are shown on Figure 4.1.16-1. Soil boring logs are provided in Appendix D.

The log of 16-C-1 shows that near-surface materials at Site 16 consisted of sandy silt and clay. In the well borehole, drilled with a casing hammer rig, sand and gravel increased with depth to about 10 feet. Clasts appeared to consist of metamorphosed mafic volcanics. At about 10 feet, the well borehole encountered a lean clay, which was likely the weathered bedrock surface. Below this point, the rock became increasingly competent, and the rate of drilling advance slowed considerably. Occasionally, thin zones of alteration were contacted along fractures where the rock was weathered to a clay-like consistency. The borehole was terminated at a total depth of 37 feet.

Surface soils at Site 16 have been mapped as belonging to the Pardee-Pardee Variant complex, a shallow, gravelly soil formed above igneous bedrock (SCS, 1985). The surface geology was also mapped as belonging to the basement complex of the Sierra Nevada, a pre-Tertiary unit comprising metamorphosed igneous and sedimentary rocks, and intrusive igneous rocks (Page, 1980). These rocks are the bedrock at Beale AFB. Outcrops of this unit are visible in the vicinity of Site 16, as described above.

4.1.16.1.2 Site Hydrogeology

Groundwater at Site 16 appears to flow in fractures in the bedrock. The first zone of alteration within the rock that produced moist cuttings occurred at a depth of 26 feet BGS (133 feet NGVD), and lasted for a few inches. Another damp alteration zone was encountered at a depth of between 35 and 36 feet BGS (123-124 feet NGVD). After the well was completed the groundwater rose to a depth of about 14 feet beneath the ground surface (145 feet NGVD), implying that the groundwater was under confining pressure in the fractures.

As Figure 4.1.16-1 shows, Upper Blackwelder Lake lies about 600 feet east of well 16-C-1. A swale with an intermittent stream lies about 500 feet west of well 16-C-1. Approximately 20 feet of relief separates these water bodies. The lake may provide recharge to groundwater in the vicinity of Site 16, while the swale may represent a discharge point. If so, then well 16-C-1 and the EOD area lie along this groundwater path between the lake and the stream. Otherwise, groundwater may move to the west along a regional gradient. More data are needed to confirm the direction of groundwater flow in the vicinity of Site 16.

Groundwater levels were measured in well 16-C-1 during the IRP Stage 2-1 investigation, and are presented in Table 4.1.16-1. A hydrograph of these levels is shown on Figure 4.1.16-2. The data show that groundwater levels varied about 3 feet during 1989. The groundwater reached its peak near the end of the rainy season, which may correspond to the time of greatest water storage in Upper Blackwelder Lake.

Table 4.1.16-1
GROUNDWATER ELEVATIONS: SITE 16
(FEET NGVD)

Well	Screened Interval	Jan. 1989	March 1989	May 1989	Aug. 1989	Nov. 1989
16-C-1	144-123	145.57	147.64	148.71	147.53	145.71

Because of the low yield of well 16-C-1, it was not possible to pump test this well. Instead, the well was given a slug test. Hydraulic conductivity was derived according to the Bouwer and Rice Method (1976). A discussion of aquifer

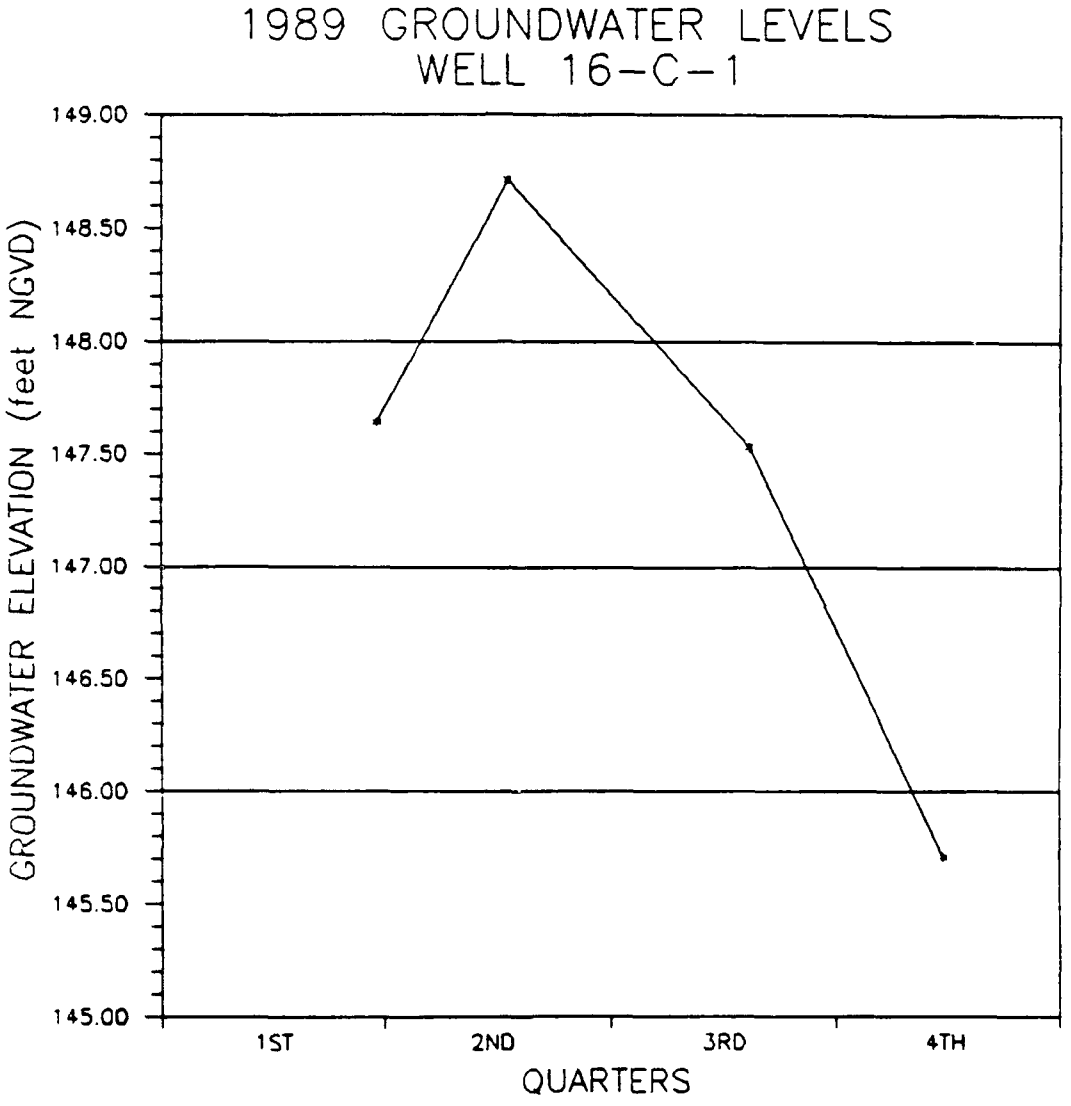


FIGURE 4.1.16-2
MONITORING WELL HYDROGRAPH
SITE 16: EOD AREA

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testing methodology and a plot of the water level recovery curve are provided in Appendix E. According to this method, the hydraulic conductivity was 1.2 feet per day (4.2 x 10^{-4} cm/sec).

4.1.16.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.16.1.4 and in Appendix A.

Three surface sediment samples (16-C-1SS, -2SS, and -3SS) were collected in the disposal trench at Site 16 (Figure 4.1.16-3). These surface sediment samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7470/7471), soil moisture (ASTM D2216), TFH-diesel and -gas (California method) and explosives.

In surface samples 16-C-1SS, -2SS, and -3SS, barium, cadmium, copper, chromium, iron, lead, nickel, potassium, magnesium, manganese, vanadium, and zinc were detected at levels over two standard deviations above average background levels in soil borings at Beale AFB. However, the background borings for this investigation were drilled in alluvial sediments whereas the trench at Site 16 was dug in weathered metamorphosed basalt which probably has higher amounts of iron and magnesium than the background samples. Lead was detected at 527 mg/kg in 16-C-1SS, 117 mg/kg in 16-C-2SS, and 71.7 mg/kg in 16-C-3SS. TFH-diesel was only detected in 16-C-1SS at 7.1 mg/kg (Figure 4.1.16-3). TFH-gas and explosives were not detected in surface sediment samples. Di-n-butyl phthalate (0.40 mg/kg) was detected in 16-C-1SS.

Through the four quarterly rounds of water sampling at Site 16, four groundwater samples were collected from monitoring well 16-C-1. Analyses performed for the groundwater sample were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), arsenic (7060), lead (7421), mercury (7470/7471), selenium

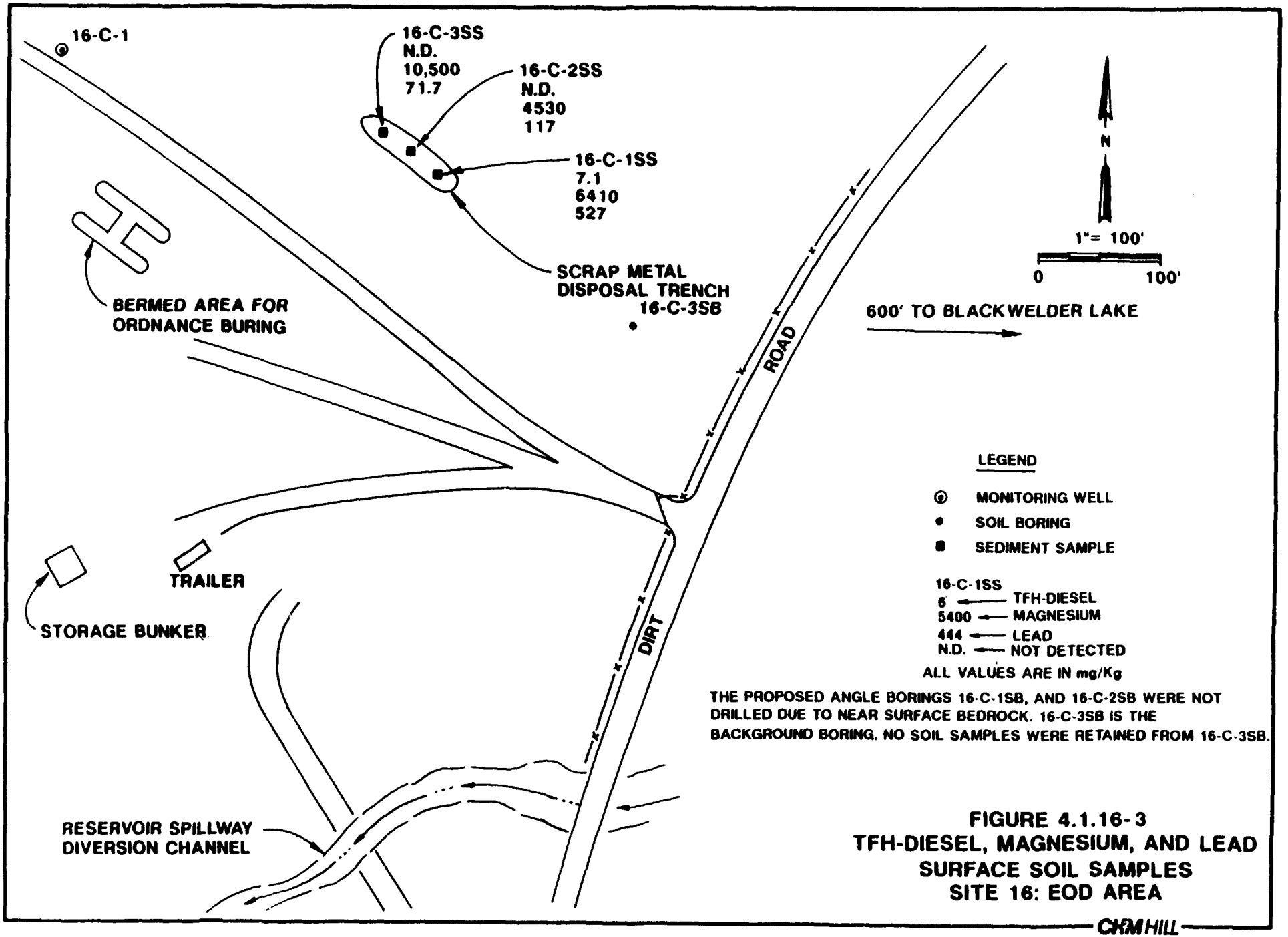


FIGURE 4.1.16-3
TFH-DIESEL, MAGNESIUM, AND LEAD
SURFACE SOIL SAMPLES
SITE 16: EOD AREA

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(7740), water quality parameters (various methods), TFH-diesel and -gas (California method), and the explosives analyses RDX, picric acid, and TNT.

No organic compounds, arsenic, lead, mercury, selenium, TFH-diesel, TFH-gas or explosives were detected in groundwater at Site 16 during the first three quarterly sampling rounds of this investigation.

In the fourth round sample at well 16-C-1 explosives were detected for the first time. TNT was tentatively identified at 0.2 ug/l (below the LOQ of 0.8 mg/l). RDX was detected at 1 ug/l. These analyses were not performed on the duplicate sample due to contractual limitations.

TFH-gas was detected at 0.080 mg/l in the original sample, at the 0.050 LOQ in the field replicate, and was not detected in the equipment wash blank. Toluene was not detected in the original sample or the field or ambient condition blanks. It was detected at 3 ug/l in the field replicate but was not detected in the second column confirmation. Methylene chloride was detected at 11 ug/l (13 ug/l in the second column) in the equipment wash blank but not in the sample, field replicate, or ambient condition blank. Trichlorofluoromethane was detected at 4 ug/l (6 ug/l in the second column) in the equipment wash blank and at 2 ug/l (1 ug/l in the second column) in the ambient condition blank but was not detected in the original sample or the field replicate.

TDS were 216, 233, 250, and 234 mg/l in successive sampling rounds. Major anions and cation concentrations at this well were generally similar to other sites at Beale AFB. Nitrite plus nitrate (expressed as nitrate) were 12.0, 13.3, 14.8, and 14.0 mg/l. Groundwater at Site 16 is a calcium-magnesium bicarbonate type.

4.1.16.1.4 Analytical Results Table

Table 4.1.16-2 presents a summary of all detected analytes for Site 16. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.16-2 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of Applicable or Relevant and Appropriate Requirements (ARARs) is given in Appendix I.

TABLE 4.1.16-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 16

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	16-C-1SS BAFB-0076 0.0-1.0' 11/23/88	16-C-2SS BAFB-0077 0.0-1.0' 11/23/88	16-C-3SS BAFB-0078 0.0-1.0' 11/23/88
Percent Moisture	ASA#9	N/A	%	NS	NS	15.7	24	25.9
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	7.1	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	12000	8660	15000
Barium	SW6010	10.0	mg/kg	NS	10,000	179	438	217
Cadmium	SW6010	1.0	mg/kg	NS	100	ND	ND	1.3
Calcium	SW6010	100	mg/kg	NS	NS	2890	2450	4080
Chromium	SW6010	3.0	mg/kg	NS	500	57.4	31.8	16.2
Cobalt	SW6010	4.0	mg/kg	NS	8,000	21.4	18.4	24.3
Copper	SW6010	3.0	mg/kg	NS	2,500	125	137	135
Iron	SW6010	10.0	mg/kg	NS	NS	37000	26100	37400
Lead	SW6010	20.0	mg/kg	NS	1,000	527	117	71.7
Magnesium	SW6010	100	mg/kg	NS	NS	6410	4530	10500
Manganese	SW6010	1.5	mg/kg	NS	NS	1490	508	668
Nickel	SW6010	4.0	mg/kg	NS	2,000	51.8	14.5	13.5
Potassium	SW6010	200	mg/kg	NS	NS	1540	1170	2430
Sodium	SW6010	100	mg/kg	NS	NS	248	212	255
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	113
Vanadium	SW6010	4.0	mg/kg	NS	2,400	92.6	87.1	121
Zinc	SW6010	2.0	mg/kg	NS	5,000	610 B	242 B	233 B
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.006	0.004 J	0.008
Toluene	SW8240	0.005	mg/kg	NS	NS	0.002 J	ND	ND
Phenol	SW8270	0.33	mg/kg	NS	NS	2.1 B	2.4 B	1.9 B
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.40	0.32 J	0.32 J
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.25 J	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nit te + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.16-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 16

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	16-C-1GW BAFB-0490 03/14/89	16-C-1GW^{nR} BAFB-0527 04/18/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	250	NT
Temperature	E170.1	N/A	deg C	NS	NS	20.2	NT
pH	E150.1	N/A	pH	5-9	NS	7.18	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	104.8	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	127.9	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	216	NT
Chloride	E325.3	1.0	mg/l	250	250	12.5	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.11	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	12.0	NT
Sulfate	E375.4	1.0	mg/l	250	250	12.9	NT
Calcium	SW6010	1.00	mg/l	NS	NS	26.3	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	12.2	NT
Sodium	SW6010	1.00	mg/l	NS	NS	11.7	NT

NOTES: Results reported for detected analytes only.

NT: analyte not tested

ND: analyte not detected.

NS: No standard criteria or action level currently exists.

(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank

J: estimated value, below quantification limit

b: field blank (ambient condition blank)

n: no analyses detected for analyses performed

e: equipment wash blank

f: field replicate

R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.16-2

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 16

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	16-C-1GW BAFB-0577 06/07/89	
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	250	
Temperature	E170.1	N/A	deg C	NS	NS	20.0	
pH	E150.1	N/A	pH	5-9	NS	7.78	
Alkalinity - Total	SM403	1.0	mg/l	20	NS	96.0	
Bicarbonate	SM403	1.0	mg/l	NS	NS	117.1	
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	233	
Chloride	E325.3	1.0	mg/l	250	250	12.4	
Fluoride	E340.2	0.050	mg/l	2	1.4	0.12	
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	13.3	
Sulfate	E375.4	1.0	mg/l	250	250	15.7	
Calcium	SW6010	1.00	mg/l	NS	NS	25.6	
Magnesium	SW6010	1.00	mg/l	NS	NS	11.9	
Sodium	SW6010	1.00	mg/l	NS	NS	11.4	
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6	BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	6	J

NOTES: Results reported for detected analytes only.

NT: analyte not tested

ND: analyte not detected.

NS: No standard criteria or action level currently exists.

(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank

J: estimated value, below quantification limit

b: field blank (ambient condition blank)

e: equipment wash blank

f: field replicate

R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.16-2

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 16

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	16-C-1GW BAFB-0656 09/19/89	
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	250	
Temperature	E170.1	N/A	deg C	NS	NS	20.0	
pH	E150.1	N/A	pH	5-9	NS	7.86	
Alkalinity - Total	SM403	1.0	mg/l	20	NS	104.0	
Bicarbonate	SM403	1.0	mg/l	NS	NS	126.9	
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	250	
Chloride	E325.3	1.0	mg/l	250	250	13.0	
Fluoride	E340.2	0.050	mg/l	2	1.4	0.10	
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	14.8	
Sulfate	E375.4	1.0	mg/l	250	250	13.0	
Calcium	SW6010	1.00	mg/l	NS	NS	26.5	
Magnesium	SW6010	1.00	mg/l	NS	NS	12.0	
Sodium	SW6010	1.00	mg/l	NS	NS	10.9	
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6	J
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	26	B

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.16-2

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 16

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	16-C-1GW BAFB-0690 11/17/89	16-C-1GW[f] BAFB-0691 11/17/89	16-C-1GW[e] BAFB-0692 11/17/89	16-C-1GW[b] BAFB-0693 11/17/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	255	255	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	20.0	20.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.94	7.94	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	98.0	98.2	6.4	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	119.6	119.8	7.8	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	234	216	13.0	NT
Chloride	E325.3	1.0	mg/l	250	250	13.0	12.4	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.12	0.14	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	14.0	10.2	ND	NT
Sulfate	E375.4	1.0	mg/l	250	250	11.1	12.0	ND	NT
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	0.080	0.050	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	26.7	27.6	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	11.5	12.0	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	1.12	ND	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	10.2	10.3	ND	NT
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	ND	11(13)	ND
Trichlorofluoromethane	SW8010	1	ug/l	NS	3,400	ND	ND	4(6)	2(1)
Toluene	SW8020	1	ug/l	14,300	100	ND	3(0)	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 J	7 J	6 J	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	6 J	ND	15	NT
TNT	USGS01	0.01	ug/l	NS	NS	0.2 J	NT	NT	NT
RDX	USGS01	0.01	ug/l	NS	NS	1	NT	NT	NT

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

4.1.16.1.5 Discussion of Analytical Data

Contaminants detected at Site 16 included metals (barium, cadmium, chromium, copper, lead, nickel, potassium, magnesium, and zinc) in the soil samples above the background range for soils at Beale. TFH-diesel was also detected in one soil sample. Soil borings originally planned for Site 16 could not be drilled because of bedrock present in the area. Table 4.1.16-3 presents the range of contaminants encountered for each of the media sampled (surface soil and groundwater), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the limit of quantification. These detections may represent laboratory "noise" and some of the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study, the LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.16.2 Sampling and Analytical Problems

4.1.16.2.1 Loss of Samples

There were no sample loss problems for Site 16 samples. The first quarter groundwater sample was resampled for analysis of explosives due to missed holding times. All scheduled analyses were completed for Site 16 except for RDX in the explosives analyses in the third groundwater sampling round. The RDX equipment calibration standard was not available from the U.S. Army in September 1989.

Table 4.1.16-3
RANGES OF CONTAMINANTS DETECTED AT SITE 16

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SURFACE SOILS				
TPH-diesel	mg/kg	ND	7.1	1/3
barium	mg/kg	179	438	3/3
cadmium	mg/kg	ND	1.3	1/3
chromium	mg/kg	16.2	57.4	3/3
copper	mg/kg	125	137	3/3
lead	mg/kg	71.7	527	3/3
magnesium	mg/kg	4530	10,500	3/3
nickel	mg/kg	13.5	51.8	3/3
potassium	mg/kg	1170	2430	3/3
thallium	mg/kg	ND	113	1/3
zinc	mg/kg	233B	610B	3/3
di-n-butyl phthalate	mg/kg	(0.32)	0.40	3/3
GROUNDWATER				
TPH-diesel	mg/kg	ND	0.080	1/4
TNT	ug/l	ND	1	1/3
RDX	ug/l	ND	0.2 J	1/3

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

4.1.16.2.2 Likelihood that Positive Samples were Contaminated in the Field or Laboratory

Surface soil samples collected at Site 16 contained several organic compounds which were probably laboratory or field induced false positive results. All of the soil samples collected contained methylene chloride. This is a common laboratory contaminant.

All of the soil samples contained the semivolatile compound di-n-butyl phthalate, and one contained bis(2-ethylhexyl) phthalate. The phthalate compounds were commonly detected in samples from throughout the base, at similar concentrations, and are probably false positive results.

Phenol was detected in all of the soil samples at concentrations of 1.9-2.4 mg/kg. This has been traced to a factory contaminated bottle of acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks that the induced contamination was 1.7 mg/kg.

Toluene was tentatively identified below the LOQ in one of the soil samples. Toluene was detected in samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent and low concentration suggests that it is a false positive result.

Zinc was detected in the soils method blank, but at a much lower concentration than in the samples. Although zinc has a "B" qualifier, it should not be considered a false positive result.

No soil replicate QC samples were collected at Site 16.

N-nitrosodiphenylamine was detected below the LOQ in both the sample and the associated method blank in the second round groundwater sample. In the third round, bis(2-ethylhexyl)phthalate was detected at 26 ug/l but was also detected in the method blank.

4.1.16.2.3 Analytical Results Obtained under Out-of-Control Conditions

In the 8270 semivolatile organics analysis of the fourth quarter sample at well 16-C-1, the surrogate spike recovery of 41 percent for 2-Fluorobiphenyl was below the acceptable range of 43 to 116 percent. The equipment wash blank for this sample had three surrogate spike recoveries below acceptable limits: Nitrobenzene-d5 was 31 percent (below

the 35 to 114 percent range), 2-Fluorobiphenyl was 35 percent (below the 43 to 116 percent range), and 2-Fluorophenol was 13 percent (below the 21 to 100 percent range).

4.1.16.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.16.3 Significance of Findings

Soil

Three surface soil samples were collected with a hand auger from the bottom of the disposal trench. TFH-diesel was detected in one of the three samples at 7.1 mg/kg. The TFH-diesel LUFT cleanup standard calculated for this sample is 100 mg/kg.

ICP metal concentrations for barium, cadmium, chromium, copper, potassium, magnesium, nickel, lead, and zinc were more than two standard deviations higher than at average background concentrations, but below DHS TTLC levels. The 527 mg/kg lead concentration in 16-C-1SS was one of the highest detected basewide. The DHS TTLCs for barium, cadmium, chromium (VI), chromium (III), copper, nickel, lead, and zinc are 10,000, 100, 500, 2,500, 2,500, 2,000, 1,000, and 5,000 mg/kg, respectively. DHS TTLCs are not available for the other metals. Based on the DHS TTLC criteria, the soil sampled at Site 16 is not a hazardous material.

Groundwater

One monitoring well was constructed at Site 16 during Stage 2-1. The samples collected from 16-C-1 had water quality parameters similar to groundwater samples from other wells on base. Lead was not detected in the groundwater. ICP metals detected were calcium, magnesium, and sodium, all at concentrations below 27 mg/l. These metals generally occur in groundwater, and were detected at similar levels in other groundwater samples on base.

In the fourth round sample at well 16-C-1, explosives were detected for the first time. TNT was tentatively identified at 0.2 ug/l (below the LOQ of 0.8 mg/l). RDX was detected at 1 ug/l) TFH-gas was detected at 0.080 mg/l in the original sample, at the 0.050 LOQ in the field replicate, and

was not detected in the equipment wash blank. These results represent the first indication of possible environmental contamination in groundwater at Site 16.

Geophysics

A geophysical magnetic survey was conducted in the vicinity of the trench at Site 16 to determine whether other trenches may exist. Figure 4.1.16-4 shows the interpreted extent of buried metal. This figure indicates one strong anomaly parallel with the existing trench on the east side. This may be an extension of the existing scrap metal trench which has been backfilled.

4.1.16.3.1 Zones of Contamination

The only contaminated zone found at Site 16 is the bottom of the disposal trench. The only organic contaminant detected was TFH-diesel at a relatively low concentration of 7.1 mg/kg. Thirteen ICP metals were detected at concentrations above those averaged from background soil borings at Sites 2, 3, 6, 13, 15, and 19. All metal concentrations were below the respective DHS TTLC. Based on soil sampling during IRP studies the depth of soil with TFH-diesel contamination or higher than base average metal concentrations cannot be determined.

The groundwater southwest of the disposal trench at Site 16 may be affected by TNT, RDX, and TFH-gas based on the fourth quarter sample results. However, additional well installation and sampling will be needed to determine flow direction and confirm fourth-quarter sampling results.

4.1.16.3.2 Contaminant Migration

Soil contamination has only been detected in the scrap metal disposal trench. Surface water does not flow out of the trench during rain, so migration will not occur in surface water. Water ponded in the trench will either evaporate or infiltrate. Infiltrating water has the potential to transport the fuel hydrocarbons, explosives, or metals to the groundwater.

4.1.16.3.2.1 Potential to Move Off Site and Off Base

The potential for contaminant migration from Site 16 is unknown. Groundwater sampled at Site 16 contained indications of contamination in the fourth sampling round.

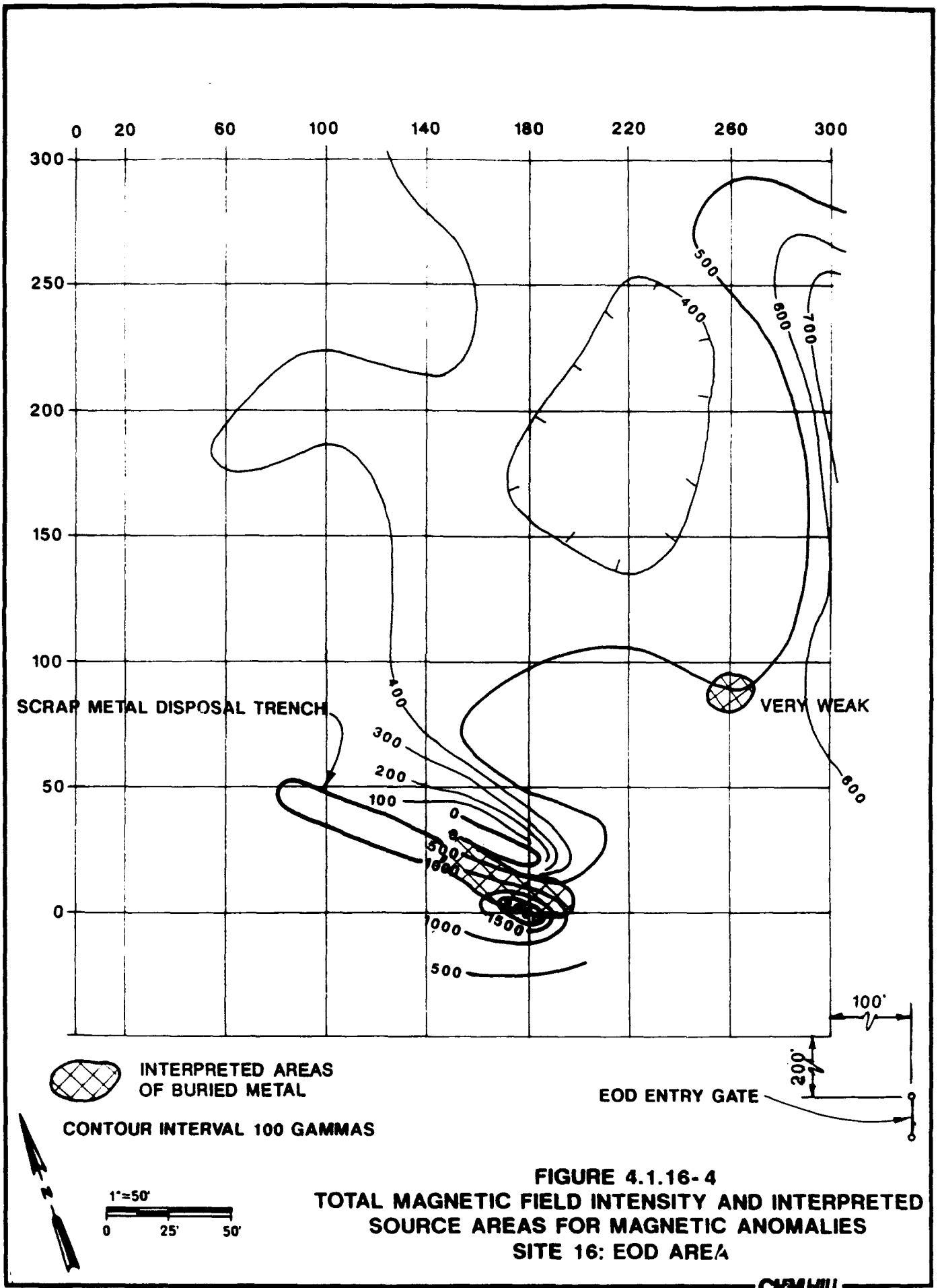


FIGURE 4.1.16-4
TOTAL MAGNETIC FIELD INTENSITY AND INTERPRETED SOURCE AREAS FOR MAGNETIC ANOMALIES
SITE 16: EOD AREA

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4.1.16.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Groundwater flow direction, gradient and velocity are unknown at Site 16. Contaminants were detected in well 16-C-1 only in the fourth sampling round.

4.1.16.3.2.3 Time of Travel to Receptors

The only human receptors at Site 16 are EOD personnel, while working in the area.

4.1.16.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 16 at this time because the groundwater gradient is not known and groundwater travels primarily by fracture flow in bedrock.

4.1.16.3.2.5 Expected Spatial and Temporal Variations in Concentration

No groundwater contaminants were detected in the first three sampling rounds but TNT, RDX, and TFH-diesel were detected in the fourth sampling round.

4.1.16.3.3 Baseline Risk Assessment

No risk assessment activities were performed as part of Stage 2-1.

4.1.17 DISCUSSION OF RESULTS FOR SITE 17: BEST SLOUGH

Best Slough is an offshoot of Dry Creek, which flows to the south and crosses Gavin Mandry Road west of the officer housing area, Figure 4.1.17-1. The site was added to the IRP investigation because old empty drums were discovered in a 50- to 100-foot trench approximately 50 feet north of the slough in January 1985.

The area investigated is north of the slough. The site has no buildings, roads, or apparent current use. Four trenches were observed in the field and are shown in Figure 4.1.17-1. Trenches 1 and 3 (trench numbers specific to this investigation) contain approximately 15 empty 55-gallon drums. The drums are severely rusted and show evidence of being punctured. No information is available on what, if anything, the drums contained. No staining of surface soils was observed. Trench 4 (Figure 4.1.17-2) is a long depression, similar in depth to the other trenches. There is also an irregular depression approximately 50 feet south of trench 4, which may be either an excavated or a natural feature.

During Phase II, Stage 1, two hand auger soil samples were collected from the bottom of trenches 2, 3, and 4. Four 15-foot deep borings were drilled around trench 2. All soil samples were analyzed for oil and grease, phenols, purgeable halocarbons, and purgeable aromatics. No analytes were detected in any soil samples.

4.1.17.1 Presentation of Results

The results for Best Slough are presented in this section. Two days of geophysical surveying were conducted in the vicinity of trenches 1, 2, 3, and 4. The purpose of this investigation was to determine if geophysical evidence of buried drums was present. Because the only work done at this site was the geophysical investigation, presentation of results does not include discussion of site geology or hydrology.

4.1.17.1.1 Site Geology--Geophysics

A geophysical investigation was conducted at Best Slough to determine if drums other than those exposed in trenches 1, 2, 3, and 4 may be buried in the vicinity. The work was done during a 2-day period; the area surveyed is shown inset in Figure 4.1.17-2. A fence which runs approximately north-south through the field was the primary reference feature.

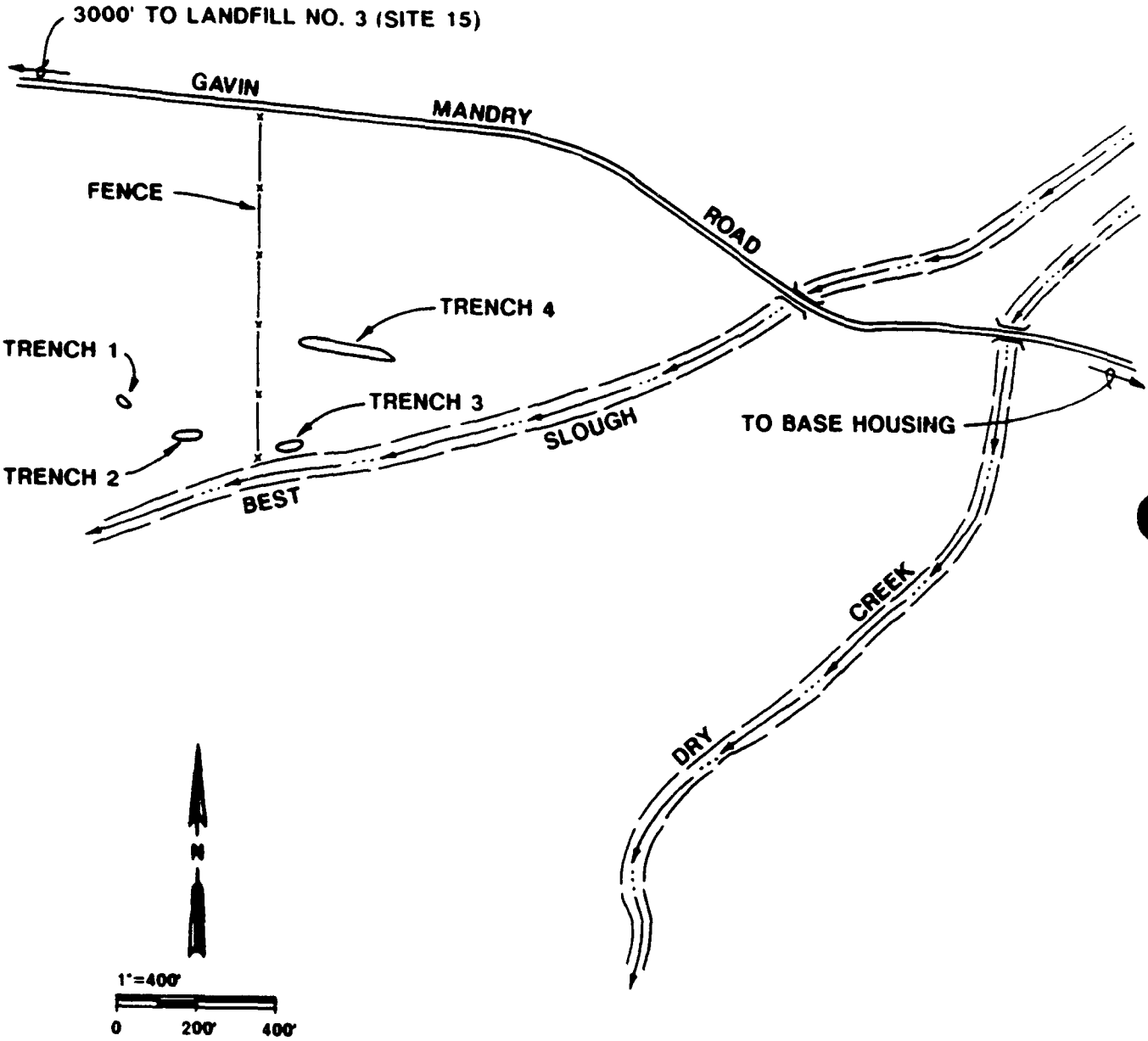
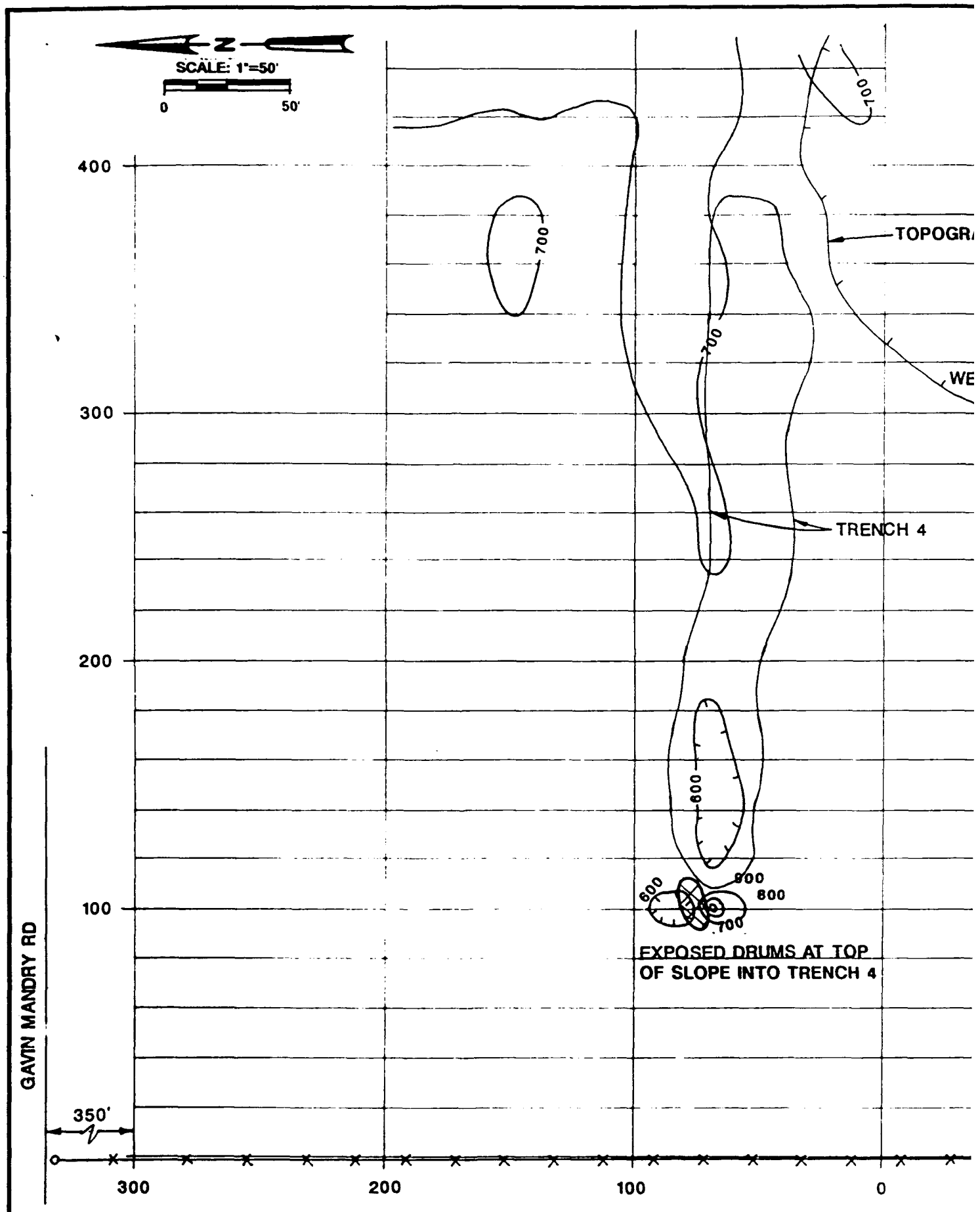


FIGURE 4.1.17-1
SITE 17: BEST SLOUGH

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N
SCALE: 1"=50'
0
50'
400
300
200
100
700
700
700
TOPOGR
WE
TRENCH 4
600
600
800
800
700
EXPOSED DRUMS AT TOP
OF SLOPE INTO TRENCH 4
GAVIN MANDRY RD
350'
300
200
100
0

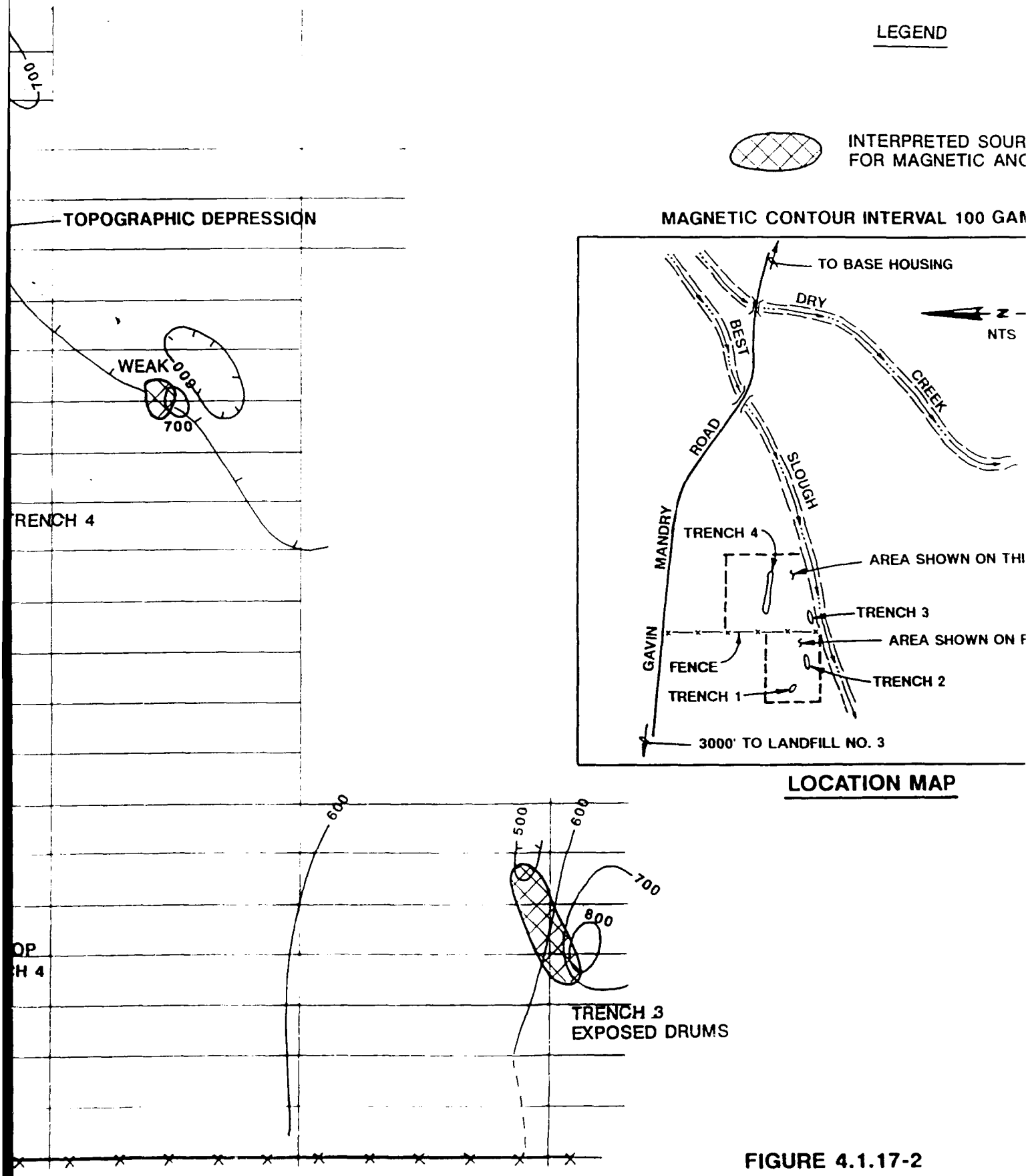
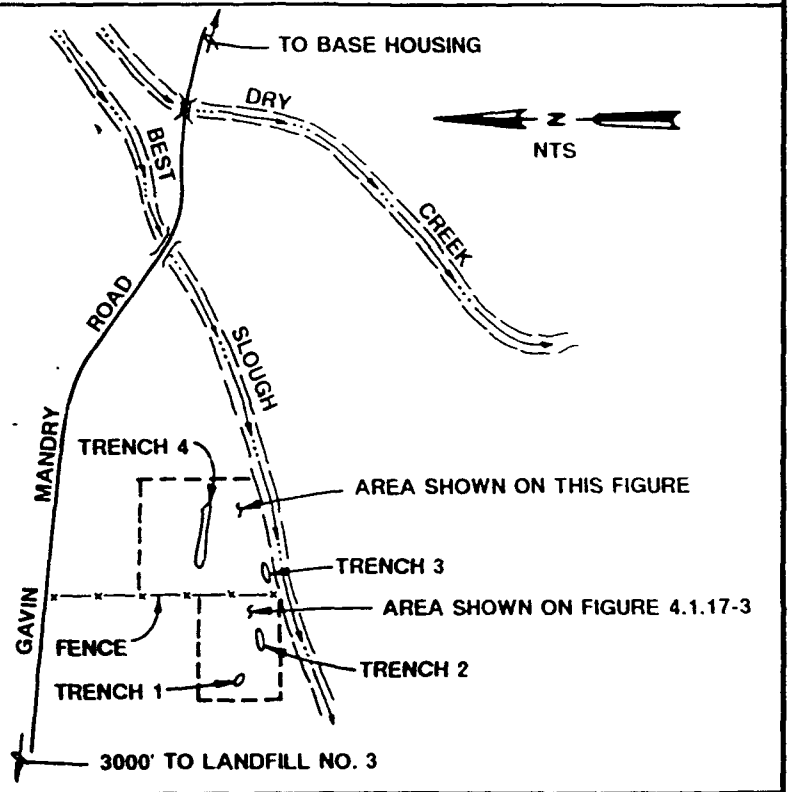


FIGURE 4.1.17-2
TOTAL MAGNETIC FIELD INTENSITY AND INT
SOURCE AREAS FOR MAGNETIC ANOM
SITE 17: BEST SLOUGH, EAST OF FE

LEGEND

INTERPRETED SOURCE AREAS FOR MAGNETIC ANOMALIES

MAGNETIC CONTOUR INTERVAL 100 GAMMAS



LOCATION MAP

700

00

ENCH 3
POSED DRUMS

FIGURE 4.1.17-2
L MAGNETIC FIELD INTENSITY AND INTERPRETED
SOURCE AREAS FOR MAGNETIC ANOMALIES
SITE 17: BEST SLOUGH, EAST OF FENCE

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Figures 4.1.17-2 and 4.1.17-3 show total field magnetic intensity and the areas interpreted as sources of magnetic anomalies at Site 17. The strongest positive anomalies were always associated with the areas where drums were exposed.

A weak magnetic low is located in the west end of trench 4. This low does not indicate metal and is most likely due to the absence (the inscribed volume of the trench) of the very weakly magnetic soils. This absence creates a "depression" or low in the naturally occurring magnetic field. Other observed anomalies were weak and were not interpreted to indicate the presence of buried drums. A plot of the total magnetic field intensity along each grid line is provided in Appendix H.

4.1.17.1.2 Site Hydrogeology

Because groundwater-related work was not performed on or near Site 17 in either IRP stage, no discussion of Site 17 hydrogeology is provided.

4.1.17.1.3 Analytical Results

No samples were collected for analysis during this site investigation.

4.1.17.1.4 Analytical Results Table

No samples were collected for analysis during this site investigation.

4.1.17.1.5 Discussion of Analytical Data

No samples were collected for analysis during this site investigation.

4.1.17.2 Sampling or Analytical Problems

No samples were collected for analysis during this site investigation.

4.1.17.3 Significance of Findings

No contaminants were detected in soil samples in the initial IRP Phase II, Stage 1 study (AeroVironment, 1987). No ground surface staining, odors, or other signs of chemical

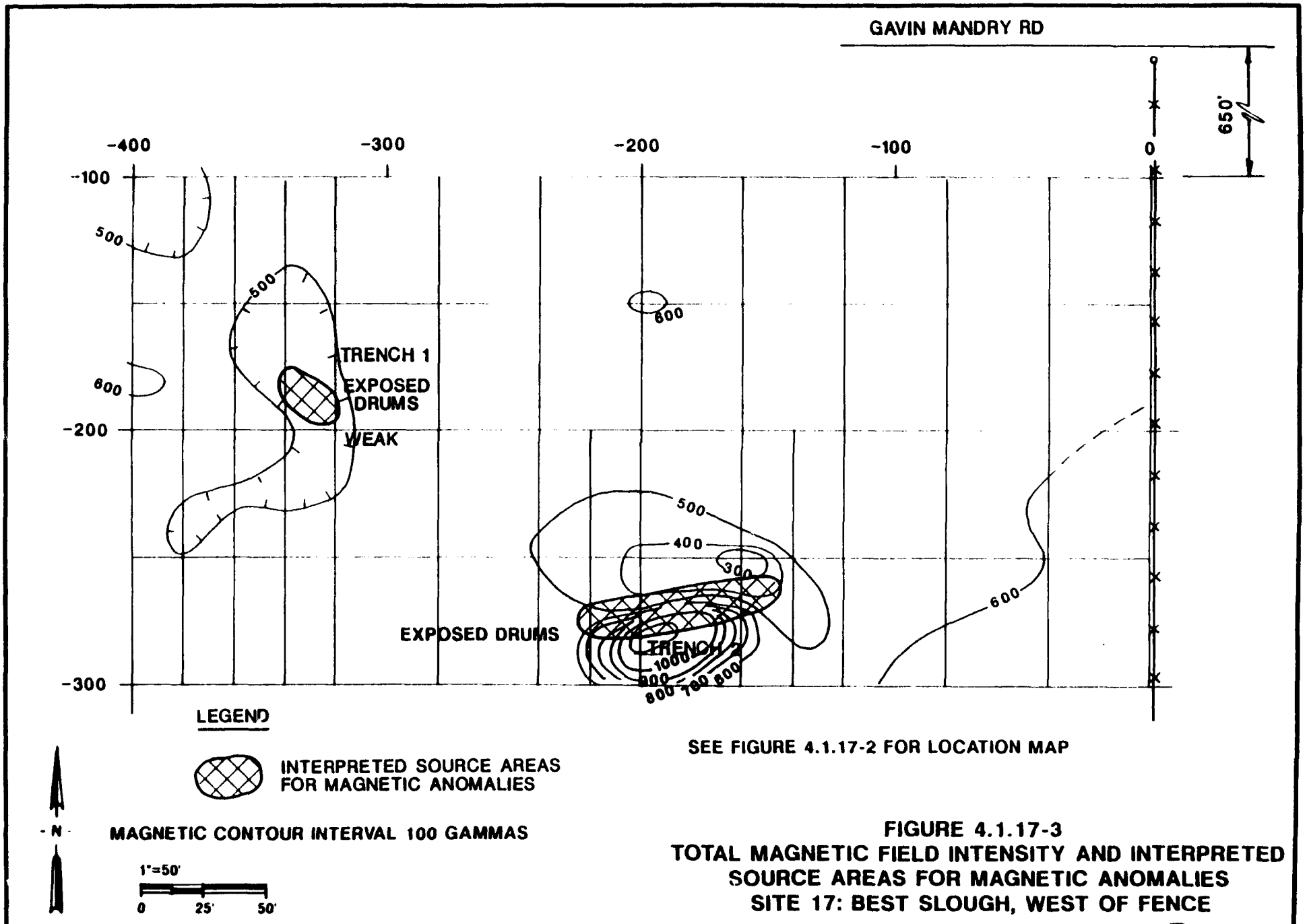


FIGURE 4.1.17-3
TOTAL MAGNETIC FIELD INTENSITY AND INTERPRETED SOURCE AREAS FOR MAGNETIC ANOMALIES
SITE 17: BEST SLOUGH, WEST OF FENCE

contamination were observed near the empty drums during Stage 2-1 field work.

Based on the magnetic geophysical data collected during the Stage 2-1 study, buried drums are not believed to be present at Site 17. Magnetic field intensities characteristic of buried metal were only detected in areas adjacent to exposed drums.

4.1.17.3.1 Zones of Contamination

No contamination was detected or interpreted to exist at Site 17. Based on IRP information collected to date, including soil and surface water sampling and magnetic geophysical surveying, no zones of contamination are evident at Site 17.

4.1.17.3.2 Contaminant Migration

No contaminant migration is expected from Site 17.

4.1.17.3.2.1 Potential to Move Off Site and Off Base

No contaminants have been identified at Site 17.

4.1.17.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

This section does not apply to Site 17.

4.1.17.3.2.3 Time of Travel to Receptors

This section does not apply to Site 17.

4.1.17.3.2.17 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 17 because no contaminants were detected.

4.1.17.3.2.5 Expected Spatial and Temporal Variations in Concentration

No spatial or temporal variations in concentrations are expected at Site 17.

4.1.17.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.18 DISCUSSION OF RESULTS FOR SITE 18: BULK FUEL STORAGE FACILITY

The bulk fuel storage facility, consisting of two areas of diked, aboveground storage tanks, is on the northeast side of the intersection of Gavin Mandry Road (6th Street) and J Streets. The facility has operated since 1958. Fuels are delivered to and from the aboveground tanks by train, truck, or pipeline. Fuels include jet fuels (AVGAS) JP-4, JP-7, and JPTS, and motor gasoline (MOGAS), diesel fuel, unleaded gasoline, and No. 2 fuel oil. No major spills have been reported, but the site was evaluated because a number of minor spills have occurred while unloading rail cars.

In the Phase II, Stage 1 study, four soil borings were sampled and analyzed. The resulting report recommended no further IRP activities (AeroVironment, 1987), but regulatory agencies suggested installing monitoring wells, groundwater and soil sampling and analysis, and pipeline testing (DHS, 1987a; RWQCB, 1987a). The pipeline testing was not included in the IRP work.

In the Stage 2-1 study, surface samples, soil borings, and monitoring wells were sampled at locations shown in Figure 4.1.18-1. Surface samples were collected in the AVGAS area from two locations within each tank berm area and from three locations along the drainage ditch. Surface samples were collected in the MOGAS area from one location in each bermed tank area, and three samples from the area where berm drainage is discharged east of the MOGAS tanks. Borings were drilled and sampled at three locations along the railroad tracks on the north side of the site, near the AVGAS unloading area. Two monitoring wells were constructed; one near the AVGAS and one near the MOGAS areas. These wells were sampled semiannually during the IRP Stage 2-1.

4.1.18.1 Presentation of Results

The following section presents the results of the field investigation at Site 18. The discussion focuses on the geology and hydrogeology at the site, and presents the results of chemical analyses performed on samples of soil and groundwater.

4.1.18.1.1 Site Geology

Evaluation of local geology at Site 18 is based on drilling activities completed during the Stage 2-1 study. Two monitoring wells at Site 18 were drilled during Stage 2-1.

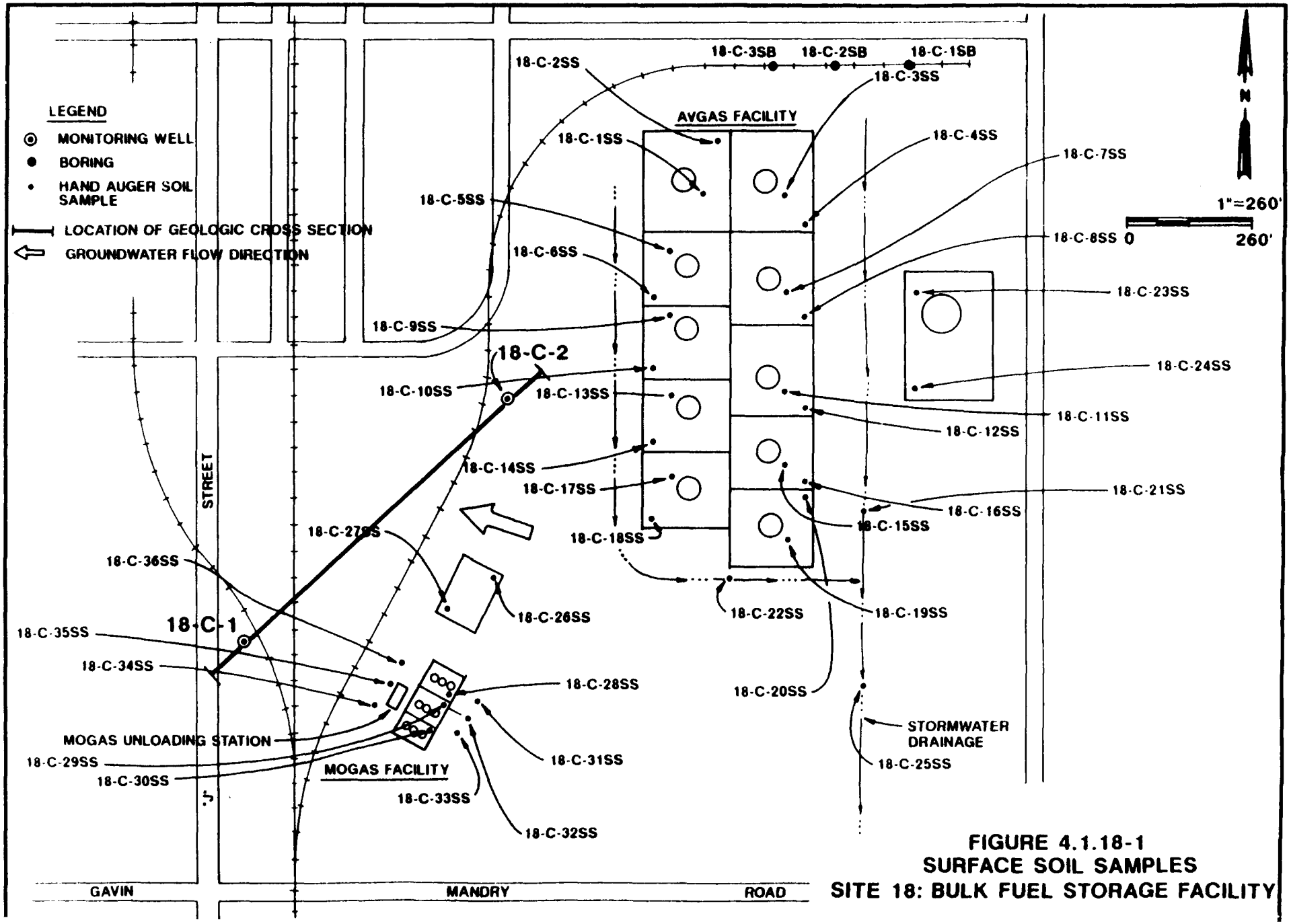


FIGURE 4.1.18-1
SURFACE SOIL SAMPLES
SITE 18: BULK FUEL STORAGE FACILITY

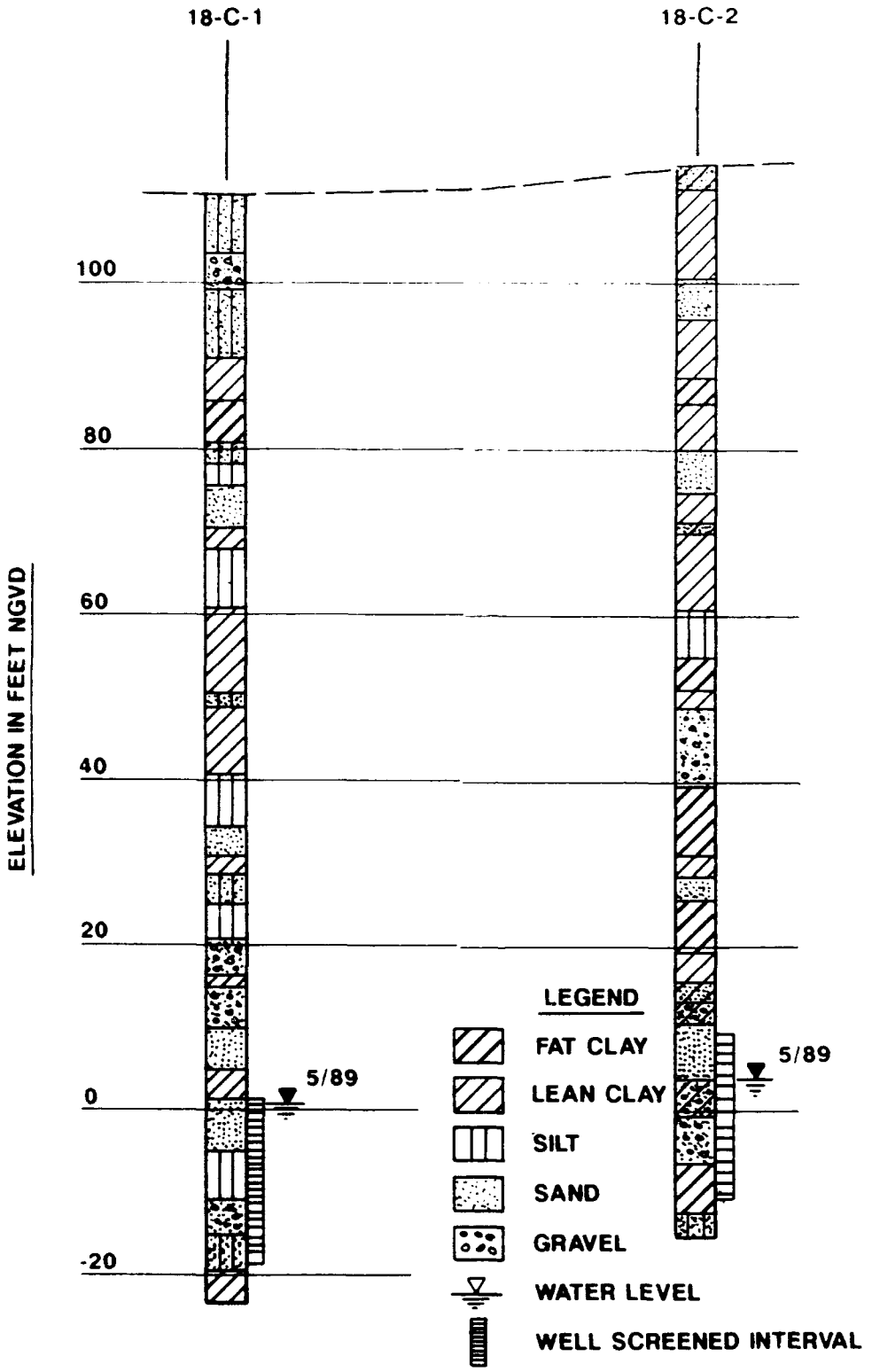
One of these wells is located west of the AVGAS facility, and one is located west of the MOGAS facility (see Figure 4.1.18-1). Both are screened across the water table. In addition, three vertical boreholes were drilled and logged along the railroad track north of the AVGAS facility. These holes ranged in depth from 11.5 to 13 feet. The location of all wells and boreholes is shown on Figure 4.1.18-1. Soil boring logs are provided in Appendix D.

A geologic cross-section drawn through soils encountered in the monitoring well boreholes is located in Figure 4.1.18-1 and shown in Figure 4.1.18-2. The investigation confirmed that subsurface soils are composed of highly variable alluvial sediments, typical of valley sediments deposited at the base of the Sierra Nevada foothills. As with many of the near-surface alluvial deposits in the Central Valley, individual beds in the vadose zone at Site 18 may generally not be correlated between drilling locations. Some correlation may be made among boreholes 18-C-1SB, 18-C-2SB and 18-C-3SB however, which were drilled close together. These holes each contacted a sandy lean clay beneath gravelly railroad ballast. Below the sandy clay, the holes encountered silts and clays to their total depths. Wells 18-C-1 and 18-C-2 were drilled through both coarse-grained stream channel deposits and fine-grained overbank deposits through their total depths. Permeable sands and gravels appear to predominate below a depth of about 90 feet BGS (about 20 feet NGVD).

Surface soils at Site 18 have been mapped as belonging to the San Joaquin Loam. This is a medium-textured soil formed on moderately old alluvial fans (SCS, 1985). The surface geology was mapped as Laguna Formation by Page (1980), a fine-to-coarse-grained continental alluvial sequence which contains cemented layers. The soil boring logs describe layers of cemented sediments in both holes. Based on color descriptions, neither hole contacted the volcanic sediments that lie under the Laguna Formation in the stratigraphic section at Beale AFB.

4.1.18.1.2 Site Hydrogeology

Near-surface groundwater in wells 18-C-1 and 18-C-2 appears to flow under generally unconfined conditions, which may be partially confined in the vicinity of each well. Well 18-C-1 produces water mainly from gravels and sandy silts overlain by a layer of moderately cemented sand. The bottom of



SCALE: 1"=260' HORIZ
1"= 20' VERT

SEE FIGURE 4.1.18-1 FOR WELL LOCATIONS

FIGURE 4.1.18-2
GEOLOGIC CROSS SECTION
SITE 18: BULK FUEL STORAGE FACILITY

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the well terminates in a lean clay at a depth of 134 feet BGS (-23 feet NGVD).

Well 18-C-2 produces water from sands and gravels that extend from a depth of 103-121 feet BGS (11 to -7 feet NGVD). The bottom of the screen lies in fat clay that extends from 121-127 feet BGS (-7 to -13 feet). The clay therefore acts as a base for the uppermost saturated permeable zone in the immediate vicinity of well 18-C-2.

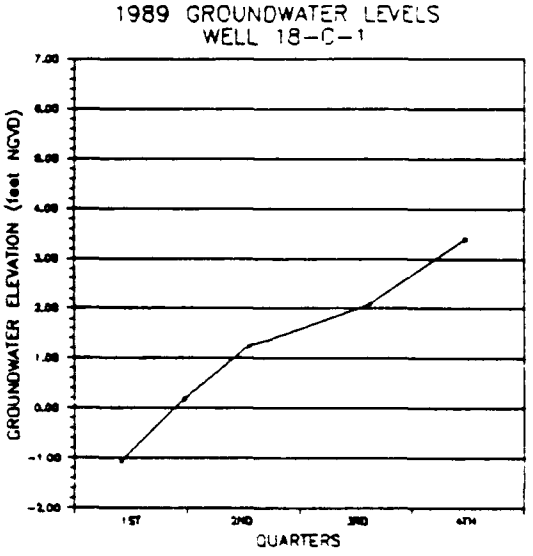
Groundwater level data from the monitoring wells at Site 18 collected during 1989 are presented in Table 4.1.18-1 and Figure 4.1.18-3. Groundwater levels in the two wells rose through all four quarters, for a total of 4.45 feet in well 18-C-1 and 3.18 feet in well 18-C-2. This continuous rise was observed in many other monitoring wells at Beale AFB that were constructed in unconsolidated sediments and may be part of a regional long-term rise in groundwater levels.

Table 4.1.18-1
GROUNDWATER ELEVATIONS: SITE 18
(FEET NGVD)

Well	Screened Interval	Feb. 1989	March 1989	May 1989	Aug. 1989	Nov. 1989
18-C-1	2 to -18	-1.06	0.19	1.25	2.10	3.39
18-C-2	9 to -11	2.72	3.07	4.06	4.85	5.90

May 1989 groundwater elevation contours plotted on wells in the southern part of Beale AFB are presented in Figure 4.1.18-4. Plate 3 provides groundwater contours for Beale AFB based on March 1989 data, while Plate 4 provides contours based on November 1989 data. These figures demonstrate that groundwater in the vicinity of Site 18 is flowing to the west, and appears to be controlled by the groundwater depression located west of the base. The gradient in May 1989 was about 0.006.

Aquifer parameters for the uppermost saturated permeable zone at Site 18 were derived from pump tests according to the Cooper-Jacob Method (1946) from the water level data generated during 6 hours of monitored drawdown and recovery in well 18-C-1, and 4 hours of monitored drawdown and recovery in well 18-C-2. Plots of the data and a discussion of



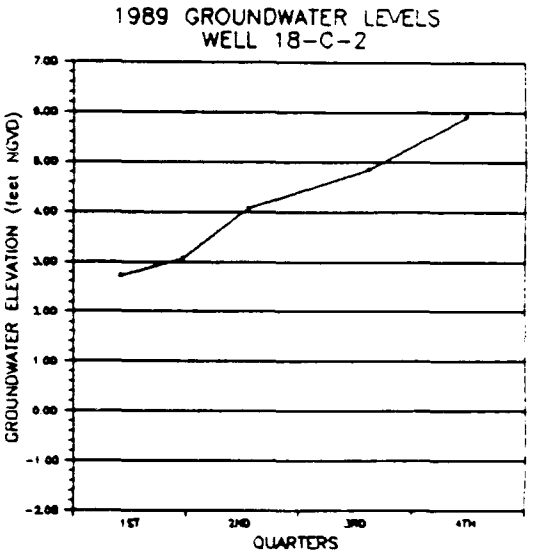


FIGURE 4.1.18-3
MONITORING WELL HYDROGRAPHS
SITE 18: BULK FUEL STORAGE FACILITY

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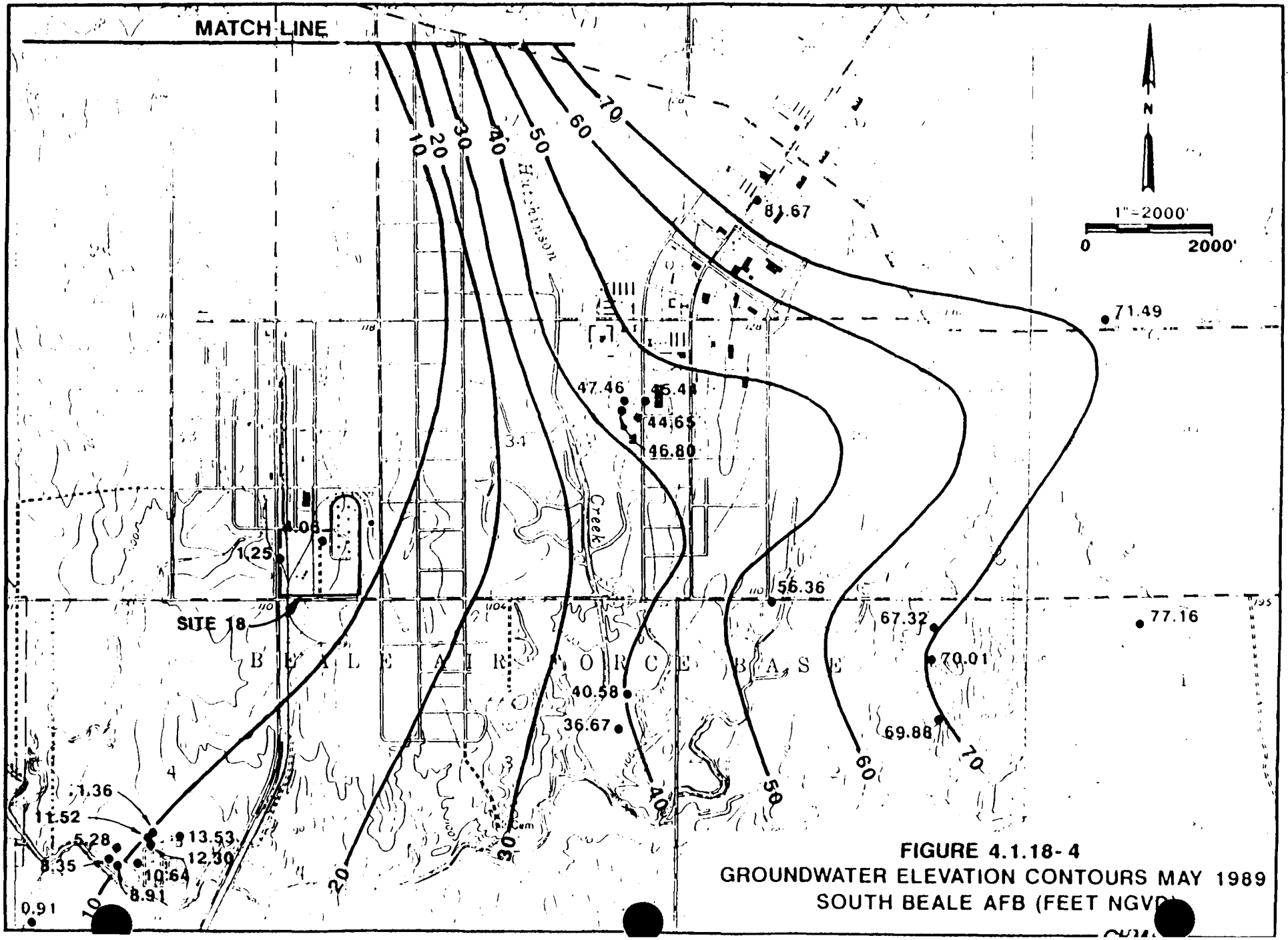


FIGURE 4.1.18-4
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGVD)

testing methodology are provided in Appendix E. A summary of pump test results is shown on Table 4.1.18-2. The pump tests yielded an average value of transmissivity of 290 square feet per day, and an average value of hydraulic conductivity of 25 feet per day (8.8×10^{-3} cm/sec). No water level change was observed in the other well at Site 18 during a test of a pumping well.

Table 4.1.18-2
SUMMARY OF RESULTS OF AQUIFER TESTING
IN SITE 18 WELLS

Well	Date	Test	Transmissivity (ft^2/d)	Hydraulic Conductivity (ft/d)
18-C-1	2/13/89	Drawdown	320	23
		Recovery	270	19
18-C-2	2/10/89	Drawdown	230	24
		Recovery	330	34
		Average:	290	25

An estimate of groundwater velocity near Site 18 may be made by substitution into Darcy's Law. Using the derived average value of hydraulic conductivity of 28 feet per day obtained during the 72-hour pump test at well 19-C-4, the calculated hydraulic gradient of 0.006, and an estimated effective porosity of 0.20, the groundwater velocity is about 0.8 feet per day, or 300 feet per year.

4.1.18.1.3. Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given with Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.18.1.4 and in Appendix A.

Soil

At Site 18, 22 surface soil samples were collected from within the AVGAS tank bermed area with two samples near each tank: one near the tank fuel water separator and one near the berm drain (18-C-1SS to -20SS, -23SS, and -24SS). Three samples (18-C-21SS, -22SS, and -25SS) were taken from the stormwater drainage ditch running south from the AVGAS tanks. Nine samples were taken from the railroad spur in the tank car unloading area: three samples (surface, 5, and 10 feet) from each of the three soil borings (18-C-1SB, -2SB, and -3SB) that were drilled on the tracks between railroad ties.

At the MOGAS facility south of the AVGAS tanks, 11 surface samples were taken: two samples in the unused bermed area north of the MOGAS tanks (18-C-26SS and -27SS), one sample from within each of the three MOGAS tank berm areas (18-C-28SS, -29SS, and -30SS), three samples where berm drainage is discharged to the east of the MOGAS tanks (18-C-31SS, -32SS, and -33SS), and three samples from the area west of the MOGAS unloading station (18-C-34SS, -35SS, and -36SS).

The surface soil and soil boring samples at Site 18 were analyzed for volatile organics (8240), ICP metals (6010), soil moisture (ASTM D2216) and TFH-diesel and -gas (California method).

TFH-diesel was detected throughout the AVGAS tank areas at from 24 to 39,000 mg/kg (Figure 4.1.18-5) except for non-detects in samples 18-C-12SS, -14SS, -16SS, -18SS, and -20SS, which were all taken near the berm drains in the southern part of the tank area. TFH-gas ranged from not detected to 7,800 mg/kg. In the stormwater drainage ditch samples south of the AVGAS tanks, TFH-diesel ranged from 12 to 5,800 mg/kg and TFH-gas ranged from not detected to 4,300 mg/kg.

In the bermed tank area at the MOGAS facility, TFH-diesel ranged from 150 to 8,200 mg/kg while TFH-gas was only detected in the center area at 100 mg/kg (150 mg/kg in replicate). TFH-diesel ranged from not detected to 1,300 mg/kg, and TFH-gas from not detected to 390 mg/kg outside the bermed tank area at the MOGAS facility.

Toluene was detected in most surface soil samples in the northern bermed AVGAS tank areas at 0.12 to 28 mg/kg and was either not detected or below the LOQ in the southern areas

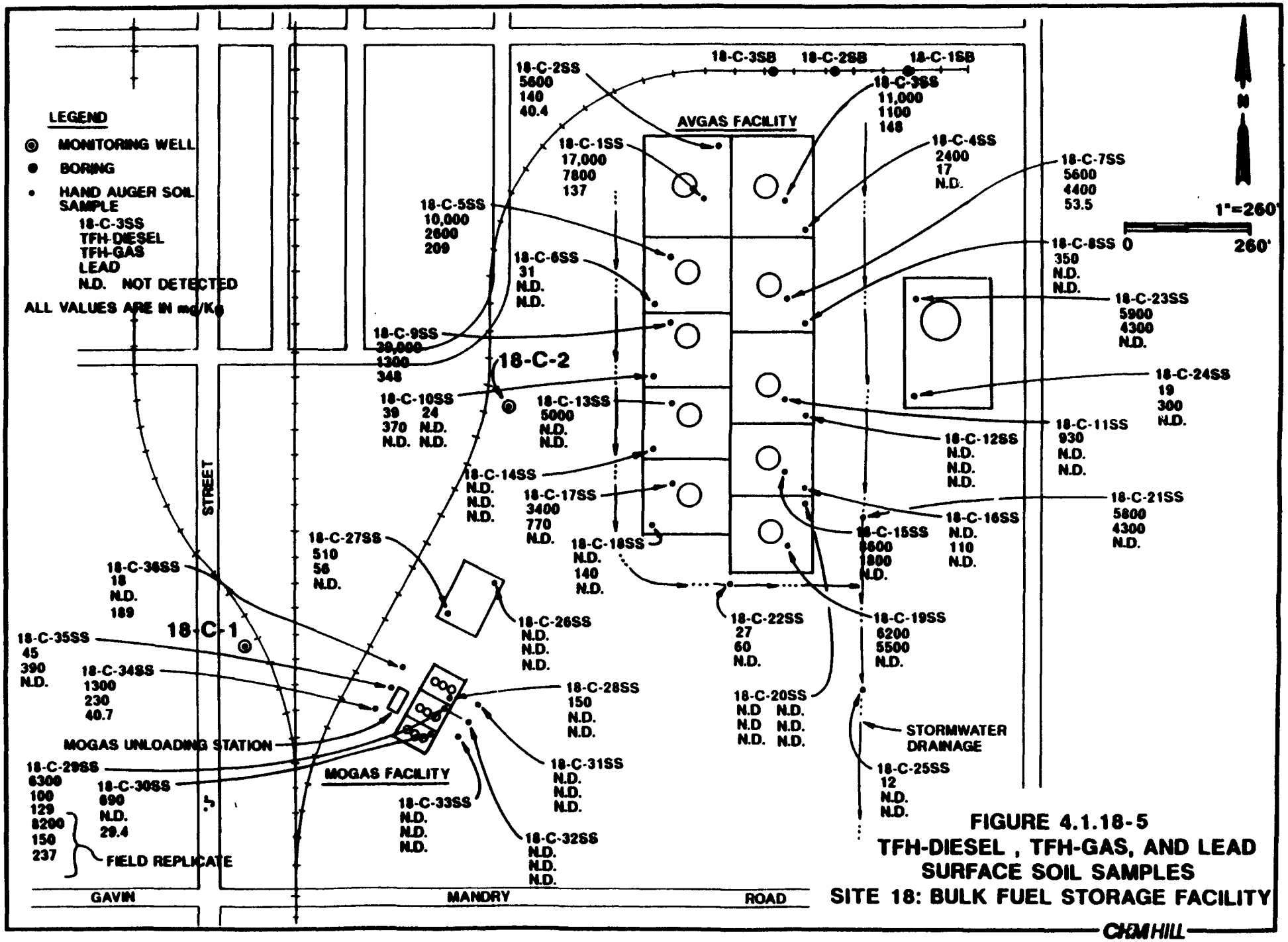


FIGURE 4.1.18-5
TFH-DIESEL , TFH-GAS, AND LEAD SURFACE SOIL SAMPLES
SITE 18: BULK FUEL STORAGE FACILITY

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and the stormwater drainage ditch (Figure 4.1.18-6). In the four northern and the eastern tank berm areas, chlorobenzene ranged from not detected to 11 mg/kg, ethylbenzene from not detected to 25 mg/kg, and total xylenes from not detected to 89 mg/kg. These three compounds were not detected at the six southern tanks or the stormwater drainage ditch.

In the MOGAS surface samples, toluene was detected at 1.3 mg/kg in 18-C-35SS west of the tanks (Figure 4.1.18-6). Ethylbenzene and total xylenes were only detected in the center bermed tank area in sample 18-C-29SS at 1.7 and 4.7 mg/kg, respectively. Lead was detected in the two southern bermed tank areas at 129 mg/kg in sample 18-C-29SS which also had 140 mg/kg zinc (Figure 4.1.18-7). Lead was 29.4 mg/kg in 18-C-30SS. West of the MOGAS tanks, sample 18-C-34SS had 40.7 mg/kg lead and sample 18-C-36SS had 189 mg/kg lead and 316 mg/kg zinc.

Lead, chromium, nickel, and zinc were detected in some surface samples at Site 18 at greater than two standard deviations above the mean concentrations measured in six background borings drilled at various locations at Beale. Figure 4.1.18-5 shows the distribution of lead in surface soil samples. Figure 4.1.18-7 shows the distribution of chromium, nickel, and zinc in surface soil samples.

Several samples taken near the fuel water separator at the northern AVGAS tanks had elevated metals concentrations (Figures 4.1.18-5 and 4.1.18-7). Lead, chromium, nickel, and zinc were detected at elevated levels compared to average concentrations for these metals from background soil borings on base. Manganese was detected at 11,200 mg/kg in 18-C-4SS. Magnesium was detected at 8,790 mg/kg in 18-C-1SS, 10,700 mg/kg in 18-C-5SS, and 13,300 mg/kg in 18-C-9SS. Other metals in soil at the AVGAS facility at Site 18 generally occurred at typical concentrations for Beale AFB.

Soil Borings

In the soil borings at the railroad spur (Figure 4.1.18-8), benzene was detected in the 10-foot sample at 18-C-2SB at 4.1 mg/kg and trans-1,2-DCE at 12 mg/kg. Ethylbenzene was detected in the surface and 5-foot samples at boring 18-C-1SB at 0.41 and 67 mg/kg, and in the 10-foot sample at 18-C-2SB at 17 mg/kg. TCE was detected at 2.2 mg/kg in the

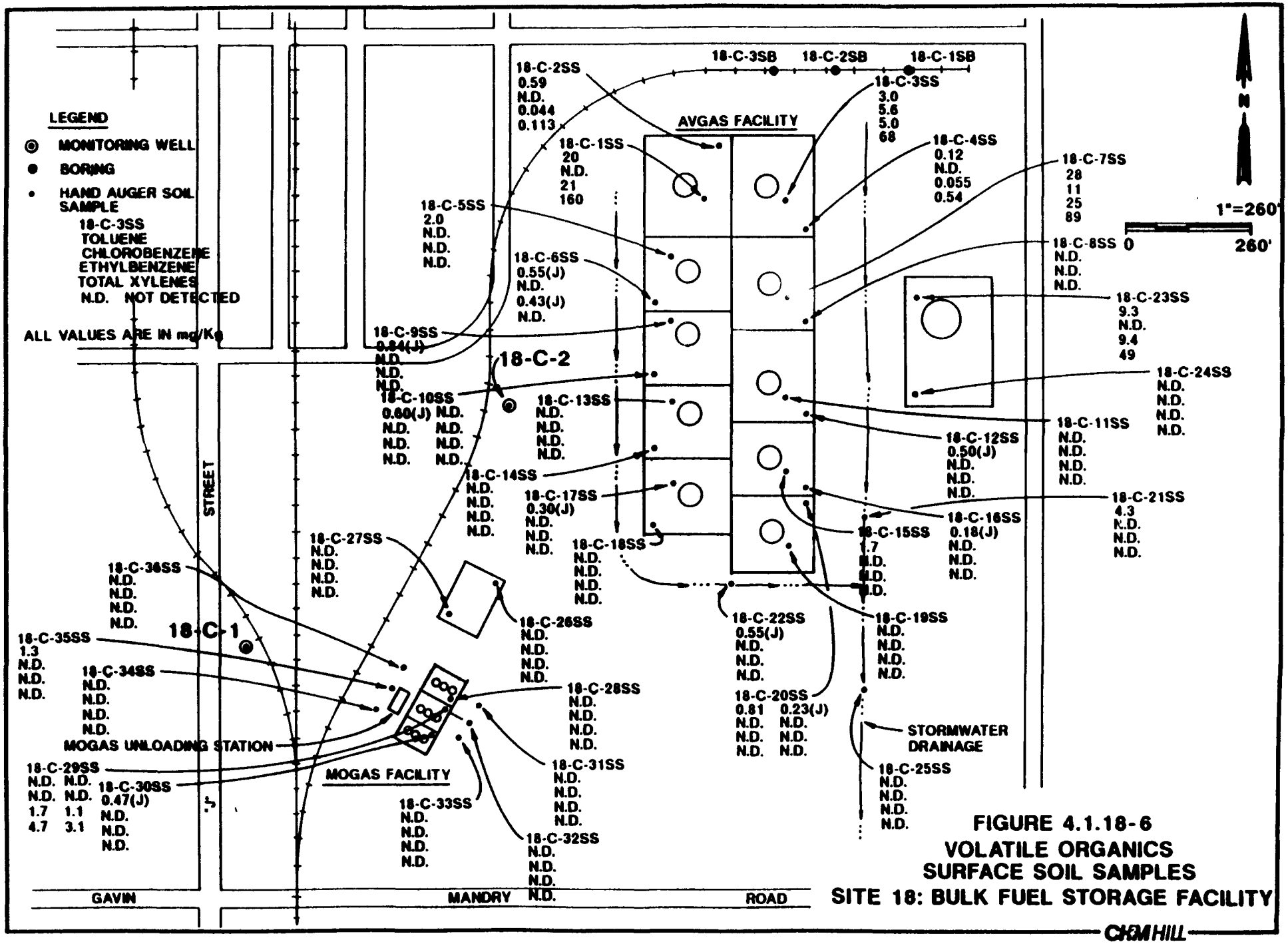


FIGURE 4.1.18-6
VOLATILE ORGANICS
SURFACE SOIL SAMPLES
SITE 18: BULK FUEL STORAGE FACILITY

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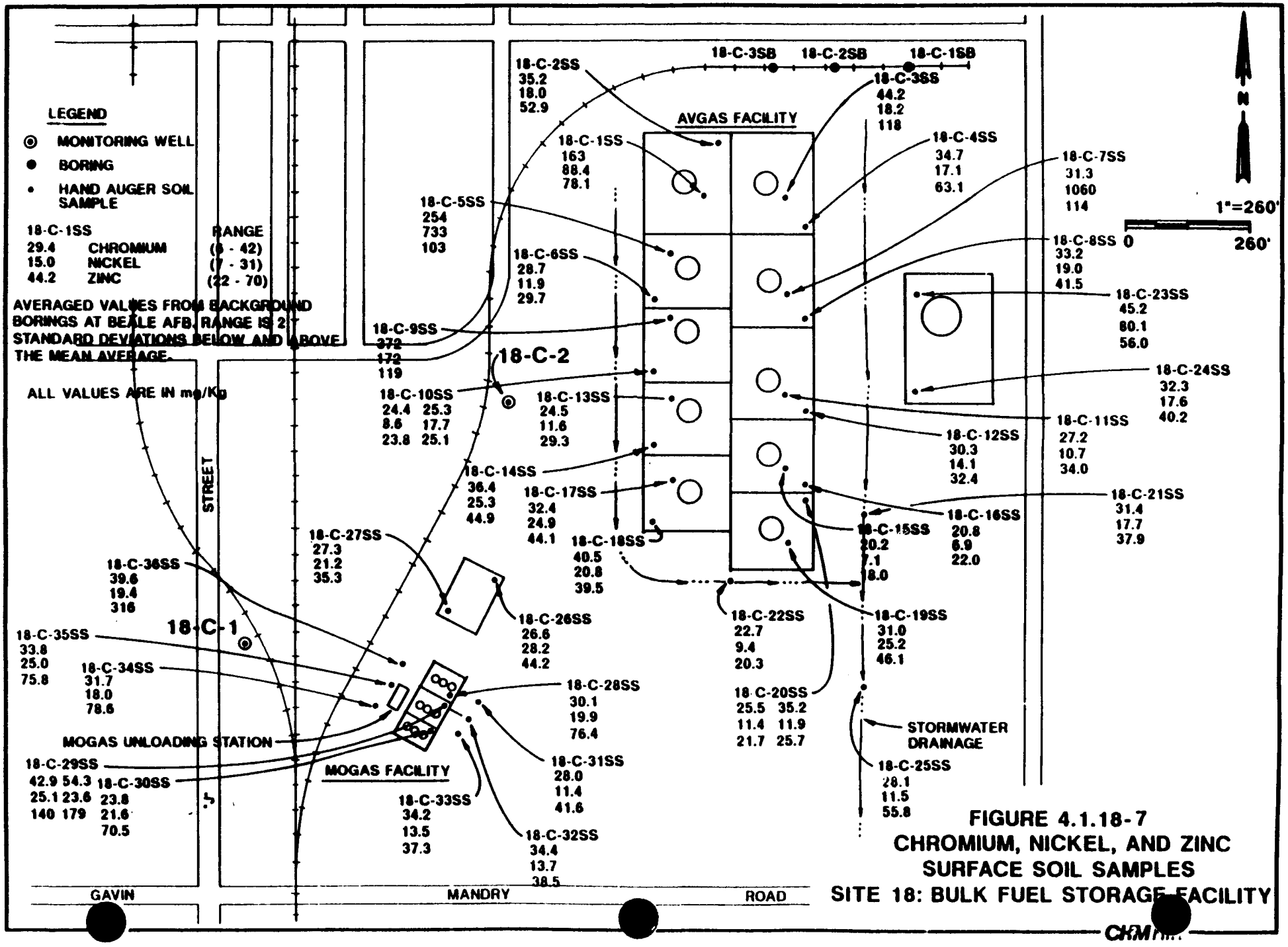
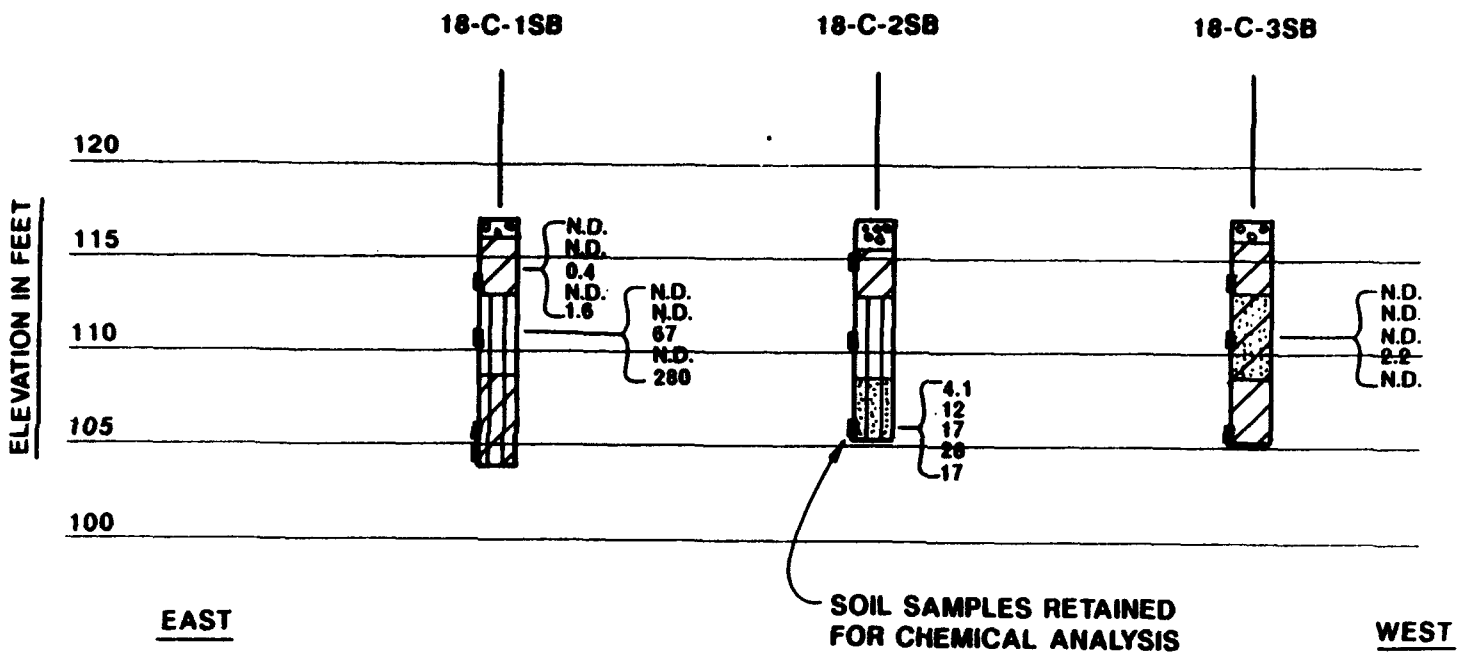


FIGURE 4.1.18-7
CHROMIUM, NICKEL, AND ZINC
SURFACE SOIL SAMPLES
SITE 18: BULK FUEL STORAGE FACILITY

CH2M HILL



LEGEND

BENZENE
TRANS-1, 2-DCE
ETHYLBENZENE
TCE
XYLENES (TOTAL)

N.D. NOT DETECTED
ALL VALUES ARE IN mg/Kg

SCALE: 1"=70' HORIZ
1"=10' VERT

0 70'

VERTICAL SCALE: 7X

NOTE: FOR BORING LOCATIONS SEE FIGURE 4.1.18-1

FIGURE 4.1.18-8
VOLATILE ORGANICS
SOIL SAMPLES
SITE 18: BULK FUEL STORAGE FACILITY

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5-foot sample at 18-C-3SB. Total xylenes were detected in the surface and 5-foot samples at 18-C-1SB at 1.6 and 280 mg/kg and in the 10-foot sample at 18-C-2SB at 17 mg/kg.

For soil borings at the railroad spur, lead was detected only in the boring 18-C-1SB replicate 10-foot sample at 37.7 mg/kg (Figure 4.1.18-9). TFH-diesel was detected at 450 to 52,000 mg/kg in all samples except the normal environmental sample at 10 feet at 18-C-1SB in which none was detected. TFH-gas was detected at 25 to 1,500 mg/kg in all samples except the 10-foot normal environmental sample at 18-C-1SB in which none was detected.

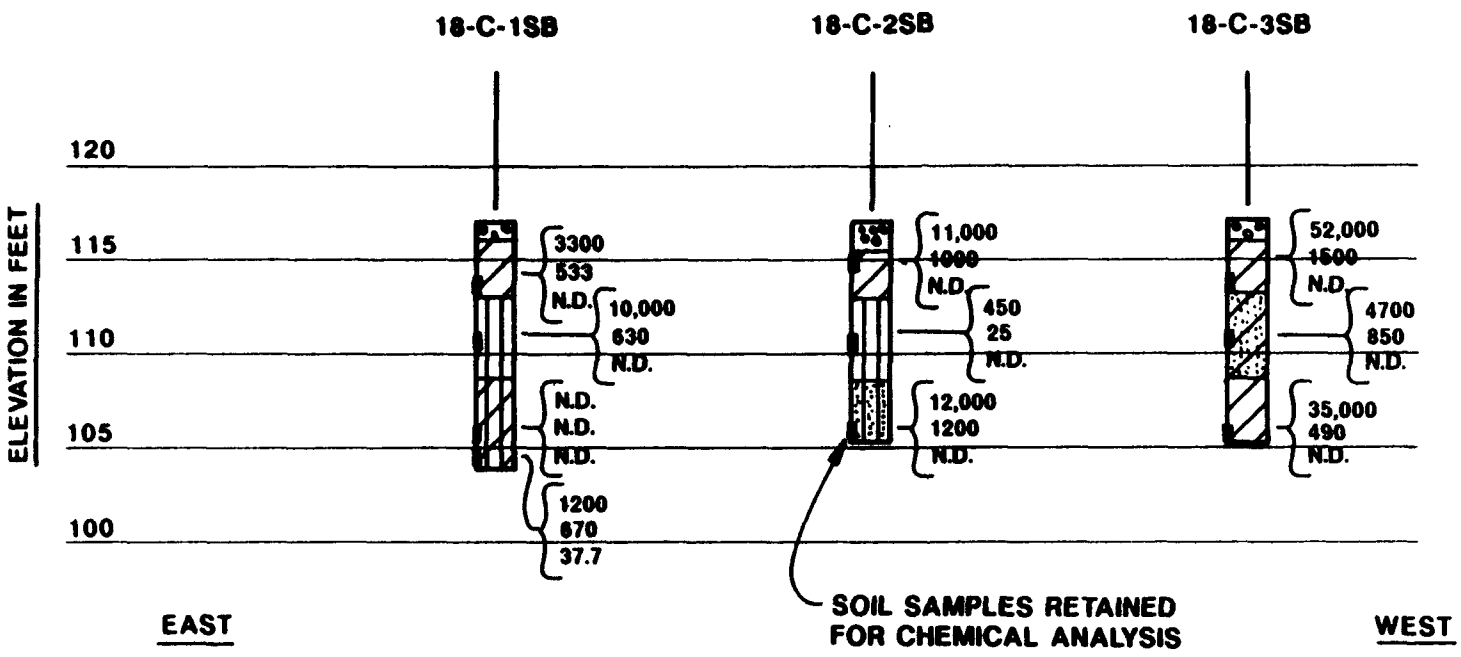
Groundwater

In the two semiannual rounds of water sampling at Site 18 during Stage 2-1, groundwater samples were collected from two new monitoring wells, 18-C-1 and 18-C-2, located west of the MOGAS and AVGAS tanks, respectively. Analyses performed for the groundwater samples were purgeable halocarbons (8010), purgeable aromatics (8020), ICP metals (6010), lead (7421), water quality parameters (various methods), and TFH-diesel and -gas (California method).

Toluene was detected in groundwater at Site 18 during the first quarterly sampling round (February 1989) of this investigation. In well 18-C-1 toluene was detected at 12 ug/l (12 ug/l in second column) and in well 18-C-2 at 3 ug/l (3 ug/l in second column). TFH-gas was detected at 0.80 mg/l in well 18-C-1 and at 0.70 mg/l in 18-C-2.

Zinc was detected at 0.023 mg/l in well 18-C-1 west of the MOGAS tanks. Nickel was detected at 0.044 mg/l in well 18-C-2 west of the AVGAS tanks. Manganese was detected at 0.053 and 0.047 mg/l in 18-C-1 and 18-C-2. TDS were 335 and 332 mg/l. Sodium (57.1 and 63.7 mg/l) and chloride (69.6 and 69.5 mg/l) concentrations at these wells are higher than most other sites at Beale AFB. Nitrite plus nitrate (expressed as nitrate) was 9.6 and 10.0 mg/l. Sulfate was 29.4 and 30.1 mg/l. Groundwater at Site 18 is a sodium chloride-bicarbonate type.

During the second semiannual sampling at Site 18 (third sampling round of Stage 2-1), toluene was detected at 2 ug/l (not confirmed in second column) in 18-C-1 and is considered to not be present. No other organic compounds or TFHs were detected during the third quarter sampling at Site 18.



LEGEND

TFH-DIESEL
TFH-GAS
LEAD

N.D. NOT DETECTED
ALL VALUES ARE IN mg/Kg

SCALE: 1"=70' HORIZ
1"=10' VERT

0 70'

VERTICAL SCALE: 7X

NOTE: FOR BORING LOCATIONS SEE FIGURE 4.1.18-1

FIGURE 4.1.18-9
TFH-DIESEL, GAS , AND LEAD
SOIL SAMPLES
SITE 18: BULK FUEL STORAGE FACILITY

CH2M HILL

Nickel was detected at 0.045 mg/l in 18-C-1. Manganese was detected at 0.016 and 0.024 mg/l. TDS were 336 and 354 mg/l in 18-C-1 and 18-C-2. Sodium (51.7 and 62.7 mg/l) and chloride (62.9 and 71.6 mg/l) concentrations in 18-C-1 and 18-C-2 were again higher than most other Beale sites. Nitrite plus nitrate (expressed as nitrate) was 8.6 and 7.0 mg/l. Sulfate was 65.0 and 43.2 mg/l.

4.1.18.1.4 Analytical Results Table

Table 4.1.18-3 presents a summary of all analyses and detected analytes for Site 18. Analytical data are also presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.18-3 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, and surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.18.1.5 Discussion of Analytical Data

Contaminants in the form of fuel hydrocarbons, chlorinated solvents, and metals were detected in soil samples collected within both tank farms and in the soil borings drilled through the railroad siding. Contaminants were also detected in groundwater samples. Table 4.1.18-4 presents the range of contaminants encountered for each of the media sampled (surface soil, soil, groundwater), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections or surrogate spike recoveries.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the LOQ. Some of these detections may represent laboratory "noise" and the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study the LOQ is equal to the detection limit as defined in the QAPP.

TABLE 4.1.18-3

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 18

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-1SS BAFB-0001 0.0-1.0' 11/15/88	18-C-2SS BAFB-0002 0.0-1.0' 11/15/88	18-C-3SS BAFB-0003 0.0-1.0' 11/15/88	18-C-4SS BAFB-0004 0.0-1.0' 11/15/88	18-C-5SS BAFB-0005 0.0-1.0' 11/16/88	18-C-6SS BAFB-0006 0.0-1.0' 11/16/88
Percent Moisture	ASA#9	N/A	%	NS	NS	15.4	16.5	12	18.2	16.2	15.8
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	17000	5600	11000	2400	10000	31
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	7800	140	1100	17	2600	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	13500	7810	10700	11800	10200	8630
Barium	SW6010	10.0	mg/kg	NS	10,000	177	106	110	100	107	125
Calcium	SW6010	100	mg/kg	NS	NS	1930	707	2240	2070	2100	1810
Chromium	SW6010	3.0	mg/kg	NS	500	163	35.2	44.2	34.7	254	28.7
Cobalt	SW6010	4.0	mg/kg	NS	8,000	9.5	ND	10.1	9.5	17.9	13.1
Copper	SW6010	3.0	mg/kg	NS	2,500	28.6	18.0	22.8	22.2	21.5	20.2
Iron	SW6010	10.0	mg/kg	NS	NS	27800	18300	21000	21000	24700	19500
Lead	SW6010	20.0	mg/kg	NS	1,000	137	40.4	148	ND	209	ND
Magnesium	SW6010	100	mg/kg	NS	NS	8790	2320	2910	2100	10700	1810
Manganese	SW6010	1.5	mg/kg	NS	NS	236	109	54.5	11200	282	492
Nickel	SW6010	4.0	mg/kg	NS	2,000	88.4	18.0	18.2	17.1	733	11.9
Potassium	SW6010	200	mg/kg	NS	NS	508	407	443	379	274	428
Sodium	SW6010	100	mg/kg	NS	NS	226	170	142	153	171	266
Vanadium	SW6010	4.0	mg/kg	NS	2,400	52.0	55.1	55.1	63.4	52.0	57.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	78.1 B	52.9 B	118 B	63.1 B	103	29.7
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	7.2 BJ	0.18 B	1.6 B	0.032 B	0.70 BJ	0.67 BJ
Acetone	SW8240	0.010	mg/kg	NS	NS	7.7 BJ	0.10 B	ND	0.032 B	0.79 BJ	2.0 B
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	2.0
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.88 J
2-Hexanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	1.2 J
Toluene	SW8240	0.005	mg/kg	NS	NS	20	0.59	3.0	0.12	2.0	0.55 J
Chlorobenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	5.6	ND	ND	ND
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	21	0.044	5.0	0.055	ND	0.43 J
Styrene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.57 J	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	170	0.11	68	0.54	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-7SS BAFB-0007 0.0-1.0' 11/16/88	18-C-8SS BAFB-0008 0.0-1.0' 11/16/88	18-C-9SS BAFB-0009 0.0-1.0' 11/16/88	18-C-10SS BAFB-0010 0.0-1.0' 11/16/88	18-C-10SS[f] BAFB-0011 0.0-1.0' 11/16/88	18-C-11SS BAFB-0012 0.0-1.0' 11/16/88
Percent Moisture	ASA#9	N/A	%	NS	NS	9.7	20.9	13.8	16	15.4	15.2
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	5600	350	39000	39	24	930
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	4400	ND	1300	370	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	4710	14800	6470	5880	7120	6700
Barium	SW6010	10.0	mg/kg	NS	10,000	40.1	67.6	96.2	101	122	93.6
Calcium	SW6010	100	mg/kg	NS	NS	701	1390	1750	1140	1310	1720
Chromium	SW6010	3.0	mg/kg	NS	500	31.3	33.2	372	24.4	25.3	27.2
Cobalt	SW6010	4.0	mg/kg	NS	8,000	14.4	6.3	17.4	13.1	16.5	11.1
Copper	SW6010	3.0	mg/kg	NS	2,500	14.4	24.0	19.7	16.7	17.7	16.5
Iron	SW6010	10.0	mg/kg	NS	NS	12500	28300	21300	16000	17100	17700
Lead	SW6010	20.0	mg/kg	NS	1,000	53.5	ND	348	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	1830	3250	13300	1390	1430	2020
Manganese	SW6010	1.5	mg/kg	NS	NS	60.9	196	673	520	694	426
Nickel	SW6010	4.0	mg/kg	NS	2,000	1060	19.0	172	8.6	17.7	10.7
Potassium	SW6010	200	mg/kg	NS	NS	ND	ND	626	524	496	542
Sodium	SW6010	100	mg/kg	NS	NS	151	147	150	ND	ND	158
Vanadium	SW6010	4.0	mg/kg	NS	2,400	23.7	73.7	46.2	49.5	52.5	55.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	114	41.5	119	23.8	25.1	34.0
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	4.9 BJ	0.83 B	ND	ND	0.71 BJ	0.42 BJ
Acetone	SW8240	0.010	mg/kg	NS	NS	8.9 BJ	1.1 BJ	ND	ND	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	28	ND	0.84 J	0.60 J	ND	ND
Chlorobenzene	SW8240	0.005	mg/kg	NS	NS	11	ND	ND	ND	ND	ND
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	25	ND	ND	ND	ND	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	89	ND	ND	ND	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.18-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-12SS BAFB-0013 0.0-1.0' 11/16/88	18-C-13SS BAFB-0014 0.0-1.0' 11/16/88	18-C-14SS BAFB-0015 0.0-1.0' 11/16/88	18-C-15SS BAFB-0016 0.0-1.0' 11/16/88	18-C-16SS BAFB-0017 0.0-1.0' 11/18/88	18-C-17SS BAFB-0018 0.0-1.0' 11/17/88
Percent Moisture	ASA#9	N/A	%	NS	NS	21.8	22.6	20.8	10.9	18.3	19.8
TPH-Diesel	TPH-DI	1.0	mg/kg	NS	NS	ND	5000	ND	8600	ND	3400
TPH-Gas	TPH-GA	50	mg/kg	NS	NS	ND	ND	ND	1800	110	770
Aluminum	SW6010	20.0	mg/kg	NS	NS	10500	6520	1770	4610	5170	13200
Barium	SW6010	10.0	mg/kg	NS	10,000	98.6	97.5	177	66.6	54.3	195
Calcium	SW6010	100	mg/kg	NS	NS	1840	1280	2460	1060	1200	3250
Chromium	SW6010	3.0	mg/kg	NS	500	30.3	24.5	36.4	20.2	20.8	32.4
Cobalt	SW6010	4.0	mg/kg	NS	8,000	14.1	11.4	13.9	7.2	6.1	11.8
Copper	SW6010	3.0	mg/kg	NS	2,500	20.5	15.5	25.3	12.3	11.5	26.9
Iron	SW6010	10.0	mg/kg	NS	NS	23500	14300	26900	11800	12400	25200
Magnesium	SW6010	100	mg/kg	NS	NS	2430	1560	4390	1050	1070	4090
Manganese	SW6010	1.5	mg/kg	NS	NS	519	384	280	287	169	294
Nickel	SW6010	4.0	mg/kg	NS	2,000	14.1	11.6	25.3	7.1	6.9	24.9
Potassium	SW6010	200	mg/kg	NS	NS	512	375	606	348	330	274
Sodium	SW6010	100	mg/kg	NS	NS	166	138	229	ND	ND	214
Vanadium	SW6010	4.0	mg/kg	NS	2,400	67.5	43.2	60.5	37.7	41.1	62.5
Zinc	SW6010	2.0	mg/kg	NS	5,000	32.4	29.3	44.9	18.0	22.0	44.1
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.84 B	ND	ND	0.38 BJ	2.2 B	3.0 B
Toluene	SW8240	0.005	mg/kg	NS	NS	0.50 J	ND	ND	1.7	0.18 J	0.30 J

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-18SS BAFB-0019 0.0-1.0' 11/17/88	18-C-19SS BAFB-0020 0.0-1.0' 11/17/88	18-C-20SS BAFB-0021 0.0-1.0' 11/17/88	18-C-20SS[f] BAFB-0022 0.0-1.0' 11/17/88	18-C-21SS BAFB-0024 0.0-1.0' 11/17/88	18-C-22SS BAFB-0025 0.0-1.0' 11/17/88
Percent Moisture	ASA#9	N/A	%	NS	NS	23	19.8	16.9	16	20.9	16.3
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	6200	ND	ND	5800	27
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	140	5500	ND	ND	4300	60
Aluminum	SW6010	20.0	mg/kg	NS	NS	16100	12100	6460	9390	13000	7200
Barium	SW6010	10.0	mg/kg	NS	10,000	165	131	90.3	98.7	126	73.0
Calcium	SW6010	100	mg/kg	NS	NS	2220	3750	1340	1700	2410	1520
Chromium	SW6010	3.0	mg/kg	NS	500	40.5	31.0	25.5	35.2	31.4	22.7
Cobalt	SW6010	4.0	mg/kg	NS	8,000	16.9	12.5	8.9	11.4	6.4	9.9
Copper	SW6010	3.0	mg/kg	NS	2,500	23.4	27.6	24.1	20.2	32.2	14.3
Iron	SW6010	10.0	mg/kg	NS	NS	24800	23600	15500	18100	23500	14800
Magnesium	SW6010	100	mg/kg	NS	NS	3340	3980	1700	1790	3240	1430
Manganese	SW6010	1.5	mg/kg	NS	NS	448	476	253	307	190	296
Nickel	SW6010	4.0	mg/kg	NS	2,000	20.8	25.2	11.4	11.9	17.7	9.4
Potassium	SW6010	200	mg/kg	NS	NS	623	411	349	512	607	454
Sodium	SW6010	100	mg/kg	NS	NS	179	201	ND	ND	204	134
Vanadium	SW6010	4.0	mg/kg	NS	2,400	58.1	54.2	52.1	55.5	64.2	45.5
Zinc	SW6010	2.0	mg/kg	NS	5,000	39.5	46.1	21.7	25.7	37.9	20.3
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	2.7 B	2.6 B	2.8 B	2.1 B	2.5 B	2.4 B
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	ND	0.81	0.23 J	4.3	0.55 J

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-23SS BAFB-0026 0.0-1.0' 11/17/88	18-C-24SS BAFB-0027 0.0-1.0' 11/17/88	18-C-25SS BAFB-0028 0.0-1.0' 11/17/88	18-C-26SS BAFB-0040 0.0-1.0' 11/21/88	18-C-27SS BAFB-0041 0.0-1.0' 11/21/88	18-C-28SS BAFB-0042 0.0-1.0' 11/21/88
Percent Moisture	ASA#9	N/A	%	NS	NS	19	20.4	19.2	18.1	10.5	19.5
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	5900	19	12	ND	510	150
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	4300	300	ND	ND	56	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	14600	12900	6660	9990	8490	12700
Barium	SW6010	10.0	mg/kg	NS	10,000	162	98.0	82.2	65.0	95.8	188
Calcium	SW6010	100	mg/kg	NS	NS	1840	2760	1510	2650	2770	3700
Chromium	SW6010	3.0	mg/kg	NS	500	45.2	32.3	28.1	26.6	27.3	30.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	8.5	12.6	8.7	6.6	7.9	11.2
Copper	SW6010	3.0	mg/kg	NS	2,500	30.7	27.6	14.9	19.5	17.9	26.8
Iron	SW6010	10.0	mg/kg	NS	NS	24600	26900	14700	15300	15600	20900
Lead	SW6010	20.0	mg/kg	NS	1,000	138	ND	ND	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	3720	3680	1710	4750	3390	3520
Manganese	SW6010	1.5	mg/kg	NS	NS	227	387	213	189	270	327
Nickel	SW6010	4.0	mg/kg	NS	2,000	80.1	17.6	11.5	28.2	21.2	19.9
Potassium	SW6010	200	mg/kg	NS	NS	642	465	384	757	547	497
Sodium	SW6010	100	mg/kg	NS	NS	174	187	ND	171	165	175
Vanadium	SW6010	4.0	mg/kg	NS	2,400	60.9	78.3	42.7	30.0	33.1	56.9
Zinc	SW6010	2.0	mg/kg	NS	5,000	56.0	40.2	55.8	44.2 B	35.3 B	76.4 B
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	3.1 B	3.6 B	3.1 B	0.85 B	0.78 B	0.75 BJ
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	0.82 BJ	0.91 BJ
Toluene	SW8240	0.005	mg/kg	NS	NS	9.3	ND	ND	ND	ND	ND
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	9.4	ND	ND	ND	ND	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	49	ND	ND	ND	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-29SS BAFB-0043 0.0-1.0' 11/21/88	18-C-29SS[f] BAFB-0044 0.0-1.0' 11/21/88	18-C-30SS BAFB-0046 0.0-1.0' 11/22/88	18-C-31SS BAFB-0047 0.0-1.0' 11/22/88	18-C-32SS BAFB-0048 0.0-1.0' 11/22/88	18-C-33SS BAFB-0049 0.0-1.0' 11/22/88
Percent Moisture	ASA#9	N/A	%	NS	NS	17	19.4	15.7	13.3	12.2	11
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	6300	8200	690	ND	ND	ND
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	100	150	ND	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	12800	10600	9630	7600	9900	9540
Barium	SW6010	10.0	mg/kg	NS	10,000	205	215	184	129	139	130
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	ND	0.57	ND
Calcium	SW6010	100	mg/kg	NS	NS	3480	3360	3610	1670	1920	2040
Chromium	SW6010	3.0	mg/kg	NS	500	42.9	54.3	23.8	28.0	34.4	34.2
Cobalt	SW6010	4.0	mg/kg	NS	8,000	11.3	12.3	9.4	11.2	26.0	12.4
Copper	SW6010	3.0	mg/kg	NS	2,500	30.8	29.2	24.9	15.0	18.2	16.9
Iron	SW6010	10.0	mg/kg	NS	NS	20600	18400	17700	17600	22300	19600
Lead	SW6010	20.0	mg/kg	NS	1,000	129	237	29.4	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	3470	3190	3190	2040	2690	2180
Manganese	SW6010	1.5	mg/kg	NS	NS	389	470	295	288	760	347
Nickel	SW6010	4.0	mg/kg	NS	2,000	25.1	23.6	21.6	11.4	13.7	13.5
Potassium	SW6010	200	mg/kg	NS	NS	446	471	356	415	809	629
Sodium	SW6010	100	mg/kg	NS	NS	224	216	187	123	134	142
Vanadium	SW6010	4.0	mg/kg	NS	2,400	55.2	56.2	47.3	56.1	62.2	57.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	140 B	179	70.5	41.6	38.5	37.3
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.48 BJ	0.63 BJ	0.51 BJ	0.48 BJ	0.62 BJ	0.48 BJ
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	ND	0.47 J	ND	ND	ND
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	1.7	1.1	ND	ND	ND	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	4.7	3.1	ND	ND	ND	ND

NOTES: Results reported for detected analytes only.
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e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-34SS BAFB-0050 0.0-2.0' 11/22/88	18-C-35SS BAFB-0051 0.0-2.0' 11/22/88	18-C-36SS BAFB-0052 0.0-2.0' 11/22/88	18-C-1SB BAFB-0353 1.5-3.0' 01/03/89	18-C-1SB BAFB-0354 5.0-6.5' 01/03/89	18-C-1SB BAFB-0355 10.0-11.5' 01/03/89
Percent Moisture	ASA#9	N/A	%	NS	NS	16.8	23.9	17.6	11.9	24	25.9
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	1300	45	18	3300	10000	ND
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	230	390	ND	530	630	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	11500	14800	11000	5700	13800	17000
Barium	SW6010	10.0	mg/kg	NS	10,000	156	150	153	92.3	239	177
Calcium	SW6010	100	mg/kg	NS	NS	2340	4340	2730	1230	3370	3990
Chromium	SW6010	3.0	mg/kg	NS	500	31.7	33.8	39.6	23.5	26.3	30.4
Cobalt	SW6010	4.0	mg/kg	NS	8,000	10.9	18.4	13.3	12.5	13.2	13.5
Copper	SW6010	3.0	mg/kg	NS	2,500	35.0	40.6	37.4	18.2	41.4	53.8
Iron	SW6010	10.0	mg/kg	NS	NS	20900	28900	20400	16100	23400	30400
Lead	SW6010	20.0	mg/kg	NS	1,000	40.7	ND	189	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	3380	6080	3560	1930	4630	5780
Manganese	SW6010	1.5	mg/kg	NS	NS	236	746	385	353	479	9.3
Nickel	SW6010	4.0	mg/kg	NS	2,000	18.0	25.0	19.4	7.8	27.8	27.8
Potassium	SW6010	200	mg/kg	NS	NS	493	473	607	318	395	931
Sodium	SW6010	100	mg/kg	NS	NS	178	194	203	115	313	316
Vanadium	SW6010	4.0	mg/kg	NS	2,400	59.4	77.3	56.3	51.2	58.9	81.9
Zinc	SW6010	2.0	mg/kg	NS	5,000	78.6	75.8	316	24.4	53.9	66.5
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	1.6 B	1.7 B	1.5 B	0.082 B	ND	0.036
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.15	16	0.023 B
Chloroform	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.022 J	ND	0.005 J
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.008 BJ
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.16	21	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	1.3	ND	0.039	ND	0.020
Chlorobenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.091	ND	ND
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.41	67	ND
Xylenes (o+m)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.74	ND	ND
Xylenes (p)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	0.87	ND	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	1.6	280	ND

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Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-1SB[f] BAFB-0356 11.5-13.0' 01/03/89	18-C-2SB BAFB-0357 1.5-3.0' 01/03/89	18-C-2SB BAFB-0358 5.0-6.5' 01/03/89	18-C-2SB BAFB-0359 10.0-11.5' 01/03/89	18-C-3SB BAFB-0360 1.0-2.5' 01/03/89	18-C-3SB BAFB-0361 5.0-6.5' 01/03/89
Percent Moisture	ASA#9	N/A	%	NS	NS	28.4	11.7	12	19.2	12.1	21.4
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	1200	11000	450	12000	52000	4700
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	670	1000	25	1200	1500	850
Aluminum	SW6010	20.0	mg/kg	NS	NS	25800	9830	5260	13100	7820	11200
Barium	SW6010	10.0	mg/kg	NS	10,000	233	169	86.1	163	158	302
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	ND	ND	0.76
Calcium	SW6010	100	mg/kg	NS	NS	5730	2220	1190	2710	1990	3220
Chromium	SW6010	3.0	mg/kg	NS	500	39.4	34.0	27.2	31.7	27.4	22.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	22.3	9.4	10.9	8.4	9.6	16.5
Copper	SW6010	3.0	mg/kg	NS	2,500	53.8	29.4	26.1	35.9	22.8	32.7
Iron	SW6010	10.0	mg/kg	NS	NS	36000	21400	15700	25700	17700	18100
Lead	SW6010	20.0	mg/kg	NS	1,000	37.7	ND	ND	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	8510	2930	1350	3970	2450	4490
Manganese	SW6010	1.5	mg/kg	NS	NS	1150	274	520	349	307	211
Nickel	SW6010	4.0	mg/kg	NS	2,000	43.4	18.1	9.0	19.8	14.8	29.3
Potassium	SW6010	200	mg/kg	NS	NS	1190	442	466	470	375	ND
Sodium	SW6010	100	mg/kg	NS	NS	363	127	105	193	108	172
Vanadium	SW6010	4.0	mg/kg	NS	2,400	88.5	61.7	52.6	69.4	57.1	51.9
Zinc	SW6010	2.0	mg/kg	NS	5,000	79.6	36.2	24.8	44.6	30.0	39.3
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.024	0.058 B	0.057 B	14 B	4.8 B	4.2 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.018 B	0.19	0.077	10	3.4	3.7
Carbon Disulfide	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	2.2 J	0.50 J	0.48 J
trans-1,2-Dichloroethene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	12	ND	ND
Chloroform	SW8240	0.005	mg/kg	NS	NS	0.006 J	ND	ND	ND	ND	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	0.093	ND	ND	0.84 J	1.1 J
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	ND	ND	ND	26	ND	2.2
Benzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	4.1	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.052	ND	0.025 J	ND	ND	0.43 J
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	17	ND	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	17	ND	ND

NOTES: Results reported for detected analytes only.
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R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-3SB BAFB-0362 10.0-11.5' 01/03/89	
Percent Moisture	ASA#9	N/A	%	NS	NS	22.5	
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	35000	
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	490	
Aluminum	SW6010	20.0	mg/kg	NS	NS	15500	
Barium	SW6010	10.0	mg/kg	NS	10,000	325	
Calcium	SW6010	100	mg/kg	NS	NS	3380	
Chromium	SW6010	3.0	mg/kg	NS	500	30.2	
Cobalt	SW6010	4.0	mg/kg	NS	8,000	21.9	
Copper	SW6010	3.0	mg/kg	NS	2,500	52.4	
Iron	SW6010	10.0	mg/kg	NS	NS	32000	
Magnesium	SW6010	100	mg/kg	NS	NS	5210	
Manganese	SW6010	1.5	mg/kg	NS	NS	1170	
Nickel	SW6010	4.0	mg/kg	NS	2,000	37.9	
Sodium	SW6010	100	mg/kg	NS	NS	226	
Vanadium	SW6010	4.0	mg/kg	NS	2,400	92.6	
Zinc	SW6010	2.0	mg/kg	NS	5,000	54.8	
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	2.8	B
Acetone	SW8240	0.010	mg/kg	NS	NS	2.1	
Toluene	SW8240	0.005	mg/kg	NS	NS	0.65	J

NOTES: Results reported for detected analytes only.
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NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 18

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-1GW BAFB-0452 02/14/89	18-C-2GW BAFB-0448 02/13/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	368	409
Temperature	E170.1	N/A	deg C	NS	NS	19.0	21.1
pH	E150.1	N/A	pH	5-9	NS	6.84	7.07
Alkalinity - Total	SM403	1.0	mg/l	20	NS	79.2	87.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	96.6	106.9
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	335	332
Chloride	E325.3	1.0	mg/l	250	250	69.6	69.5
Fluoride	E340.2	0.050	mg/l	2	1.4	0.23	0.27
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	9.6	10.0
Sulfate	E375.4	1.0	mg/l	250	250	29.4	30.1
TPH-Gas	TPH-GA	0.10	mg/l	NS	NS	0.80	0.70
Calcium	SW6010	1.00	mg/l	NS	NS	22.1	19.0
Magnesium	SW6010	1.00	mg/l	NS	NS	10.3	7.86
Manganese	SW6010	0.0150	mg/l	.05	.05	0.0530	0.0470
Nickel	SW6010	0.0400	mg/l	.16	.4	ND	0.0440
Potassium	SW6010	1.00	mg/l	NS	NS	2.10	1.40
Sodium	SW6010	1.00	mg/l	NS	NS	57.1	63.7
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0230	ND
Toluene	SW8020	1	ug/l	14,300	100	12(15)	3(3)

NOTES: Results reported for detected analytes only.

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ND: analyte not detected.
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B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.18-3

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 18

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	18-C-1GW BAFB-0616 08/30/89	18-C-2GW BAFB-0617 08/31/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	381	428
Temperature	E170.1	N/A	deg C	NS	NS	21.0	20.5
pH	E150.1	N/A	pH	5-9	NS	7.38	7.45
Alkalinity - Total	SM403	1.0	mg/l	20	NS	87.2	85.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	106.4	104.4
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	336	354
Chloride	E325.3	1.0	mg/l	250	250	62.9	71.6
Fluoride	E340.2	0.050	mg/l	2	1.4	0.18	0.21
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	8.6	7.0
Sulfate	E375.4	1.0	mg/l	250	250	65.0	43.2
Calcium	SW6010	1.00	mg/l	NS	NS	20.3	20.2
Magnesium	SW6010	1.00	mg/l	NS	NS	9.86	9.48
Manganese	SW6010	0.0150	mg/l	.05	.05	0.0161	0.0240
Nickel	SW6010	0.0400	mg/l	.16	.4	0.0449	ND
Potassium	SW6010	1.00	mg/l	NS	NS	1.09	1.38
Sodium	SW6010	1.00	mg/l	NS	NS	51.7	62.7
Toluene	SW8020	1	ug/l	14,300	100	2	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Table 4.1.18-4
RANGES OF CONTAMINANTS DETECTED AT SITE 18

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SURFACE SOILS				
TFH-diesel	mg/kg	ND	39,000	27/36
TFH-gas	mg/kg	ND	7,800	21/36
chromium	mg/kg	20.2	372	36/36
nickel	mg/kg	6.9	1060	36/36
lead	mg/kg	ND	348	11/36
zinc	mg/kg	18.0	316	36/36
2-butanone	mg/kg	ND	2.2	1/36
chlorobenzene	mg/kg	ND	11	2/36
ethylbenzene	mg/kg	ND	25	9/36
toluene	mg/kg	ND	28	20/36
xylenes (total)	mg/kg	ND	49	7/36
SOIL BORINGS				
TFH-diesel	mg/kg	ND	52,000	9/9
TFH-gas	mg/kg	ND	1,500	9/9
2-butanone	mg/kg	ND	1.1	4/9
carbon disulfide	mg/kg	ND	(2.2)	3/9
chloroform	mg/kg	ND	(0.022)	2/9
ethylbenzene	mg/kg	ND	67	2/9
toluene	mg/kg	ND	(0.65)	5/9
trichloroethene	mg/kg	ND	26	2/9
trans-1,2-dichloroethene	mg/kg	ND	12	1/9
4-methyl-2-pentanone	mg/kg	ND	21	2/9
xylenes (total)	mg/kg	ND	49	2/9
GROUNDWATER				
nickel	mg/l	ND	0.045	2/4
zinc	mg/l	ND	0.023	1/4
TFH-gas	mg/l	ND	0.80	2/4
toluene	ug/l	ND	12.0	3/4

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.18.2 Sampling and Analytical Problems

4.1.18.2.1 Loss of Samples

There were no sample loss problems for Site 18 samples. No samples needed to be resampled and all scheduled analyses were completed.

4.1.18.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil samples collected at Site 18 contained several organic compounds which were probably laboratory or field induced false positive results. Many of the soil samples collected contained acetone and methylene chloride. These are common laboratory contaminants and were also found in some of the method blanks.

In the first semiannual samples, TFH-gas was detected in both Site 18 monitoring wells (less than 1 mg/l), and also in background well BG-C-2 (2 mg/l). These three samples were run on the same day in the laboratory. Based on this, and the lack of any subsequent TFH-gas detections in the August 1989 samples, the TFH-gas detected at Site 18 in first round sampling is suspect. Toluene was detected in the first semiannual sample round but was not confirmed in the second round which makes the first round results suspect.

Toluene was detected in many of the Site 18 soil samples at concentrations ranging from the detection limit to 28 mg/kg. Toluene was also detected in soil samples from throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent suggests that it is usually a false positive result. For soil replicate QC samples in which toluene was detected, duplication of the toluene result was not good, with the relative percent difference (RPD) ranging from 89 to 112 percent, or toluene was found in one of the samples and not the associated replicate sample. This is another indication that the toluene may not be a true contaminant present at the site. At Site 18 toluene was detected in some samples at higher concentrations than observed at other sites. For these samples, toluene probably is a true contaminant.

Four field replicate QC soil samples were collected at Site 18. The replicate for surface soil 18-C-10SS did not have good comparison to the original sample results. Metals results were comparable but TFH-diesel had an RPD of 48 percent and TFH-gas was detected in the original sample at 370 mg/kg but not detected in the replicate. Additionally, toluene and methylene chloride were both detected in one of the samples but not in the other.

The surface sample 18-C-20SS had better agreement between the sample and the replicate. Only toluene had a high RPD of 112 percent. Similarly, the surface sample 18-C-29SS and the associated replicate had generally good comparison with RPDs ranging from 26 percent for TFH-diesel to 59 percent for lead.

The replicate soil boring sample from 18-C-1SB, 11.5 to 13 feet, had little comparison to the original sample taken from 10 to 11.5 feet. Relatively high concentrations of TFH-diesel and -gas were detected in the replicate sample but not in the original sample. Some metals results had good agreement (copper concentrations equal in original and duplicate samples), while other metals had vastly different concentrations (manganese RPD = 197 percent). It is not known what caused these replicate disparities as the lithology and sample blow counts were similar.

4.1.18.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 18 samples.

4.1.18.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.18.3 Significance of Findings

Soil

TFH-diesel and gas were detected in each of the borings, at sample depths including the deepest, as illustrated on Figure 4.1.18-9. In 18-C-2SB, the TFH concentrations in the 10-foot sample (deepest), 12,000 mg/kg diesel and 1,200 mg/kg gas, were the highest in the boring.

Within the AVGAS area, samples were collected at the tank overflow discharge pipe, if present, at the bermed area surface drain, and in the drainage ditch outside the berms. Generally, TFH and volatile organic concentrations were greater in the sample collected near the overflow discharge pipe than at the surface drain inside the berm or the sediment sample from the ditch outside the berms, see Figures 4.1.18-5 and 4.1.18-6. This indicates that fuel which may have dripped from the overflow pipe on the AVGAS tanks generally remained in the soil, and was not significantly transported by surface water. However, based on Stage 2-1 information, the depth of TFH contamination within the AVGAS area has not been determined.

The distribution of TFH and volatile organics in the MOGAS area is similar to that in the AVGAS area. Although only one surface sample was collected in each berm area, the concentrations of TFH and volatile organics are greater here than in the samples collected from the ground surface east of the bermed MOGAS area. TFH-diesel and -gas were not detected in the three surface samples collected east of the bermed area.

Three surface samples were also collected from an unbermed area between the MOGAS unloading station and the railroad tracks. TFH-diesel in these samples ranged from 15 to 1,100 mg/kg; TFH-gas from non-detect to 300 mg/kg.

The LUFT cleanup standards calculated for soil samples at Site 18 are 10,000 mg/kg for TFH-diesel, and 1,000 for TFH-gas, except for the 11.5-13.0-foot field replicate sample in 18-C-1SB. Cleanup standards calculated for this sample are 1,000 and 100 mg/kg for TFH-diesel and -gas.

Four ICP metals were detected in surface soil samples from the AVGAS area at levels above the background range of two standard deviations above the mean average. Lead was detected in six surface samples collected within bermed areas in the AVGAS area (Figure 4.1.18-5). The lead concentrations ranged from 40.7 to 348 mg/kg. Lead was detected in two background soil boring samples collected at six other sites with an average concentration of 17 mg/kg. Chromium was detected in three surface samples at levels greater than two statistical standard deviations above the mean averaged value determined from background soil borings at other IRP sites at Beale AFB (Figure 4.1.18-7). These samples were each from the location within the bermed area below the overflow discharge pipe. Nickel and zinc were detected at similarly elevated concentrations in five and four samples

from the AVGAS area. Three of the nickel and two of the zinc samples coincided with the three samples containing high chromium levels. The highest concentration for each of these four metals was less than one half of the DHS TTLC for the respective metal. By the DHS TTLC criteria for lead, chromium, nickel, and zinc the sampled surface soil in the AVGAS area does not constitute a hazardous waste.

In the MOGAS area, lead was detected in four of the samples. Two of the samples were from the bermed tank area, and two from the MOGAS unloading area. The highest concentration was 237 mg/kg. The TTLC for lead is 1,000 mg/kg. Zinc was detected in two samples and the replicate of one of these samples at levels greater than two standard deviations above the mean average value for zinc from background soil borings on base. The highest zinc level, 316 mg/kg, was less than 10 percent of the DHS TTLC for zinc. By the DHS TTLC criteria, the soil sampled in the MOGAS area is not a hazardous waste.

The areas in which higher-than-average levels of these ICP metals occurred coincide with heavy use areas within the bulk fuel facility. Chemical analyses for specific fuels handled at Beale AFB were not available.

Several volatile organic compounds were detected in surface samples from the AVGAS and MOGAS areas (see Figure 4.1.18-5). The concentration pattern is similar to that of the TFHs and ICP metals discussed above. Volatile organic concentrations outside of the bermed areas are either suspected as false positive or were not detected. TTLC values are not available for the detected compounds.

Groundwater

Two groundwater monitoring wells were constructed and have been sampled semiannually during Stage 2-1 at Site 18. Well 18-C-1 is located near the AVGAS area and 18-C-2 is near the MOGAS area. In the first round of sampling, TFH-gas was detected in both groundwater samples at 0.80 and 0.70 mg/l, although these are believed to be false positive results. The BG-C-2 first quarter sample was laboratory tested on the same day as Site 18 samples, and had a similar TFH-gas detection. TFH-gas has not been confirmed in subsequent Site 18 or BG-C-2 well sampling.

No metals except manganese were detected at levels equalling or exceeding available DHS or EPA primary or secondary MCL values. The first round 18-C-1 sample manganese concentration was 0.053 mg/l, above the secondary MCL value of 0.05 mg/l. No other water quality parameters or analytes suggest any contamination of groundwater near Site 18 monitoring wells.

4.1.18.3.1 Zones of Contamination

The soil within the bermed tank areas is contaminated with fuel hydrocarbons and organic compounds. The soil in several of the bermed areas also contains higher than background averaged levels of lead, chromium, nickel, and zinc. Generally, contaminants in samples collected from outside the bermed areas were either not detected, or were at lower concentrations than those in samples from inside the bermed areas. This suggests that the lateral extent is limited to the bermed tank areas in the AVGAS area, and the bermed areas and tanker unloading facility in the MOGAS area. TFH and volatile organic compound contamination was detected in samples collected from the surface drainage ditches at Site 18. Since only surface samples were collected in these areas, the depth of soil contamination cannot be determined.

TFH-gas was detected in both monitoring wells at Site 18 in samples collected in the first semiannual sampling round, but not confirmed in the second (semiannual) sample. The first round detection is believed to be a false positive. Nickel and zinc were detected (one in each sample) in the initial round, and nickel only in the final round, at concentrations below 0.05 mg/l. Manganese was detected in all samples, with the first round 18-C-1 concentration exceeding 0.05 mg/l.

4.1.18.3.2 Contaminant Migration

Migration of contaminants detected in the surface soil and soil borings is likely to be downward, towards the groundwater. Based on the distribution of contamination in surface samples, migration by surface water is possible. Surface water from Site 18 drains to the south into Huchinson Creek.

If contaminants enter the groundwater at Site 18, they will migrate towards the west in the general groundwater flow direction.

4.1.18.3.2.1 Potential to Move Off Site and Off Base

Contamination detected in the soil may be moving towards the groundwater. Contaminants reaching the groundwater may move off the site.

As demonstrated by the decreasing concentrations away from the overflow discharge pipe samples the lateral migration of TFHs and organic compounds has been minimal. Infiltration through the vadose zone is essentially vertical, towards the groundwater table. Migration of the detected contaminants at Site 18 is expected to be vertical.

4.1.18.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Based on the 72-hour pump test of well 19-C-4, the average groundwater velocity in the vicinity of Site 18 is approximately 300 feet per year. From Figure 4.1.18-4, it can be seen that the direction of groundwater flow at Site 18 is to the west. Actual rates of migration for contaminants in groundwater would be affected by dispersion and retardation factors.

4.1.18.3.2.3 Time of Travel to Receptors

The nearest domestic or irrigation well to Site 18 is about 4,000 feet to the west. Groundwater moving about 300 feet per year will take about 13 years to travel this distance.

4.1.18.3.2.4 Applicability of Solute Transport Models

Solute transport models may not be applicable at Site 18 because of the lack of well-defined physical parameters such programs require for accurate modeling.

4.1.18.3.2.5 Expected Spatial and Temporal Variations in Concentration

The TFH-gas detected in both Site 18 wells during the first semiannual sampling round was not detected in the second semiannual sampling and is believed to be a false positive. No confirmed spatial or temporal variations of concentrations in groundwater have been observed.

4.1.18.3.3 Baseline Risk Assessment

No risk assessment activities were performed as part Stage 2-1.

4.1.19 DISCUSSION OF RESULTS FOR SITE 19: PHOTO WASTE EMERGENCY HOLDING BASIN

The photo waste emergency holding basin (EHB) was used intermittently to contain photographic laboratory discharges that were diverted from a concrete wet well during overflow conditions. The concrete wet well is used to hold laboratory discharges prior to piping to the photo wastewater treatment plant (Site 2). The EHB has a compacted clay bottom, concrete sides, and is fenced.

This site has not been previously included in the base IRP studies. The RWQCB conducted limited soil sampling of the EHB in April 1987 in which one sample had 1,300 mg/kg PCP, compared to the TTLC of 17 mg/kg. On the basis of this result, the RWQCB considers the site subject to provisions of the Toxic Pits Cleanup Act (RWQCB, 1987b). Soil, surface water, and groundwater sampling and analysis were conducted in Stage 2-1.

Wastewater discharge from the photo lab is the contaminant source at Site 19. The photo lab discharged into the basin only when the pipeline to the photo wastewater treatment plant (Site 2) could not carry all of the discharge or because of pump failure. Waste types included photo processing wastes containing metals. Prior to 1986, PCP was metered into the wastewater as an anti-slime agent. Residual PCP in the basin soils was sampled and reported at hazardous levels by the RWQCB in 1987.

4.1.19.1 Presentation of Results

The following section presents the results of the field investigation at Site 19. The discussion focuses on the geology and hydrogeology at the site, and presents the results of chemical analyses performed on samples of soils, surface water, and groundwater.

4.1.19.1.1 Site Geology

Evaluation of local geology at Site 19 is based on drilling activities completed during Stage 2-1. Four wells at Site 19 were drilled during Stage 2-1. Three of these were designed as monitoring wells and are screened across the uppermost permeable zone encountered during drilling (see Figure 4.1.19-1 for locations). One pumping well (well 19-C-4) was installed south of the EHB to facilitate a long-term aquifer test. This well was drilled to a total depth of 145 feet (-36 feet NGVD), and screened over a 60-foot

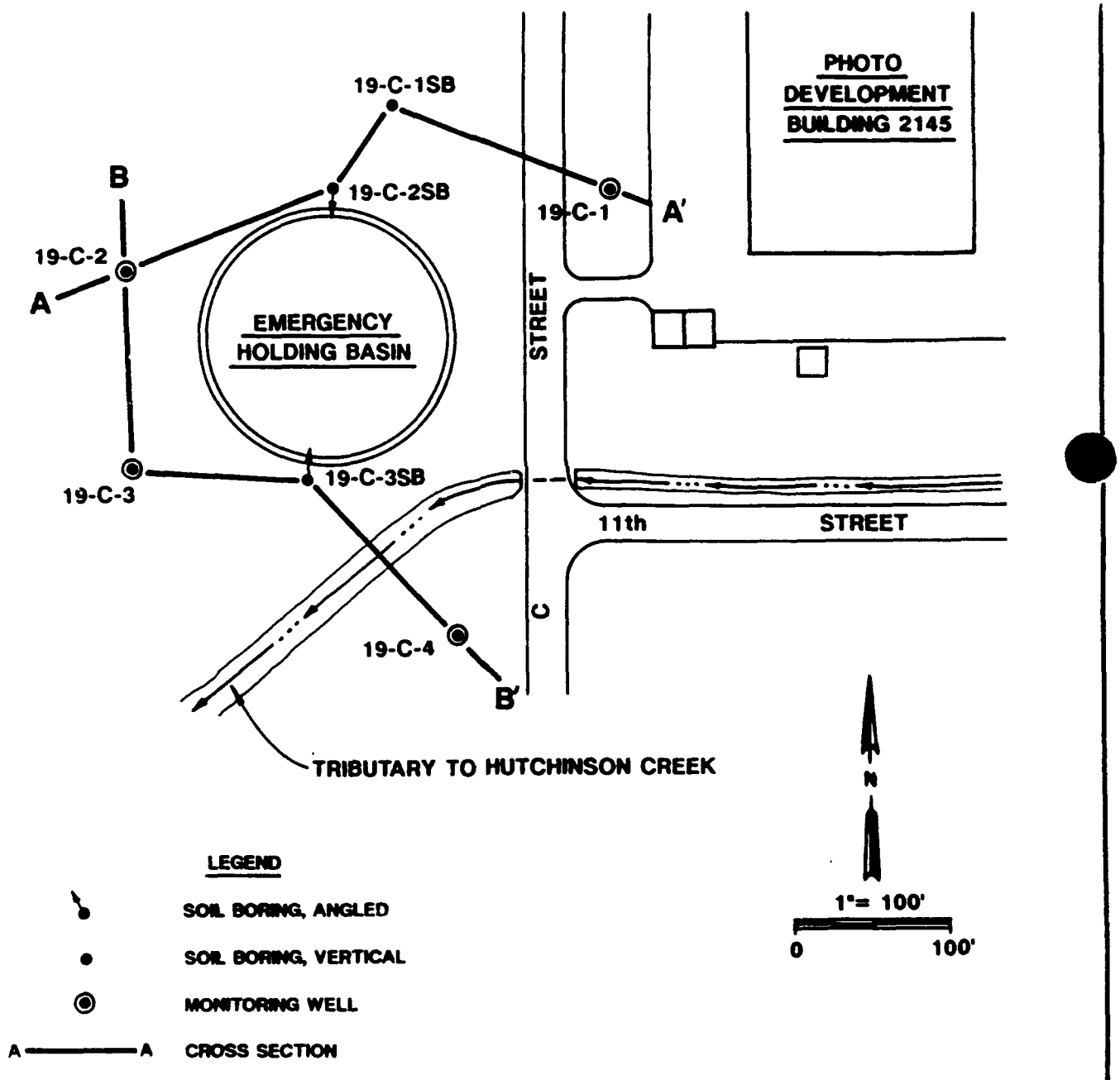


FIGURE 4.1.19-1
LOCATION OF GEOLOGIC CROSS SECTIONS
SITE 19: EMERGENCY HOLDING BASIN

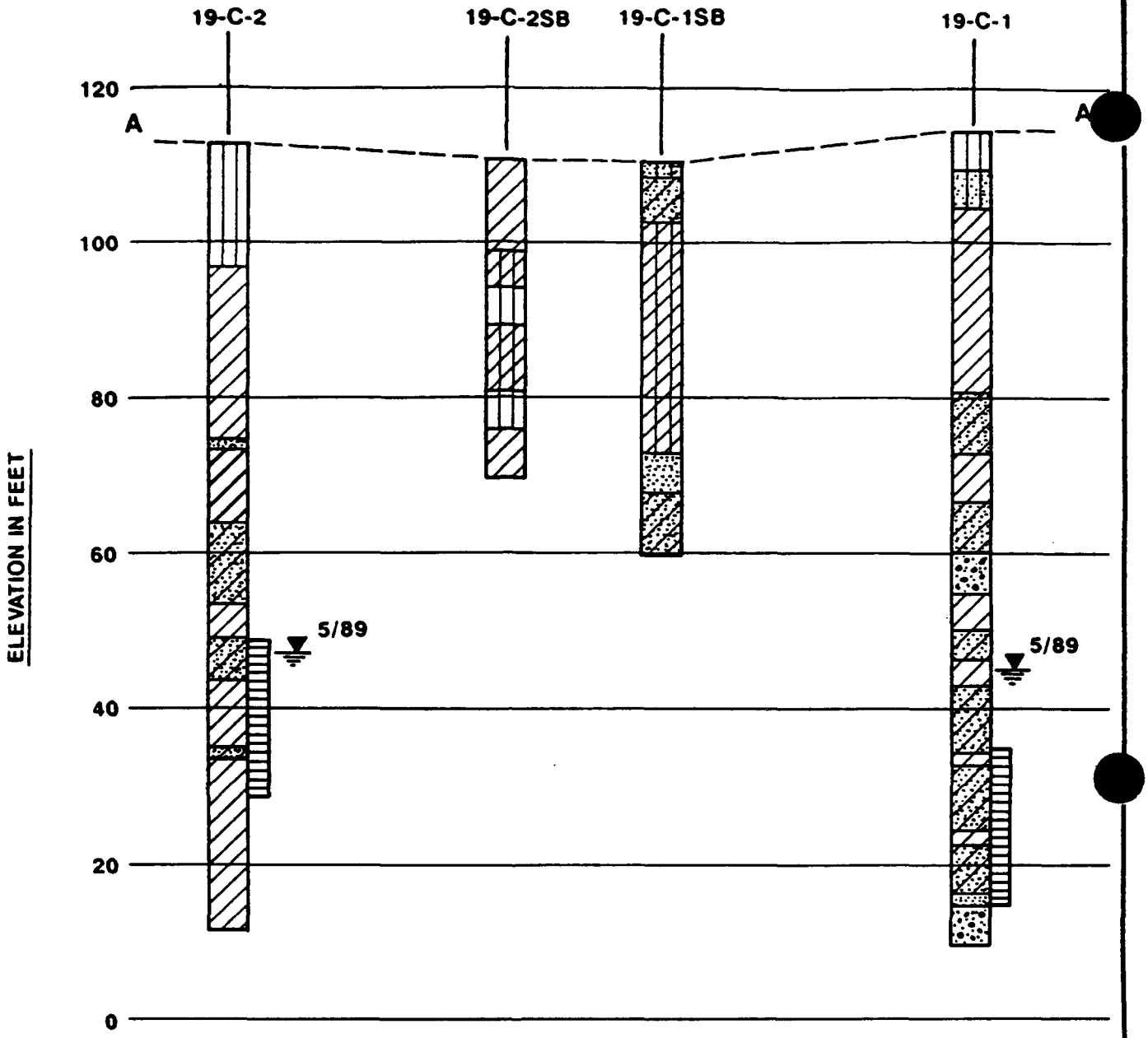
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interval across the uppermost permeable zone. In addition, two angled boreholes were drilled and logged along the north and south perimeter of the EHB to a total depth of 50 feet (43 feet beneath the surface of the basin). Finally, a vertical background boring was drilled north of the EHB to a total depth of 51.5 feet. The location of all wells and boreholes is shown in Figure 4.1.19-1. Soil boring logs are provided in Appendix D.

Geologic cross-sections drawn through sediments encountered in the Site 19 boreholes and wells are located in Figure 4.1.19-1 and shown in Figures 4.1.19-2 and 4.1.19-3. These figures illustrate that the soil beneath the EHB is composed of an alluvial sequence of primarily fine-grained materials, with discontinuous zones of coarse-grained materials. As is typical of near-surface alluvium deposited in the Central Valley at the base of the Sierra Nevada foothills, individual beds in the soil profile at Site 19 may generally not be correlated among drilling locations.

Geologic cross-sections demonstrate that the EHB is almost entirely underlain by over 20 feet of clay (see Figures 4.1.19-2 and 4.1.19-3). Boring 19-C-2SB contains minor interbeds of silt and sand below a depth of about 13 feet (98 feet NVGD). Boring 19-C-3SB encountered clay throughout its entire length to a depth of 43 feet (67 feet NGVD) beneath the basin. Background boring 19-C-1SB and the well boreholes all encountered predominantly fine-grained and low-permeability materials to their total depths.

Surface soils at Site 19 have been mapped as being Redding-Corning gravelly loam, a medium-textured soil formed in alluvium from mixed sources (SCS, 1985). The surface geology at Site 19 was mapped by Page (1980) as lying on the contact between river deposits of Holocene Age and the Victor Formation of Pleistocene Age. Both of these units contain highly variable fine- to coarse-grained alluvium. Soil boring logs note the presence of cemented sediments at various depths, which are typical of both the Victor Formation and the Laguna Formation which lies under the Victor Formation in the stratigraphic section. Logs also note the presence of volcanic materials at depth in wells 19-C-1 and 19-C-4. These materials, together with layers of cemented sands and silts, imply that the boreholes contacted the volcanic rocks from the Sierra Nevada. This formation lies under the Laguna Formation in the stratigraphic section at Beale AFB.



LEGEND

- FAT CLAY
- LEAN CLAY
- SILT
- SAND
- GRAVEL
- WATER LEVELS
- WELL SCREENED INTERVAL

SCALE: 1"=80' HORIZ

1"= 20' VERT

0 80'

VERTICAL SCALE 4 x

NOTE: DUE TO UNEQUAL SCALES, ANGLED BORINGS ARE PLOTTED VERTICALLY

FIGURE 4.1.19-2
CROSS SECTION A-A'
SITE 19: EMERGENCY HOLDING BASIN

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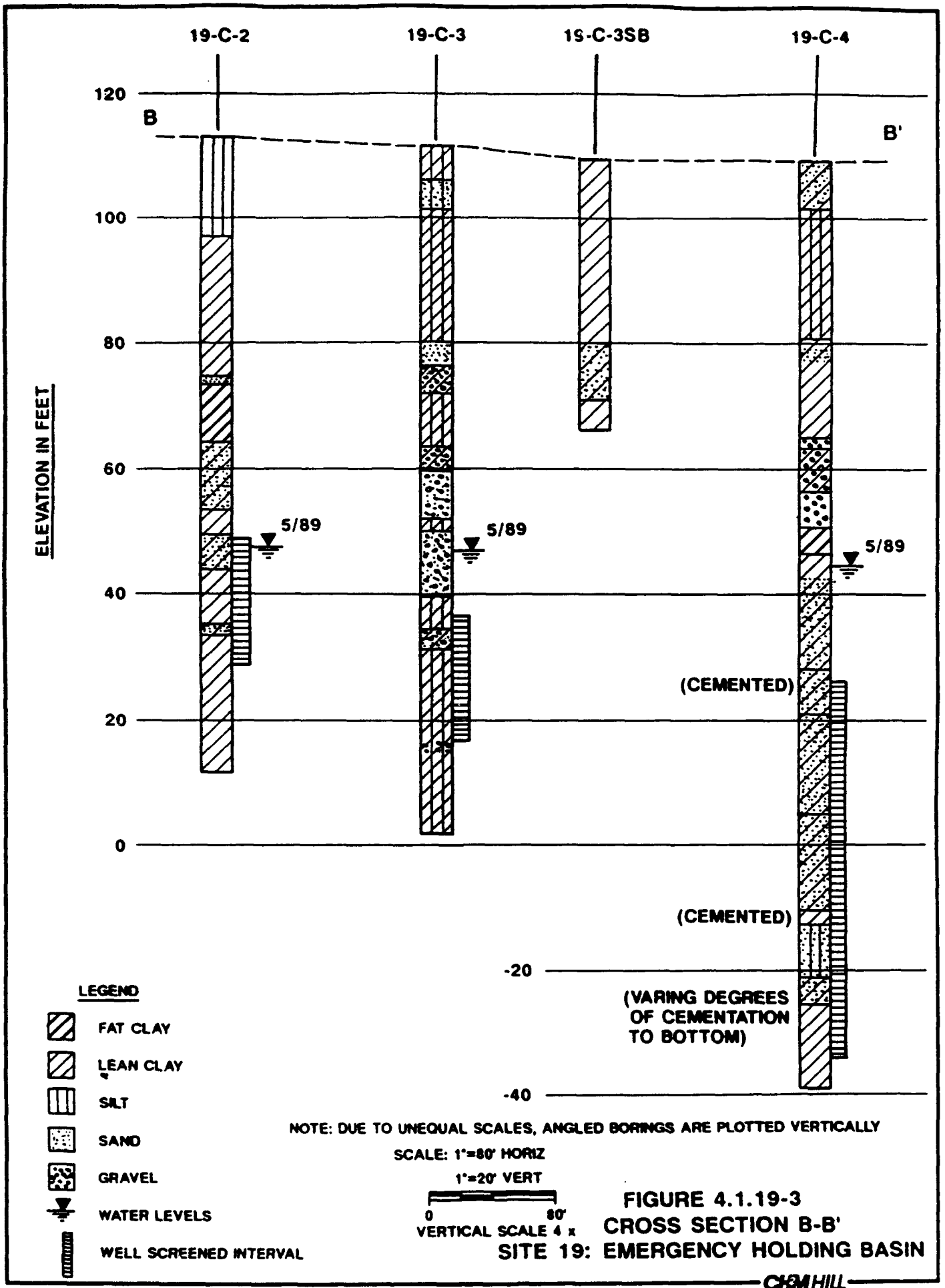


FIGURE 4.1.19-3
CROSS SECTION B-B'
SITE 19: EMERGENCY HOLDING BASIN

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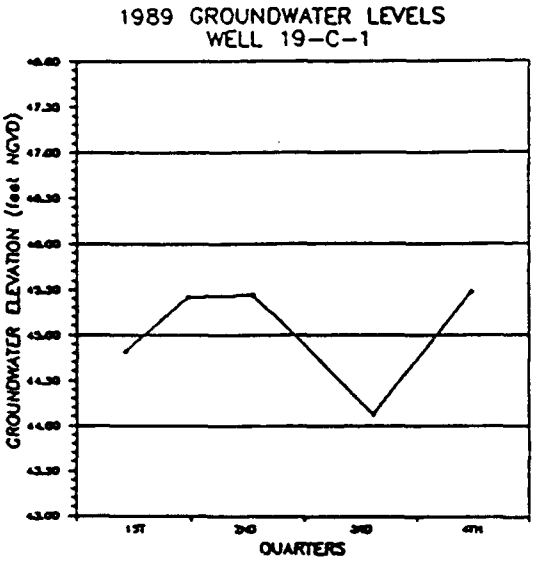
4.1.19.1.2 Site Hydrogeology

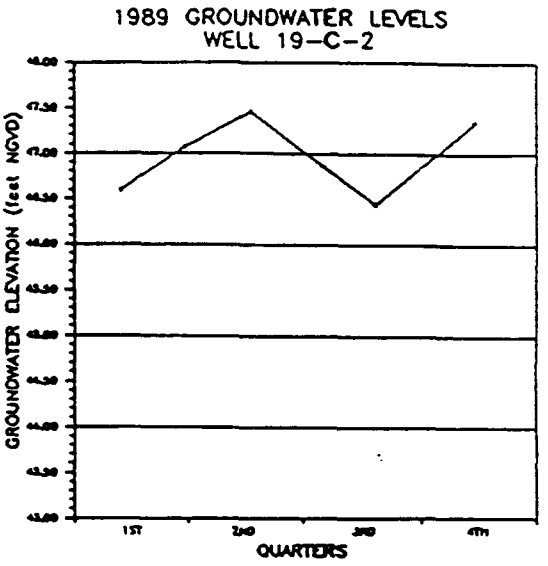
Groundwater flows preferentially through subsurface zones of greater permeability. Because of the predominance of lower permeability fine-grained materials beneath the EHB, the groundwater within the perimeter zones may be partially confined. The confining units are discontinuous, however, so the degree of confinement varies from well to well. Borehole 19-C-1, for example, first encountered a permeable zone that yielded water to the hole at a depth of 97 feet below the ground surface (18 feet NGVD). Overnight, however, water rose to a depth of about 70 feet BGS (45 feet NGVD). Well 19-C-2, on the other hand, first encountered water at a depth of 69 feet BGS (44 feet NGVD). Overnight, water rose to about 67 feet BGS (46 feet NGVD). In hydrogeologic settings such as this, the degree of confinement also typically increases with depth (Page, 1980).

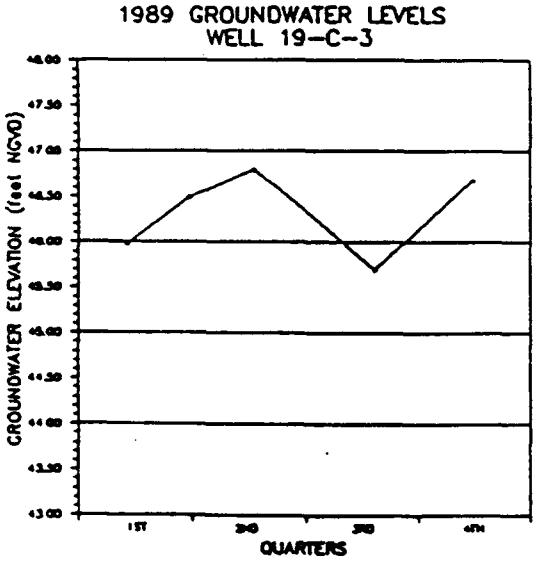
Table 4.1.19-1 and Figure 4.1.19-4 show the variation in water levels in the monitoring wells at the EHB during 1989. A complete summary of groundwater level data, including elevations and depths to water, is provided in Appendix G. Water levels in these wells varied only about 1 foot during this time. The variation seemed to follow a seasonal pattern, rising during the spring, falling during the summer, and rising during the fall. However, the magnitude of the fluctuations was too low to allow definite conclusions. This lack of change was typical of wells constructed on the eastern side of Beale AFB.

Table 4.1.19-1
GROUNDWATER ELEVATIONS: SITE 19
(FEET NGVD)

Well	Screened Interval	Jan. 1989	March 1989	May 1989	Aug. 1989	Nov. 1989
19-C-1	35 to 15	44.43	45.41	45.44	44.12	45.47
19-C-2	48 to 28	46.46	47.07	47.46	46.44	47.35
19-C-3	37 to 17	45.75	46.49	46.80	45.70	46.68
19-C-4	34 to -26	--	44.76	44.65	43.26	44.67







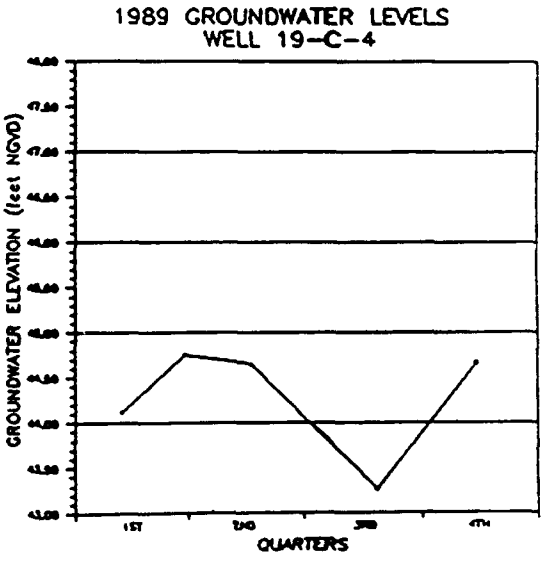


FIGURE 4.1.19-4

MONITORING WELL HYDROGRAPHS
SITE 19: EMERGENCY HOLDING BASIN

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Figure 4.1.19-5 plots groundwater elevation contours in the south portion of Beale AFB based on water level measurements taken in May 1989. Plate 3 plots groundwater level contours based on elevations measured in March 1989 over the base as a whole. Plate 4 plots contours based on November 1989 data. The presence of the groundwater depression west of the base is implied in this figure and these plates, which show that the depression controls flow directions in the western part of the base. A groundwater trough is visible to the east of the cantonment area. This trough may be caused by materials with relatively higher permeability in this area, perhaps due to the presence of buried stream channel alluvium. Flow directions shown in Figure 4.1.19-5 and Plates 3 and 4 are generally from east to west on base, with local variation occurring because of the regional groundwater depression and groundwater trough. The horizontal gradient in the vicinity of the EHB is about 10 feet per 1,600 feet, or 0.006.

Figure 4.1.19-6 shows groundwater elevations at Site 19 based on data collected in May 1989. Groundwater contours cannot be drawn with certainty from these data because the wells are screened at different depth intervals. The monitoring wells at the EHB are listed in order of decreasing elevation of screened interval as follows: 19-C-2 (28-48 feet NGVD), 19-C-3 (17-37 feet NGVD), 19-C-1 (15-35 feet NGVD), and 19-C-4 (-26 to 34 feet NGVD). This order correlates with the order of decreasing groundwater elevations in Figure 4.1.19-6. Table 4.1.19-1 indicates that the order of decreasing groundwater elevations was the same for all measurements taken during 1989. The data may imply the existence of a vertical groundwater gradient downward at the EHB. This downward flow may reflect groundwater recharge induced by the depression west of the base. Alternatively, there may be a horizontal gradient of flow to the southeast beneath the EHB, induced by the trough shown on Plates 3 and 4 and Figure 4.1.19-5. The data are inconclusive.

A long-term multiple well pump test conducted at the EHB consisted of 72 hours of drawdown followed by 72 hours of recovery. Well 19-C-4 was the pumping well, and 19-C-1, 19-C-2, and 19-C-3 were observation wells. Water levels in 19-C-1 were measured with a calibrated electric sounder. Water levels in the other wells were monitored automatically with In-situ Hermit dataloggers and pressure transducers. Data were transferred directly to a portable computer in the field. Water levels were measured during the test in well 6-C-1 to allow comparison to background water level changes in a well unaffected by the pump test. In addition, water

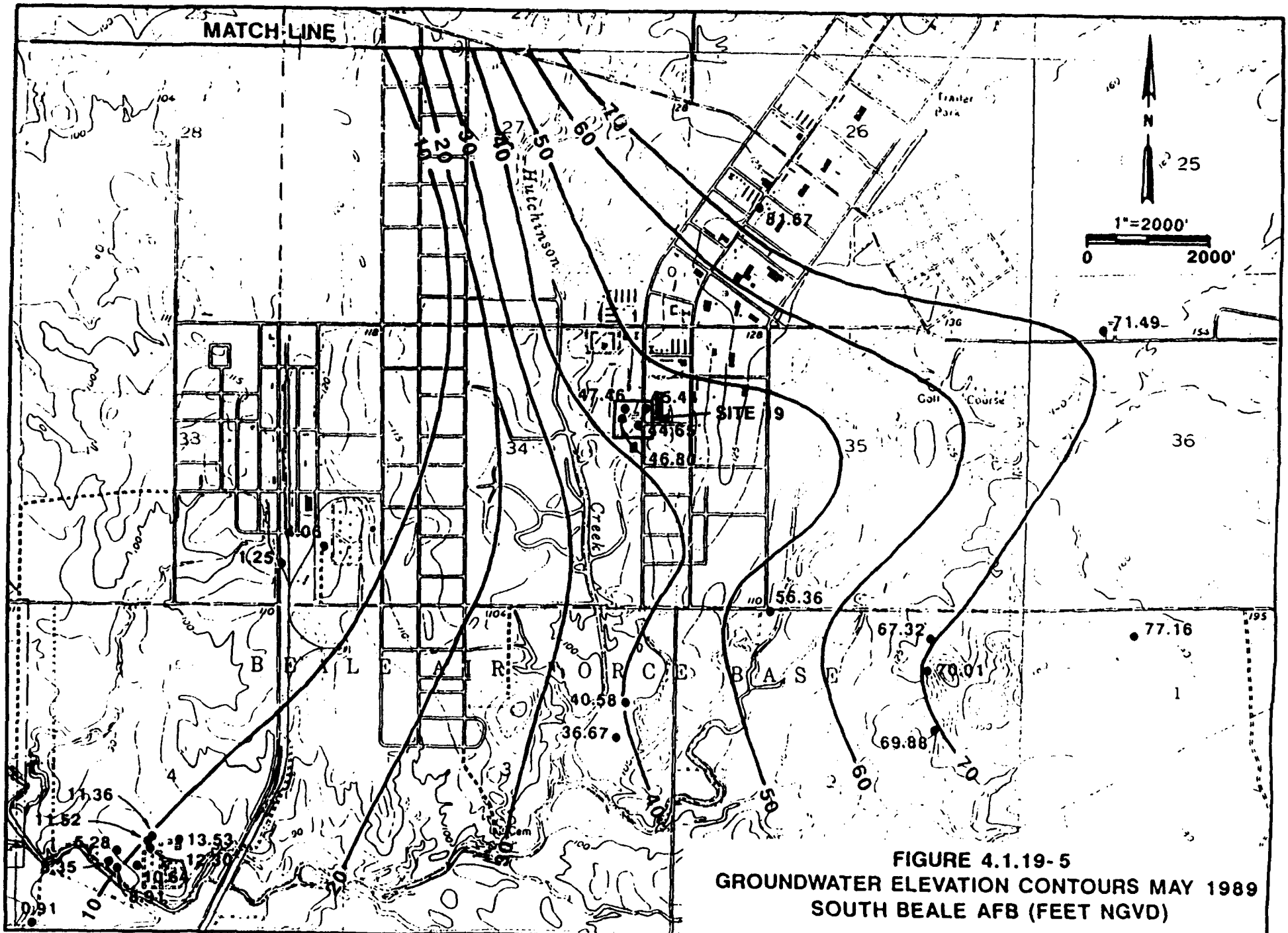
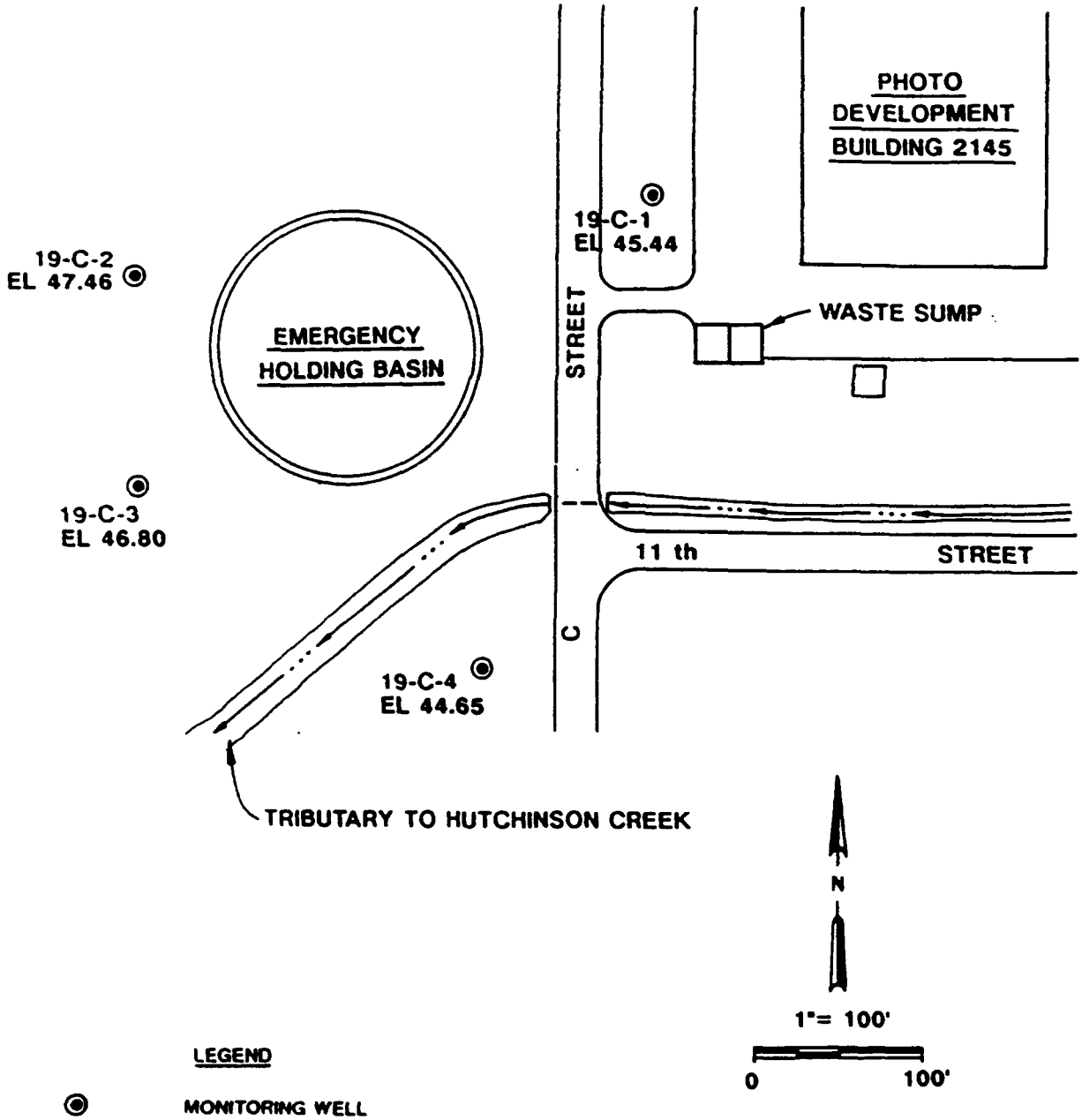


FIGURE 4.1.19-5
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGVD)



NOTE: CONTOURS ARE NOT DRAWN ON THE GROUNDWATER LEVELS BECAUSE WELL SCREENS ARE NOT ALL LOCATED IN THE SAME PERMEABLE ZONE.

FIGURE 4.1.19-6
GROUNDWATER ELEVATION MAY 1989
SITE 19: EMERGENCY HOLDING BASIN

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levels in wells 6-C-1, 19-C-2, and 19-C-3 were also monitored over a 5-day period after the test. These data were then compared with barometric pressure data collected hourly at the Beale AFB weather station, allowing pump test data to be corrected for barometric pressure changes. Plots showing barometric pressure and groundwater fluctuations are contained in Appendix E.

Short-term (3 to 8 hours) pump tests were also conducted in wells 19-C-1, 19-C-2, and 19-C-3. In each test, water levels were measured with data loggers and pressure transducers. Drawdown and recovery data from all of the pump tests were analyzed using the semilog plot method (Cooper and Jacob, 1946). A summary of the results of the analyses is presented in Table 4.1.19-2. A more complete discussion of aquifer testing methodology, as well as drawdown and recovery plots, is included in Appendix E.

Values of transmissivity and hydraulic conductivity obtained from plots on data collected in observation wells during the 72-hour test should be viewed with caution. The investigation at the EHB revealed a high level of stratification in subsurface geologic materials. Permeable zones are interbedded with materials of lesser permeability, which results in a lower hydraulic conductivity in the vertical direction than in the horizontal direction. The observation wells are screened in the upper portion of the aquifer and only partially penetrate the zone screened by the pumping well. Drawdown in these wells, particularly wells 19-C-2 and 19-C-3, may have been reduced because of the lower vertical permeability. If so, this would artificially elevate the values of transmissivity and hydraulic conductivity derived from these wells.

Values of transmissivity and hydraulic conductivity obtained from short-term tests should be regarded as representative of the hydrogeology in the immediate vicinity of the well-screens. Results obtained from pumping well 19-C-4 during the 72-hour test may be viewed as good representative values for the upper portion of the aquifer. The average transmissivity was 1,700 square feet per day, while the average hydraulic conductivity was 28 feet per day (9.9×10^{-3} cm/sec).

The average linear velocity of groundwater flow may be estimated by substitution into Darcy's Law. Using the average hydraulic conductivity derived from the pumping well during the 72-hour pump test of 28 feet per day, the measured hydraulic gradient of 0.006, and an estimated effective

Table 4.1.19-2

RESULTS OF AQUIFER TESTING AT THE EMERGENCY HOLDING BASIN

(Cooper-Jacob Method)

Well	Pumping (P) or Observation (O)	Date	Drawdown (D) or Recovery (R)	Transmissivity T (ft^2/d)	Hydraulic Conductivity K (ft/d)	Storativity S
19-C-4	P	3/16-19/89	D	1,300	22	-
19-C-4	P	3/19-22/89	R	2,000	34	-
19-C-1[a]	O	3/16-19/89	D	4,000	67	-
19-C-1[a]	O	3/19-22/89	R	4,000	67	-
19-C-2[a]	O	3/16-19/89	D	3,400	56	7.4×10^{-3}
19-C-2[a]	O	3/19-22/89	R	3,000	50	-
19-C-3[a]	O	3/16-19/89	D	3,100	52	8.3×10^{-3}
19-C-3[a]	O	3/19-22/89	R	2,500	42	-
19-C-1	P	2/22/89	D	1,100	55	-
19-C-1	P	2/22/89	R	735	37	-
19-C-2	P	2/27/89	D	100	5.3	-
19-C-2	P	2/27/89	R	81	4.3	-
19-C-3	O	2/27/89	D	370	18	4.8×10^{-4}
19-C-3	P	3/1/89	D	200	10	-
19-C-3	P	3/1/89	R	190	9.7	-
19-C-2	O	3/1/89	D	190	10	3.5×10^{-4}

[a]Transmissivity and hydraulic conductivity values may be elevated (see text).

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transport porosity in the permeable materials of 0.20, the approximate velocity of groundwater movement beneath the EHB is about 0.84 feet per day, or 310 feet per year.

4.1.19.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results table in Section 4.1.19.1.4 and in Appendix A.

Surface Soils

Six soil samples were taken at Site 19 from three locations within the emergency holding basin with two samples at each location: one from zero to 1 foot and another from 1 to 2 feet. These samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7470/7471), soil moisture (ASTM D2216), and TFH-diesel and -gas (California method). The upper basin soil sample at 19-C-2SS from the EHB was also analyzed for dioxins and furans.

Toluene was detected above the LOQ in three of six samples from the basin at up to 0.055 mg/kg. In the zero- to 1-foot sample at 19-C-1SS bis(2-ethylhexyl) phthalate was detected at 1.4 mg/kg (1.4 mg/kg in field replicate) and fluoranthene at 0.83 mg/kg (0.65 mg/kg in field replicate). In the 1- to 2-foot sample, di-n-butyl phthalate was detected at 0.72 mg/kg. Xylenes (0.53 mg/kg) and several semivolatile compounds were detected in the zero- to 1-foot sample at 19-C-3SS including PCP (3.6 mg/kg), fluoranthene (8.8 mg/kg) 2 methylnaphthalene (11 mg/kg), and naphthalene (1.6 mg/kg).

Silver, potassium, sodium, and mercury were detected in the basin samples at levels more than two standard deviations above background levels at Beale with the zero- to 1-foot samples having generally higher concentrations than the 1- to 2-foot samples (Figure 4.1.19-7). Silver was detected in the six EHB samples at 2.8 to 53.0 mg/kg. Potassium ranged from 224 to 1,690 mg/kg. Sodium ranged from 150 to 1,120 mg/kg. Mercury was detected in the 0 to 1 foot samples at 19-C-1SS at 0.14 mg/kg (0.11 mg/kg in field replicate) and

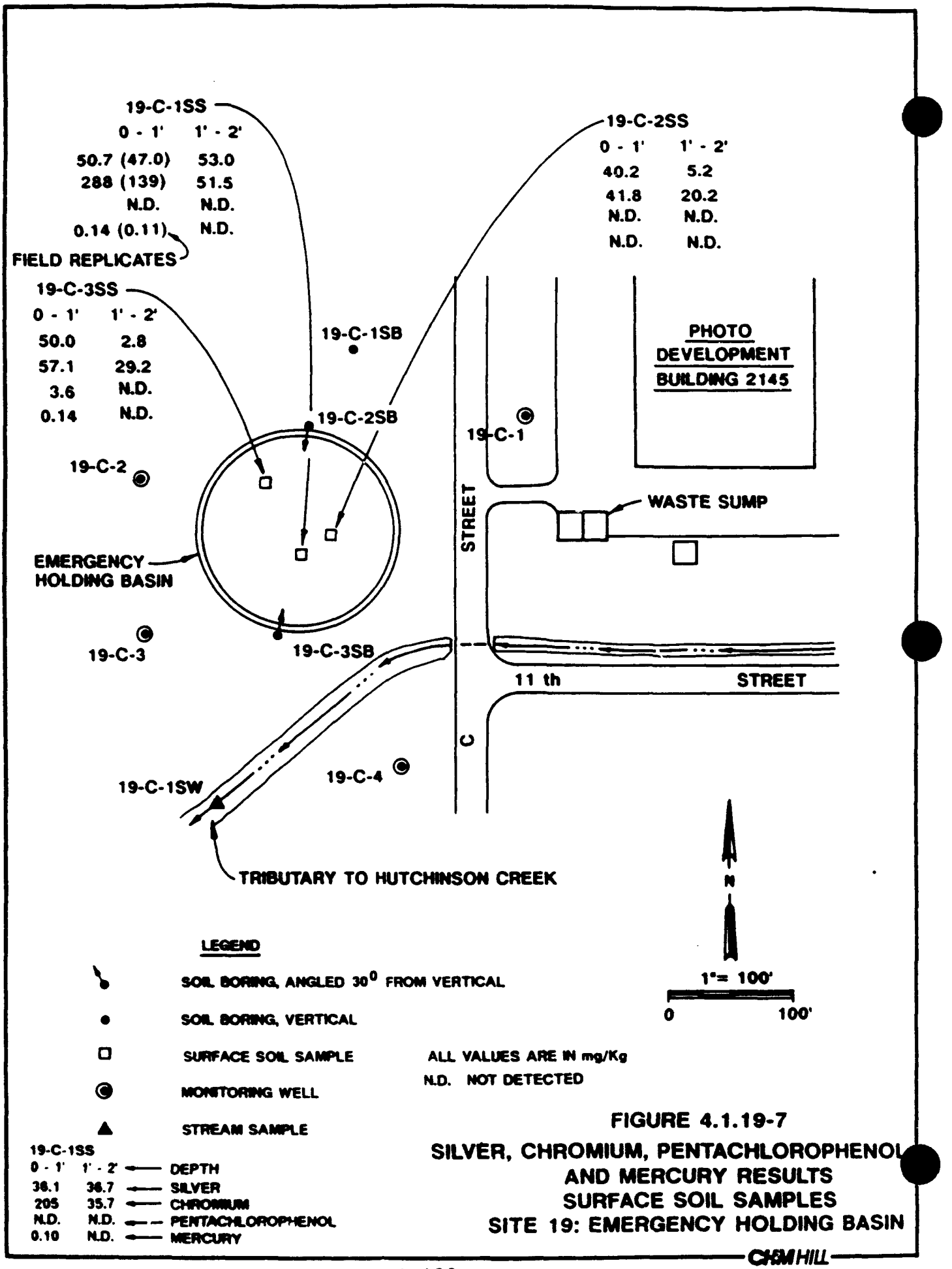


FIGURE 4.1.19-7

SILVER, CHROMIUM, PENTACHLOROPHENOL AND MERCURY RESULTS SURFACE SOIL SAMPLES SITE 19: EMERGENCY HOLDING BASIN

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at 19-C-3SS at 0.14 mg/kg. TFH-diesel (340 mg/kg) and -gas (280 mg/kg) were detected in the upper samples at 19-C-1SS (650 and 210 mg/kg in field replicate) and 19-C-3SS (3,800 and 720 mg/kg) and the lower sample at 19-C-3SS at 290 and 70 mg/kg.

The zero- to 1-foot sample at 19-C-2SS was analyzed for dioxins and furans. Tetra dioxins were 0.00003 mg/kg (0.03 ug/kg), penta dioxins 0.0001 mg/kg (0.1 ug/kg), hexa dioxins 0.0028 mg/kg (2.8 ug/kg), hepta dioxins 0.188 mg/kg (18.8 ug/kg), and octa dioxins 0.069 mg/kg (69 ug/kg). Tetra furans were 0.0001 mg/kg (0.1 ug/kg), penta furans 0.0003 mg/kg (0.3 ug/kg), hexa furans 0.0017 mg/kg (1.7 ug/kg), hepta furans 0.0091 mg/kg (9.1 ug/kg), and octa furans 0.023 mg/kg (23 ug/kg).

Soil Borings

A total of 15 soil boring samples were collected at Site 19: five from each of the two angle borings under the EHB and five samples from the vertical background boring north of the basin. These samples were analyzed for the same analytes as the basin soil samples, except that no dioxin/ furan analyses were conducted.

The only volatile organic compounds detected in Site 19 soil borings were toluene, which was detected in 11 samples up to 0.044 mg/kg, trans-1,2-DCE, which was detected at 0.008 mg/kg in the 49-foot sample at 19-C-3SB, and benzene, which was detected at 0.007 mg/kg in the 8-foot sample in boring 19-C-2SB. Semivolatile organic chemicals were estimated in several soil boring samples at Site 19 at levels near the LOQ. Bis(2- ethylhexyl) phthalate was estimated in three samples below the LOQ. Di-n-butyl phthalate was detected in three samples up to 0.48 mg/kg; 2-butanone was estimated below the LOQ in three samples.

ICP metals were detected in Site 19 soil boring samples at concentrations generally similar to background levels. Mercury was detected in all samples from soil boring 19-C-2SB at 0.074 to 0.090 mg/kg. TFH-diesel and -gas were not detected in soil borings at Site 19.

Surface Water and Groundwater

During the IRP Stage 2-1 investigation, surface water samples were collected on a quarterly basis from the small drainage ditch that is a tributary to Hutchinson Creek just downstream from the EHB. The sample location is shown in

Figure 4.1.19-7. The results of the analyses are included in Appendix A, while Table 4.1.19-3 summarizes results for purgeable aromatics and purgeable halocarbons (EPA 8010 and 8020 compounds), semivolatile organics (EPA 8270 compounds), ICP metals, TFH (diesel and gasoline), arsenic, lead, mercury, selenium, TDS, major anions, nitrates, and chemical oxygen demand. A complete list of these compounds may be found in Appendix A.

Arsenic was detected only in the first quarter surface water sample at 0.015 mg/l. Chromium was detected in the second quarter sample at 0.107 mg/l and in the fourth quarter at 0.137 mg/l. Iron was detected in the first quarter at 0.307 mg/l, in the second at 0.168 mg/l, in the third at 0.149 mg/l, and in the fourth at 4.67 mg/l. Barium was detected at 0.130 mg/l and fluoride at 0.46 mg/l, only in the second round. Manganese was below the 0.015 mg/l LOQ in the first quarter, 0.119 mg/l in the second quarter, 0.043 mg/l in the third quarter, and 1.22 mg/l in the fourth. The following metals were detected only in the fourth quarter sample: aluminum at 3.00 mg/l, cadmium at 0.0369 mg/l, cobalt at 0.0552 mg/l, copper at 1.68 mg/l, and nickel at 0.0631 mg/l. This sample had a low field pH of only 4.15 which may account for some of the elevated metals concentrations.

Nitrate was detected in all rounds at 1.3 to 2.2 mg/l. Chemical oxygen demand varied from 25.4 in the first round to 137 mg/l in the second, 24.1 mg/l in the third, and 77.9 mg/l in the fourth. TDS followed a similar pattern going from 106 mg/l in the first round to 654 mg/l in the second, 52.0 mg/l in the third, and 445 mg/l in the fourth. TFH-gas was detected in the first round sample at 0.20 mg/l but not in later samples. TFH-diesel was only detected in the fourth round at 0.16 mg/l.

No volatile organic chemicals were detected and confirmed in the first, third, and fourth round surface water samples. Semivolatile components were not detected in the first or fourth rounds and in the third round N-Nitrosodiphenylamine and bis(2-ethylhexyl) phthalate were detected below the LOQ.

In the second quarter surface water sample, toluene was detected at 1 and 2 ug/l in the normal and replicate samples, at or near the detection limit of 1 ug/l. Toluene was not confirmed in the second column for the normal sample, but was confirmed for the replicate. Ethylbenzene was detected at 2 ug/l in both the normal and replicate samples, slightly above the detection limit of 1 ug/l. However, no ethylbenzene was detected in second-column confirmations for

these samples. Total xylenes were found at 5 ug/l in both second quarter samples, again with no second-column confirmation. Phenol, 2-methylphenol, and phenanthrene were found slightly above detection limits in the second quarter replicate sample, but not in the regular sample. 4-Methylphenol, benzoic acid, napthaline were detected below the LOQ in the replicate sample but not the original. Pyrene, benzo(a) anthracene, chrysene and bis(2-ethylhexyl) phthalate were detected below the LOQ in both the normal and the replicate samples. No semivolatile compounds were detected in the equipment wash blank.

Trichloroethene was detected in the fourth quarter surface water sample at 30 ug/l in the first column but this was not confirmed in the second column conformation or in a third column run to attempt to confirm the first column results. Therefore, TCE is considered to not be present in the sample. Aside from major cations and anions, no other compounds were detected in surface water samples.

Monitoring wells at Site 19 were sampled on a quarterly basis during 1989. The location of these wells is shown on Figure 4.1.19-7. During the first quarter, only monitoring wells 19-C-1, 19-C-2, and 19-C-3 were sampled. After it was determined that well 19-C-4 may be downgradient of the EHB, this well was also sampled during subsequent sampling episodes. Analyses included purgeable halocarbons and aromatics (EPA 8010 and 8020 compounds), semivolatile organics (EPA 8270 compounds), ICP metals, TFH (gasoline and diesel), arsenic, lead, mercury, selenium, major ions, nitrates, chemical oxygen demand, TDS, electrical conductivity, alkalinity, temperature, and pH. Results of analyses of samples collected from wells at the EHB are attached in Appendix A.

Table 4.1.19-3 summarizes the parameters detected in each well during the four quarterly sampling episodes. COD was 20.6 mg/l in the first round sample from 19-C-1 and 24.0 mg/l in the second sample from 19-C-2 and was below the 7.0 mg/l detection limit in all other groundwater samples. The nitrate levels in all the samples ranged from 12.5 to 27.8 mg/l. The nitrates may originate at the golf course, which is irrigated with reclaimed wastewater and is located about 1 mile upgradient from the EHB. In well 19-C-1, chloride was detected at 81.8 mg/l in the first round, but dropped to 26.8 mg/l in the second round, 30.8 mg/l in the third round, and 28.8 mg/l in the fourth. No dominant cation could be identified from the samples. Among the anions, bicarbonate exceeded sulfate and chloride.

Manganese was 0.058 mg/l in the second round sample and 0.388 mg/l in the fourth round sample from 19-C-1. Lead was detected in the first quarter sample from well 19-C-2 at 0.017 mg/l. Several metals were detected which had not been previously: aluminum at 7.23 mg/l, barium at 0.131 mg/l, and iron at 11.2 mg/l. Potassium and zinc, which were detected in the first quarter, were 1.22 and 0.021 mg/l, respectively.

No purgeable halocarbons or aromatics or semivolatile organic compounds were detected in the first quarter samples. TFH-gasoline was not detected in any sample round and TFH-diesel was not detected in the first three sample rounds. The second and third quarter samples from wells 19-C-1 and 19-C-4 both contained TCE from 2 to 3 ug/l (all confirmed in second column). The second quarter sample from well 19-C-4 also contained 1 ug/l of carbon tetrachloride (2 ug/l in second column).

In the fourth quarter, TCE was detected at 19-C-1 at 4 ug/l (4 ug/l in the second column) and 19-C-4 at 2 ug/l (3 ug/l in the second column). TFH-diesel was detected at 0.070 mg/l in 19-C-1, 0.050 mg/l in 19-C-2, 0.070 mg/l in 19-C-3, and 0.060 mg/l in 19-C-4. Diethylphthalate, N-Nitrosodiphenylamine and Di-n-Butylphthalate were detected below the LOQ in 19-C-1. Bis(2-ethylhexyl)Phthalate was detected below the LOQ in 19-C-2. N-Nitrosodiphenylamine was detected at the 10 ug/l LOQ in 19-C-4.

Toluene was detected in the second quarter sample from well 19-C-1, and the second and third quarter samples from wells 19-C-2 and 19-C-3. However, three of these samples failed to show toluene in second column confirmations. In addition, the second quarter sample from 19-C-3 detected toluene in the field replicate sample, and not in the regular sample. Furthermore, toluene was detected in the equipment wash blank and field blank samples accompanying the replicate. Toluene was not detected in the fourth quarter samples.

4.1.19.1.4 Analytical Results Table

Table 4.1.19-3 presents a summary of all detected analytes for Site 19. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.19-3 are generally the lowest federal and state levels applicable to the sampled media

TABLE 4.1.19-3

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 19

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-1SS BAFB-0079 0.0-1.0' 11/23/88	19-C-1SS[f] BAFB-0080 0.0-1.0' 11/23/88	19-C-1SS BAFB-0081 1.0-2.0' 11/23/88	19-C-2SS BAFB-0144 0.0-1.0' 12/02/88	19-C-2SS BAFB-0181 1.0-2.0' 12/02/88	19-C-3SS BAFB-0182 0.0-1.0' 12/02/88
Percent Moisture	ASA#9	N/A	%	NS	NS	28.8	28.7	30.7	25.6	10.7	24
Mercury	SW7471	0.060	mg/kg	NS	20	0.14	0.11	ND	ND	ND	0.14
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	340	650	ND	ND	ND	3800
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	280	210	ND	ND	ND	720
Aluminum	SW6010	20.0	mg/kg	NS	NS	17800	20200	16200	14500	2510	20100
Barium	SW6010	10.0	mg/kg	NS	10,000	243	272	235	222	34.6	230
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	ND	ND	0.53
Calcium	SW6010	100	mg/kg	NS	NS	2960	3280	3190	2960	645	3390
Chromium	SW6010	3.0	mg/kg	NS	500	288	139	51.5	41.8	20.2	57.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	7.6	8.1	8.7	11.0	1.7	13.2
Copper	SW6010	3.0	mg/kg	NS	2,500	26.7	34.4	30.2	28.9	7.8	37.9
Iron	SW6010	10.0	mg/kg	NS	NS	24300	28500	22800	21600	5350	27200
Magnesium	SW6010	100	mg/kg	NS	NS	4940	5330	4170	4620	965	5390
Manganese	SW6010	1.5	mg/kg	NS	NS	177	185	170	277	54.4	361
Nickel	SW6010	4.0	mg/kg	NS	2,000	23.9	28.2	23.1	25.5	12.3	28.3
Potassium	SW6010	200	mg/kg	NS	NS	1690	1680	952	1300	224	1300
Silver	SW6010	3.0	mg/kg	NS	500	50.7	47.0	53.0	40.2	5.2	50.0
Sodium	SW6010	100	mg/kg	NS	NS	538	558	395	801	150	1120
Vanadium	SW6010	4.0	mg/kg	NS	2,400	44.7	53.0	42.0	44.1	11.2	55.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	48.3 B	52.7 B	41.6 B	45.2	8.8	50.3
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.014 B	0.008 B	0.009 B	0.013 B	0.004 BJ	0.10 BJ
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.037 B	0.026 B	ND
4-Methyl-2-Pentanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.006 J	0.004 J	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.045	0.055	0.010	0.002 J	ND	ND
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.17 J
Xylenes (o+m)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.53
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.53
Phenol	SW8270	0.33	mg/kg	NS	NS	1.7 B	1.3 B	2.5 B	ND	ND	ND
1,3-Dichlorobenzene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.22 J

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.19-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-1SS BAFB-0079 0.0-1.0' 11/23/88	19-C-1SS[f] BAFB-0080 0.0-1.0' 11/23/88	19-C-1SS BAFB-0081 1.0-2.0' 11/23/88	19-C-2SS BAFB-0144 0.0-1.0' 12/02/88	19-C-2SS BAFB-0181 1.0-2.0' 12/02/88	19-C-3SS BAFB-0182 0.0-1.0' 12/02/88
1,4-Dichlorobenzene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.34 J
1,2-Dichlorobenzene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.20 J
Naphthalene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	1.6
2-Methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	11
Pentachlorophenol	SW8270	1.6	mg/kg	NS	17	ND	ND	ND	ND	ND	3.6
Anthracene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.26 J
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.34 J	0.24 J	0.72	0.42 BJ	ND	1.3 B
Fluoranthene	SW8270	0.33	mg/kg	NS	NS	0.83	0.65	ND	ND	ND	8.8
Pyrene	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	0.24 J
Butylbenzylphthalate	SW8270	0.33	mg/kg	NS	NS	ND	ND	ND	ND	ND	1.1
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	1.4	1.4	ND	ND	ND	ND
Tetra Furans (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.0001	NT	NT
Penta Furans (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.0003	NT	NT
Hexa Furans (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.001	NT	NT
Hepta Furans (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.009	NT	NT
Octa Furans (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.023	NT	NT
Tetra Dioxins (total)	SW8280	0.00001	mg/kg	NS	.01	NT	NT	NT	0.00003	NT	NT
Penta Dioxins (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.00009	NT	NT
Hexa Dioxins (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.003	NT	NT
Hepta Dioxins (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.019	NT	NT
Octa Dioxins (total)	SW8280	0.00001	mg/kg	NS	NS	NT	NT	NT	0.069	NT	NT

NOTES: Results reported for detected analytes only.

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b: field blank (ambient condition blank)
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f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.19-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-3SS BAFB-0183 1.0-2.0' 12/02/88	19-C-1SB BAFB-0188 10.0-11.5' 12/08/88	19-C-1SB BAFB-0189 20.0-21.5' 12/08/88	19-C-1SB BAFB-0208 30.0-31.5' 12/08/88	19-C-1SB BAFB-0209 40.0-41.5' 12/08/88	19-C-1SB BAFB-0210 50.0-51.5' 12/08/88
Percent Moisture	ASA#9	N/A	%	NS	NS	20.9	17.9	18.8	21.2	12.8	24.9
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	290	ND	ND	ND	ND	ND
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	70	ND	ND	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	16600	14900	10900	14700	7720	14600
Barium	SW6010	10.0	mg/kg	NS	10,000	206	352	159	171	102	198
Beryllium	SW6010	0.50	mg/kg	NS	75	0.51	ND	ND	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	3830	5090	4270	5110	3780	5340
Chromium	SW6010	3.0	mg/kg	NS	500	29.2	55.1	35.3	42.4	30.3	36.1
Cobalt	SW6010	4.0	mg/kg	NS	8,000	16.4	37.5	27.8	33.9	14.9	25.3
Copper	SW6010	3.0	mg/kg	NS	2,500	30.6	69.4	48.2	56.6	38.4	48.3
Iron	SW6010	10.0	mg/kg	NS	NS	23300	36300	28200	34500	21300	30200
Magnesium	SW6010	100	mg/kg	NS	NS	4400	8220	7020	6700	2720	5810
Manganese	SW6010	1.5	mg/kg	NS	NS	649	1860	1060	1150	663	1080
Nickel	SW6010	4.0	mg/kg	NS	2,000	29.0	37.0	26.6	24.1	13.8	20.0
Potassium	SW6010	200	mg/kg	NS	NS	544	585	406	431	344	506
Silver	SW6010	3.0	mg/kg	NS	500	2.8	ND	ND	ND	ND	ND
Sodium	SW6010	100	mg/kg	NS	NS	798	188	163	174	155	225
Vanadium	SW6010	4.0	mg/kg	NS	2,400	49.9	138	94.3	104	76.5	77.6
Zinc	SW6010	2.0	mg/kg	NS	5,000	43.2	84.3	63.2	75.3	37.0	66.4
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.007 B	0.004 BJ	0.005 BJ	0.004 BJ	0.003 BJ	0.004 BJ
Acetone	SW8240	0.010	mg/kg	NS	NS	0.025 B	0.018 B	0.054 B	0.062 B	0.046 B	0.047 B
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.29 BJ	ND	0.48	0.46	0.44	ND
Fluoranthene	SW8270	0.33	mg/kg	NS	NS	0.29 J	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.25 BJ	0.055 J	ND	0.080 J	0.070 J	ND

NOTES: Results reported for detected analytes only.

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ND: analyte not detected.
NS: No standard criteria or action level currently exists.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

(): values listed in () are 2nd column confirmation values.

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.19-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-2SB BAFB-0234 2.0-3.5' 12/13/88	19-C-2SB BAFB-0235 7.0-8.5' 12/13/88	19-C-2SB BAFB-0236 17.0-18.5' 12/13/88	19-C-2SB BAFB-0237 27.0-28.5' 12/13/88	19-C-2SB BAFB-0238 37.0-38.5' 12/13/88	19-C-2SB BAFB-0239 47.0-48.5' 12/13/88
Percent Moisture	ASA#9	N/A	%	NS	NS	13.3	21.9	16.7	20.8	19.2	19.4
Mercury	SW7471	0.060	mg/kg	NS	20	0.081	0.090	0.084	0.076	0.074	0.087
Aluminum	SW6010	20.0	mg/kg	NS	NS	9240	10800	12200	21700	11000	12800
Barium	SW6010	10.0	mg/kg	NS	10,000	141	147	173	274	162	216
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	0.76	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	3110	4060	3930	6520	4020	4780
Chromium	SW6010	3.0	mg/kg	NS	500	33.3	24.3	35.3	51.8	38.4	31.8
Cobalt	SW6010	4.0	mg/kg	NS	8,000	17.3	12.8	32.9	28.7	30.1	23.6
Copper	SW6010	3.0	mg/kg	NS	2,500	35.4	40.7	45.9	68.2	48.1	40.0
Iron	SW6010	10.0	mg/kg	NS	NS	19700	21800	32400	40200	293(0	25100
Magnesium	SW6010	100	mg/kg	NS	NS	3330	3920	5760	8860	6110	5250
Manganese	SW6010	1.5	mg/kg	NS	NS	539	499	1260	1340	1050	1070
Nickel	SW6010	4.0	mg/kg	NS	2,000	17.3	19.2	24.6	32.4	21.0	21.1
Potassium	SW6010	200	mg/kg	NS	NS	265	333	ND	429	ND	ND
Silver	SW6010	3.0	mg/kg	NS	500	6.9	ND	ND	ND	ND	ND
Sodium	SW6010	100	mg/kg	NS	NS	152	360	166	259	161	196
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	ND	63.1	ND	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	58.8	53.1	98.7	102	93.2	76.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	111	69.4	61.3	89.4	61.4	51.6
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.016	0.020	0.010 B	0.028	0.032	0.12
Acetone	SW8240	0.010	mg/kg	NS	NS	0.027	0.019	0.044	ND	0.009 J	0.006 J
Benzene	SW8240	0.005	mg/kg	NS	NS	ND	0.007	ND	ND	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.023	0.039	0.012	0.010	0.012	0.013
Phenol	SW8270	0.33	mg/kg	NS	NS	1.3 B	ND	2.2 B	2.0 B	2.4 B	1.7 B
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.43 B	1.4 B	0.84 B	0.86 B	0.58 B	0.58 B
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	ND	0.090 BJ	0.094 BJ	0.092 BJ	ND	0.11 BJ

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.19-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-3SB BAFB-0311 8.5-10.0' 01/05/89	19-C-3SB BAFB-0312 18.5-20.0' 01/05/89	19-C-3SB BAFB-0313 28.5-30.0' 01/05/89	19-C-3SB BAFB-0314 38.5-40.0' 01/05/89	19-C-3SB BAFB-0315 48.5-50.0' 01/05/89
Percent Moisture	ASA#9	N/A	%	NS	NS	20.9	21.5	16.5	18.2	20.7
Aluminum	SW6010	20.0	mg/kg	NS	NS	15700	14000	15900	6550	8970
Barium	SW6010	10.0	mg/kg	NS	10,000	101	97.5	149	156	30.0
Calcium	SW6010	100	mg/kg	NS	NS	5440	4740	5020	2640	3580
Chromium	SW6010	3.0	mg/kg	NS	500	39.1	45.4	45.9	24.6	29.6
Cobalt	SW6010	4.0	mg/kg	NS	8,000	19.0	15.3	22.8	35.2	8.8
Copper	SW6010	3.0	mg/kg	NS	2,500	56.5	48.0	50.5	34.0	35.1
Iron	SW6010	10.0	mg/kg	NS	NS	30300	26500	34900	23200	22300
Magnesium	SW6010	100	mg/kg	NS	NS	8390	7690	6620	4290	5250
Manganese	SW6010	1.5	mg/kg	NS	NS	455	580	923	1450	216
Nickel	SW6010	4.0	mg/kg	NS	2,000	27.8	27.3	24.7	19.6	18.9
Potassium	SW6010	200	mg/kg	NS	NS	961	395	263	ND	ND
Sodium	SW6010	100	mg/kg	NS	NS	425	203	195	159	153
Vanadium	SW6010	4.0	mg/kg	NS	2,400	75.5	58.0	98.6	76.5	64.7
Zinc	SW6010	2.0	mg/kg	NS	5,000	80.9	67.3	68.3	45.4	47.0
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.053 B	0.031 B	0.025 B	0.044 B	0.033 B
Acetone	SW8240	0.010	mg/kg	NS	NS	0.032 B	0.036 B	0.020 B	0.033 B	0.024 B
trans-1,2-Dichloroethene	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.008
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	0.008 J	0.007 J	ND	0.006 J
Trichloroethene	SW8240	0.005	mg/kg	NS	2,040	0.004 BJ	ND	ND	ND	0.004 BJ
Toluene	SW8240	0.005	mg/kg	NS	NS	0.038	0.013	0.044	0.006	0.038
Di-n-butylphthalate	SW8270	0.33	mg/kg	NS	NS	0.25 BJ	ND	0.43 B	0.28 BJ	0.30 BJ

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.19-3

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 19

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-1GW BAFB-0479 02/24/89	19-C-1GW^{R} BAFB-0528 04/18/89	19-C-2GW BAFB-0517 03/31/89	19-C-3GW BAFB-0516 03/31/89	19-C-1SW BAFB-0487 03/09/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	470	298	290	269	98
Temperature	E170.1	N/A	deg C	NS	NS	20.0	21.2	21.0	9.9	15.0
pH	E150.1	N/A	pH	5-9	NS	7.03	7.02	6.91	7.08	7.40
Alkalinity - Total	SM403	1.0	mg/l	20	NS	74.4	NT	96.2	85.8	42.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	90.8	NT	117.4	104.7	51.7
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	385	NT	277	281	106
Chloride	E325.3	1.0	mg/l	250	250	81.8	NT	28.5	24.2	5.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.16	NT	0.29	0.32	ND
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	12.5	NT	19.6	19.8	2.2
Sulfate	E375.4	1.0	mg/l	250	250	25.7	NT	19.4	13.8	8.8
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	20.6	NT	ND	ND	25.4
Arsenic	SW7060	0.0050	mg/l	.05	.05	ND	NT	ND	ND	0.0150
Lead	SW7421	0.0050	mg/l	.05	.05	ND	NT	0.0170	ND	ND
TFH-Gas	TFH-GA	0.10	mg/l	NS	NS	NT	ND	ND	ND	0.20
Calcium	SW6010	1.00	mg/l	NS	NS	28.0	NT	22.1	16.3	8.76
Iron	SW6010	0.100	mg/l	.3	.3	ND	NT	ND	ND	0.307
Magnesium	SW6010	1.00	mg/l	NS	NS	15.9	NT	14.2	10.4	3.44
Manganese	SW6010	0.0150	mg/l	.05	.05	0.0310	NT	ND	ND	ND
Potassium	SW6010	1.00	mg/l	NS	NS	2.00	NT	ND	1.20	ND
Sodium	SW6010	1.00	mg/l	NS	NS	31.9	NT	24.1	28.6	11.4
Zinc	SW6010	0.0200	mg/l	0.110	0.012	1.22	NT	0.0250	0.0250	ND
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	NT	ND	ND	15

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.19-3

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 19

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-1GW BAFB-0579 06/07/89	19-C-2GW BAFB-0578 06/07/89	19-C-3GW BAFB-0580 06/08/89	19-C-3GW[f] BAFB-0581 06/08/89	19-C-3GW[e] BAFB-0582 06/08/89	19-C-3GW[b] BAFB-0583 06/08/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	252	308	270	270	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	20.5	20.5	20.0	20.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.02	6.85	7.03	7.03	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	63.6	94.2	89.8	90.8	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	77.6	114.9	109.6	110.8	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	364	300	331	285	33.0	NT
Chloride	E325.3	1.0	mg/l	250	250	26.8	26.4	25.2	25.2	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.16	0.22	0.22	0.24	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	21.0	22.6	19.3	19.8	0.37	NT
Sulfate	E375.4	1.0	mg/l	250	250	13.9	20.7	16.0	16.5	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	16.2	21.9	17.1	17.0	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	9.71	14.2	11.2	11.0	ND	NT
Manganese	SW6010	0.0150	mg/l	.05	.05	0.0580	ND	ND	ND	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	ND	ND	ND	1.20	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	21.5	22.6	29.5	29.1	ND	NT
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	0.0250	ND	0.0420	0.0410	NT
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	ND	ND	ND	13(19)	10(11)
Chloroform	SW8010	1	ug/l	NS	100	ND	ND	ND	ND	3(3)	3(4)
Trichloroethene	SW8010	1	ug/l	5	5	3(5)	ND	ND	ND	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	2(1)	8(2)	ND	4	7(4)	8(10)
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 BJ	6 BJ	6 BJ	6 BJ	6 BJ	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	ND	ND	ND	20 B	NT

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ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.19-3 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-4GW BAFB-0584 06/08/89	19-C-1SW BAFB-0595 06/13/89	19-C-1SW[f] BAFB-0596 06/13/89	19-C-1SW[f] BAFB-0597 06/13/89	19-C-1SW[b] BAFB-0598 06/13/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	272	1200	1200	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	21.0	28.0	28.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	6.85	7.11	7.12	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	68.2	199.0	206.4	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	83.2	242.8	251.8	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	272	654	663	ND	NT
Chloride	E325.3	1.0	mg/l	250	250	31.0	148	127	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.28	0.46	0.48	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	18.7	1.3	0.93	0.43	NT
Sulfate	E375.4	1.0	mg/l	250	250	16.0	110	128	ND	NT
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	ND	137	99.4	ND	NT
Barium	SW6010	0.100	mg/l	NS	NS	ND	0.130	0.132	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	15.3	47.0	47.9	ND	NT
Chromium	SW6010	0.0300	mg/l	NS	NS	ND	0.107	0.108	ND	NT
Iron	SW6010	0.100	mg/l	.3	.3	ND	0.168	0.151	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	9.81	26.6	27.2	ND	NT
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	0.119	0.121	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	ND	6.50	7.00	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	27.7	77.2	79.0	ND	NT
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0540	ND	0.0420	0.0410	NT
Chloroform	SW8010	1	ug/l	NS	100	ND	ND	ND	4(4)	3(4)
Carbon tetrachloride	SW8010	1	ug/l	5	5	1(2)	ND	ND	ND	ND
Trichloroethene	SW8010	1	ug/l	5	5	3(4)	ND	ND	ND	ND
Toluene	SW8020	1	ug/l	14,300	100	ND	1	2(1)	ND	1(4)
Ethylbenzene	SW8020	1	ug/l	680	680	ND	2	2	ND	ND
meta-Xylene	SW8020	1	ug/l	NS	NS	ND	2	2	ND	ND
o&p-Xylene	SW8020	1	ug/l	NS	NS	ND	3	3	ND	ND
Phenol	SW8270	10	ug/l	NS	NS	ND	6 J	11	ND	NT
2-Methylphenol	SW8270	10	ug/l	NS	NS	ND	ND	17	ND	NT
4-Methylphenol	SW8270	10	ug/l	NS	NS	ND	5 J	ND	ND	NT
Benzoic Acid	SW8270	50	ug/l	NS	NS	ND	7 J	7 J	ND	NT
Naphthalene	SW8270	10	ug/l	NS	NS	ND	2 J	2 J	ND	NT
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	7 BJ	6 BJ	6 BJ	4 BJ	NT
Phenanthrene	SW8270	10	ug/l	NS	NS	ND	6 J	11	ND	NT
Fluoranthene	SW8270	10	ug/l	NS	NS	ND	ND	9 J	ND	NT
Pyrene	SW8270	10	ug/l	NS	NS	ND	5 J	8 J	ND	NT
Benzo(a)anthracene	SW8270	10	ug/l	NS	NS	ND	2 J	4 J	ND	NT
Chrysene	SW8270	10	ug/l	NS	NS	ND	3 J	5 J	ND	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	5 J	2 J	2 J	ND	NT
Benzo(b)fluoranthene	SW8270	10	ug/l	NS	NS	ND	ND	2 J	ND	NT
Benzo(k)fluoranthene	SW8270	10	ug/l	NS	NS	ND	ND	3 J	ND	NT
Benzo(a)pyrene	SW8270	10	ug/l	NS	NS	ND	ND	3 J	ND	NT

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ND: analyte not detected.
NS: No standard criteria or action level currently exists.
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a: Values represent most stringent standard, criteria or action level. See Appendix I.
*The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.19-3

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 19

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-1GW BAFB-0631 09/08/89	19-C-2GW BAFB-0629 09/07/89	19-C-3GW BAFB-0630 09/07/89	19-C-4GW BAFB-0632 09/11/89	19-C-1SW BAFB-0651 09/18/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	256	302	280	288	52
Temperature	E170.1	N/A	deg C	NS	NS	20.5	20.5	21.0	22.5	15.5
pH	E150.1	N/A	pH	5-9	NS	7.24	7.30	7.49	7.33	7.45
Alkalinity - Total	SM403	1.0	mg/l	20	NS	62.0	95.0	83.0	70.4	25.6
Bicarbonate	SM403	1.0	mg/l	NS	NS	75.6	115.9	101.3	85.9	31.2
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	219	240	228	241	52.0
Chloride	E325.3	1.0	mg/l	250	250	30.8	25.7	24.8	32.0	4.1
Fluoride	E340.2	0.050	mg/l	2	1.4	0.15	0.22	0.25	0.21	ND
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	27.8	22.7	21.1	18.1	1.9
Sulfate	E375.4	1.0	mg/l	250	250	14.0	20.0	14.0	17.0	8.5
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	ND	24.0	ND	2.2	24.1
Calcium	SW6010	1.00	mg/l	NS	NS	17.5	22.3	16.4	15.0	4.90
Iron	SW6010	0.100	mg/l	.3	.3	ND	ND	ND	ND	0.149
Magnesium	SW6010	1.00	mg/l	NS	NS	10.3	14.1	10.3	9.42	1.80
Manganese	SW6010	0.0150	mg/l	.05	.05	ND	ND	ND	ND	0.0430
Potassium	SW6010	1.00	mg/l	NS	NS	ND	ND	1.45	1.19	2.30
Sodium	SW6010	1.00	mg/l	NS	NS	21.1	20.4	27.1	25.7	3.34
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	ND	ND	0.0620
Trichloroethene	SW8010	1	ug/l	5	5	3(3)	ND	ND	2(3)	ND
Toluene	SW8020	1	ug/l	14,300	100	ND	1	13	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	ND	5 J	5 J	ND	6 J
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	8 J	6 J	7 J	ND	9 J

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
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f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.19-3

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 19

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	19-C-1GW BAFB-0699 11/19/89	19-C-2GW BAFB-0701 11/20/89	19-C-3GW BAFB-0698 11/19/89	19-C-4GW BAFB-0725 12/01/89	19-C-1SW BAFB-0731 12/05/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	252	320	280	250	610
Temperature	E170.1	N/A	deg C	NS	NS	20.5	21.0	20.0	19.0	7.0
pH	E150.1	N/A	pH	5-9	NS	7.29	7.23	7.38	7.57	4.15
Alkalinity - Total	SM403	1.0	mg/l	20	NS	64.4	97.2	94.8	82.0	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	78.6	118.6	115.7	100.0	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	263	235	272	245	445
Chloride	E325.3	1.0	mg/l	250	250	28.8	26.8	24.6	32.2	24.8
Fluoride	E340.2	0.050	mg/l	2	1.4	0.55	0.26	0.32	0.28	0.28
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	19.7	13.3	16.2	18.1	6.2
Sulfate	E375.4	1.0	mg/l	250	250	12.8	20.9	ND	18.0	320
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	ND	ND	ND	ND	77.9
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	0.070	0.050	0.070	0.060	0.16
Aluminum	SW6010	0.200	mg/l	NS	NS	7.23	ND	ND	ND	3.00
Barium	SW6010	0.100	mg/l	NS	NS	0.131	ND	ND	ND	ND
Cadmium	SW6010	0.0100	mg/l	NS	NS	ND	ND	ND	ND	0.0369
Calcium	SW6010	1.00	mg/l	NS	NS	18.6	22.5	17.1	16.0	46.7
Chromium	SW6010	0.0300	mg/l	NS	NS	ND	ND	ND	ND	0.137
Cobalt	SW6010	0.0400	mg/l	NS	NS	ND	ND	ND	ND	0.0552
Copper	SW6010	0.0300	mg/l	NS	NS	ND	ND	ND	ND	1.68
Iron	SW6010	0.100	mg/l	.3	.3	11.2	ND	ND	ND	4.67
Magnesium	SW6010	1.00	mg/l	NS	NS	11.6	14.4	10.4	9.83	14.5
Manganese	SW6010	0.0150	mg/l	.05	.05	0.388	ND	ND	ND	1.22
Nickel	SW6010	0.0400	mg/l	.16	.4	ND	ND	ND	ND	0.0631
Potassium	SW6010	1.00	mg/l	NS	NS	1.22	ND	1.25	ND	4.89
Sodium	SW6010	1.00	mg/l	NS	NS	20.8	22.0	28.1	27.1	29.4
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.0210	ND	ND	ND	2.44
Trichloroethene	SW8010	1	ug/l	5	5	4(4)	ND	ND	2(3)	30(0)
Tetrachloroethene	SW8010	1	ug/l	2000	5	2(0)	ND	1(0)	ND	ND
Diethylphthalate	SW8270	10	ug/l	NS	NS	8 J	6 BJ	ND	ND	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	7 J	7 BJ	7 J	10	7 J
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	7 J	6 BJ	ND	11 B	6 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	9 J	ND	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

(soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.19.1.5 Discussion of Analytical Data

Contaminants in the form of fuel hydrocarbons, silver, chromium, mercury, dioxins/furans, PCP, and other organic compounds were detected in soil samples collected within the EHB. Soil samples from beneath the basin and groundwater samples also contained some of these contaminants. Table 4.1.19-4 presents the range of contaminants encountered for each of the media sampled (surface sediment, soil, groundwater), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections or surrogate spike recoveries.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the limit of quantification. These detections may represent laboratory "noise," and some of the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study, the LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.19.2 Sampling and Analytical Problems

4.1.19.2.1 Loss of Samples

There were no sample loss problems for Site 19 samples. One groundwater sample was resampled due to a holding time violation for TFH-gas. One soil analysis for TFH-diesel (boring 19-C-2SB, 2.0 to 3.5 feet) was not completed due to laboratory handling problems. All other scheduled analyses were completed for Site 19 samples. The omission of the one TFH-diesel analysis is not considered critical to the evaluation of this site.

Table 4.1.19-4
RANGES OF CONTAMINANTS DETECTED AT SITE 19

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SURFACE SOIL				
mercury	mg/kg	ND	0.14	2/6
TFH-diesel	mg/kg	ND	3,800	3/6
TFH-gas	mg/kg	ND	720	3/6
silver	mg/kg	2.8	53.0	6/6
chromium	mg/kg	20.2	288	6/6
toluene	mg/kg	ND	0.055	3/6
4-methyl-2-pentanone	mg/kg	ND	(0.006)	2/6
xylenes (total)	mg/kg	ND	0.53	1/6
bis(2-ethylhexyl) phthalate	mg/kg	ND	1.4	1/6
di-n-butyl phthalate	mg/kg	ND	0.72	3/6
fluoranthene	mg/kg	ND	8.8	2/6
butyl benzyl phthalate	mg/kg	ND	1.1	1/6
2-methylnaphthalene	mg/kg	ND	11	1/6
naphthlene	mg/kg	ND	1.6	1/6
pentachlorophenol	mg/kg	ND	3.6	1/6
tetra dioxins	mg/kg	0.00003	0.00003	1/1
penta dioxins	mg/kg	0.0001	0.0001	1/1
hexa dioxins	mg/kg	0.0028	0.0028	1/1
hepta dioxins	mg/kg	0.0188	0.0188	1/1
octa dioxins	mg/kg	0.069	0.069	1/1
tetra furans	mg/kg	0.0001	0.0001	1/1
penta furans	mg/kg	0.0003	0.0003	1/1
hexa furans	mg/kg	0.0017	0.0017	1/1
hepta furans	mg/kg	0.0091	0.0091	1/1
octa furans	mg/kg	0.023	0.023	1/1
SOIL BORINGS				
mercury	mg/kg	ND	0.090	6/16
silver	mg/kg	ND	6.9	1/16
chromium	mg/kg	22.9	55.1	16/16
toluene	mg/kg	ND	0.044	11/16
benzene	mg/kg	ND	0.007	1/16
2-butanone	mg/kg	ND	(0.008)	3/16
trans-1,2-dichloroethene	mg/kg	ND	0.008	1/16
bis(2-ethylhexyl) phthalate	mg/kg	ND	(0.080)	3/16
di-n-butyl phthalate	mg/kg	ND	0.48	3/16
GROUNDWATER				
lead	mg/l	ND	0.017	1/15
manganese	mg/l	ND	0.388	3/15
toluene	ug/l	ND	13.0	5/15
trichloroethene	ug/l	ND	3.0	6/15
SURFACE WATER				
TFH-gas	mg/l	ND	0.20	2/4
chromium	mg/l	ND	0.137	2/4
barium	mg/l	ND	0.131	2/4
fluoride	mg/l	ND	0.46	1/3
iron	mg/l	0.149	4.67	4/4
manganese	mg/l	ND	1.22	3/4
arsenic	mg/l	ND	0.0150	1/4
toluene	ug/l	ND	2.0	1/4
ethylbenzene	ug/l	ND	2.0	1/4
xylene (total)	ug/l	ND	5.0	1/4
phenol	ug/l	ND	11.0	1/4
2-methylphenol	ug/l	ND	17.0	1/4

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

4.1.19.2.2 Likelihood that Positive Samples were Contaminated in the Field or Laboratory

Soil samples collected at Site 19 contained several organic compounds, which were probably laboratory- or field-induced false positive results. Many of the soil samples collected contained acetone and methylene chloride. These are common laboratory contaminants and were also found in some of the method blanks.

Several soil samples contained the semivolatile compounds bis(2-ethylhexyl) phthalate and di-n-butyl phthalate. These compounds were also detected in some of the method blanks. The phthalate compounds were commonly detected in samples from throughout the base and are probably false positive results.

Phenol was detected in eight soil samples at concentrations ranging from 1.3 mg/kg to 2.2 mg/kg. Phenol contamination in soil samples has been traced to a factory-contaminated bottle of acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks that the induced contamination was 1.7 mg/kg.

Toluene was detected in most of the soil samples at low concentrations. This occurred for samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent suggests that it is a false positive result.

Two soil samples had estimated TCE concentrations below the LOQ. TCE was also detected in the method blanks associated with each of these samples. Although TCE is not a common laboratory contaminant, the concentrations estimated below the LOQ and presence in the laboratory blank suggests that TCE is a false positive in these soil samples. One field replicate QC soil sample was collected at Site 19. For the most part, the analytical results are very similar with the exception of TFH-diesel which had a RPD of 63 percent.

In the second round water samples, n-nitrosodiphenylamine was detected below the LOQ in both the sample and the matrix blank for all samples, including field replicates and wash blanks.

In the 8270 analysis of the fourth round sample from well 19-C-2, diethylphthalate, n-nitrosodiphenylamine, and di-n-butylphthalate were detected below the LOQ and in the

method blank. Di-n-butylphthalate was detected in the sample and the method blank for 19-C-4.

4.1.19.2.3 Analytical Results Obtained under Out-of-Control Conditions

The bromochloromethane surrogate spike for the third quarter 8010 analysis for 19-C-1SW was 131 percent, which exceeded the allowable range of 70 to 130 percent.

In the fourth quarter groundwater samples, the 8020 analysis surrogate spike recoveries for trifluorotoluene of 60 percent for 19-C-1 and 63 percent for 19-C-3 were below the acceptable range of 70 to 130 percent. The 8270 analysis surrogate spike recoveries of 21 percent for nitrobenzene-d5, 23 percent for 2-fluorobiphenyl, 31 percent for p-terphenyl-d14, and 15 percent for 2-fluorophenol for 19-C-1 were all below acceptable ranges. For 19-C-3, the recoveries of 8 percent for nitrobenzene-d5, 15 percent for 2-fluorobiphenyl, and 17 percent for 2-fluorophenol were below acceptable ranges.

4.1.19.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.19.3 Significance of Findings

Soils

Surface soil samples were collected from three locations in the bottom of the EHB. At each location an upper (zero to 1.0 feet BGS) and a lower (1.0 to 2.0 feet BGS) sample was collected.

TFH-diesel and -gas were detected in the upper and lower surface soil samples at one location at concentrations of 3,800 and 720 mg/kg (upper) and 290 and 70 mg/kg (lower), respectively. TFH-diesel and -gas were detected in the upper sample and its field replicate at one other location at concentrations of 340 and 650 for the TFH-diesel and 280 and 210 mg/kg for the TFH-gas. No DHS TTLC is available for TFH analytical results. The LUFT cleanup standards calculated for these samples are 1,000 mg/kg for TFH-diesel, and 100 mg/kg for TFH-gas.

Metals were detected in soil samples from the EHB at concentrations higher than averaged from soil background values

plus two standard deviations. Silver, not typical in background samples from other sites at Beale AFB, was detected in all six soil samples from the EHB at concentrations ranging from 2.8 to 53.0 mg/kg. Chromium was detected at 288 mg/kg in the upper sample from 19-C-1SS and at 139 mg/kg in the field replicate at 19-C-1SS. The upper end of the statistical range (mean plus twice the standard deviation) used to categorize chromium levels in the soil as statistically above background, was 46 mg/kg. In relation to apparent naturally occurring chromium levels at Beale AFB, some samples from the EHB have high chromium concentrations. The DHS TTLC for chromium III is 2,500 mg/kg and 500 mg/kg for chromium VI. The ICP chromium concentrations are total chromium. The component concentrations of the two cations were not determined. Since each of the concentrations is below the DHS TTLC for chromium VI, the sampled soil in the EHB cannot be classified as a hazardous material by chromium content compared to TTLC.

Volatile organic compounds were detected in soil samples from the EHB. Toluene, methylene chloride, and acetone, were detected in many of the samples and some of the blanks, and are believed to be false positives. Total xylenes were detected at 0.53 mg/kg in one soil sample (19-C-3SS, zero to 1.0 foot). A DHS TTLC for xylenes is not available. The calculated LUFT recommended cleanup level is 1.0 mg/kg for xylenes.

Semivolatile organics were detected in one soil sample from the EHB. Pentachlorophenol (PCP), naphthalene, 2-methylnaphthalene, and fluoranthene were detected in one upper sample at concentrations of 3.6, 1.6, 11, and 8.8 mg/kg. The DHS TTLC for PCP in soil is 17 mg/kg. DHS TTLC values for the three other semivolatile organics were not available. By this criteria the PCP in the soil does not cause the soil to be categorized as a hazardous waste.

One randomly selected surface soil sample was analyzed for polychlorinated dioxins and furans. Tetra-, penta-, hexa-, hepta-, and octa-dioxins were detected at concentrations ranging from 0.00003 to 0.069 mg/kg (0.03 to 69 ug/kg). Similarly, tetra- through octa-furans were detected at concentrations ranging from 0.0001 to 0.023 mg/kg (0.1 to 23 ug/kg). Generally the dioxin or furan concentration was lowest with the tetra- species and increased towards the octa- species. Since only one soil sample was analyzed no patterns or trends may be made. The dioxin concentrations reported are for total isomers within isomer groups. The TTLC (0.01 mg/kg [0.00001 ug/kg]) is established specifi-

cally for 2,3,7,8 TCDD. Comparison of detected concentrations to the TTLC assumes that all detected TCDD is the 2,3,7,8 cogener form, which is highly unlikely.

An evaluation of toxicity equivalency was conducted to assess the approximate concentration of tetra through hepta isomer groups based on the relative toxicity to 2,3,7,8-tetraCDD. The results are given in Table 4.1.19-5. Because analysis of individual dioxin and furan congeners (210 potential congeners) was not conducted, the concentration of 2,3,7,8 congeners that could occur within each isomer group was estimated. This was based on the total possible 2,3,7,8 congeners that could occur within each isomer group, assuming each congener has an equal possibility of occurring. For example, the hexaCDD isomer group has 10 congeners of which 3 are 2,3,7,8 isomers. Therefore, the detected concentration of 2.8 ug/kg for hexaCDD is multiplied by 3/10 to obtain the estimated 2,3,7,8-congener concentration = 0.00084 mg/kg (0.84 ug/kg).

The toxicity equivalency analysis was completed using both EPA and DHS Toxicity Equivalency Factors (TEF). The total relative toxicity concentration (RTC) by the EPA method equals 0.000059 mg/kg (0.059 ug/kg) for dioxins and furans combined. The DHS method yields a relative toxicity concentration 0.000485 mg/kg (0.485 ug/kg), more than eight times higher than the EPA method.

Caution should be used when applying the RTC results to decision making processes. RTC results vary widely depending on the assumptions made and methods used in the calculations.

Soil Borings

One vertical background and two angled soil borings were drilled at Site 19. Aside from the probable false positive results for acetone, methylene chloride, and toluene, no organics were detected at quantifiable concentrations. Benzene and trans-1,2-DCE were detected in samples from the angled borings drilled beneath the photo waste emergency holding basin at angled sample distances of 7 and 48.5 feet (actual vertical depths of 6 and 42 feet). These compounds were found at or near the LOQ.

Silver was detected in one sample from an angled boring at a depth of 2 feet at 6.0 mg/kg. The DHS TTLC for silver is 500 mg/kg.

Table 4.1.19-5
TOXICITY EQUIVALENCY OF DIOXIN AND FURAN ISOMER GROUPS

Isomer Groups[a]	Detected[b] Concentration (ug/kg)	Estimated 2,3,7,8[c] Congener Concentration (ug/kg)	EPA[d] TEF	CDHS[e] TEF	EPA[f] RTC (ug/kg)	CDHS[g] RTC (ug/kg)
Furan Groups						
TetraCDF	0.1	0.00	0.1	1.0	0.000	0.000
PentaCDF	0.3	0.02	0.1	1.0	0.002	0.020
HexaCDF	1.7	0.4	0.01	0.03	0.004	0.013
HeptaCDF	9.1	4.55	0.001	0.03	0.005	0.137
Total CDFs	11.2	5.00			0.011	0.170
Dioxin Groups						
TetraCDD	0.03	0.001	1.0	1.0	0.001	0.001
PentaCDD	0.1	0.006	0.5	1.0	0.004	0.007
HexaCDD	2.8	0.840	0.04	0.03	0.034	0.025
HeptaCDD	18.8	9.500	0.001	0.03	0.009	0.282
Total CDDs	21.7	10.347			0.048	0.315
Total CDFs and CDDs	32.9	15.346			0.059	0.485

[a]Isomer groups analyzed. OctaCDD and OctaCDF were detected but are not part of toxicity equivalency evaluation.
[b]Concentration of dioxin and furan groups detected. Actual concentrations may be higher based on low spike recovery data.
[c]Estimated concentration of 2,3,7,8 congeners based upon possible number of 2,3,7,8 isomers within each isomer group.
[d]EPA Toxicity Equivalency Factor.
[e]California DHS Toxicity Equivalency Factor.
[f]EPA Relative Toxicity Concentration (estimated 2,3,7,8 congener concentration x EPA TEF.
[g]California DHS Relative Toxicity Concentration (estimated 2,3,7,8 congener concentration x DHS TEF).

Information in this table derived from "Chlorinated Dibenzo-P-Dioxin and Dibenzofuran Contamination in California from Chlorophenol Wood Preservation Use." Report No. 88-5WQ, Division of Water Quality, State Water Resources Control Board, March 1988.

Mercury was detected in all samples from 19-C-2SB at concentrations up to 0.090 mg/kg. The DHS TTLC for mercury is 20 mg/kg.

Surface Water

Four quarterly surface water samples were collected from the unnamed stream near Site 19. Chemical oxygen demand was 137 mg/l in the second quarter sample, higher than the first and third quarters and about twice the surface water COD measured in samples collected in the second quarter from Hutchinson Creek. The reason for this difference is not known.

Arsenic was present only in the first quarter surface water sample at 0.015 mg/l. The DHS Drinking Water Standard MCL for arsenic is 0.050 mg/l; the EPA Drinking Water Standard MCL is 0.100 mg/l. The arsenic level present in the first quarter surface water sample is below both Drinking Water Standards.

Chromium was only detected in the second quarter sample at 0.107 mg/l, and the fourth quarter at 0.137 mg/l, both of which exceeded the MCL of 0.05 mg/l.

Several inorganic parameters were detected at levels exceeding secondary MCLs for these compounds. Secondary MCLs have been established mainly to provide criteria for taste or odor, and do not necessarily reflect public health concerns. Iron exceeded the secondary MCL of 0.300 mg/l in the first round sample (0.307 mg/l) and the fourth round sample (4.67 mg/l). Manganese was 0.119 mg/l in the second round and 1.22 mg/l in the fourth round, above the secondary MCL of 0.05 mg/l. Zinc was 2.44 mg/l in the fourth round below the California secondary MCL of 5 mg/l. The 4.15 pH of the fourth round sample was below the Federal Clean Water Act Criteria of 5 to 9 pH. This low pH may account for some of the elevated metals concentrations. TDS was 654 mg/l in the second round, above the secondary MCL of 500 mg/l.

TFH-gas was detected in the surface water only in the first round, at 0.20 mg/l and TFH-diesel only in the fourth round, at 0.16 mg/l. No regulatory standards for TFH-gas or diesel in surface water were available.

Contaminants detected in surface water are believed to originate from a unknown source other than Site 19.

Groundwater

TCE was detected in the second, third, and fourth sampling rounds at wells 19-C-1 and 19-C-4 at 2 to 4 ug/l, which is below the EPA MCL of 5 ug/l. Carbon tetrachloride was detected in the second quarter sample from well 19-C-4 at the detection limit of 1 ug/l, below the MCL of 5 ug/l, but was not detected in the third quarter sample. Manganese was detected at 0.058 mg/l in the second round sample and 0.388 mg/l in the fourth round sample from well 19-C-1, above the secondary MCL of 0.05 mg/l. A lead level of 0.017 mg/l was detected only in the first round in well 19-C-2. MCL for lead is 0.050 mg/l and the EPA MCL goal is 0.020 mg/l. Zinc was also detected inconsistently in all four monitoring wells at levels below the California secondary MCL of 5.0 mg/l. General water quality parameters were all similar to those for groundwater sampled elsewhere on base.

4.1.19.3.1 Zones of Contamination

The zone of contamination at Site 19 is the clay liner in the EHB, which is classified as a toxic pit by the California RWQCB according to the TPCA on the basis of samples taken in April 1987. One of those samples had 1,300 mg/kg of PCP which was many times the 17 mg/kg TTLC. However, in the Stage 2-1 investigation of the six soil samples taken in the EHB, only one had detected PCP at 3.6 mg/kg. Soil samples from the vadose zone below the EHB and site groundwater samples do not contain concentrations of the analytes detected in the surface soil samples from the clay liner equal to or above EPA or California DHS action levels. Based on the samples collected and analyzed, the clay liner and concrete sides appear to have retarded the movement of the photo wastewater which was periodically stored in the EHB.

Based on four rounds of samples collected during Stage 2-1, the TCE in wells 19-C-1 and 19-C-4 is the only consistent characteristic of contamination detected in groundwater at Site 19. TCE was not known to be part of the photo wastewater stream and was not detected in the surface soils. The source of TCE is unknown.

4.1.19.3.2 Contaminant Migration

Soil

Based on comparison of analytes detected in the soil samples collected from the clay liner of the EHB with those in the

soil samples collected from two angled soil borings beneath the EHB, migration downward is not apparent.

Surface Water

Contamination detected in the surface water sample, believed to be from another source off site, will migrate in the surface water.

Groundwater

The TCE detected in groundwater would be expected to travel at approximately the rate of groundwater flow.

4.1.19.3.2.1 Potential to Move Off Site and Off Base

The potential for contamination detected in soil from the EHB clay liner to move off the site or off the base is low. Based on data from the two angled borings beneath the EHB, contamination is not migrating through the soil beneath Site 19.

The potential for contamination detected in the surface water near Site 19 to move off the site and off the base is high. Site 19 is about 16,000 feet from the edge of the base, estimated along the streams. Analytes similar to the arsenic and TFH-gas and diesel detected in surface water from Site 19 were not detected downstream at Site 6 or Site 13. This may be due to mixing and dilution of surface water as the unnamed stream joins with Hutchinson Creek. The surface water also flows towards the groundwater. Contaminants detected in the surface water, not necessarily originating from Site 19, may migrate to the groundwater.

TCE detected in groundwater samples at Site 19 will migrate off site. Following flow paths across the contour lines on Plates 3 and 4, Site 19 is about 12,000 feet from the base boundary.

4.1.19.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

The velocity of the surface stream was not measured at Site 19, but was estimated (based on observations) to range between 1 and 5 feet per second. Stream flow is generally to the west and south.

The average velocity of groundwater flow may be estimated by substitution into Darcy's Law. Using data derived from the

pumping well during the 72-hour pump test and an estimated effective transport porosity in the permeable materials of 0.20, the approximate velocity of groundwater movement beneath the EHB is about 0.84 feet per day, or 310 feet per year. The direction of groundwater flow at Site 19 appears to be to the southeast, although this cannot be concluded from the data. If flow is actually to the southeast, this probably represents localized flow conditions. Generally groundwater flow at Beale AFB is to the west.

4.1.19.3.2.3 Time of Travel to Receptors

Human receptors of surface water at or downstream of Site 19 would be those using water in Hutchinson Creek, west of the base. Based on the estimated stream velocity of 1 to 5 feet per second, surface water flowing past Site 19 will reach the base boundary in about 1 to 5 hours.

The nearest off base domestic or irrigation well to Site 19 is about 12,000 feet to the west. Based on observed regional groundwater flow conditions, groundwater would require many years to flow from Site 19 to the nearest off base well.

4.1.19.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 19 because of the complicated alluvial deposits in the subsurface.

4.1.19.3.2.5 Expected Spatial and Temporal Variations in Concentration

TCE concentration in groundwater from wells 19-C-1 and 19-C-4 were similar in the second, third, and fourth sampling rounds. At this time, temporal variability is unknown.

4.1.19.3.3 Baseline Risk Assessment

No risk assessment activities were performed as part of IRP Stage 2-1.

4.1.20 DISCUSSION OF RESULTS FOR SITE 20: SANITARY TREATMENT PLANT GREASE PIT

The grease pit is an unlined excavation located northwest of the sewage treatment plant. It is presently used to dispose of sewage plant clarifier skimmings. During the Stage 2-1 field work, the pit contained a liquid material with a foamy, greasy substance on the surface.

No investigations were done at the grease pit during Phase II, Stage 1. California RWQCB conducted limited surface water sampling in 1987. Grease pit fluid samples collected and analyzed by the RWQCB detected toluene at 1.8 mg/l, chloroethane at 0.16 mg/l, oil and grease at 6,800 mg/l, and total petroleum hydrocarbons at 1.5 mg/l.

During Stage 2-1, three surface soil samples were collected from within the grease pit and one angled soil boring was drilled beneath the pit.

4.1.20.1 Presentation of Results

The following section presents the results of the field investigation at Site 20. The discussion focuses on the geology and hydrogeology at the site, and presents the results of chemical analyses performed on soil samples.

4.1.20.1.1 Site Geology

Evaluation of the geology at Site 20 is based on a borehole drilled during the Stage 2-1 investigation and on drilling activities completed at nearby Sites 2 and 13. During the current investigation, one angled boring was drilled to a depth of 49 feet (42 feet beneath the ground surface). The location of this borehole is shown on Figure 4.1.20-1. A soil boring log is provided in Appendix D. Additional information on subsurface geology in the vicinity of Site 20 may be found in the discussion for Site 13, in Section 4.1.13.1.1.

The log of boring 20-C-1SB indicates that near-surface materials at the grease pit consist almost entirely of clays to the total depth of the hole. A clayey sand was encountered from a depth of about 11 to 19 feet in the hole. At 37 feet (33 feet vertically) and again at 47 feet (42 feet vertically), the lean clay varied to lean clay with sand. Otherwise, borehole 20-C-1SB contacted only lean clay. This predominance of fine-grained materials was also found in boreholes in adjacent Site 13.

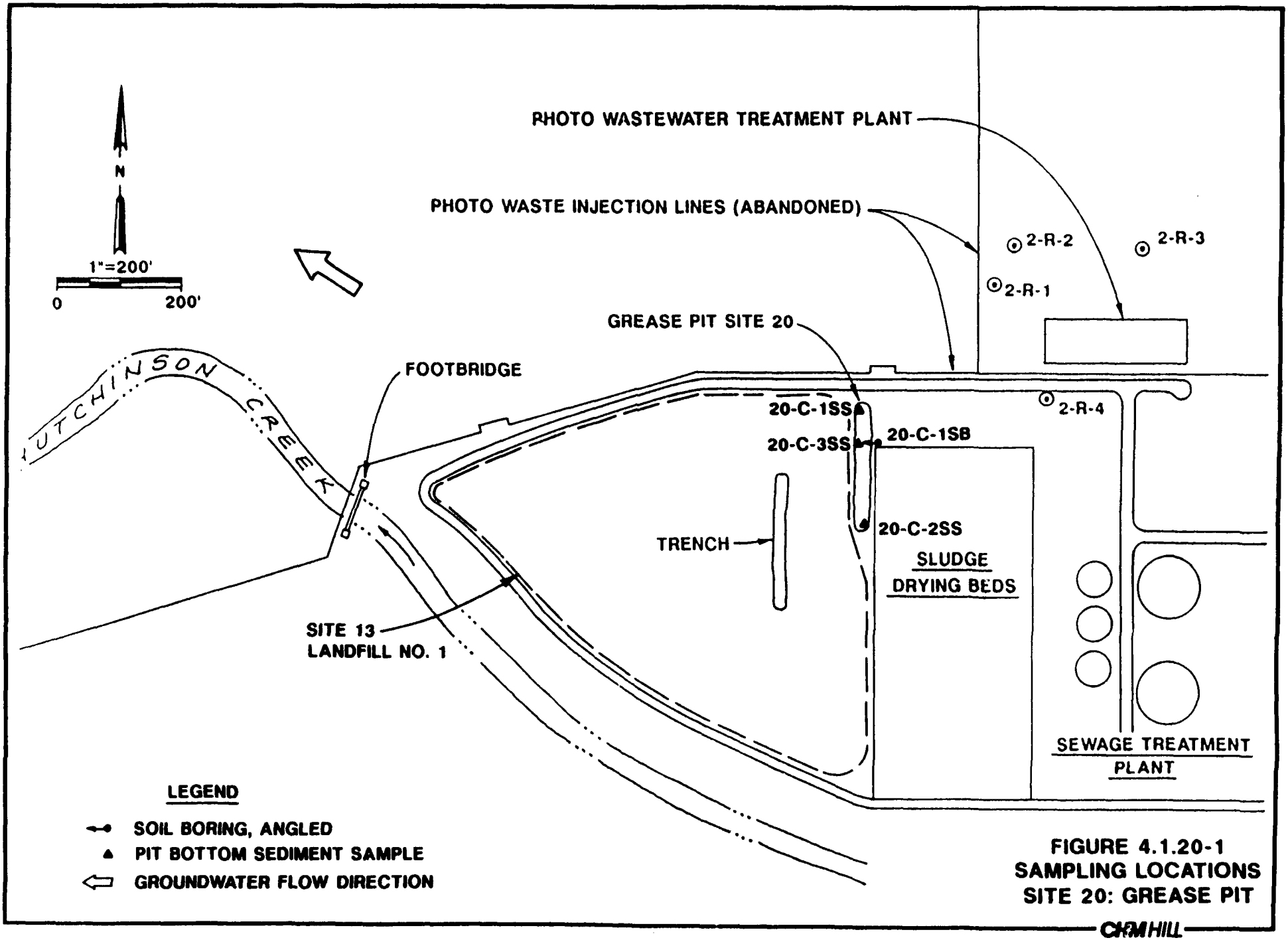


FIGURE 4.1.20-1
SAMPLING LOCATIONS
SITE 20: GREASE PIT

CH2MHILL

Near-surface deposits at Site 20 have been mapped as Quaternary river deposits by the Geological Survey (Page, 1980). These materials are recent channel and flood plain deposits from Hutchinson Creek. This alluvial sequence is predominantly fine-grained overbank deposits with occasional discontinuous sand and gravel channel deposits forming more permeable zones.

4.1.20.1.2 Site Hydrogeology

No wells were installed at Site 20. However, based on the investigation at Site 13, the first saturated permeable zone occurs from approximately 80 to 105 feet below grade, and may be partly confined at some locations.

Figure 4.1.20-2 presents a groundwater elevation contour map for the southern part of Beale AFB based on groundwater level data collected in May 1989. Plates 3 and 4 show contours from similar data collected in March and November 1989. These figures show that a large groundwater depression immediately west of Beale AFB controls groundwater gradients in the western part of the base. Several wells in the depression northwest of Site 20 are measured semiannually by the California Department of Water Resources. Water levels in these wells dropped steadily from the 1940s until 1981. From 1981 through 1987, the last year data were available, water levels have typically risen 20 feet or more in those wells. Based on Figure 4.1.20-2, the horizontal groundwater gradient in the uppermost permeable zone of the aquifer in the vicinity of Site 20 is approximately 0.007 feet per foot to the northwest.

Values of aquifer parameters derived from pump tests conducted on wells at Site 13 are useful as estimated values for Site 20. Transmissivity ranged from 230 to 1,200 square feet per day with an average value of 580 square feet per day. Hydraulic conductivity ranged from 11 to 74 feet per day with an average value of 32 feet per day (0.01 cm/sec). Storativity (a dimensionless aquifer property) calculated from observation wells ranged from 4.5×10^{-4} to 9.6×10^{-4}. Because of the complexity of the groundwater system near Site 13, these values must be regarded as estimates. By substituting into Darcy's Law a value of hydraulic conductivity of 28 feet per day, as measured in the 72-hour pump test in well 19-C-4 and assuming an effective porosity of 0.20, the linear groundwater velocity at Site 13 was estimated at about 1 foot per day, or 360 feet per year.

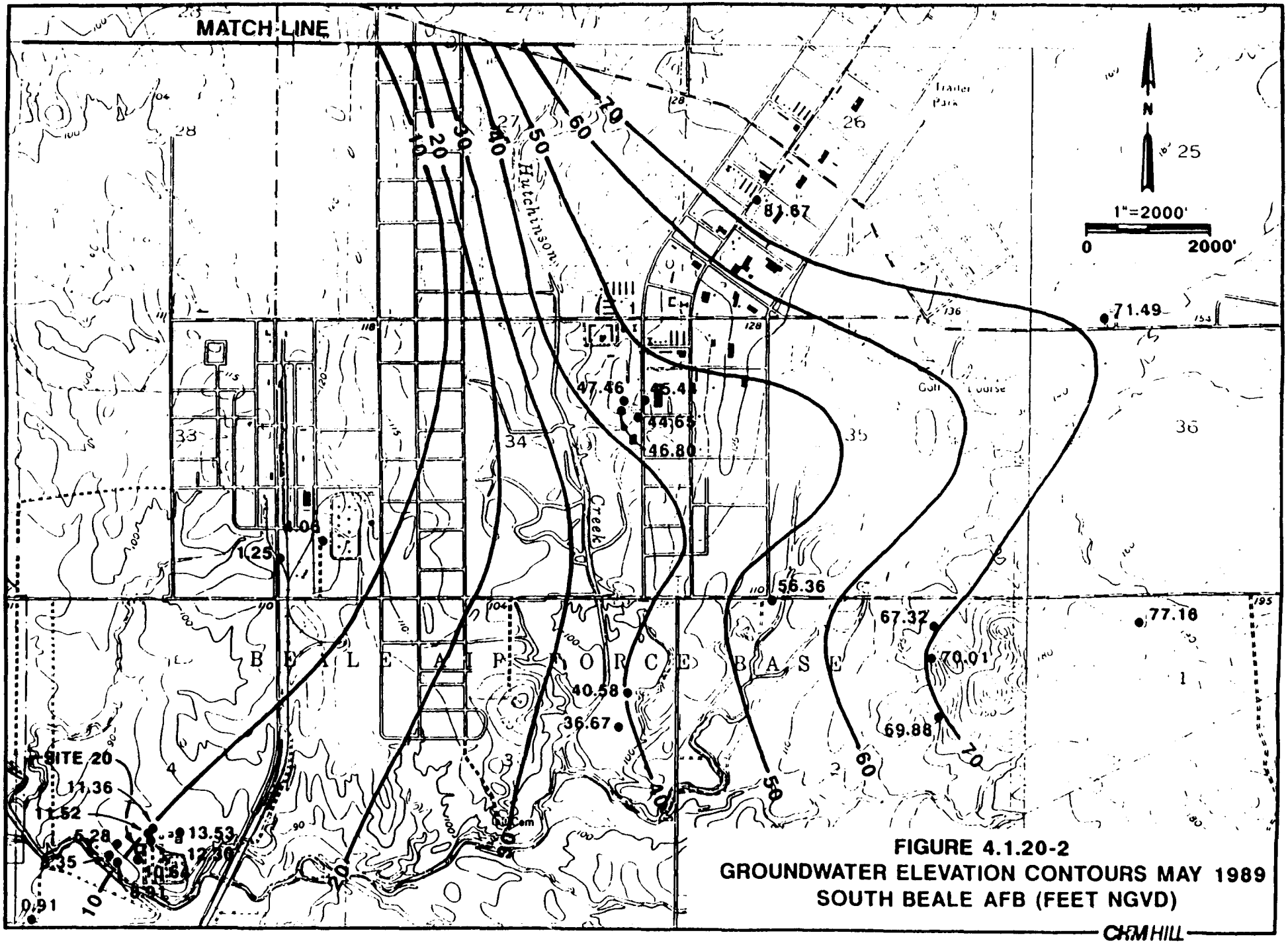


FIGURE 4.1.20-2
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGVD)

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4.1.20.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given with Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.20.1.4 and in Appendix A.

Three pit bottom sediment samples (20-C-1SS, -2SS, and -3SS) were collected in the Site 20 grease pit. One angled soil boring was drilled to a 50-foot depth underneath the pit; five samples were taken for analysis. These pit bottom sediment samples and soil boring samples were analyzed for volatile organics (8240), semivolatile organics (8270), ICP metals (6010), mercury (7470/7471), soil moisture (ASTM D2216), ignitability (1010), and oil and grease (9071).

Grease Pit Sediments

The following organic compounds were detected in pit bottom sediment samples: toluene at 2.0 mg/kg, phenol at 33 mg/kg, and 4-methylphenol at 13 mg/kg in 20-C-3SS; bis(2-ethylhexyl) phthalate at 6.3 mg/kg in 20-C-2SS; and 5.6 mg/kg in 20-C-3SS. The following metals were detected at concentrations above two standard deviations greater than background levels in grease pit sediment sample 20-C-2SS: silver (11.5 mg/kg), cadmium (2.2 mg/kg), copper (133 mg/kg), and zinc (189 mg/kg). In 20-C-3SS, barium was detected at 491 mg/kg, silver at 58.4 mg/kg, cadmium at 5.9 mg/kg, lead at 84.1 mg/kg, sodium at 8,190 mg/kg, and zinc at 411 mg/kg. Mercury was detected at 0.11 mg/kg in 20-C-1SS, 1.4 mg/kg in 20-C-2SS, and 3.0 mg/kg in 20-C-3SS (Figure 4.1.20-3). None of the pit bottom sediment samples were ignitable. Oil and grease were detected in 20-C-1SS at 460 mg/kg, in 20-C-2SS at 4,000 mg/kg, and in 20-C-3SS at 2,600 mg/kg.

Soils

Toluene was detected in boring 20-C-1SB at 0.036 mg/kg at 8 feet (7 feet vertically), 0.10 mg/kg at 18 feet (16 feet vertically), 0.050 mg/kg at 28 feet (24 feet vertically), 0.038 mg/kg at 39 feet, and 0.038 mg/kg at 48 feet (actual vertical depths of 7, 16, 24, 33, and 42 feet). 2-butanone was detected at 0.034 mg/kg at 28 feet, 0.025 mg/kg at

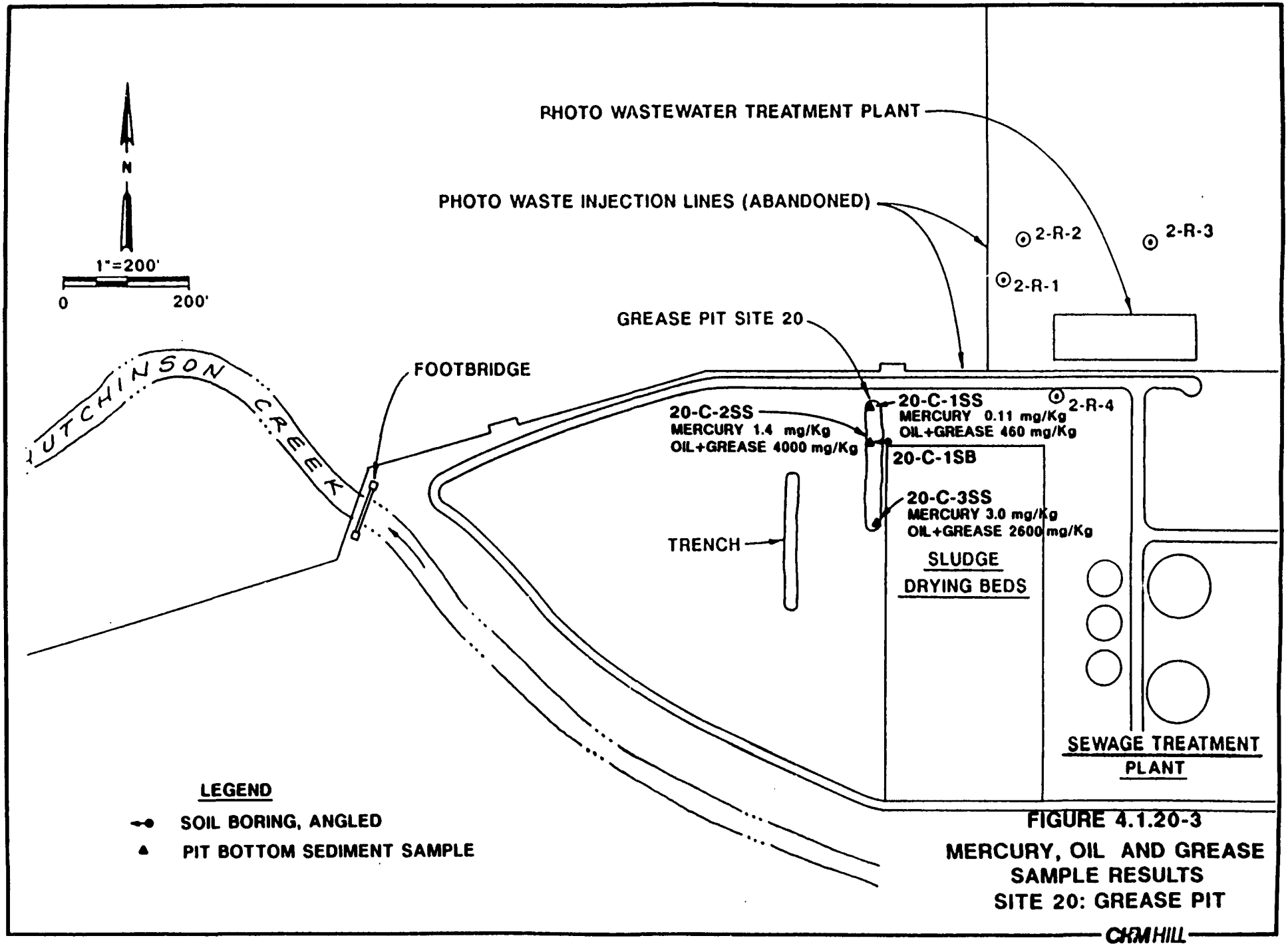


FIGURE 4.1.20-3
MERCURY, OIL AND GREASE SAMPLE RESULTS SITE 20: GREASE PIT

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38 feet, and 0.018 mg/kg at 48 feet (24, 33, and 42 feet vertically). Carbon disulfide was detected in four samples below the LOQ. No semivolatile organic compounds were detected.

ICP metals were detected at levels similar to those typically found in background soil samples at Beale AFB. No mercury or oil and grease were detected in any soil boring samples. No soil boring samples were ignitable.

4.1.20.1.4 Analytical Results Table

Table 4.1.20-1 presents a summary of all detected analytes for Site 20. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.20-1 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.20.1.5 Discussion of Analytical Data

Contaminants detected at Site 20 included oil and grease and several metals (silver, cadmium, copper, mercury, lead, zinc) in the surface soil samples. A few volatile organic compounds were detected in the soil boring samples. Groundwater was not sampled at Site 20. Table 4.1.20-2 presents the range of contaminants encountered for each of the media sampled (surface soils and soil borings), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the LOQ. These detections may represent laboratory "noise" and some of the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was

TABLE 4.1.20-1

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 20

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	20-C-1SS BAFB-0054 0.0-1.0' 11/22/88	20-C-2SS BAFB-0055 0.0-1.0' 11/22/88	20-C-3SS BAFB-0056 0.0-1.0' 11/22/88	20-C-1SB BAFB-0317 7.5-9.0' 01/10/89	20-C-1SB BAFB-0318 17.5-19.0' 01/10/89	20-C-1SB BAFB-0319 27.5-29.0' 01/10/89
Percent Moisture	ASA#9	N/A	%	NS	NS	25.3	36.5	36	13.3	20.3	38.6
Mercury	SW7471	0.060	mg/kg	NS	20	0.11	1.4	3.0	ND	ND	ND
Oils and Greese	SW9071	1.0	mg/kg	NS	NS	460	4000	2600	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	15000	7320	14900	8790	15800	23600
Barium	SW6010	10.0	mg/kg	NS	10,000	147	206	491	120	108	84.7
Beryllium	SW6010	0.50	mg/kg	NS	75	0.80	ND	ND	ND	ND	ND
Cadmium	SW6010	1.0	mg/kg	NS	100	ND	2.2	5.9	ND	ND	ND
Calcium	SW6010	100	mg/kg	NS	NS	3750	5530	6140	2790	2900	8080
Chromium	SW6010	3.0	mg/kg	NS	500	36.5	38.0	56.4	30.9	35.3	74.3
Cobalt	SW6010	4.0	mg/kg	NS	8,000	21.4	8.5	13.4	17.3	12.5	16.3
Copper	SW6010	3.0	mg/kg	NS	2,500	38.0	133	192	27.9	30.1	58.5
Iron	SW6010	10.0	mg/kg	NS	NS	26800	11500	24500	20300	27100	38800
Lead	SW6010	20.0	mg/kg	NS	1,000	ND	ND	84.1	ND	ND	ND
Magnesium	SW6010	100	mg/kg	NS	NS	3640	1610	3380	3930	4770	11600
Manganese	SW6010	1.5	mg/kg	NS	NS	659	261	588	567	596	334
Nickel	SW6010	4.0	mg/kg	NS	2,000	18.7	11.3	20.3	18.5	36.5	41.0
Potassium	SW6010	200	mg/kg	NS	NS	535	ND	625	ND	552	928
Silver	SW6010	3.0	mg/kg	NS	500	ND	11.5	58.6	ND	ND	ND
Sodium	SW6010	100	mg/kg	NS	NS	290	280	8190	187	248	332
Thallium	SW6010	50.0	mg/kg	NS	700	ND	ND	ND	ND	74.0	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	78.4	37.6	65.3	69.6	66.0	66.0
Zinc	SW6010	2.0	mg/kg	NS	5,000	53.3	189	411	34.8	53.1	92.2
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	1.3	0.85 J	0.97 J	0.006	0.016	0.026
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	1.7 J	0.028	0.029	0.049
Carbon Disulfide	SW8240	0.005	mg/kg	NS	NS	ND	ND	ND	ND	0.004 J	0.005 J
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	ND	0.009 J	ND	0.034
Toluene	SW8240	0.005	mg/kg	NS	NS	ND	ND	2.0	0.036	0.10	0.050
Phenol	SW8270	0.33	mg/kg	NS	NS	2.7 B	3.0 B	33 B	ND	ND	ND
4-Methylphenol	SW8270	0.33	mg/kg	NS	NS	ND	ND	13	ND	ND	ND
2,4-Dimethylphenol	SW8270	0.33	mg/kg	NS	NS	ND	ND	0.77 J	ND	ND	ND
Benzoic Acid	SW8270	1.6	mg/kg	NS	NS	ND	ND	2.7 J	ND	ND	ND
Naphthalene	SW8270	0.33	mg/kg	NS	NS	ND	0.68 J	ND	ND	ND	ND
2-Methylnaphthalene	SW8270	0.33	mg/kg	NS	NS	ND	0.63 J	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	SW8270	0.33	mg/kg	NS	NS	0.58 J	6.3	5.6	ND	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.20-1 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	20-C-1SB BAFB-0320 37.5-39.0' 01/10/89	20-C-1SB BAFB-0321 47.5-49.0' 01/10/89
Percent Moisture	ASA#9	N/A	%	NS	NS	20.6	18.1
Aluminum	SW6010	20.0	mg/kg	NS	NS	15100	15900
Barium	SW6010	10.0	mg/kg	NS	10,000	114	201
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	0.61
Calcium	SW6010	100	mg/kg	NS	NS	3680	5230
Chromium	SW6010	3.0	mg/kg	NS	500	38.4	75.5
Cobalt	SW6010	4.0	mg/kg	NS	8,000	18.9	31.3
Copper	SW6010	3.0	mg/kg	NS	2,500	32.5	59.1
Iron	SW6010	10.0	mg/kg	NS	NS	20300	36600
Magnesium	SW6010	100	mg/kg	NS	NS	4330	7880
Manganese	SW6010	1.5	mg/kg	NS	NS	655	1380
Nickel	SW6010	4.0	mg/kg	NS	2,000	38.0	50.4
Potassium	SW6010	200	mg/kg	NS	NS	390	379
Sodium	SW6010	100	mg/kg	NS	NS	382	247
Thallium	SW6010	50.0	mg/kg	NS	700	68.9	ND
Vanadium	SW6010	4.0	mg/kg	NS	2,400	48.4	116
Zinc	SW6010	2.0	mg/kg	NS	5,000	52.6	70.5
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.019	0.013
Acetone	SW8240	0.010	mg/kg	NS	NS	0.038	0.032
Carbon Disulfide	SW8240	0.005	mg/kg	NS	NS	0.005 J	0.004 J
2-Butanone	SW8240	0.010	mg/kg	NS	NS	0.025	0.018
Toluene	SW8240	0.005	mg/kg	NS	NS	0.038	0.038

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Table 4.1.20-2
RANGES OF CONTAMINANTS DETECTED AT SITE 20

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
GREASE PIT SEDIMENTS				
mercury	mg/kg	0.11	3.0	3/3
silver	mg/kg	ND	58.6	2/3
beryllium	mg/kg	ND	0.80	1/3
cadmium	mg/kg	ND	5.9	2/3
copper	mg/kg	38	192	3/3
lead	mg/kg	ND	84.1	1/3
zinc	mg/kg	53.3	411	3/3
bis(2-ethylhexyl) phthalate	mg/kg	(0.58)	6.3	3/3
toluene	mg/kg	ND	2.0	1/3
oil and grease	mg/kg	460	4000	3/3
SOIL BORINGS				
copper	mg/kg	27.9	59.1	5/5
zinc	mg/kg	34.8	92.2	5/5
2-butanone	mg/kg	ND	0.034	4/5
toluene	mg/kg	0.036	0.10	5/5
carbon disulfide	mg/kg	ND	(0.005)	4/5

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

tentatively identified below the LOQ. For this study, the LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.20.2 Sampling and Analytical Problems

4.1.20.2.1 Loss of Samples

There were no sample loss problems for Site 20 samples. No samples needed to be resampled and all scheduled analyses were completed for Site 20.

4.1.20.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil samples collected at Site 20 contained several organic compounds which were probably laboratory- or field-induced false positive results. All of the soil samples collected contained methylene chloride and many of the samples also contained acetone. These are common laboratory contaminants and are probably false positive results.

All of the grease pit sediment samples contained the semivolatile compound bis(2-ethylhexyl) phthalate. The phthalate compounds were commonly detected in samples from throughout the base and are probably false positive results.

Phenol was detected in all three surface soil samples at concentrations of 2.7, 3.0, and 33 mg/kg. The two lower concentrations have been traced to a factory contaminated bottle of acetone used in the extraction process. The laboratory estimated from analysis of soil method blanks that the induced contamination was 1.7 mg/kg. The highest concentration (33 mg/kg) represents a true positive result. Toluene was detected in one of the surface soil samples and all of the soil boring samples. Toluene was detected in samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent and low concentration suggest that it is a false positive result. For the soil replicate QC samples taken at other sites, in which toluene was detected, duplication of the toluene result was not good. This is another indication that the toluene is probably not a true contaminant present at the site.

No soil replicate QC samples were collected at Site 20.

4.1.20.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 16 samples.

4.1.20.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.20.3 Significance of Findings

Soil

Grease pit sediment samples were collected from three locations in the grease pit. Each had detected mercury from 0.11 to 3.0 mg/kg, oil and grease from 460 to 4,000 mg/kg, and phenol from 2.7 to 33 mg/kg. The surface sample from the south end of the grease pit, 20-C-3SS, had the highest mercury and phenol content; 20-C-2SS, from the west side near the center of the pit had the highest oil and grease concentration. 20-C-3SS also had detected silver and lead at 58.6 and 84.1 mg/kg, respectively. The DHS TTLC for mercury is 20 mg/kg; for silver, 500 mg/kg; and for lead, 1,000 mg/kg. All of the metals detected are at concentrations below the respective DHS TTLC.

One angled soil boring was drilled at Site 20. The detected ICP metals concentrations were generally similar to those detected in soil samples from other sites on base. Five volatile organic compounds were detected in all soil samples near, at, or below the detection limits. Acetone, 2-butanone, toluene, methylene chloride, and carbon disulfide were detected although some of these may represent false positives.

Geophysics

In conjunction with the investigation of Site 13, a geophysical investigation was conducted in the western side of Site 20 to determine if other trenches or grease pits existed. Seven areas of buried metal were delineated, as illustrated in Figure 4.1.20-4. The ground surface was irregular with depressions indicative of previous excavation and backfilling.

4.1.20.3.1 Zones of Contamination

The only contaminants apparent from the sampling conducted in Stage 2-1 at Site 20 are the oil and grease, phenol, mercury, lead and silver in the sediment in the bottom of the grease pit. Based on the sampling conducted in the Stage 2-1 study, the depth of contaminated soil has not been determined. However, none of these analytes were detected in soil samples from beneath the grease pit.

4.1.20.3.2 Contaminant Migration

Based on the angled boring results, there is no indication that contaminants are migrating beyond the grease pit sediments, and contamination is not expected to migrate from Site 20. Although the detected contaminants could potentially move downward through the soil, the lack of these in all soil samples collected from 20-C-1SB indicates that such migration is not taking place at the location of the angled soil boring.

4.1.20.3.2.1 Potential to Move Off Site and Off Base

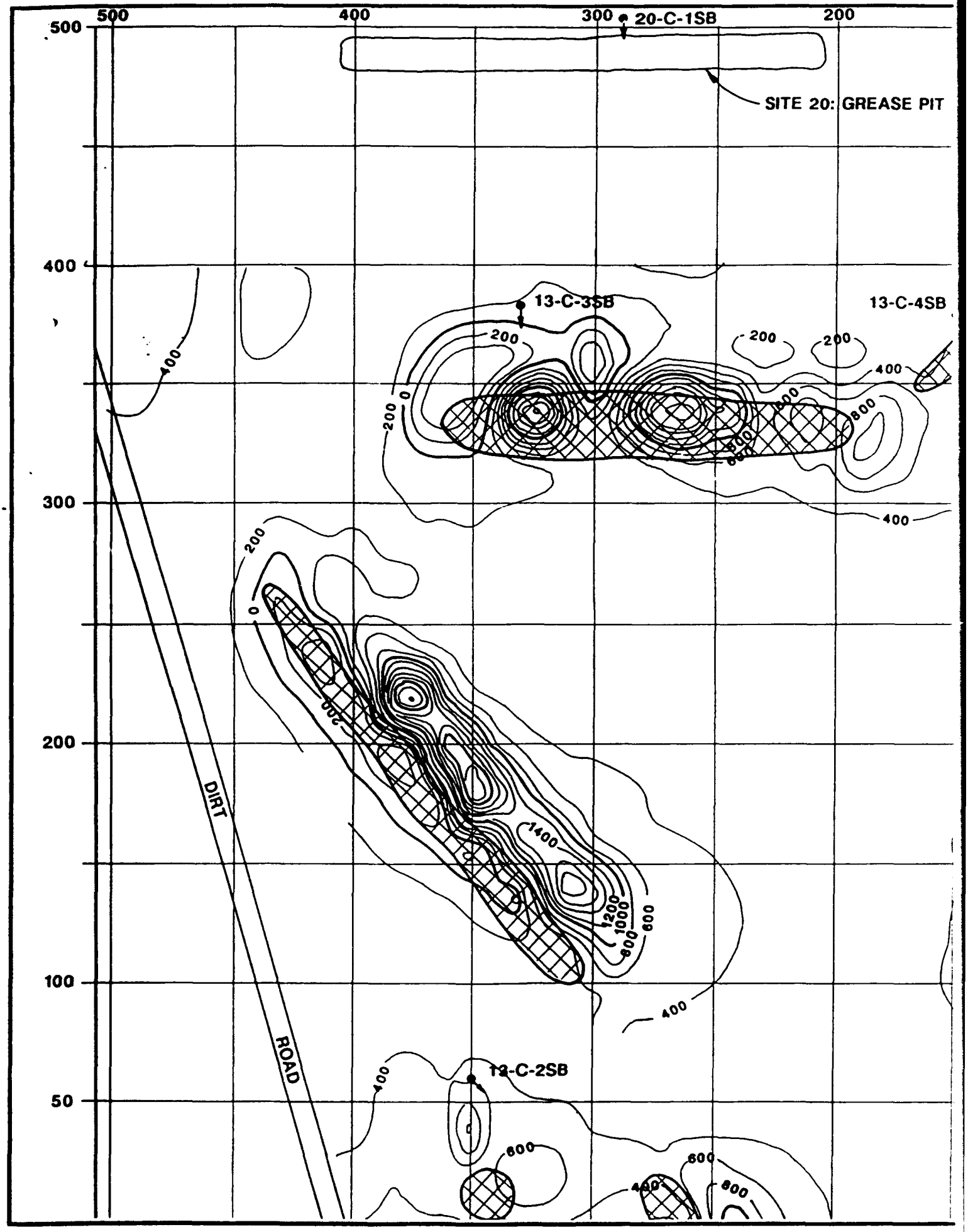
Based on sediment and soil sampling conducted in Stage 2-1, the potential for detected contaminants to move off the site or off the base is low. Samples from the angled soil boring indicate that contamination detected in the grease pit are not moving towards groundwater.

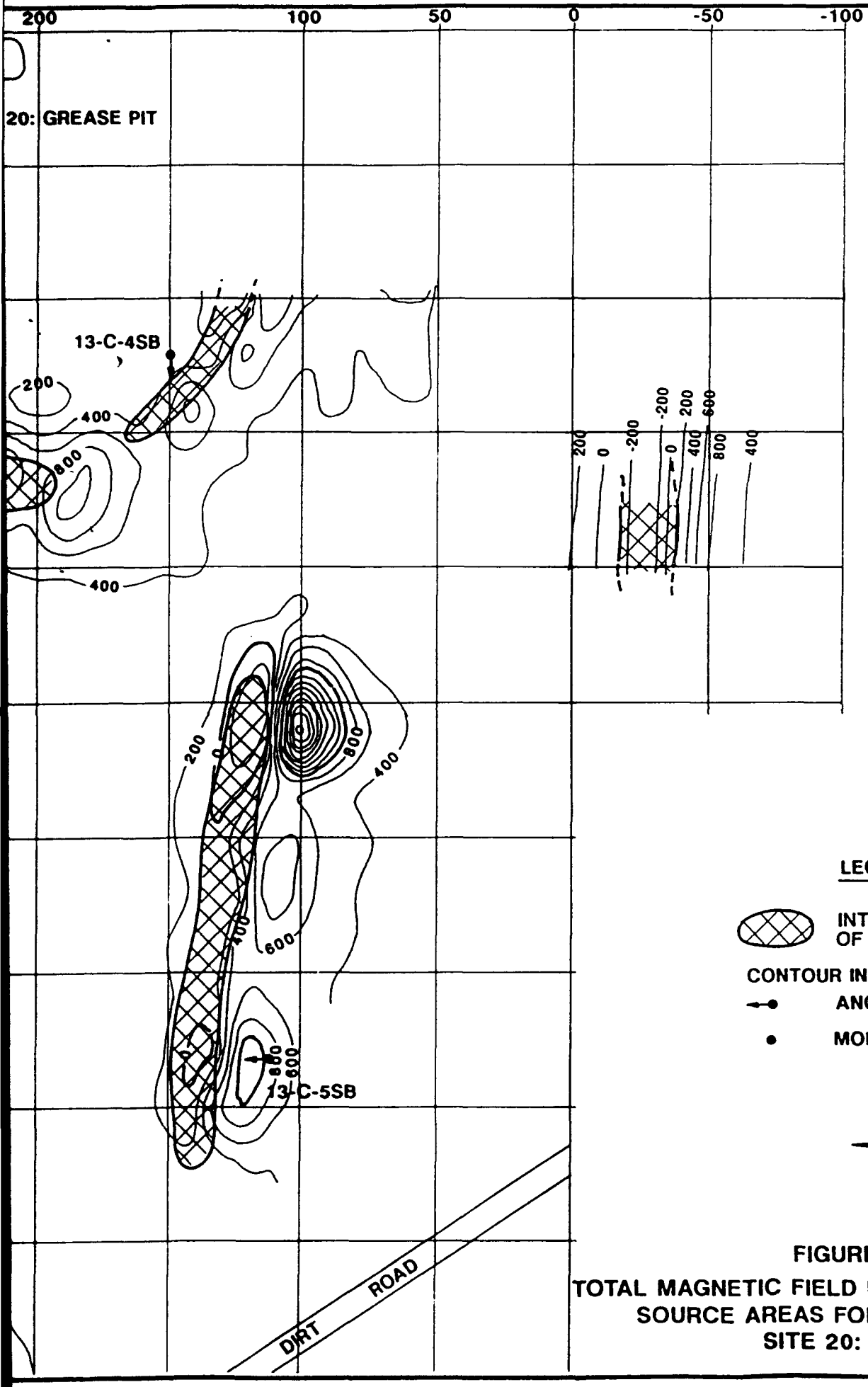
4.1.20.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

No groundwater studies were conducted at Site 20. This section is not applicable to Site 20. Groundwater was examined at Site 13 adjacent to Site 20. See Section 4.1.13.1.2 for more information.

4.1.20.3.2.3 Time of Travel to Receptors

There are no known human receptors at Site 20. However, should contaminants from the grease pit migrate to groundwater, they would migrate to the west with the regional groundwater flow. Groundwater could reach the nearest off base domestic or irrigation well in about 5 years based on work completed at Site 13.


500
400
300
200
20-C-1SB
SITE 20: GREASE PIT
500
400
300
100
50
13-C-3SB
13-C-4SB
13-C-2SB
DIRT
ROAD
0
200
400
600
800
1000
1200
1400



LEGEND

INTERPRETED AREAS OF BURIED METAL

CONTOUR INTERVAL 200 GAMMAS

ANGLED BORING

MONITORING WELL

N

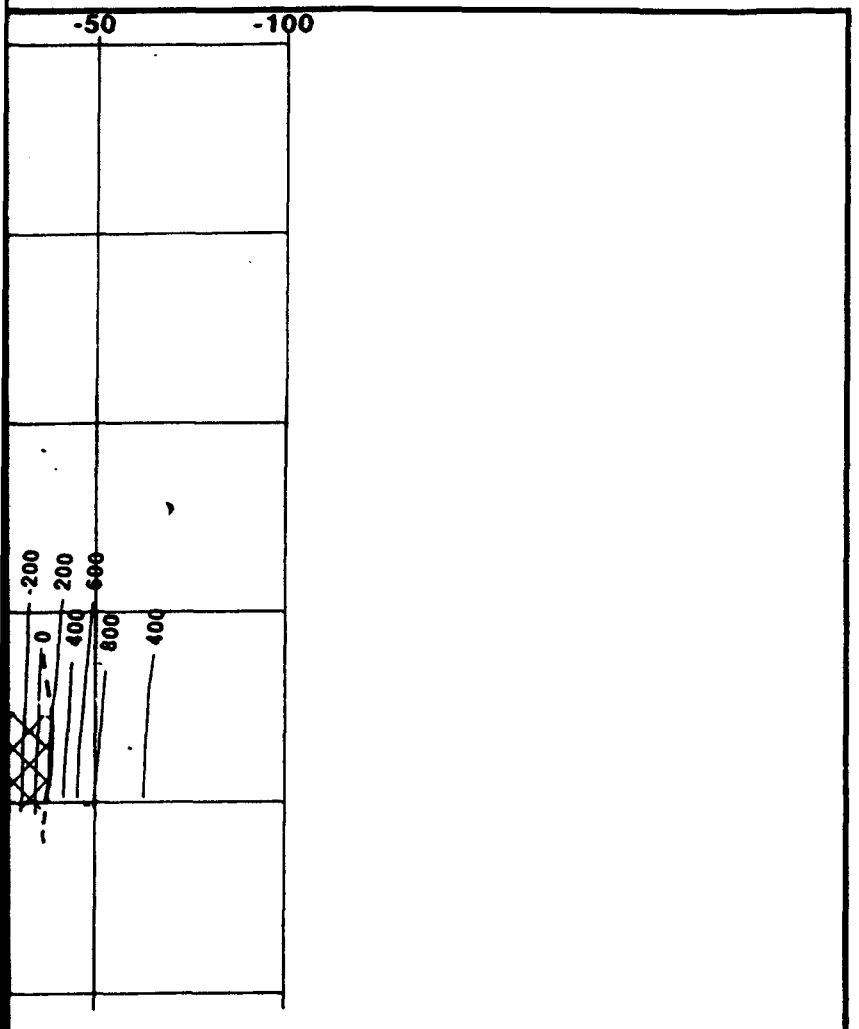
1"=50'

0 25' 50'

FIGURE 4.1.20-4

TOTAL MAGNETIC FIELD INTENSITY AND INTERI
SOURCE AREAS FOR MAGNETIC ANOMAL
SITE 20: GREASE PIT

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LEGEND

INTERPRETED AREAS OF BURIED METAL

CONTOUR INTERVAL 200 GAMMAS

ANGLED BORING

MONITORING WELL

N

1"=50'

0 25' 50'

FIGURE 4.1.20-4

MAGNETIC FIELD INTENSITY AND INTERPRETED OURCE AREAS FOR MAGNETIC ANOMALIES SITE 20: GREASE PIT

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4.1.20.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable because no groundwater studies have been conducted at Site 20.

4.1.20.3.2.5 Expected Spatial and Temporal Variations in Concentration

Vertical spatial variations were evident in the soil sampling conducted in Stage 2-1. Oil and grease, silver, and lead were detected in sediment samples from the grease pit, but not from soil boring samples to a vertical depth of about 42 feet beneath the grease pit. No further IRP sampling is scheduled at Site 20. Temporal variations cannot be determined from a single round of sampling.

4.1.20.3.3 Baseline Risk Assessment

No risk assessment work was conducted as part of Stage 2-1.

4.1.21 DISCUSSION OF RESULTS FOR SITE 21: ABOVE GROUND JP-7 FUEL TANKS AT THE FLIGHTLINE

The JP-7 above ground storage tanks are located between taxiway No. 6 and the main runway, west of Site 5, the SR-71 Shelter Drainage Area (see Figure 4.1.21-1). A bermed area, approximately 80 feet square, contains four 25,000-gallon horizontal tanks. Stormwater that accumulates within the bermed area is allowed to flow into a small ditch, which discharges to the field west of the tanks.

Many active underground fuel tanks and pipelines exist in the area but were not included in the Stage 2-1 activities. The JP-7 above ground fuel storage tanks have not previously been included in the IRP process at the base. Initial sampling was conducted during Stage 2-1 to determine if contamination exists.

Five surface samples were collected at Site 21 in Stage 2-1. Three of the samples were collected from within the bermed area surrounding the above ground tanks, and two from the drainage ditch downstream from the bermed area. All samples were analyzed for soil moisture and TFH-diesel and -gas.

4.1.21.1 Presentation of Results

The following section presents the results of the field investigation at Site 21. The discussion focuses on the geology and hydrogeology at the site, and presents the results of chemical analyses performed on groundwater and soil samples.

4.1.21.1.1 Site Geology

Evaluation of the geology at Site 21 is based on a borehole drilled during the current Stage 2-1 investigation and completed as a monitoring well and on drilling activities completed at nearby IRP Sites 1 and 5. The well at Site 21 was drilled to a total depth of 139 feet (-37 feet NGVD), and screened across the uppermost permeable zone at a depth of 104 to 124 feet BGS (-2 to -22 feet NGVD). The location of this well is shown in Figure 4.1.21-1. A soil boring log is provided in Appendix D. Additional information on subsurface geology in the vicinity of Site 21 may be found in discussions for Sites 1 and 5 in Sections 4.1.1.1.1 and 4.1.5.1.1.

A geologic cross-section prepared from soil boring logs of 21-C-1, 5-C-1 and 5-C-1SB is shown in Figure 4.1.21-2. This

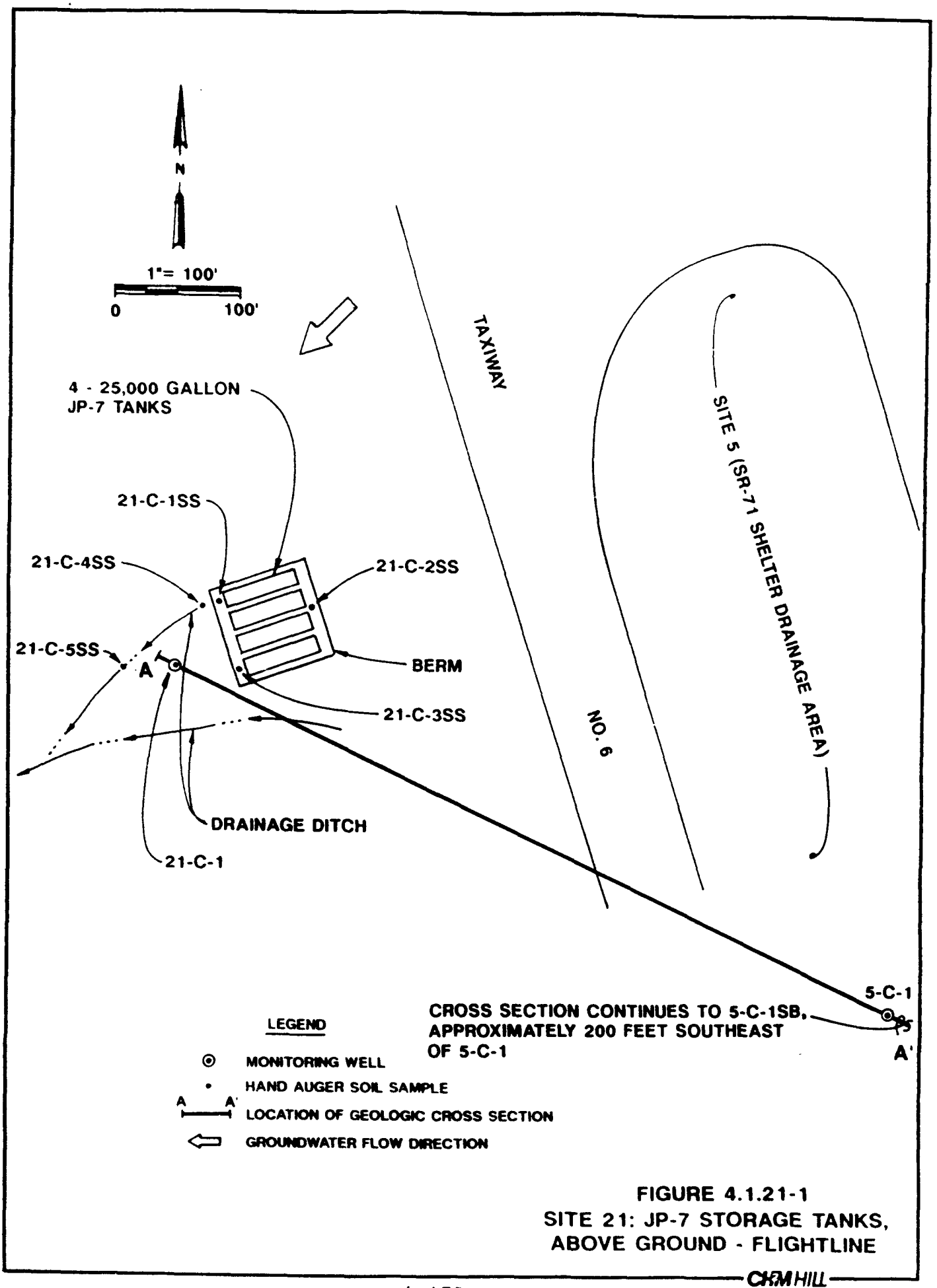
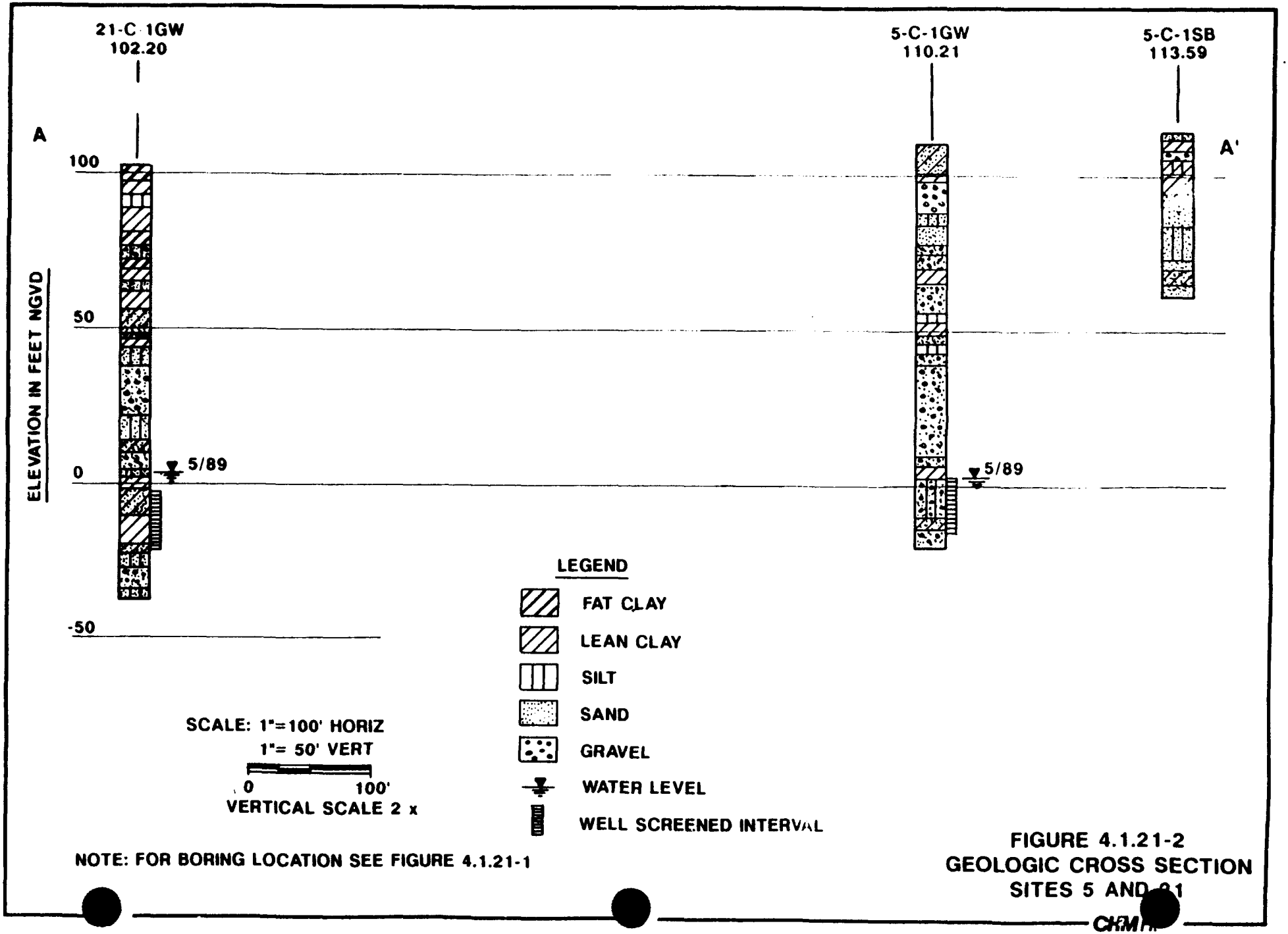


FIGURE 4.1.21-1
SITE 21: JP-7 STORAGE TANKS,
ABOVE GROUND - FLIGHTLINE

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NOTE: FOR BORING LOCATION SEE FIGURE 4.1.21-1

FIGURE 4.1.21-2
GEOLOGIC CROSS SECTION
SITES 5 AND 21

figure and the log of well 21-C-1 indicate that near-surface materials at Site 21 consist almost entirely of silts and clays to a depth of about 50 feet (52 feet NGVD). From this point to a depth of about 100 feet (2 feet NGVD), the borehole penetrated mainly sands that ranged from clayey and silty sands to coarse sands and gravel. This sand may correlate with thick sequences of sands noted in other boreholes in the flightline area of Beale AFB, such as 5-C-1 (Figure 4.1.21-2). From a depth of 100 feet to the total depth of the hole at 139 feet (-37 feet NGVD), the deposits varied from clays to sands.

Near-surface deposits at Site 20 have been mapped as near the contact of the Victor Formation and the Laguna Formation (Page, 1980). These units both consist of highly variable continental alluvial deposits, which are difficult to distinguish in the field. Both units are known to contain layers of cemented sediments. The soil boring log of well 21-C-1 indicates that several cemented layers were penetrated. Based on this log, no volcanics were contacted to the total depth of the hole.

4.1.21.1.2 Site Hydrogeology

The first wet cuttings in 21-C-1 were encountered in a clayey sand interval that extended from a depth of 108-112 feet (-6 to -10 feet NGVD). This unit was overlain and underlain by lean clay that yielded dry cuttings. At a depth of 121 feet (-19 feet NGVD), the hole contacted wet clayey sand again. This turned to silty sand at a depth of 124 feet (-22 feet NGVD) and was permeable enough to yield water from the hole during drilling. The sands continued yielding water to the total depth of the hole (-37 feet NGVD). The well was screened from 104-124 feet BGS (-2 to -22 feet NGVD), across the uppermost water-bearing deposits. Prior to development, an oily sheen was observed on the surface of water withdrawn from this well. Following development of 21-C-1, the water level in the casing stabilized at a depth of about 99 feet (3 feet NGVD), and the oily sheen has not been observed again.

Groundwater levels recorded in well 21-C-1 during 1989 are presented in Table 4.1.21-1 and in Figure 4.1.21-3. A complete summary of groundwater measurements, including elevations and depths to water, is provided in Appendix G. These measurements indicate that the groundwater level in well 21-C-1 has risen nearly 3 feet during 1989. This steady rise was typical for wells constructed in alluvium on the

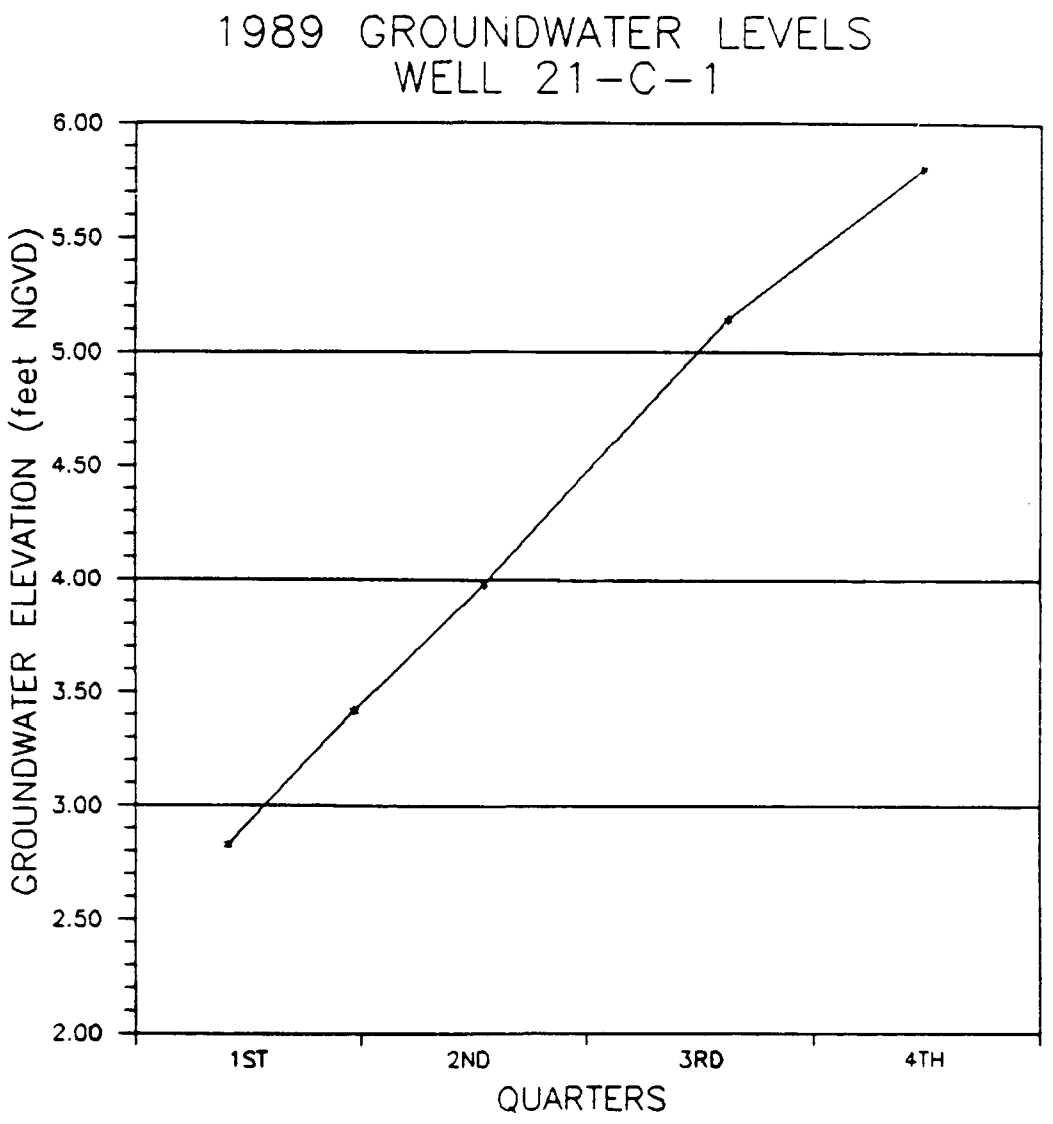


FIGURE 4.1.21-3
MONITORING WELL HYDROGRAP
SITE 21: JP-7 STORAGE TANKS
ABOVE GROUND - FLIGHT LINE

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western edge of Beale AFB, and may reflect a long-term regional rise in groundwater levels.

Table 4.1.21-1
GROUNDWATER ELEVATIONS: SITE 21
(feet NGVD)

Well	Screened Interval	February 1989	March 1989	May 1989	August 1989	November 1989
21-C-1	125-104	2.83	3.42	3.98	5.14	5.80

Figure 4.1.21-4 presents a groundwater elevation contour map based on data from wells in the northern portion of Beale AFB collected in May 1989. Plates 3 and 4 show contours from similar data collected in March and November 1989. These figures show that groundwater in the vicinity of Site 21 is flowing to the southwest under the influence of the groundwater depression located immediately west of Beale AFB. Based on Figure 4.1.21-4, the horizontal groundwater gradient in the uppermost permeable zone of the aquifer in the vicinity of Site 21 is approximately 1 foot per 625 feet, or 0.0016. This low gradient may be due partly to the curve in the flowpath from west to southwest in response to the groundwater depression and partly to the possible presence of subsurface coarse-grained materials in this region of the base.

Well 21-C-1 was pump tested to derive aquifer parameters. Data were analyzed according to the recovery of step-drawdown method devised by Harrill (1970). A description of testing methodology and a plot of the data are provided in Appendix E. Based on this test, the transmissivity was 750 square feet per day, and the hydraulic conductivity was 37 feet per day (0.013 cm/sec). These values are very similar to those derived in nearby well 5-C-1. Groundwater velocity may be estimated by substituting into Darcy's Law. Using a hydraulic conductivity of 28 feet per day, as determined in the 72-hour test of well 19-C-4, a gradient of 0.0016, and an estimated effective porosity of 0.20, the approximate groundwater velocity is 0.2 feet per day, or 80 feet per year. However, this value is only an estimate.

4.1.21.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality

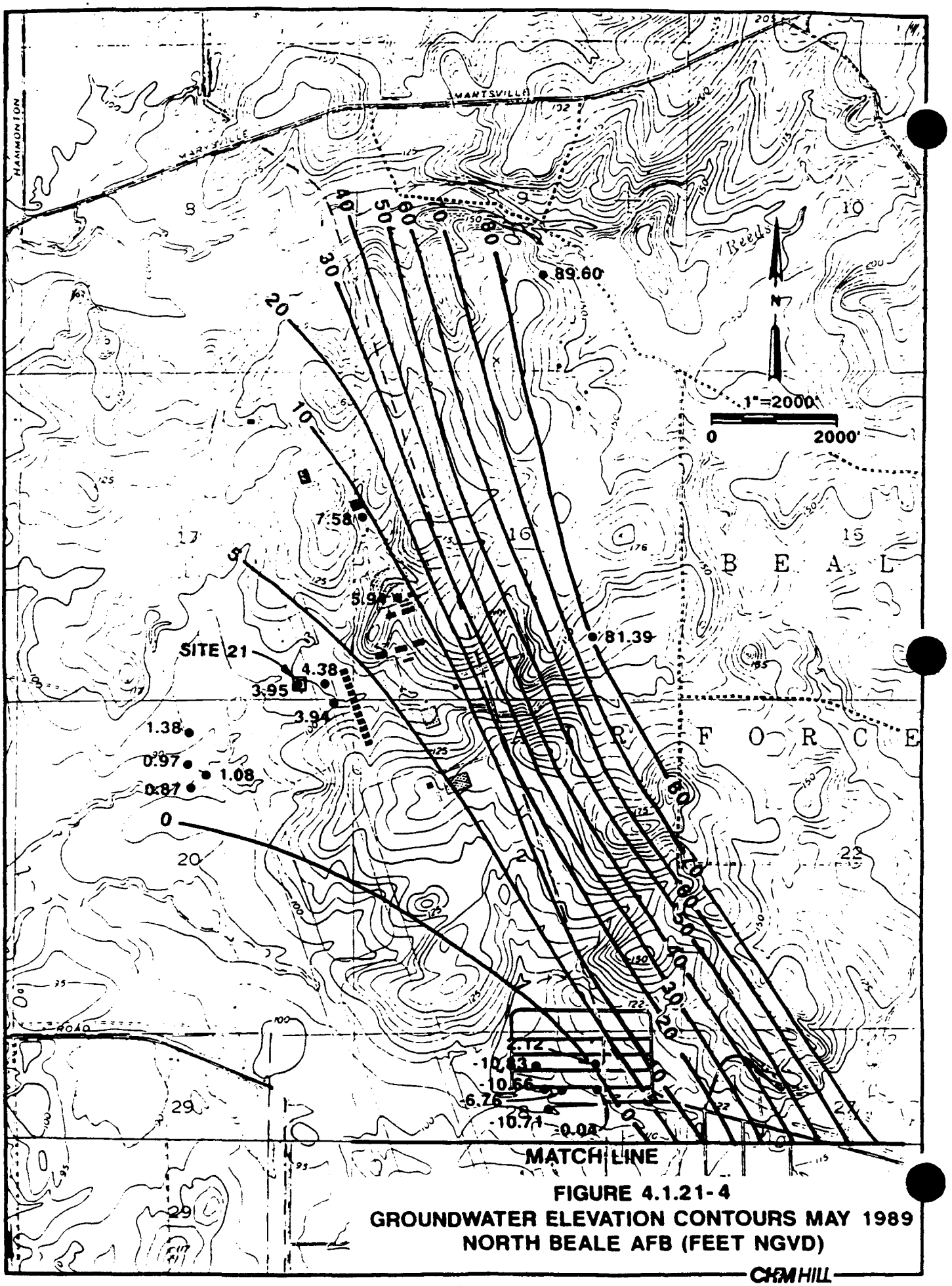


FIGURE 4.1.21-4
GROUNDWATER ELEVATION CONTOURS MAY 1989
NORTH BEALE AFB (FEET NGVD)

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control results are given within Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.21.1.4 and in Appendix A.

Surface Soils

Five surface soil samples were collected at Site 21: three from within the bermed JP-7 tank area (21-C-1SS, -2SS, and -3SS) and two from the drainage ditch running west from the tanks (21-C-4SS and -5SS). These samples were analyzed for soil moisture (ASTM D2216) and TFH-diesel and -gas (California method).

TFH-diesel was detected in all surface soil samples at 48 to 2,500 mg/kg (Figure 4.1.21-5). TFH-gas was detected in all surface samples at from 130 to 410 mg/kg.

Groundwater

Through the two semiannual rounds of water sampling at Site 21, three groundwater samples (two samples and one replicate) were collected from the new monitoring well 21-C-1. Analyses performed on the groundwater samples were purgeable halocarbons (8010), ICP metals (6010), water quality parameters, and TFH-diesel and -gas (California method).

Purgeable halocarbons and TFH-diesel were not detected in groundwater at Site 21 during the first semiannual sampling round (March 1989) of Stage 2-1. TFH-gas was detected at 0.2 mg/l. An oily sheen was noted on the groundwater surface in the first bailer of water removed from well 21-C-1 during development. TDS were 233 mg/l. Major anions and cation concentrations at this well are generally similar to other sites near the flightline at Beale AFB. Nitrite plus nitrate (expressed as nitrate) was 3.4 mg/l. Sulfate was higher than at other flightline sites at 30.8 mg/l.

A field replicate was collected with the second semiannual sample from 21-C-1. All analyses were comparable for the two samples. No purgeable halocarbons or TFHs were detected in this round. TDS were 163 and 176 mg/l. Nitrate plus nitrite (expressed as nitrate) were 6.3 and 4.7 mg/l. Sulfate values were 9.3 and 9.0 mg/l. Groundwater at Site 21 is a sodium bicarbonate type.

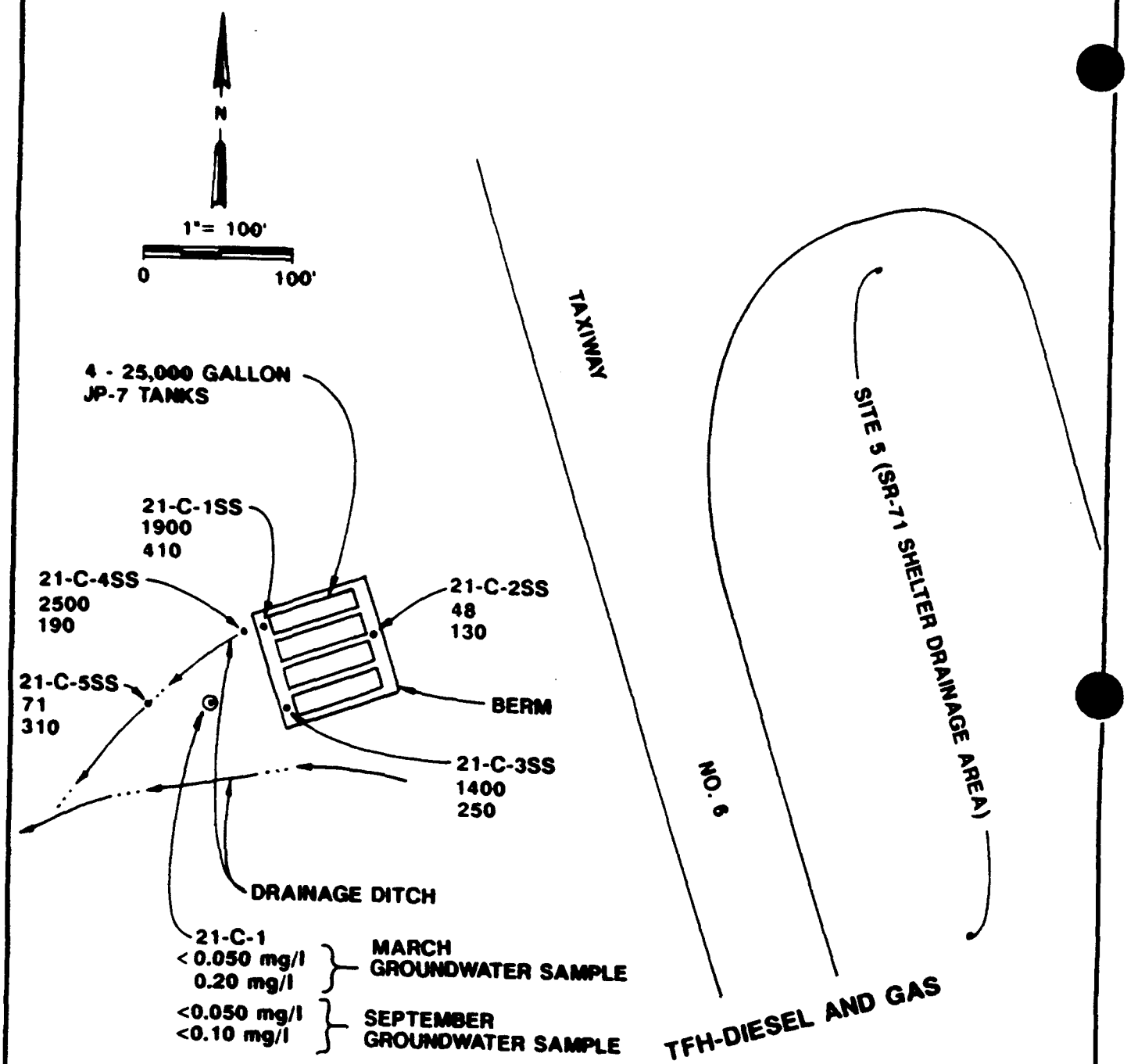


FIGURE 4.1.21-5
TFH-DIESEL, AND TFH-GAS SURFACE SOIL AND GROUNDWATER SAMPLES SITE 21: JP-7 STORAGE TANKS, ABOVE GROUND - FLIGHTLINE

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4.1.21.1.4 Analytical Results Table

Table 4.1.21-2 presents a summary of all detected analytes for Site 21. Analytical data are given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.21-2 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.21.1.5 Discussion of Analytical Data

Contaminants detected at Site 21 included TFH-diesel and -gas in the surface soil samples and possibly TFH-gas in the groundwater. TFH-diesel was detected in all five surface samples at concentrations from 48 to 2,500 mg/kg. TFH-gas was detected in all samples at 130 to 410 mg/kg. In the semiannual groundwater samples, TFH-gas was detected at 0.20 mg/l in the first round and not in the second. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections.

4.1.21.2 Sampling and Analytical Problems

4.1.21.2.1 Loss of Samples

There were no sample loss problems for Site 21 samples. No resampling was necessary and all scheduled analyses were completed for Site 21.

4.1.21.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

None of the detected analytes are considered to be false positive results.

No soil replicate QC samples were collected at Site 21.

4.1.21.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 21 samples.

TABLE 4.1.21-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 21

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	21-C-1SS BAFB-0035 0.0-0.0' 11/18/88	21-C-2SS BAFB-0036 0.0-1.0' 11/18/88	21-C-3SS BAFB-0037 0.0-1.0' 11/18/88	21-C-4SS BAFB-0038 0.0-1.0' 11/18/88	21-C-5SS BAFB-0039 0.0-1.0' 11/18/88
Percent Moisture	ASA#9	N/A	%	NS	NS	15.2	15.9	12.2	24.4	22.9
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	1900	48	1400	2500	71
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	410	130	250	190	310

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.21-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 21

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	21-C-1GW BAFB-0482 03/10/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	188
Temperature	E170.1	N/A	deg C	NS	NS	21.0
pH	E150.1	N/A	pH	5-9	NS	7.48
Alkalinity - Total	SM403	1.0	mg/l	20	NS	70.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	86.4
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	233
Chloride	E325.3	1.0	mg/l	250	250	15.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.33
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	3.4
Sulfate	E375.4	1.0	mg/l	250	250	30.8
TFH-Gas	TFH-GA	0.10	mg/l	NS	NS	0.20
Calcium	SW6010	1.00	mg/l	NS	NS	15.6
Magnesium	SW6010	1.00	mg/l	NS	NS	3.25
Potassium	SW6010	1.00	mg/l	NS	NS	6.90
Sodium	SW6010	1.00	mg/l	NS	NS	39.5
Zinc	SW6010	0.0200	mg/l	0.110	0.012	0.166

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.21-2

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 21

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	21-C-1GW BAFB-0624 09/06/89	21-C-1GW[f] BAFB-0625 09/06/89	21-C-1GW[e] BAFB-0623 09/06/89	21-C-1GW[b] BAFB-0622 09/06/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	190	NT	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	21.5	NT	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.76	NT	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	68.0	NT	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	83.0	NT	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	163	176	ND	NT
Chloride	E325.3	1.0	mg/l	250	250	14.1	13.5	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.17	0.18	0.050	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	6.3	4.7	0.89	NT
Sulfate	E375.4	1.0	mg/l	250	250	9.3	9.0	ND	NT
Calcium	SW6010	1.00	mg/l	NS	NS	12.6	12.5	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	5.14	5.07	ND	NT
Manganese	SW6010	0.0150	mg/l	.05	.05	0.0214	0.0209	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	1.97	2.34	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	18.9	18.9	ND	NT

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

4.1.21.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.21.3 Significance of Findings

TFH-diesel and -gas were detected in all surface soil samples at concentrations illustrated in Figure 4.1.21-5. Samples collected within the bermed area had TFH-diesel concentrations between 48 and 1,900 mg/kg and TFH-gas between 130 and 410 mg/kg. The sample collected from the ditch nearest the bermed area had TFH-diesel and -gas of 190 and 2,500 mg/kg; the sample collected 75 feet downstream was 71 and 310 mg/kg. DHS TTLC values for TFH-diesel or -gas were not available. LUFT cleanup standards were calculated and are 1,000 mg/kg for TFH-diesel, and 100 mg/kg for TFH-gas.

One monitoring well was constructed and sampled twice during Stage 2-1. No wells previously existed on the site. The first semiannual round groundwater sample collected had 0.20 mg/l TFH-gas detected (Figure 4.1.21-5), but TFH-gas was not detected in the second (semiannual) round. No regulatory standards for TFH-gas in groundwater were available.

4.1.21.3.1 Zones of Contamination

Based on the samples collected, the surface soil within the bermed tank area is contaminated with fuel hydrocarbons. The source of the contamination is leaks and spills from the above ground fuel tanks. Soil lining the drainage ditch which carries stormwater from the area is also contaminated with fuel hydrocarbons, although the depth cannot be determined from sampling conducted in Stage 2-1. TFH-diesel concentrations decrease in the downstream direction.

Groundwater from 21-C-1 may be contaminated with TFH-gas based on the first semiannual round sample, although the source of this is not necessarily the JP-7 fuel tanks. TFH-gas was not detected in the second semiannual round. A background well was not available for comparison.

4.1.21.3.2 Contaminant Migration

The fuel hydrocarbons detected in the soil within the bermed area at Site 21 may have migrated into the drainage ditch. It is not known if the fuel hydrocarbons detected in the samples from the ditch were transported by stormwater from the bermed area or resulted from a spill or leak directly

into the drainage ditch. Surface water samples were not collected from the drainage ditch at Site 21 during Stage 2-1.

The fuel hydrocarbons in the soil may be moving vertically towards the groundwater. However, a defensible conclusion cannot be made about the source of TFH-gas in the groundwater at Site 21 based on one detection from two sample rounds collected from the single monitoring well. Although a Site 21 background well was not constructed during Stage 2-1, wells constructed at Sites 4, 5, and 11, all located upgradient of Site 21, may be used for reference. No TFH-diesel or -gas was detected in monitoring wells at any of these sites. This indicates that the source may be located north or west of Site 5 and upgradient of Site 21.

4.1.21.3.2.1 Potential to Move Off Site and Off Base

The potential for the fuel hydrocarbons to move off Site 21 and off the base is high. Site 21 likely contributes to the fuel hydrocarbons detected in surface water and sediment samples at Site 1, about 2,000 feet to the west. Based on stream flow visual observations made during rainfall in Stage 2-1, fuel hydrocarbons transported by surface water flowing in the drainage ditch will cross the base boundary within 15 or 20 minutes after leaving Site 21.

The groundwater in the area is moving to the southwest, and the TFH-gas detected in the groundwater will also move in this direction. The potential for this TFH-gas to migrate off the site is high.

4.1.21.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Groundwater at Site 21 moves to the southwest, towards the groundwater depression west of the base. The estimated interstitial groundwater velocity is about 80 feet per year, based on hydrogeologic investigations conducted at the base. Because of the lack of well-defined parameters relating to migration rates of TFH-gas in mixed flow, the rate is assumed to be that of the groundwater.

4.1.21.3.2.3 Time of Travel to Receptors

If contaminants pass into groundwater, users of base and domestic supply wells to the west of the site could be potential receptors. Based on estimates of groundwater velocity in the immediate vicinity of well 21-C-1, it would

take many years to reach the nearest production wells. However, groundwater contamination may have been occurring for years.

4.1.21.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 21 because of the lack of well-defined parameters required for accurate modeling.

4.1.21.3.2.5 Expected Spatial and Temporal Variations in Concentration

TFH-gas was detected in the first semiannual sampling round at 0.20 mg/l. TFH-gas was not detected in the second semi-annual sampling round at a LOQ of 0.10 mg/l. From the limited available data at Site 21, an accurate estimate of expected spatial and temporal changes in concentrations cannot be made.

4.1.21.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.22 DISCUSSION OF RESULTS FOR SITE 22: ABANDONED UNDERGROUND TANKS

There were approximately 750 underground storage tanks in the area of the Beale AFB previously occupied by Camp Beale, a World War II Army base. These tanks stored fuel oil and gasoline.. It is not known whether they were emptied or removed when the Army closed the camp.

Site 22 covers a central portion of Beale AFB. Review of Camp Beale records indicated four significant areas in which underground tanks had been located. These areas, Hospital Area, C.A.S.C Troops Area, Corps Troops Area, and Armored Division, are indicated in Figure 4.1.22-1.

The Stage 2-1 investigation at Site 22 consisted of a review of Camp Beale records, locating areas believed to have buried tanks, and conducting a magnetic geophysical survey at selected locations. No soil, surface water or groundwater investigations were performed. Therefore, no discussion of site geology or hydrogeology is included for Site 22. Geologic and hydrologic conditions are discussed in sections addressing individual IRP sites within the Site 22 area.

A review of 1943 maps of Camp Beale indicated the following tanks were present at the camp:

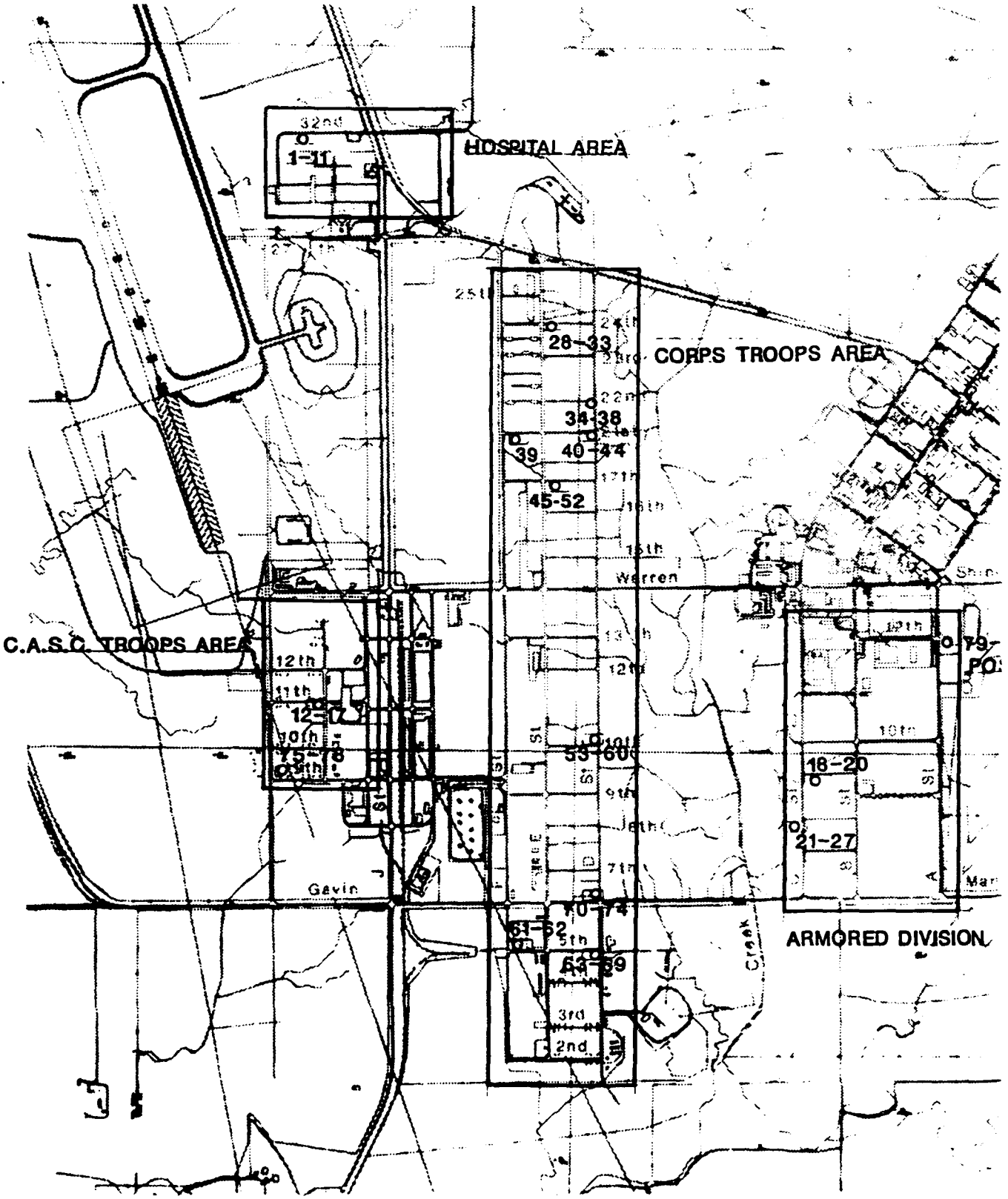
Gasoline Tanks

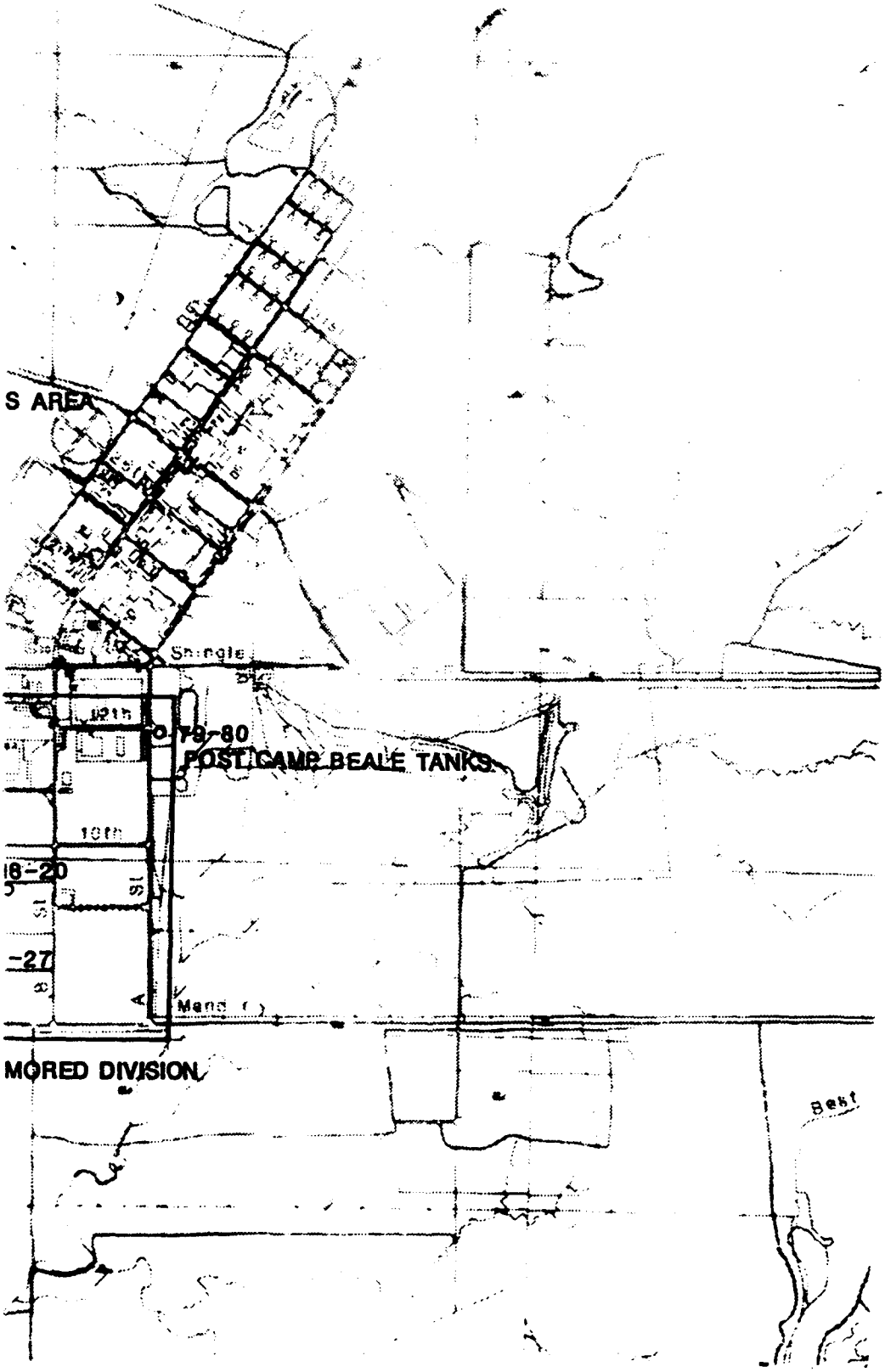
30	12,000 gallons
6	10,000 gallons
2	5,500 gallons
38	Gasoline Tanks

Fuel Oil Tanks

176	264 gallons (Size A)
10	420 gallons (Size B)
324	580 gallons (Size C)
194	1,150 gallons (Size E)
6	1,500 gallons (Size F)
1	2,500 gallons (Size G)
2	3,000 gallons (Size H)
1	10,000 gallons (Size J)
1	12,000 gallons (Size K)
715	Fuel Oil Tanks

At the time of the Stage 2-1 study, the existence, condition, and contents of these tanks were not known. The


HOSPITAL AREA
1-11
CORPS TROOPS AREA
28-33
34-38
39
40-44
45-52
C.A.S.C. TROOPS AREA
53-60
18-20
21-27
ARMORED DIVISION
70-74
61-62
63-69
Warren
Gavin
12th
11th
10th
9th
8th
7th
5th
3rd
2nd



LEGEND

o NN-NN INDICATES TANK NUMI
ASSIGNED DURING IRP STAGE :

NOTES:

1. 80 TANK LOCATIONS INVESTIGATE MAGNETOMETER.
2. BURIED METAL WAS DETECTED A LOCATIONS.
3. POSSIBLE BURIED METAL WAS DE 8 LOCATIONS.
4. NO BURIED METAL WAS DETECTE LOCATIONS.
5. BURIED TANK LOCATIONS NUMBER WERE DETERMINED FROM CAMP E DATED 1944.

N

1" = 2000'

0 2000'

FIGURE 4.1.22-1
SITE 22: ABANDONED UNDERGROUND STORAG

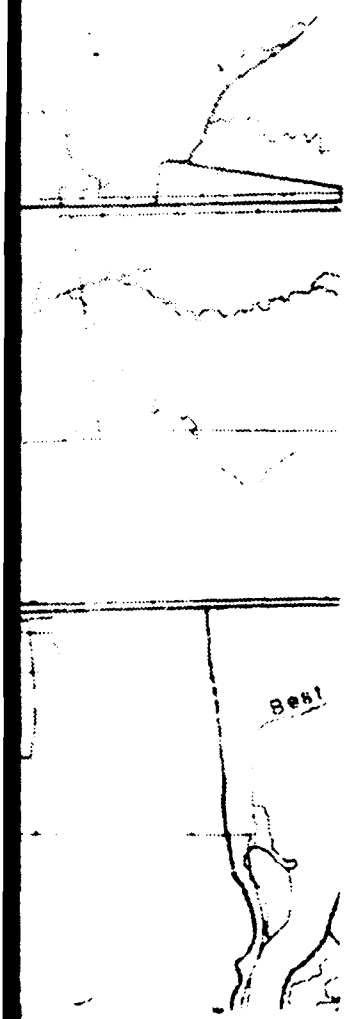
CH2MH

LEGEND

o NN-NN INDICATES TANK NUMBERS 1 TO 80 ASSIGNED DURING IRP STAGE 2-1 STUDY

NOTES:

1. 80 TANK LOCATIONS INVESTIGATED WITH MAGNETOMETER.
2. BURIED METAL WAS DETECTED AT 47 LOCATIONS.
3. POSSIBLE BURIED METAL WAS DETECTED AT 8 LOCATIONS.
4. NO BURIED METAL WAS DETECTED AT 25 LOCATIONS.
5. BURIED TANK LOCATIONS NUMBERED 1 TO 78 WERE DETERMINED FROM CAMP BEALE PLANS DATED 1944.



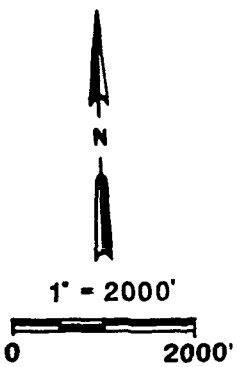


FIGURE 4.1.22-1
SITE 22: ABANDONED UNDERGROUND STORAGE TANKS

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objective of the work done at Site 22 was to evaluate a "representative" 10 percent of the tank sites. In choosing representative tanks, the following criteria were used:

- Consider accessible tanks only. Tanks shown to be underlying existing buildings or roads were not considered.
- Evaluate approximately 10 percent of the tanks of each size.
- Study the influence of reinforced concrete foundations, roads, telephone lines, and fences on magnetometer readings. Some tanks near objects that might affect magnetometer readings were selected to determine if these objects affected results.
- Review other tank maps and consider notes on the maps when evaluating tank sites for magnetometer survey. A set of 1944 Camp Beale maps included comments about facility changes, Air Force job numbers, and construction dates pertaining to work done as the base was changed from an Army to an Air Force base.

The sizes and number of tanks shown in the 1943 maps and the 1944 maps differ. The tank totals listed above, compiled from the 1943 maps, indicate 194 tanks of 1,150-gallon. However, the 1944 maps show no tanks of that size. Also the 1943 maps show only 10 tanks of 420 gallons, whereas the 1944 maps show more 420-gallon tanks than any other tank size. These discrepancies probably reflect the difference between designed and as-built conditions, although this is not clearly indicated. Overall, the 1944 maps were judged to be the more reliable and were used throughout the investigation.

Figure 4.1.22-1 shows the areas evaluated and tank numbers assigned during the Stage 2-1 study. Locations are given on an individual tank basis in Table 4.1.22-1. In addition to tank locations, Table 4.1.22-1 includes a list of the 1944 indicated tank size, a brief site description and associated Camp Beale building number, whether metal was detected, reference to where the anomaly is located, and the 1944 Camp Beale sheet number associated with each tank location. The 1943 and 1944 Camp Beale maps are available at the Beale AFB Civil Engineering office.

TABLE 4.1.22-1 SITE 22: MAGNETIC GEOPHYSICS RESULTS

TANK NUMBER	TYPE/ CAPACITY (gallon)	TANK LOCATIONS E-W Street Distance (feet) north or south of Street edge	TANK LOCATIONS N-S Street Distance (feet) east or west of Street edge	SITE DESCRIPTION/ CAMP BEALE BUILDING NUMBER	METAL DETECTION	GRID LINE	LOC-ATION	COMMENTS	CAMP BEALE MAP SHEET NUMBER AND COMMENTS
C-T-1	B/420	175 S of 32th	420 E of M St	End of driveway, undisturbed. T-2580	YES	10E	5N		
C-T-2	300	125 N of 31st	185 E of M St	Undisturbed T-2549	YES	15W	10S		
C-T-3	300	125 N of 31st	275 E of M St	Undisturbed T-2551	YES	20W	10S		
C-T-4	300	145 N of 31st	428 E of J St	Undisturbed w/ asphalt chunks covering site. T-2651	YES	0	0		HOSPITAL AREA SHEET # 44 Hospital and troop housing areas as shown on sheets 44, 45, 64 & 65 were re-habilitated under Job No. Camp Beale 51-M and O-AF Contract eng. 556, completed January 1952.
C-T-5	300	122 S of 31st	100 E of M St	Undisturbed T-2546	YES	10E	5S		
C-T-6	750	106 S of 31st	190 E of M St	Undisturbed T-2548, T-2550	YES	10E	0		
C-T-7	750	85 S of 31st	185 W of J St	Undisturbed T-2558, T-2560	YES	0	10S		
C-T-8	300	85 S of 31st	107 E of J St	Undisturbed T-2568	YES	10E	5N		
C-T-9	300	130 N of 31st	402 E of J St	Undisturbed T-2469	YES	10W	5N		
C-T-10	1000	60 N of 29th	10 E of asphalt between J & M	Edge of asphalt T-2533	NO				
C-T-11	B/420	45 N of 29th	5 W of asphalt between J & M	Edge of asphalt T-2533	YES	10E	0		
C-T-12	K/12000	90 N of 12th	90 W of K St	Grid oriented N45E, depression at tank location. T-1496	UNCERTAIN	0	5N	Weak.	SHEET #51 No buildings or power lines concrete foundations and underground utilities remain.
C-T-13	C/580	50 N of 11th	184 W of M St	Between foundations, disturbed surface. T-1172, T-1174	UNCERTAIN			Other magnetic sources are present.	
C-T-14	B/420	50 N of 11th	35 W of M St	Foundation west, disturbed surface. T-1176	UNCERTAIN			Other magnetic sources are present.	
C-T-15	C/580	50 S of 11th	184 W of M St	Between foundations, disturbed surface, valve in NE corner. T-1147, T-1149	YES	10E	0		
C-T-16	B/420	50 S of 11th	35 W of M St	Foundation west, disturbed T-1151	UNCERTAIN	0	0-15N	Other magnetic sources.	
C-T-17	E/1150	75 N of 10th	68 E of M St	Concrete foundation to east. T-1184	YES	10E	0		C.A.S.C. TROOPS AREA SHEET #52 Same as above.

TANK1.WK1

TABLE 4.1.22-1 SITE 22: MAGNETIC GEOPHYSICS RESULTS
(Continued)

TANK NUMBER	TYPE/ CAPACITY (gallon)	TANK LOCATIONS: E-W Street Distance (feet) north or south of Street edge	TANK LOCATIONS: N-S Street Distance (feet) east or west of Street edge	SITE DESCRIPTION/ CAMP BEALE BUILDING NUMBER	METAL DETECTION	GRID LINE	LOC-ATION	COMMENTS	CAMP BEALE MAP SHEET NUMBER AND COMMENTS
C-T-18	C/580	40 S of 9th	100 E of C St	Even surface w/ coarse gravel. T-6253, T-6255	YES	0	5S		
C-T-19	B/420	95 S of 9th	320 E of C St	Even, featureless surface. T-6259, T-6263	NO			Some metal may be present.	
C-T-20	A/264	205 S of 9th	110 E of C St	Disturbed surface. T-6251	NO				
C-T-21	B/420	100 N of 8th	60 W of C St	E-W depression @ 15 S. T-6252	YES	20W	15S		ARMORED DIVISION SHEET # 142
C-T-22	C/580	40 N of 8th	100 E of C St	Ditch @ 30 S. T-6252, T-6254	YES	0	5N?		Concrete foundations only.
C-T-23	B/420	90 N of 8th	320 E of C St	Concrete rubble @ 30 S 5 E. T-6258, T-6260	NO				
C-T-24	B/420	75 S of 8th	60 W of C St	Depression where building was. T-6138	NO			Some metal may be present.	
C-T-25	C/580	40 S of 8th	60 E of C St	Disturbed w/several depressions. T-6229, T-6231	YES	10W	0	Weak.	
C-T-26	B/420	90 S of 8th	320 E of C St	Even surface. T-6235, T-6239	NO				
C-T-27	A/264	205 S of 8th	110 E of C St	Disturbed surface. T-6226, T-6227	NO				
C-T-28	H/3000	225 N of 24th	105 E of E St	Pit w/ rebar @ 50S 25E. T-4776	NO				
C-T-29	C/580	60 N of 24th	100 E of E St	Ditch @ 5N. T-4778, T-4780	NO			Buried metal along line W.	
C-T-30	C/580	60 N of 24th	240 E of E St	Ditch @ 20N. T-4782	YES	0	5-20S	Position uncertain.	CORPS TROOPS AREA SHEET # 86
C-T-31	C/580	60 S of 24th	100 E of E St	Concrete slab @ 30S. T-4753, T-4755	YES	10W	5S		Concrete foundations only.
C-T-32	C/580	60 S of 24th	240 E of E St	Sidewalk @ 40N. T-4757	YES	10W	5S		
C-T-33	H/3000	225 S of 24th	105 E of E St	Several sidewalks within grid, no effect on readings. T-4750, T-4751	NO				
C-T-34	H/3000	208 N of 22nd	110 W of D St	Depression at N-S, 20w. T-4748	UNCERTAIN	20W	5S	Weak. May be farther west.	CORPS TROOPS AREA SHEET # 87
C-T-35	C/580	40 N of 22nd	180 W of D St	Even, undisturbed surface. T-4742, T-4744	YES	10E	5S?	Position along line uncertain.	Concrete foundations only.
C-T-36	B/420	40 N of 22nd	35 W of D St	Disturbed surface. T-4746	YES	0	5S		
C-T-37	C/580	40 S of 22nd	180 W of D St	Uneven w/ depressions left by buildings. T-4717, T-4719	YES	10E	0		

TANK2.WK1

TABLE 4.1.22-1 SITE 22: MAGNETIC GEOPHYSICS RESULTS
(Continued)

		TANK LOCATIONS							
TANK NUMBER	TYPE/ CAPACITY (gallon)	E-W Street Distance (feet) north or south of Street edge	N-S Street Distance (feet) east or west of Street edge	SITE DESCRIPTION/ CAMP BEALE BUILDING NUMBER	METAL DETECTION	GRID LINE	LOC-ATION	COMMENTS	CAMP BEALE MAP SHEET NUMBER AND COMMENTS
C-T-38	B/420	40 S of 22nd	35 W of D St	Sidewalk @ 30S. T-4721	YES	10E	0		
C-T-39	K/12000	80 S of 21st	80 E of F St	Lines oriented N45E; depression at tank location. T-4396	YES	10SE	5SW		CORPS TROOPS AREA SHEET # 87 Concrete foundations only.
C-T-40	C/580	60 N of 21st	176 W of D St	Sidewalk @ 40S, 0E-W. Rebar at 25S, 20E. T-4716, T-4718	YES	0	0		
C-T-41	B/420	60 N of 21st	35 W of D St	Sidewalk @ 10E. Rebar at 20N, 5W. T-4720	NO				
C-T-42	C/580	60 S of 21st	176 W of D St	Relatively even, depressions to both east and west. T-4493, T-4495	YES	0	15N		
C-T-43	B/420	60 S of 21st	35 W of D St	Shallow depression, sidewalk along 10 E. T-4497	YES	10W	0	Position uncertain.	
C-T-44	A/264	225 S of 21st	111 W of D St	Even, disturbed area to NW. T-4499	NO			Some metal may be present.	
C-T-45	A/264	225 N of 17th	105 E of E St	Even surface, ditch @ 25N. T-4476	NO				
C-T-46	C/580	60 N of 17th	98 E of E St	Disturbed surface, concrete pad at 15S, 0E. T-4478, T-4480	NO				
C-T-47	B/420	60 N of 17th	240 E of E St	Even surface w/sidewalks. T-4482	UNCERTAIN	0	0	Weak.	
C-T-48	B/420	105 N of 17th	400 E of E St	Even surface w/ a few depressions and a mound at 30N, 10W. T-4486, T-4490	YES	0	5N		CORPS TROOPS AREA SHEET # 88 Concrete foundations only.
C-T-49	C/580	60 S of 17th	98 E of E St	Even surface w/sidewalks. T-4453, T-4455	UNCERTAIN	0	0	Weak.	
C-T-50	B/420	60 S of 17th	240 E of E St	Even surface w/sidewalks. T-4457	YES	10W	5N		
C-T-51	A/264	225 S of 17th	105 E of E St	Uneven surface. T-4451, T-4450	YES	0	0		
C-T-52	B/420	105 S of 17th	400 E of E St	Asphalt @ 0 N-S, depression at 15E. T-4463, T-4465	YES	20E	10S		
C-T-53	C/580	200 N of 11th	148 E of D St	Open field, uneven surface, small ditch at 30N. T-4230	YES	10W	15S		CORPS TROOPS AREA SHEET # 91 Concrete foundations only
C-T-54	B/420	118 N of 11th	80 E of D St	Open field, uneven surface. T-4228	YES	10W	0		

TABLE 4.1.22-1 SITE 22: MAGNETIC GEOPHYSICS RESULTS
(Continued)

		TANK LOCATIONS							
TANK NUMBER	TYPE/ CAPACITY (gallon)	E-W Street Distance (feet) north or south of Street edge	N-S Street Distance (feet) east or west of Street edge	SITE DESCRIPTION/ CAMP BEALE BUILDING NUMBER	METAL DETECTION	GRID LINE	LOC-ATION	COMMENTS	CAMP BEALE MAP SHEET NUMBER AND COMMENTS
C-T-55	B/420	20 S of 11th	125 E of D St	Open field, undisturbed, End of sidewalk @ 30S, 20W. T-4210	YES		10S		
C-T-56	C/580	165 S of 11th	155 E of D St	Open field, even surface. T-4208, T-4206	NO			Some metal may be present.	CORPS TROOPS AREA SHEET # 91 Concrete foundations only.
C-T-57	C/580	100 N of 10th	170 E of D St	Open field, even surface, with coarse gravel. T-4204, T-4202	NO				
C-T-58	A/264	3 N of 10th	75 E of D St	Open field w/ E-W feature from 10S to 30S. Hawk nest @ 20N. T-4200	NO			Grid short due to nesting hawk.	
C-T-59	B/420	118 S of 10th	33E of D St	N-S sidewalk along 0 E-W. T-3988	NO			Some metal may be present.	
C-T-60	C/580	165 S of 10th	70 E of D St	Open field. T-3986	YES	20W	15S		
C-T-61	K/12000	60 N of 5th	60 E of F St	Some pavement remnants, two depressions at tank location. T-3496	NO			Some metal may be present.	
C-T-62	K/12000	Same as above	Same as above	Same as above. T-3498	NO			Same grid as C-T-61.	
C-T-63	A/264	170 N of 5th	135 W of D St	Disturbed surface, with foundation rubble. Depression at 10N, 10W. T-3596	YES	0	0	Other metal present.	
C-T-64	B/420	105 N of 5th	328 W of D St	Disturbed surface, with foundation rubble; depression at grid center. T-3586, T-3590	YES	0	10S	Weak.	
C-T-65	B/420	60 N of 5th	252 W of D St	Uneven surface w/ stone-lined troughs at 20S. T-3592	YES	.0E	10S	May be farther east.	CORPS TROOPS AREA SHEET # 94 Concrete foundations only.
C-T-66	C/580	60 N of 5th	150 W of D St	Depression at building foundations, with a deeper depression at grid center. T-3594, T-3596	YES	0	0	Position uncertain.	
C-T-67	B/420	110 S of 5th	328 W of D St	Uneven surface, foundation rubble; recent excavation NE excavation NE of grid. T-3563, T-3565	YES	0	10N		
C-T-68	B/420	60 S of 5th	252 W of D St	Uneven surface, foundation rubble; recent excavation west of grid. T-3567	YES	10E	0		

TABLE 4.1.22-1 SITE 22: MAGNETIC GEOPHYSICS RESULTS
(Continued)

		TANK LOCATIONS							
TANK NUMBER	TYPE/ CAPACITY (gallon)	E-W Street Distance (feet) north or south of Street edge	N-S Street Distance (feet) east or west of Street edge	SITE DESCRIPTION/ CAMP BEALE BUILDING NUMBER	METAL DETECTION	GRID LINE	LOC-ATION	COMMENTS	CAMP BEALE MAP SHEET NUMBER AND COMMENTS
C-T-69	A/264	225 S of 5th	115 W of D St	Uneven surface, foundations T-3573, T-3572	NO				CORPS TROOPS AREA SHEET # 94 Concrete foundations only.
C-T-70	B/420	105 N of 6th	325 W of D St	Slightly disturbed, several depressions. T-3810, T-3814	NO				
C-T-71	A/264	105 S of 6th	325 W of D St	Even surface, shallow depression along 10E; T-3591	YES	10E	5N		
C-T-72	B/420	60 S of 6th	245 W of D St	Even surface, E-W ridge at 15S. T-3593	YES	0	5N		CORPS TROOPS AREA SHEET # 93 Concrete foundations only.
C-T-73	C/580	60 S of 6th	103 W of D St	Even surface, filled E-W depression between 10S and 10N. T-3595, T-3597	YES	0	5N	Weak. Position uncertain.	
C-T-74	A/264	165 S of 6th	125 W of D St	Even surface w/ some concrete rubble. T-3599	NO				
C-T-75	B/420	48 S of 9th	70 W of N St	Undisturbed field, foundation at SE corner. T-776	UNCERTAIN	10W	5S	Weak. May be farther west.	
C-T-76	C/580	69 N of 9th	100 E of N St	Foundation 40 to east and west; small depression from 30S to 10 S along 0E. T-1102, T-1104	YES	0	15S		C.A.S.C. TROOPS AREA SHEET #52 No buildings or power lines concrete foundations and underground utilities
C-T-77	B/420	50 N of 9th	240 E of N St	Foundation along 10W from 0S to 10N; shallow depression in center. T-1106	NO			Anomaly probably related to foundation.	remain.
C-T-78	B/420	100 of 9th	322 E of N St	Foundations to east and west. T-1108, T-1110	NO			Some metal may be present.	
C-T-79	K/12000	197 S of 12th	82 W of A St	Undisturbed, w/filler pipe at tank location.	YES			Only one line was run. Source of anomaly is from about 5 to 30 feet south of fill cap.	Post-Camp Beale abandoned tank.
C-T-80	K/12000	Same as above	Same as above	Same as above	YES			Same as above.	

TANK5.WK1

4.1.22.1 Presentation of Results

The presentation of results for Site 22 is restricted to the geophysical investigation. The total area encompassed by Site 22 includes IRP Sites 3, 9, 12, 14, 18, 19, 23, and 24.

Four areas within Site 22 were selected for investigation. The number of tanks located in each area in Figure 4.1.22-1 are listed below:

11 tanks	-	Hospital Area
10 tanks	-	C.A.S.C. Troops Area
49 tanks	-	Corps Troops Area
10 tanks	-	Armored Division (includes two post-Camp Beale tanks)
80 tanks total		

The results of the abandoned underground tank investigation at Site 22 are presented in Table 4.1.22-1. All of the tanks potentially detected in the magnetometer survey, according to size are given in Table 4.1.22-2 (top of next page).

Tanks C-T-79 and C-T-80 are referred to as post-Camp Beale abandoned tanks. These are gasoline tanks located along A Street. The filler pipe for the tanks is evident at the location specified in Table 4.1.22-1. Two other abandoned gasoline tanks were removed from the excavation for the foundation of the Burger King near the intersection of 24th Street and A Street when this building was constructed in 1987. Several other gasoline tanks are located along A Street and are currently being used.

Table 4.1.22-1 also lists the line in the grid established for this study along which the largest anomaly was located. A plot of the anomaly along that line for each tank is included in Appendix H. An explanation of how the grid was established at each tank location is presented in Section 3.4.1.

4.1.22.2 Sampling or Analytical Problems

No sampling or analyses were conducted for the Site 22 investigations.

Table 4.1.22-2
LIST OF RESULTS FOR GEOPHYSICAL INVESTIGATION

Number of Tanks	Tank Capacity and Size	Results
6	300 gallon	6 detected
2	750 gallon	2 detected
10	264 gallon (Size A)	3 detected
29	420 gallon (Size B)	16 detected 4 uncertain
22	580 gallon (Size C)	16 detected 2 uncertain
1	1,000 gallon (Size D)	0 detected
1	1,150 gallon (Size E)	1 detected
3	3,000 gallon (Size H)	0 detected 1 uncertain
6	12,000 gallon (Size K)	3 detected 1 uncertain
80		47 detected 8 uncertain 25 not detected

4.1.22.3 Significance of Findings

The findings of the abandoned underground tank investigation are summarized in Table 4.1.22-2. Of the 80 sites investigated, 55 (69 percent) yielded results indicating buried metal may be present. Of this number, 8 (10 percent) had some level of uncertainty, usually associated with a weak anomaly. Therefore only 25 (31 percent) of the sites yielded a definite negative response. These results indicate that a large number of the tanks from Camp Beale may still be buried at Beale AFB.

Generally there were no consistent features evident in locations with positive magnetic anomalies. Often the ground surface was disturbed where an anomaly was detected, but frequently the ground was undisturbed. Conversely, at some locations, the ground surface was disturbed where an anomaly was absent, suggesting that a tank may have been removed. However some anomalies were detected in disturbed areas.

One possible explanation for the apparent randomness in buried metal detection is the manner in which the Air Force "auctioned" buildings when taking over the base. Buildings that were to be razed were auctioned off. The buyer may have demolished the building and removed the associated fuel oil tank or may have razed the building and left the tank. No detailed records of demolition during the base transition were encountered during the Stage 2-1 study.

Part of this investigation was to examine the effects of foundations, telephone wires, and roads on the magnetometer. In most areas, foundations appeared to have a minimal effect, except within 5 feet of reinforcing steel embedded in concrete. However, anomalies did exist on sites close to foundations in C.A.S.C. Troops Areas. Throughout the area, the magnetometer readings were consistently lower than at other locations on base. These lower readings may have been caused by a local anomaly rather than the foundations. No significant effects were observed in the vicinity of roads, telephone wires, or fences.

The only other factors that appeared to significantly affect the method were buried pipes. Comparison of locations of detected magnetic anomalies with the 1944 Camp Beale maps and with modern utility plans may discern when an anomaly could be attributed to a buried pipe rather than a buried tank. This effort was not undertaken during the Stage 2-1 study.

During June 1989, Beale AFB excavated possible underground storage tanks as presented in the initial draft of this report. Excavations were conducted at the following locations of positive metal detection: building (tank number) T-4482, T-4228, and T-4210 (CT-55); T-3986 and T-3565 (CT-67); and T-3593 (CT-71). Beale AFB personnel reported no underground storage tanks. However, at the six excavations, three pipes were found leading from the UST location at a depth of about 18 to 24 inches. These were assumed to be the fill pipe and fuel and return lines. There was physical evidence that these buried pipes had been sawn off.

It appeared the six tanks "potholed" for by Beale AFB in 1989 may have been removed and the areas filled with brick, broken concrete pipe, and other building debris. The excavation site at building T-4482 (CT-55) also revealed an extensive underground concrete foundation reinforced with rebar. Buildings T-4210 (CT-55) and T-3986 (CT-67) also had some remaining concrete foundations with rebar.

In 1990, Beale AFB removed 21 post Camp Beale tanks from the armored division area south of Warren Shingle Boulevard (Figure 4.1.22-1) prior to construction of a navigation school. The 21 removed tanks range in size from 150 to 10,000 gallons, and soil cleanup was achieved along with the tank removals. These tanks had been installed in the 1950s during conversion of Camp Beale to Beale AFB.

Conclusions about the presence of buried tanks at the surveyed sites cannot be based solely on the geophysical magnetic survey data. A further potholing excavation program is required to ascertain whether a tank is associated with each magnetic anomaly. The location of each magnetic anomaly grid center and the line within the grid with the peak magnetometer reading are presented in Table 4.1.22-1. A plot of each peak anomaly line is included in Appendix H. However, due to the inclination of the earth's magnetic field in the Beale AFB vicinity, the source location may not correspond exactly with the peak intensity location. It is necessary to split the distance between the relative high and low magnetic peaks and begin digging at this point.

There was some element of error in locating these tank sites, as it was done with a fiberglass tape and a standard compass and based on 45-year-old maps. It is recommended that a magnetometer be used during any follow-up investigation to more precisely locate the anomaly before potholing.

4.1.22.2 Contaminant Migration

No contaminant migration studies were conducted specifically for Site 22 during Stage 2-1.

4.1.22.3 Baseline Risk Assessment

No risk assessment activities were performed during the Stage 2-1.

4.1.23 DISCUSSION OF RESULTS FOR SITE 23: NINTH TRANSPORTATION REFUELING/MAINTENANCE SHOP

The transportation shop is located east of B Street between Warren Shingle Boulevard and Doolittle Drive. The site was used as a repair shop for fuel tank trucks. The site is mostly paved and has a large repair shop. An oil/water separator is present next to the shop.

The transportation shop has not been previously included in the IRP process at the base. Initial sampling has been completed to determine if contamination exists.

4.1.23.1 Presentation of Results

The following section presents the results of the field investigation at Site 23. The discussion focuses on the geology and hydrogeology at the site, and presents the results of chemical analyses performed on groundwater and soil samples.

4.1.23.1.1 Site Geology

Evaluation of the geology at Site 23 is based on a borehole drilled during the current Stage 2-1 investigation and completed as a monitoring well, and on four shallow soil borings. The well was drilled to a total depth of 79 feet (49 feet NGVD), and screened across the uppermost permeable zone at a depth of 45-65 feet BGS (63 to 83 feet NGVD). The boreholes were vertical borings drilled to a total depth below ground surface of 21.5 feet. The locations of the well and soil borings are shown on Figure 4.1.23-1. Soil boring logs are provided in Appendix D.

Soils beneath Site 23 consist primarily of brown sandy silts with some clay, as noted in the soil boring logs. These fine-grained materials appear to have a low permeability. The gravel at the top of boring 23-C-2SB is probably a coarse aggregate base laid down prior to construction of the concrete surface. At the south end of the site, sandy clays and sands occurred with the sandy silt. Below 20 feet BGS (108 feet NVGD), interbedded clays, sands, and gravels were encountered in monitoring well 23-C-1 with indurated claystone and sandstone occurring deeper than 60 feet BGS (68 feet NGVD). The consolidated materials became increasingly dense and competent with depth.

Surface materials at Site 23 are alluvial in origin and have been mapped as Victor Formation (Page, 1980). These mainly

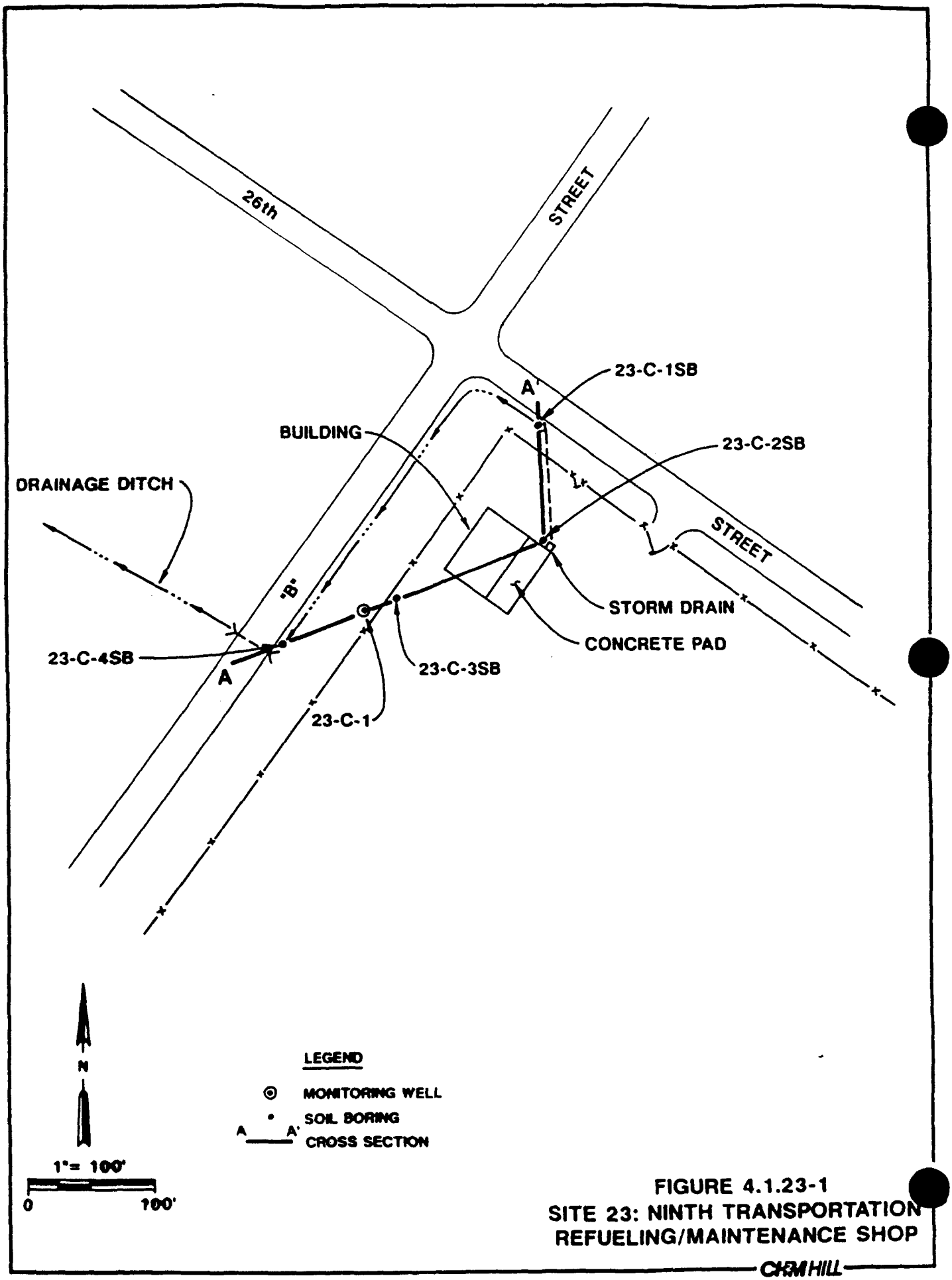


FIGURE 4.1.23-1
SITE 23: NINTH TRANSPORTATION
REFUELING/MAINTENANCE SHOP

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fine-grained, highly variable deposits are stream channel and overbank materials laid down in the Pleistocene Epoch. The dark gray sandstones at the bottom of well 23-C-1 may belong to the volcanic rocks from the Sierra Nevada, a unit that dates from the Pliocene and Eocene Epochs.

4.1.23.1.2 Site Hydrogeology

Site 23 is underlain by low permeability materials which likely retard infiltration of water through the unsaturated zone down to groundwater. Groundwater was first encountered during well drilling at a depth of 53 feet (75 feet NGVD) in a well-graded sand below a lean clay. The sand, which quickly graded to a sandy clay, yielded water to nearly the 60-foot depth (68 feet NGVD), as the borehole contacted the top of the consolidated rocks. Below this depth, the well-indurated claystone and sandstone produced very little water. After construction and development of the well the water level stabilized at about 47 feet below the ground surface (81 feet NGVD).

Groundwater levels measured in well 23-C-1 during 1989 are presented in Table 4.1.23-1 and Figure 4.1.23-2. A complete summary of groundwater level measurements, including elevations and depths to water, is provided in Appendix G. These measurements indicate that groundwater levels changed very little in this well during 1989. This pattern was typical of wells constructed on the eastern side of Beale AFB.

Table 4.1.23-1
GROUNDWATER ELEVATIONS: SITE 23
(feet NGVD)

Well	Screened Interval	February 1989	March 1989	May 1989	August 1989	November 1989
23-C-1	65-45	81.51	81.19	81.67	81.91	81.98

Figure 4.1.23-3 presents a groundwater elevation contour map based on data from wells in the southern portion of Beale AFB collected in May 1989. Plates 3 and 4 show contours from similar data collected base-wide in March and November 1989. These figures show that groundwater in the vicinity of Site 23 is flowing to the southwest under the influence of the groundwater depression located immediately west of Beale AFB. Based on Figure 4.1.23-3, the horizontal groundwater gradient in the uppermost permeable zone of the

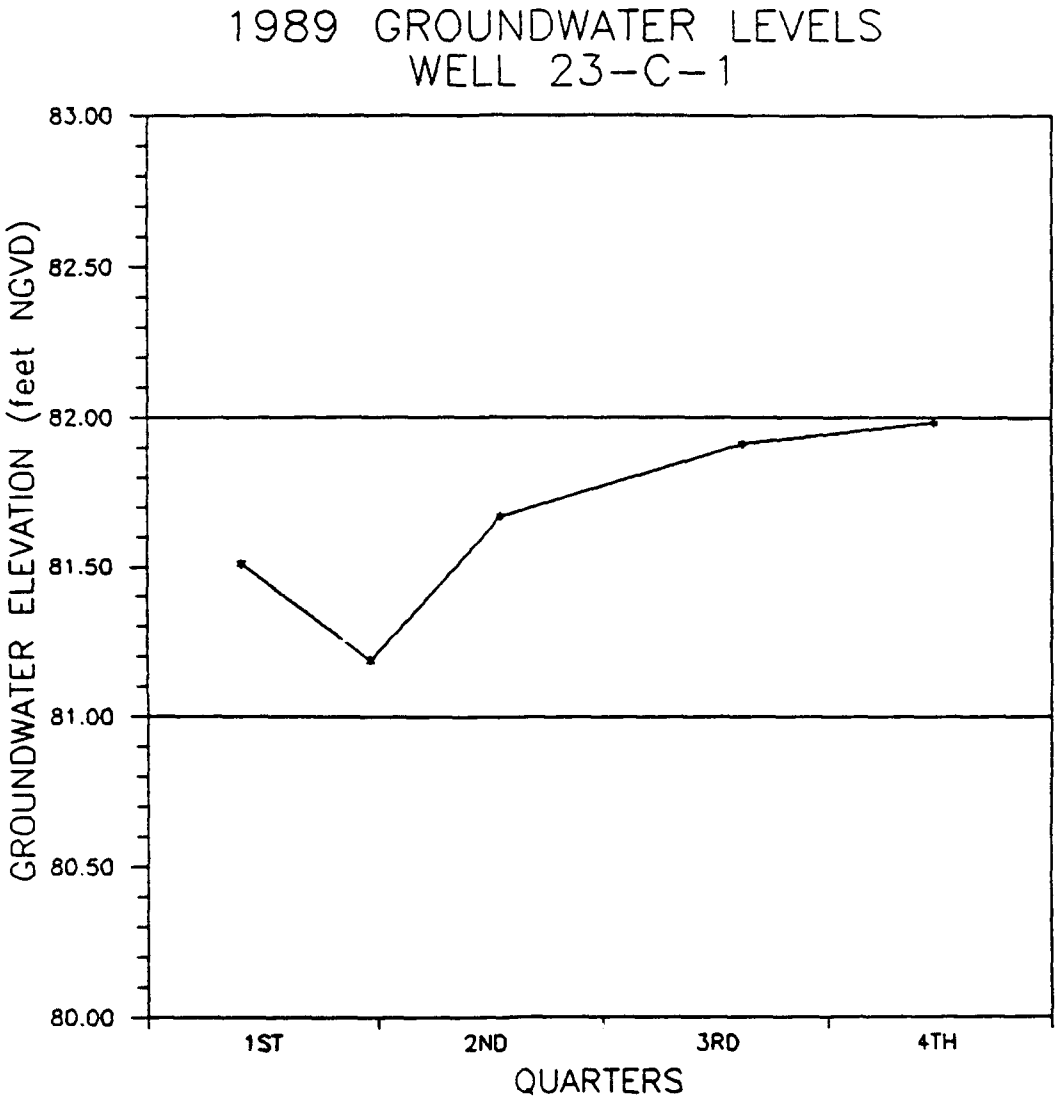


FIGURE 4.1.23-2
MONITORING WELL HYDROGRAPH
SITE 23: NINTH TRANSPORTATION
REFUELING/MAINTENANCE SHOP

CH2M HILL

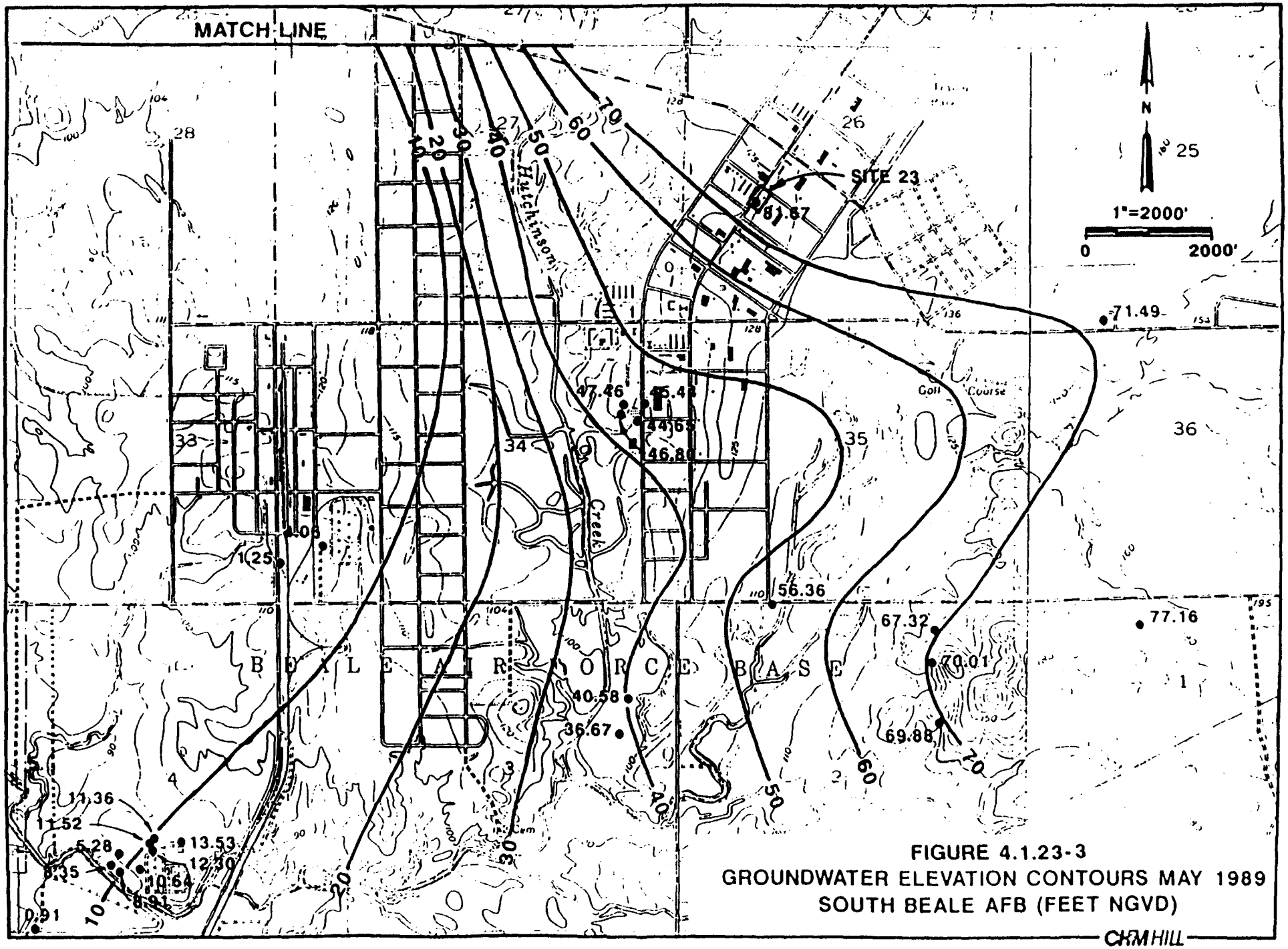


FIGURE 4.1.23-3
GROUNDWATER ELEVATION CONTOURS MAY 1989
SOUTH BEALE AFB (FEET NGVD)

CH2M HILL

aquifer in the vicinity of Site 23 is approximately 10 feet per 1,000 feet, or 0.01. This relatively high gradient is typical in the eastern part of Beale AFB near the foothills. Well 23-C-1 was slug-tested to derive aquifer parameters because of the low permeability of the geologic materials and the low available drawdown. Data were analyzed according to the Bouwer-Rice method (1976). A discussion of aquifer testing methodology and plots of the data are provided in Appendix E. Based on the results of the analysis, the average value derived for transmissivity was 33 square feet per day, while the average value derived for hydraulic conductivity was 1.9 feet per day (6.7×10^{-4} cm/sec).

Groundwater velocity may be estimated by substituting into Darcy's Law. Using a hydraulic conductivity of 1.9 feet per day, a hydraulic gradient of 0.01, and an estimated effective porosity of 0.20, the approximate groundwater velocity is 0.10 feet per day, or 35 feet per year. However, the velocity of groundwater flow through fractures may vary considerably.

The 72-hour pump test conducted in well 19-C-4 was performed in different geologic materials. However, if the hydraulic conductivity value of 28 feet per day is substituted into Darcy's law, the resulting groundwater velocity becomes 1.4 feet per day, or 510 feet per year.

4.1.23.1.3 Analytical Results

The following discussion of analytical results summarizes information contained in Appendix A. Associated quality control results are given with Appendix A and in Appendix F. Discussion of analytical results in this and following subsections, and presentation of analytical results in figures and tables, are limited to results that are indicators of site-specific contamination. Not all analytes are individually discussed or illustrated, but all analytes are presented in the Analytical Results Table in Section 4.1.23.1.4 and in Appendix A.

Twenty-one soil boring samples were collected at Site 23 from four 20-foot soil borings. These soil samples were analyzed for volatile organics (8240), ICP metals (6010), soil moisture (ASTM D2216) and TFH-diesel and -gas (California method).

Groundwater samples were collected from monitoring well 23-C-1 during the first and fourth quarterly sampling rounds. Analysis performed for the groundwater samples were

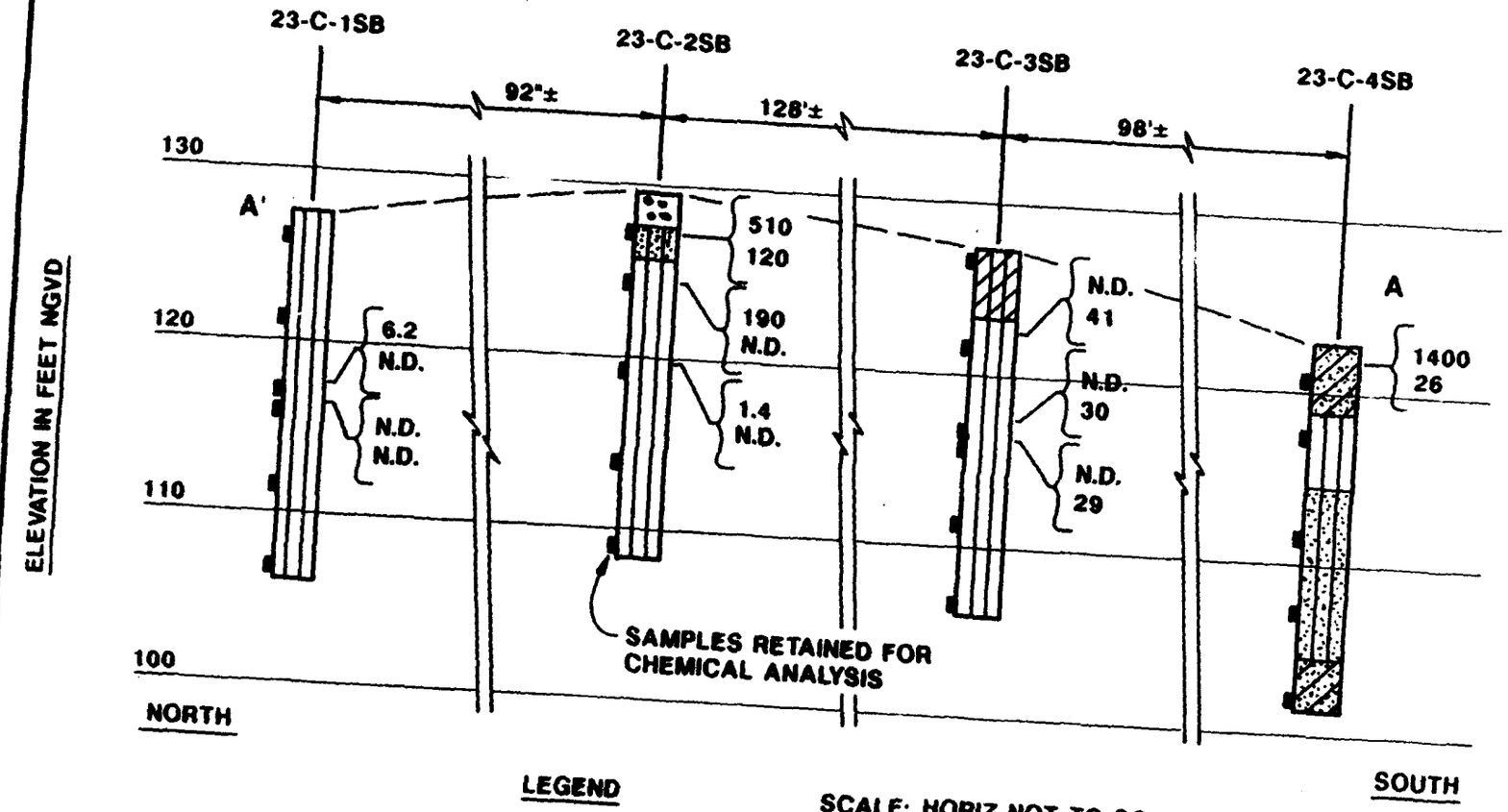
purgeable aromatics (8020), ICP metals (6010), lead (7421), water quality parameters, and TFH-diesel and -gas.

In this investigation toluene was detected in 20 soil boring samples at up to 1.1 mg/kg. 2-butanone was detected in seven samples at up to 0.20 mg/kg. In 23-C-2SB, ethylbenzene and total xylenes were detected in the 2.4 to 4-foot sample both at 0.005 mg/kg, in the 5-foot sample at 0.96 and 1.0 mg/kg, and in the 11.5- to 13-foot sample (field replicate for 10- to 11.5-foot) at 0.018 and 0.020 mg/kg. They were estimated below the LOQ at 10 feet.

At boring 23-C-2SB, lead was detected in the 2.4- to 4-foot sample at 38.4 mg/kg. Other metals were at similar levels to background soil values at Beale AFB. TFH-diesel was detected at 6.2 mg/kg in the 10-foot sample at 23-C-1SB (Figure 4.1.23-4). TFH-diesel was detected in boring 23-C-2SB in the 2.4- to 4-foot sample at 510 mg/kg, 190 mg/kg at 5 feet, and 1.4 mg/kg at 10 feet. TFH-gas was detected at 120 mg/kg in the 2.4- to 4-foot sample at 23-C-2SB. In 23-C-3SB, TFH-gas was detected at 41 mg/kg at 5 feet and 30 mg/kg at 10 feet. In 23-C-4SB, TFH-diesel was 1,400 mg/kg and TFH-gas was 26 mg/kg at 1 foot.

Toluene was detected at 2 ug/l (3 ug/l in second column) in the first quarter 23-C-1 groundwater sample and 2 ug/l (1 ug/l in second column) in a replicate, but toluene was not detected in the equipment wash blank or ambient condition blank. TFH-gas was detected at 0.30 mg/l and at 0.70 mg/l in a replicate. However, TFH-gas was also detected at 0.80 mg/l in the equipment wash blank. TFH-diesel and lead were not detected. TDS were 359 and 349 mg/l. Major anions and cation concentrations at 23-C-1 are generally similar to other sites near Site 23. Nitrite plus nitrate (expressed as nitrate) was 23.4 and 26.5 mg/l. Groundwater at Site 23 is a calcium bicarbonate type.

In the fourth quarter samples, toluene, lead, and TFH-gas were not detected in the original or field replicate samples. TFH-diesel was detected at 0.060 mg/l in the original sample and 0.080 mg/l in the field replicate. However, TFH-diesel was also detected at 0.050 mg/l in the equipment wash blank. TDS and nitrate were similar to the first round results: TDS was 422 and 345 mg/l in the original and field replicate samples, nitrate 23.1, and 25.2 mg/l.



NOTE: IF NO VALUES GIVEN, BOTH ANALYTES WERE N.D.
ALL VALUES ARE IN mg/Kg

NOTE: FOR BORING LOCATIONS S[illegible] FIGURE 4.1.23-1

FIGURE 4.1.23- 4
SOIL PROFILE
TFH-DIESEL, AND TFH-GAS RESULTS
SITE 23: NINTH TRANSPORTATION
REFUELING/MAINTENAN[illegible] SHOP

CH[illegible]

4.1.23.1.4 Analytical Results Table

Table 4.1.23-2 presents a summary of all detected analytes for Site 23. Analytical data are presented in Appendix A. Related quality control data are also given in Appendix A as well as in Appendix F. Standards, criteria, and action levels presented in Table 4.1.23-2 are generally the lowest federal and state levels applicable to the sampled media (soil, groundwater, surface water). The values have been compiled from various sources. A more detailed assessment of ARARs is given in Appendix I.

4.1.23.1.5 Discussion of Analytical Data

Contaminants detected at Site 23 included total fuel hydrocarbons and related volatile organics in the soil boring samples. Lead was also detected in one of the soil boring samples. TFH-gas and diesel were detected in the groundwater, but those results are suspect (discussed below). Table 4.1.23-3 presents the range of contaminants encountered for each of the media sampled (soil borings and groundwater), as well as the number of positive detections compared to the total number of samples collected. Analytical data are presented in Appendix A.

No data corrections have been made based on method blank detections.

With the exception of certain possible false positive results (discussed below), analytical data are believed to accurately represent site conditions at the time of sampling. It should be noted that several of the possible contaminants detected in some soil samples were tentatively identified below the LOQ. These detections may represent laboratory "noise" and some of the analytes may not actually be present at the site. Analysis results for detected analytes are flagged with a "J" if the analyte was tentatively identified below the LOQ. For this study the LOQ is equal to the detection limit as defined in the QAPP. Analysis results for detected analytes are flagged with a "B" if the analyte was also detected in the method blank.

4.1.23.2 Sampling and Analytical Problems

4.1.23.2.1 Loss of Samples

There were no sample loss problems for Site 23 samples. Five soil samples, all from boring 23-C-2SB, were resampled for volatile organics analysis (8240) due to holding time

TABLE 4.1.23-2

BEALE AFB: SOIL DATA 1988/1989

ANALYTICAL RESULTS TABLE FOR SITE 23

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	23-C-1SB BAFB-0338 1.0-2.5' 12/20/88	23-C-1SB BAFB-0339 5.0-6.5' 12/20/88	23-C-1SB BAFB-0340 10.0-11.5' 12/20/88	23-C-1SB[f] BAFB-0341 11.5-13.0' 12/20/88	23-C-1SB BAFB-0342 15.0-16.5' 12/20/88	23-C-1SB BAFB-0343 20.0-21.5' 12/20/88
Percent Moisture	ASA#9	N/A	%	NS	NS	20.7	20.7	19.8	16.9	16.7	16.4
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	ND	6.2	ND	ND	ND
Aluminum	SW6010	20.0	mg/kg	NS	NS	15100	23700	12800	12000	9950	10100
Barium	SW6010	10.0	mg/kg	NS	10,000	106	271	128	144	204	64.5
Calcium	SW6010	100	mg/kg	NS	NS	4330	5070	4540	11500	3820	3700
Chromium	SW6010	3.0	mg/kg	NS	500	37.7	41.1	45.0	38.1	31.1	37.2
Cobalt	SW6010	4.0	mg/kg	NS	8,000	9.2	16.4	16.2	16.8	20.4	9.7
Copper	SW6010	3.0	mg/kg	NS	2,500	60.0	61.5	141	49.6	42.0	37.3
Iron	SW6010	10.0	mg/kg	NS	NS	28400	37100	23800	23300	21400	23200
Magnesium	SW6010	100	mg/kg	NS	NS	7770	8650	8190	6980	6070	6330
Manganese	SW6010	1.5	mg/kg	NS	NS	112	228	364	462	800	199
Nickel	SW6010	4.0	mg/kg	NS	2,000	17.7	25.6	24.9	22.9	20.4	16.7
Potassium	SW6010	200	mg/kg	NS	NS	ND	555	736	493	ND	ND
Sodium	SW6010	100	mg/kg	NS	NS	214	279	171	152	182	196
Vanadium	SW6010	4.0	mg/kg	NS	2,400	49.4	54.7	64.1	69.1	62.9	78.5
Zinc	SW6010	2.0	mg/kg	NS	5,000	64.9	75.5	128	69.3	56.3	54.4
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.048	0.16	0.19	NT	0.060	0.063
Acetone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.021 J	NT	0.080	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	ND	0.13	NT	ND	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.009	1.1	0.41	NT	0.089	0.21
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	ND	0.006 J	ND	NT	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.23-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	23-C-2SB BAFB-0333 2.4-4.0' 12/20/88	23-C-2SB[R] BAFB-0374 1.5-5.0' 01/06/89	23-C-2SB BAFB-0334 5.0-6.5' 12/20/88	23-C-2SB[R] BAFB-0375 5.0-6.5' 01/06/89	23-C-2SB BAFB-0335 10.0-11.5' 12/20/88	23-C-2SB[R] BAFB-0376 10.0-11.5' 01/06/89	
Percent Moisture	ASA#9	N/A	%	NS	NS	32.8	NT	22	NT	27.5	NT	
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	510	NT	190	NT	1.4	NT	
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	120	NT	ND	NT	ND	NT	
Aluminum	SW6010	20.0	mg/kg	NS	NS	16700	NT	18100	NT	14100	NT	
Barium	SW6010	10.0	mg/kg	NS	10,000	240	NT	164	NT	166	NT	
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	NT	0.64	NT	ND	NT	
Calcium	SW6010	100	mg/kg	NS	NS	4940	NT	5050	NT	3960	NT	
Chromium	SW6010	3.0	mg/kg	NS	500	20.8	NT	39.7	NT	23.4	NT	
Cobalt	SW6010	4.0	mg/kg	NS	8,000	17.9	NT	25.9	NT	13.0	NT	
Copper	SW6010	3.0	mg/kg	NS	2,500	36.8	NT	63.3	NT	53.2	NT	
Iron	SW6010	10.0	mg/kg	NS	NS	31400	NT	33200	NT	26800	NT	
Lead	SW6010	20.0	mg/kg	NS	1,000	38.4	NT	ND	NT	ND	NT	
Magnesium	SW6010	100	mg/kg	NS	NS	3350	NT	9080	NT	4970	NT	
Manganese	SW6010	1.5	mg/kg	NS	NS	1440	NT	451	NT	331	NT	
Nickel	SW6010	4.0	mg/kg	NS	2,000	13.7	NT	24.4	NT	19.3	NT	
Potassium	SW6010	200	mg/kg	NS	NS	298	NT	ND	NT	276	NT	
Sodium	SW6010	100	mg/kg	NS	NS	379	NT	203	NT	246	NT	
Vanadium	SW6010	4.0	mg/kg	NS	2,400	88.8	NT	59.4	NT	62.8	NT	
Zinc	SW6010	2.0	mg/kg	NS	5,000	87.6	NT	87.6	NT	73.0	NT	
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	NT	0.035	NT	ND	NT	0.030	
Acetone	SW8240	0.010	mg/kg	NS	NS	NT	0.012	NT	ND	NT	ND	
Toluene	SW8240	0.005	mg/kg	NS	NS	NT	0.021	NT	ND	NT	0.036	
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	NT	0.005	NT	0.96	NT	0.003	J
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	NT	0.005	NT	1.0	NT	0.003	J

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
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e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.23-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	23-C-2SB[R] BAFB-0377 11.5-13.0' 01/06/89	23-C-2SB BAFB-0336 15.0-16.5' 12/20/88	23 ..B[R] BAFB-0378 15.0-16.5' 01/06/89	23-C-2SB BAFB-0337 20.0-21.5' 12/20/88	23-C-2SB[R] BAFB-0379 20.0-21.5' 01/06/89	23-C-3SB BAFB-0282 1.0-2.5' 12/19/88
Percent Moisture	ASA#9	N/A	%	NS	NS	NT	18.8	NT	25.9	NT	14.7
Aluminum	SW6010	20.0	mg/kg	NS	NS	NT	20800	NT	19000	NT	4510
Barium	SW6010	10.0	mg/kg	NS	10,000	NT	575	NT	169	NT	113
Beryllium	SW6010	0.50	mg/kg	NS	75	NT	ND	NT	0.67	NT	ND
Calcium	SW6010	100	mg/kg	NS	NS	NT	5440	NT	5360	NT	1510
Chromium	SW6010	3.0	mg/kg	NS	500	NT	46.7	NT	33.6	NT	25.0
Cobalt	SW6010	4.0	mg/kg	NS	8,000	NT	42.5	NT	17.5	NT	22.3
Copper	SW6010	3.0	mg/kg	NS	2,500	NT	69.3	NT	49.9	NT	25.3
Iron	SW6010	10.0	mg/kg	NS	NS	NT	40000	NT	28600	NT	15500
Magnesium	SW6010	100	mg/kg	NS	NS	NT	9420	NT	7270	NT	1170
Manganese	SW6010	1.5	mg/kg	NS	NS	NT	2240	NT	609	NT	882
Nickel	SW6010	4.0	mg/kg	NS	2,000	NT	29.1	NT	21.6	NT	8.6
Potassium	SW6010	200	mg/kg	NS	NS	NT	505	NT	324	NT	ND
Sodium	SW6010	100	mg/kg	NS	NS	NT	183	NT	201	NT	107
Vanadium	SW6010	4.0	mg/kg	NS	2,400	NT	120	NT	57.9	NT	61.4
Zinc	SW6010	2.0	mg/kg	NS	5,000	NT	92.5	NT	73.7	NT	22.3
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.054	NT	0.052	NT	0.035	0.009
Acetone	SW8240	0.010	mg/kg	NS	NS	0.027	NT	[illegible]	NT	0.004 J	0.033
Toluene	SW8240	0.005	mg/kg	NS	NS	0.063	NT	0.006	NT	0.015	0.012
Ethylbenzene	SW8240	0.005	mg/kg	NS	NS	0.018	NT	ND	NT	ND	ND
Xylenes (total)	SW8240	0.005	mg/kg	NS	NS	0.020	NT	ND	NT	ND	ND

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
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f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.23-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	23-C-3SB BAFB-0283 5.0-6.5' 12/19/88	23-C-3SB BAFB-0284 10.0-11.5' 12/19/88	23-C-3SB BAFB-0285[f] 11.5-13.0' 12/19/88	23-C-3SB BAFB-0286 15.0-16.5' 12/19/88	23-C-3SB BAFB-0332 20.0-21.5' 12/19/88	23-C-4SB BAFB-0344 1.0-2.5' 12/22/88
Percent Moisture	ASA#9	N/A	%	NS	NS	19.3	17.3	18.1	18.2	18.3	23.9
TFH-Diesel	TFH-DI	1.0	mg/kg	NS	NS	ND	ND	ND	ND	ND	1400
TFH-Gas	TFH-GA	50	mg/kg	NS	NS	41	30	29	ND	ND	26
Aluminum	SW6010	20.0	mg/kg	NS	NS	11600	12200	9520	11800	13200	15000
Barium	SW6010	10.0	mg/kg	NS	10,000	143	260	156	176	229	193
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	ND	0.73	0.61	ND
Calcium	SW6010	100	mg/kg	NS	NS	5330	4330	3710	4080	4080	5230
Chromium	SW6010	3.0	mg/kg	NS	500	26.1	38.5	28.0	31.7	39.4	35.9
Cobalt	SW6010	4.0	mg/kg	NS	8,000	18.6	24.2	19.5	18.3	26.2	19.7
Copper	SW6010	3.0	mg/kg	NS	2,500	50.8	65.7	48.6	44.5	62.7	50.3
Iron	SW6010	10.0	mg/kg	NS	NS	20600	33400	22000	21500	31700	24300
Magnesium	SW6010	100	mg/kg	NS	NS	6600	7400	6690	6970	7370	5120
Manganese	SW6010	1.5	mg/kg	NS	NS	419	1040	747	611	1050	378
Nickel	SW6010	4.0	mg/kg	NS	2,000	38.4	23.0	24.4	19.6	27.5	23.7
Potassium	SW6010	200	mg/kg	NS	NS	248	302	256	306	306	289
Sodium	SW6010	100	mg/kg	NS	NS	230	191	176	210	208	196
Vanadium	SW6010	4.0	mg/kg	NS	2,400	38.9	129	76.1	64.9	118	61.6
Zinc	SW6010	2.0	mg/kg	NS	5,000	64.2	68.4	58.7	58.3	75.6	99.6
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.011	0.005 J	0.010	0.013 J	0.006	0.016
Acetone	SW8240	0.010	mg/kg	NS	NS	0.043	0.007 J	0.016	0.016 J	0.015	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	ND	0.017	0.044	ND	0.070	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.021	0.065	0.13	0.095	0.12	0.012

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
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R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.23-2 (continued)

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	23-C-4SB BAFB-0345 5.0-6.5' 12/22/88	23-C-4SB BAFB-0346 10.0-11.5' 12/22/88	23-C-4SB BAFB-0347 15.0-16.5' 12/22/88	23-C-4SB BAFB-0348 20.0-21.5' 12/22/88
Percent Moisture	ASA#9	N/A	%	NS	NS	19.5	20.3	23.5	6.9
Aluminum	SW6010	20.0	mg/kg	NS	NS	16600	15300	12800	6240
Barium	SW6010	10.0	mg/kg	NS	10,000	209	116	463	154
Beryllium	SW6010	0.50	mg/kg	NS	75	ND	ND	0.78	ND
Calcium	SW6010	100	mg/kg	NS	NS	5590	5280	4550	2560
Chromium	SW6010	3.0	mg/kg	NS	500	45.5	42.0	37.1	19.3
Cobalt	SW6010	4.0	mg/kg	NS	8,000	26.3	17.6	47.1	17.2
Copper	SW6010	3.0	mg/kg	NS	2,500	68.8	56.0	47.6	56.0
Iron	SW6010	10.0	mg/kg	NS	NS	32300	29900	27800	17800
Magnesium	SW6010	100	mg/kg	NS	NS	8210	7280	7030	3910
Manganese	SW6010	1.5	mg/kg	NS	NS	850	637	2380	757
Nickel	SW6010	4.0	mg/kg	NS	2,000	32.4	28.5	33.2	14.0
Potassium	SW6010	200	mg/kg	NS	NS	335	ND	366	ND
Sodium	SW6010	100	mg/kg	NS	NS	176	179	180	132
Vanadium	SW6010	4.0	mg/kg	NS	2,400	103	67.1	90.2	60.8
Zinc	SW6010	2.0	mg/kg	NS	5,000	84.0	71.1	69.7	60.2
Methylene Chloride	SW8240	0.005	mg/kg	NS	NS	0.032	0.013	0.017	ND
Acetone	SW8240	0.010	mg/kg	NS	NS	0.019	ND	ND	ND
2-Butanone	SW8240	0.010	mg/kg	NS	NS	0.043	0.043	0.20	ND
Toluene	SW8240	0.005	mg/kg	NS	NS	0.073	0.11	0.077	0.23 J

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.23-2

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 23

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	23-C-1GW BAFB-0454 02/15/89	23-C-1GW[f] BAFB-0455 02/15/89	23-C-1GW[e] BAFB-0456 02/15/89	23-C-1GW[b] BAFB-0457 02/15/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	405	405	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	17.0	17.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.11	7.11	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	156.0	156.0	NT	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	190.3	190.3	NT	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	359	349	6.0	NT
Chloride	E325.3	1.0	mg/l	250	250	34.2	33.8	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.16	0.15	0.050	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	23.4	26.5	0.15	NT
Sulfate	E375.4	1.0	mg/l	250	250	16.0	18.4	ND	NT
TPH-Gas	TPH-GA	0.10	mg/l	NS	NS	0.30	0.70	0.80	NT
Calcium	SW6010	1.00	mg/l	NS	NS	45.4	50.0	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	16.4	17.3	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	30.4	31.6	ND	NT
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	ND	0.0400	NT
Toluene	SW8020	1	ug/l	14,300	100	2(3)	2(1)	ND	ND

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.23-2

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 23

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	23-C-1GW BAFB-0718 11/29/89	23-C-1GW[f] BAFB-0719 11/29/89	23-C-1GW[e] BAFB-0720 11/29/89	23-C-1GW[b] BAFB-0721 11/29/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	460	460	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	20.0	20.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	7.77	7.77	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	190.8	188.2	30.2	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	232.8	229.6	36.8	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	422	345	15.0	NT
Chloride	E325.3	1.0	mg/l	250	250	34.4	35.1	ND	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.18	0.17	ND	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	23.1	25.2	0.18	NT
Sulfate	E375.4	1.0	mg/l	250	250	21.4	14.5	ND	NT
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	0.060	0.080	0.050	NT
Calcium	SW6010	1.00	mg/l	NS	NS	49.3	50.4	ND	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	16.2	16.4	ND	NT
Potassium	SW6010	1.00	mg/l	NS	NS	1.19	ND	ND	NT
Sodium	SW6010	1.00	mg/l	NS	NS	31.1	31.9	ND	NT

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

Table 4.1.23-3
RANGES OF CONTAMINANTS DETECTED AT SITE 23

CONTAMINANT ANALYTE	UNITS	MINIMUM CONC.	MAXIMUM CONC.	# DETECTIONS/ # SAMPLES
SOIL BORINGS				
TFH-diesel	mg/kg	ND	1,400	5/21
TFH-gas	mg/kg	ND	120	4/21
lead	mg/kg	ND	38.4	1/21
2-butanone	mg/kg	ND	0.20	7/21
ethylbenzene	mg/kg	ND	0.96	4/21
toluene	mg/kg	ND	1.1	20/21
xylenes (total)	mg/kg	ND	1.0	2/21
GROUNDWATER				
TFH-gas	mg/l	ND	0.30	1/2
TFH-diesel	mg/l	ND	0.08	1/2
toluene	ug/l	ND	2	1/2

NOTES: This table does not necessarily contain all analytes detected.

For organics, analytes also detected in method blanks at similar levels (B), and analytes detected only once at a level below the LOQ (J), are not included. Metals listed are those greater than 2 standard deviations above the background averages and possible indicators of site-specific contamination. General water quality parameters are also not included.

If present, ( ) indicates that the value was tentatively detected below the LOQ.

violations. All scheduled analyses were completed for Site 23 except for one volatile organic analysis for the soil replicate QC sample collected at 11.5-13.0 feet in boring 23-C-1SB.

4.1.23.2.2 Likelihood that Positive Samples Were Contaminated in the Field or Laboratory

Soil samples collected at Site 23 contained several organic compounds that were probably laboratory or field induced false positive results. All but one of the soil samples collected contained methylene chloride and many of the samples also contained acetone. These are common laboratory contaminants and are probably false positive results.

Toluene was detected in all but one of the soil samples and only in the first quarter groundwater sample. Toluene was detected in samples taken throughout the base. Although toluene is not considered a common laboratory contaminant, the ubiquitous extent suggests that it is a false positive result. For the soil replicate QC samples (taken at this and other sites) in which toluene was detected, duplication of the toluene result was not good. This is another indication that the lower levels of toluene at the site probably are not true contaminants.

Two soil replicate QC samples were collected at Site 23. The first replicate, collected at 11.5-13.0 feet in boring 23-C-1SB, compared well to the original sample except for the following analytes: TFH-diesel was detected in the original at 6.2 mg/kg but not detected in the replicate, RPDs for calcium, copper, and zinc were 87, 96, and 60 percent, respectively. Volatile organic analysis was not completed for the replicate sample.

The second replicate QC sample, collected at 11.5-13.0 feet in boring 23-C-2SB, had good agreement to the original sample for metals, but volatile organics results did not agree well with the original sample. Acetone was not detected in the original sample but was reported in the replicate. Toluene, methylene chloride, ethylbenzene, and xylenes had RPDs of 56, 57, 157, and 161 percent, respectively.

A replicate groundwater QC sample was collected, as well as an equipment wash blank and an ambient condition blank in the first and the fourth rounds. Replicate results compared well to the original sample except that TFH-gas had a RPD of 80 percent. However, TFH-gas was also detected in the

equipment wash blank at 0.8 mg/l. In the fourth round, replicate results compared well to the original sample. TFH-diesel was 0.060 and 0.80 mg/l (RPD of 28 percent), but the TFH-diesel was also detected in the equipment wash blank at 0.050 mg/l.

4.1.23.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of Site 23 samples.

4.1.23.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.23.3 Significance of Findings

Soil

TFH-diesel and -gas were detected in samples from all four soil borings (Figure 4.1.23-4). Xylenes and ethylbenzene were detected up to 1.0 and 0.96 mg/kg in 23-C-2SB. No TFHs were detected in 15-foot or 20-foot samples from any borings at Site 23. These data suggest that fuel hydrocarbons leaked or spilled onto the pavement in the maintenance area and were washed into the storm drain and the drainage ditch. No DHS TTLC values are available for TFH-diesel or -gas. The LUFT cleanup standards calculated for Site 23 are 1,000 mg/kg for TFH-diesel, 100 mg/kg for TFH-gas, 1.0 mg/kg for xylene, and 1.0 for ethylbenzene.

Lead was detected in the 2.4- to 4-foot sample from 23-C-2SB at 38.4 mg/kg. The DHS TTLC for lead is 1,000 mg/kg.

Groundwater

TFH-gas was detected in the first round groundwater sample and in the field replicate, with an RPD of 80 percent. The concentration in the equipment wash blank (0.80 mg/l) exceeded that in the environmental sample (0.30 mg/l) or the field replicate (0.70 mg/l). Based on these findings the TFH-gas in the groundwater is suspect. In the fourth round, TFH-gas and toluene were not detected in any sample, further suggesting that they were not actually present in the groundwater in the first round. TFH-diesel, which was not detected in the first round, was detected in the sample,

replicate, and equipment wash blank in the fourth round, which suggests that TFH-diesel is not actually present in the groundwater.

4.1.23.3.1 Zones of Contamination

The contaminated zone at Site 23, based on four soil borings conducted in the Stage 2-1 study, is the uppermost 12 to 15 feet of soil near the borings.

Because of the uncertainty of the groundwater data, an accurate conclusion on groundwater contamination cannot be made at this time. The lack of reproducibility of toluene, TFH-gas, and TFH-diesel results at Site 23 suggests that they are not true contaminants in the groundwater at well 23-C-1. Additional sampling and analysis is required to reliably determine groundwater quality at Site 23.

4.1.23.3.2 Contaminant Migration

Based on the distribution of TFH contamination in the soil, contaminant migration in surface water is suspected. However, past fuel spill(s) into the storm drain may be the source of TFH in the soil at the drainage ditch. Review of the soil depths where TFH were detected indicate that, in the area of the borings, the vertical migration has not exceeded 15 feet.

Groundwater at Site 23 flows to the west at an unknown velocity. If the TFH-gas and diesel contamination detected in the groundwater represents actual contamination and not a false positive, then this would be expected to move with the groundwater.

4.1.23.3.2.1 Potential to Move Off Site and Off Base

The potential is high for fuel hydrocarbons transported in surface water to move off site and off base. Based on fuel hydrocarbon distribution in the sampled soil, it is probable that stormwater has transported the hydrocarbons from the pavement into the soil.

Although a conclusion has not been made about groundwater contamination, the potential is high for contaminated groundwater, if present, to move off site. However, based on the available information, the potential for migration cannot be accurately assessed at this time.

4.1.23.3.2.2 Rate and Direction of Migration Based on Hydrogeologic Properties

Based on stream flow observations made during Stage 2-1 field activities and the approximate distance to the base boundary along the path of surface streams (drainage ditch to Hutchinson Creek), runoff from Site 23 could cross the base boundary in 1-3 hours. This drainage path is to the south and west from the site.

4.1.23.3.2.3 Time of Travel to Receptors

Domestic water wells exist downgradient, but the impact, if any, from Site 23 is unknown. The groundwater velocity is unknown.

4.1.23.3.2.4 Applicability of Solute Transport Models

Solute transport models are not applicable at Site 23 because of the uncertainty of groundwater contamination.

4.1.23.3.2.5 Expected Spatial and Temporal Variations in Concentration

Concentrations detected in the soil decrease with depth, with no TFH detections in the 15-foot samples or below. Outside of the immediate building and concrete pad area, the concentrations are expected to be limited to the drainage ditch.

There does not appear to be any true temporal variation in groundwater at Site 23. The TFH-gas and diesel defections in the first and fourth rounds respectively are both suspect. They were each present in only one sample round.

4.1.23.3.3 Baseline Risk Assessment

No risk assessment activities were conducted as part of Stage 2-1.

4.1.24 DISCUSSION OF RESULTS FOR SITE 24: LANDFILL NO. 4

A records search was conducted to determine the location and operations history of Landfill No. 4. The landfill is located in the southern portion of the base, south of Gavin Mandry Road, north of 2nd Street and west of E Street and the World War II prisoner of war cell block (Figure 4.1.24-1).

4.1.24.1 Presentation of Results

No written records about the operation of Landfill No. 4 were available at Beale AFB. An interview was conducted on December 7, 1989, with Mr. James Armstrong, Superintendent of Horizontal Construction, 9th Civil Engineering Squadron, USAF, who has been employed at Beale AFB from the early 1960s. When interviewed at the site, he recalled that Landfill No. 4 consisted of two open trenches which were filled with general refuse. Used as burn pits, they often burned for a week at a time. A tree-lined trench running north-south was (at the time of Stage 2-1 field work) approximately 900 feet long, 25 to 30 feet wide, and about 5 feet deep. During this site visit, the trench contained rubble and roofing material. A reported second trench, about 100 feet east of the first trench, has apparently been filled. It runs parallel to the open trench and is about 750 feet long by 30 feet wide. A series of mounds of soil oriented north-south lie east of the second trench. They are about 6 feet high.

If these trench dimensions are correct and the trenches contained 10 feet of refuse, then the approximate volume of material would be about 18,000 cubic yards. However, due to the trenches being burn pits, the actual volume of buried refuse may be a fraction of this.

Mr. Armstrong reported that the landfill was used by Air Force personnel and, during weekends, civilians from off base. The material disposed of in the trenches consisted primarily of household rubbish and construction debris. According to Mr. Armstrong, Landfill No. 4 operated from the 1960s to the early 1970s which corresponds, in part, to the operation of Landfill No. 2. If Landfill No. 4 was in operation prior to 1967, it could be a transition site between Landfill No. 1 (IRP Site 13), which was operated from World War II until an unknown date in the 1950s or 1960s, and Landfill No. 2, (IRP Site 6) which was opened in 1967. It seems unlikely that the base would have operated two landfills close to each other for an extended period.

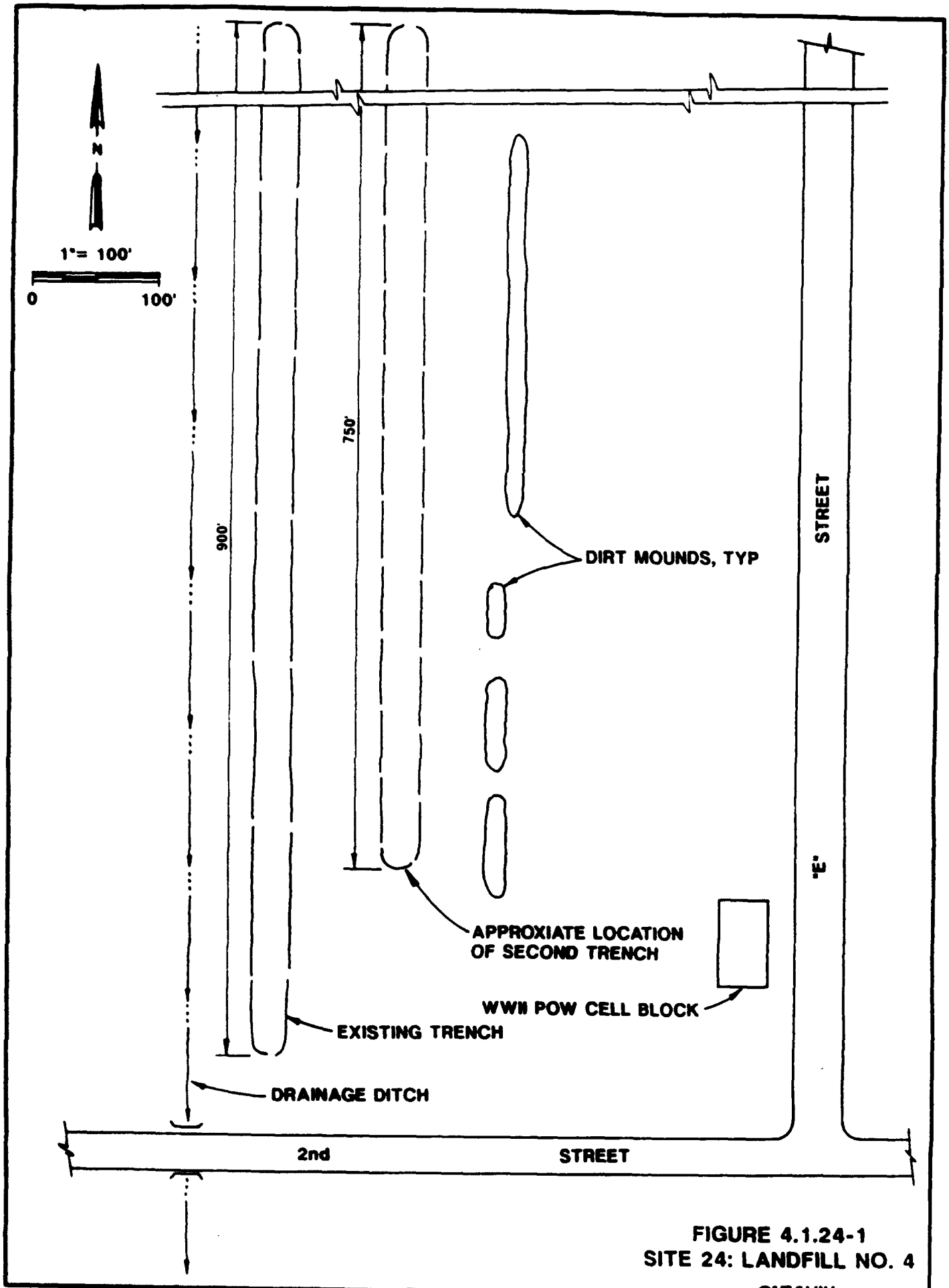


FIGURE 4.1.24-1
SITE 24: LANDFILL NO. 4

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Beale AFB Fire Chief Russell Dauterive has worked at the base since 1973. In an interview on August 15, 1989, he recalled that the landfill was used for many years prior to his arrival and covered a "large area," but was unsure of the dimensions. In 1974, a trench at Landfill No. 4, measuring about 150 feet by 30 feet and filled with blacktop and many other materials, was burned by the fire department to eliminate a large infestation of rats that posed a health risk. Chief Dauterive recalled the entire trench being lit at once and burning fiercely for several days before it was eventually extinguished by dousing it with large volumes of water and covering the trench with dirt using bulldozers.

4.1.24.1.1 Site Geology

No soil borings or monitoring wells were drilled at Site 24. No site-specific geologic descriptions are available. The nearest IRP site is Site 18 located about 2,000 feet north northwest of Landfill No. 4. A description of the geology of that site is given in Section 4.1.18.1.1.

4.1.24.1.2 Site Hydrogeology

No monitoring wells existed or were constructed at Site 24 during Stage 2-1. No site-specific hydrogeologic descriptions are available. The nearest IRP site is Site 18 located about 2,000 feet north northwest of Landfill No. 4. A description of the hydrogeology of that site is given in Section 4.1.18.1.2.

4.1.24.1.3 Analytical Results

No samples were collected from Site 24.

4.1.24.1.4. Analytical Results Table

No samples were collected from Site 24.

4.1.24.1.5. Discussion of Analytical Data

No samples were collected or analyzed from Site 24.

4.1.24.2 Sampling or Analytical Problems

No samples were collected from Site 24.

4.1.24.3 Significance of Findings

Based on the personal interviews conducted with Mr. Armstrong and Fire Chief Dauterive and a visual site inspection, a small scale landfill is evidenced at Site 24. No specific information on the operation or waste received was found. No liner or leachate collection system is believed to have been used at Landfill No. 4.

4.1.24.4 Baseline Risk Assessment

No risk assessment activities were performed as part of Stage 2-1.

4.1.25 DISCUSSION OF RESULTS FOR BACKGROUND MONITORING WELLS AND BACKGROUND SOIL BORINGS AT SITES 2, 3, 6, 13, 15, AND 19

This section provides discussion of environmental background conditions for groundwater and soils at Beale AFB. Though the IRP program at Beale AFB does not currently include a site numbered 25, the background information is discussed in this section as a matter of convenience.

Groundwater

Background groundwater conditions are described based on water samples collected from two monitoring wells installed upgradient of all IRP sites. Background wells were also installed at several individual IRP sites and are discussed in previous sections. These site-specific wells were not considered in this section because, although the wells may be upgradient from individual sites, they may be downgradient from other sites. Therefore, background wells at individual sites may not represent natural background conditions.

Soil

Background soil conditions are discussed as a point of comparison to results obtained at individual sites. This discussion is limited to analyses conducted for concentrations of metals. It was assumed that other contaminants of concern (fuels, solvents, and other organic compounds) are not naturally present in subsurface soils. To determine background metals concentrations, results of 31 soil sample analyses, collected in background soil borings at 6 IRP sites were averaged. Unlike the background wells at various sites, it was assumed that background soils at the six sites have not been affected by other IRP sites.

4.1.25.1 Presentation of Results

The following section presents the results of the field investigation at the two background wells. The discussion focuses on the geology and hydrogeology at the wells and presents the results of chemical analyses performed on samples of groundwater.

4.1.25.1.1 Site Geology

Evaluation of local geology at the background wells is based on drilling activities completed during the Stage 2-1

Remedial Investigation. There are two background monitoring wells at Beale AFB that were drilled during Stage 2-1. Background well No. 1 (BG-C-1) is located near the north edge of the base about 3,000 feet east of the Doolittle Gate on Alert Drive. Background well No.2 (BG-C-2) is located in the southeastern part of the base on Warren Shingle Boulevard across from the golf course. Both are screened across the water table. The location of these wells is shown on Figure 4.1.25-1.

Geologic cross-sections drawn through sediments encountered in the monitoring well boreholes in the north of Beale AFB, which includes BG-C-2, are located in Figure 4.1.25-1 and shown in Figure 4.1.25-2. Soil boring logs of wells BG-C-1 and BG-C-2 are provided in Appendix D.

BG-C-1 encountered a thick sequence of coarse-grained sediments throughout the vadose zone, with the exception of the uppermost 3 feet. The geologic cross-section shows that this sequence appears to be continuous with other wells in the north part of Beale AFB. As the borehole reached a depth of about 76 feet BGS (93 feet NGVD), however, the soil matrix began to be filled with clay. The saturated zone at this well lay in sandy clays, and the well is screened at a depth of 72-92 feet BGS (97 to 77 feet NGVD) in these materials of relatively low permeability. According to the soil boring log (Appendix D), the clasts were angular and composed of metabasalts. Therefore, the sediments may be derived from the basement complex of the Sierra Nevada. Page (1980) mapped the surface materials as belonging to the volcanic rocks from the Sierra Nevada. Soils at BG-C-1 were mapped as part of the Redding-Corning Association, a moderately deep and well-drained soil formed of alluvium derived from mixed sources (SCS, 1985).

Well BG-C-2 penetrated mainly sands and gravels to a depth of 36 feet (124 feet NGVD). At that point, the borehole entered a thick (over 20 feet) cemented conglomerate. The sands above this unit were wet, implying that some groundwater perching was occurring. The sediments were cemented through most of the remainder of the hole, except for a sand and gravel unit from 62 to 80 feet (98 to 80 feet NGVD). The hole was left open with the drill bit retracted in this unit overnight to see if it would yield water to the hole. However, the hole was dry in the morning. This confirmed that the wet sands at a depth of 36 feet (124 feet NGVD) were perched. The well was screened across the water table in sandstone at a depth of 84 to 104 feet (76 to 56 feet NGVD). Surface geologic materials at BG-C-2 were mapped as

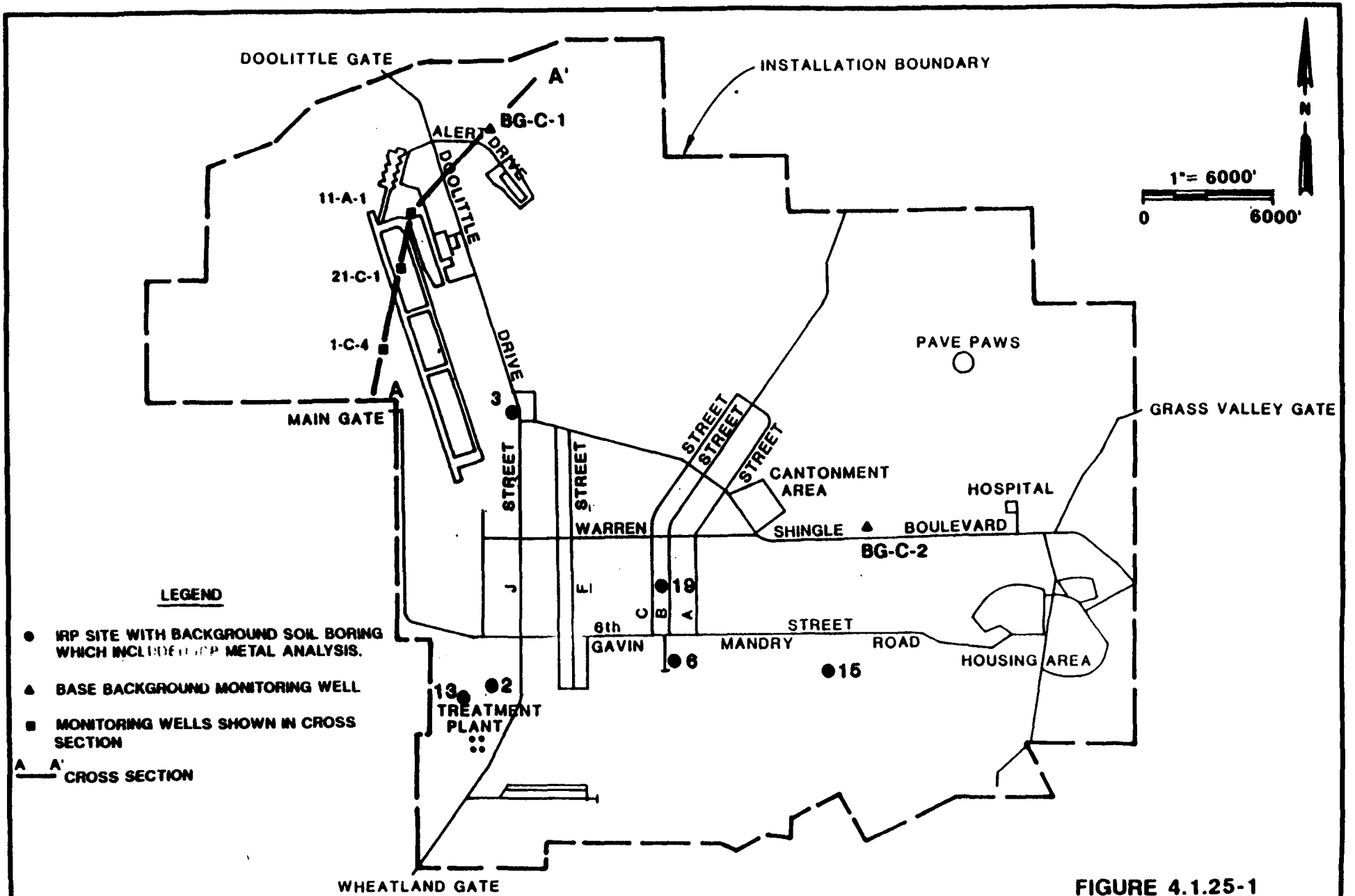


FIGURE 4.1.25-1
BACKGROUND SOIL BORINGS
AND MONITORING WELLS

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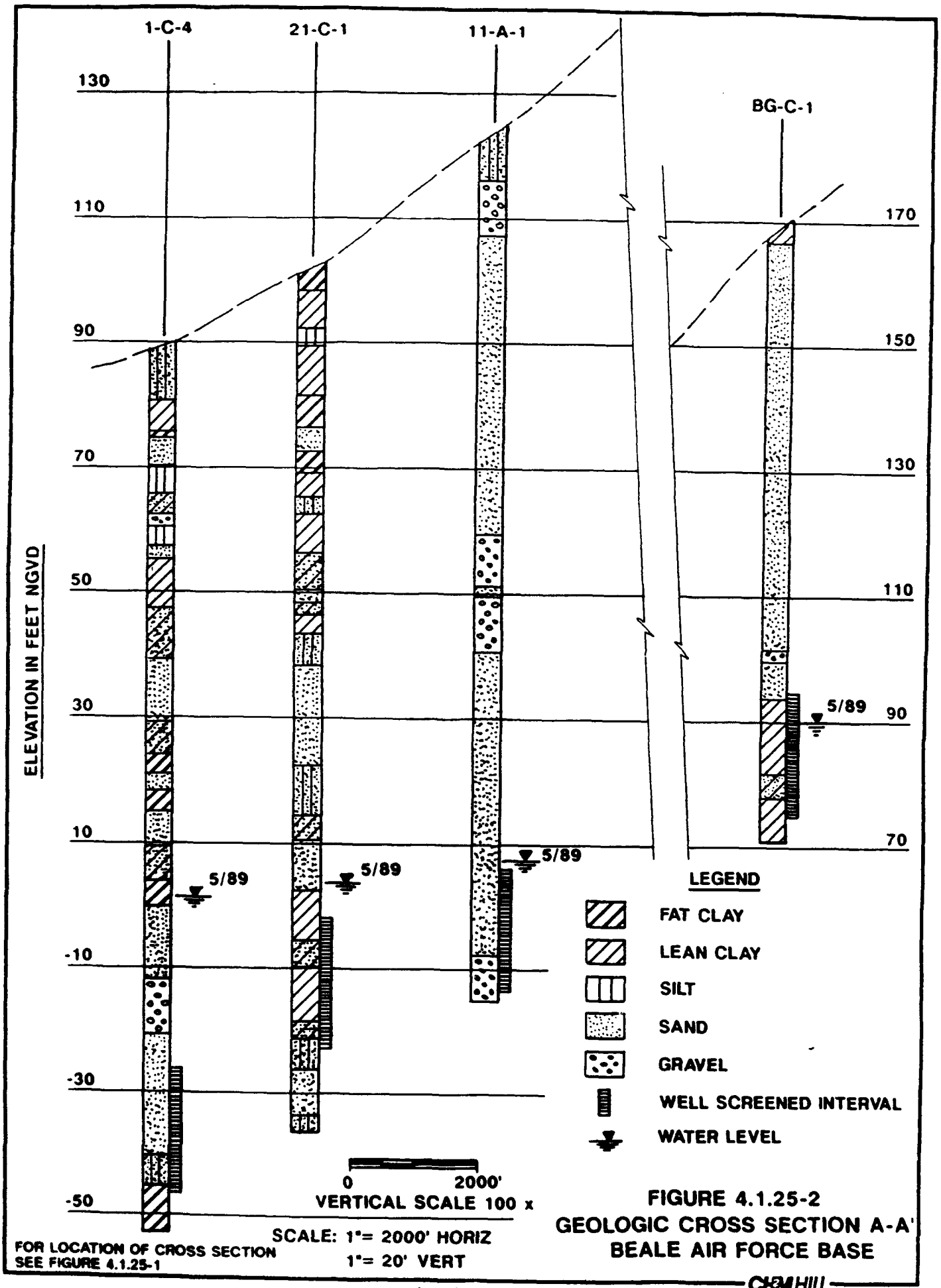


FIGURE 4.1.25-2
GEOLOGIC CROSS SECTION A-A'
BEALE AIR FORCE BASE

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belonging to the Laguna Formation by Page (1980). Conglomerates and sandstones contacted at depth may have been part of the volcanic rocks from the Sierra Nevada. Soils were mapped as Redding-Corning Association (SCS, 1985).

4.1.25.1.2 Site Hydrogeology

Near-surface groundwater in wells BG-C-1 and BG-C-2 appears to flow under unconfined conditions. Well BG-C-1 produces water mainly from a sandy lean clay with gravel. Water was first noted during drilling at a depth of about 79 feet in well BG-C-1. After development, the depth to water in the well remained at about 79 feet (about 90 feet NGVD). Well BG-C-2 produces water mainly from a sandstone unit. Moist cuttings were first noted during drilling near the water table at a depth of between 85 and 90 feet. After development, the depth to water in the well was about 89 feet (72 feet NGVD).

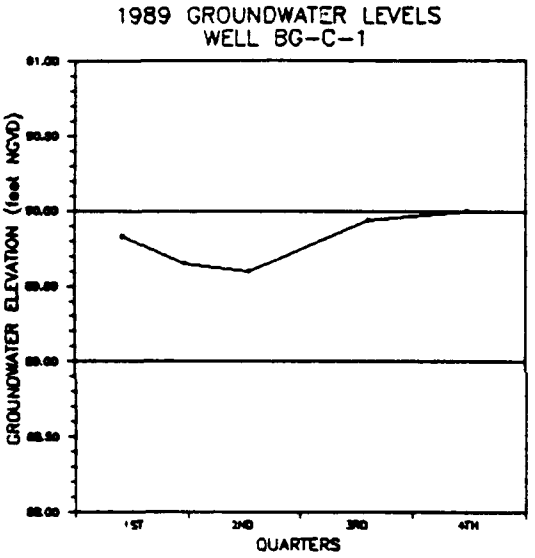
Groundwater level data from the background monitoring wells collected between February 1989 and May 1989 are presented in Table 4.1.25-1 and Figure 4.1.25-3. This table shows that the groundwater level remained relatively stable in both wells during this time, and may have slightly declined.

Table 4.1.25-1
GROUNDWATER ELEVATIONS IN BACKGROUND WELLS
(feet NGVD)

Well	Screened Interval	February 1989	March 1989	May 1989	August 1989	November 1989
BG-C-1	95 to 75	89.83	89.65	89.60	89.94	90.00
BG-C-2	76 to 56	71.66	71.57	71.49	71.51	71.42

A complete summary of groundwater level measurements, including elevations and depths to water, is provided in Appendix G. These data show that water levels in wells BG-C-1 and BG-C-2 changed very little during 1989. This pattern was typical of wells constructed on the east side of Beale AFB.

March and November 1989 groundwater elevation contours plotted on wells at Beale AFB are presented on Plates 3 and 4. These plates demonstrate that groundwater in the vicinity of well BG-C-1 is flowing to the west-southwest. The hydraulic gradient west of the well is about 0.017. This relatively



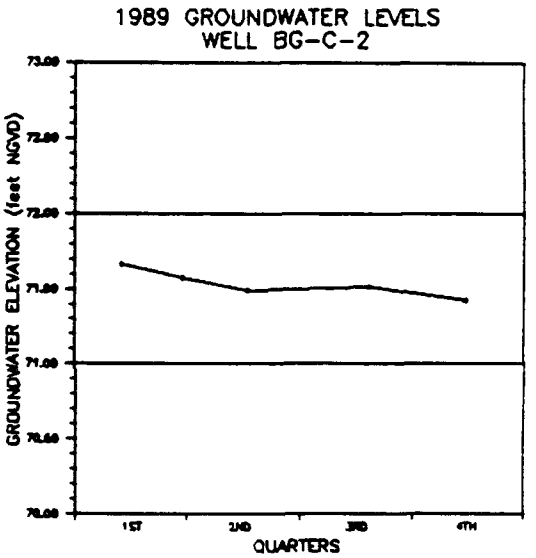


FIGURE 4.1.25-3
MONITORING WELL HYDROGRAPHS
BACKGROUND MONITORING WELLS

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steep gradient is reflected in surface topography and is typical of flow along the boundary of the foothills and the Central Valley.

According to Plates 3 and 4, groundwater in the vicinity of BG-C-2 is also flowing to the west-southwest. The groundwater elevation in this well is depressed relative to that of other wells on the eastern edge of the base. This has the effect of causing the groundwater elevation contours to form a trough, with flow paths converging downgradient from well BG-C-2. A possible cause of the convergence may be the presence of a subsurface zone of relatively higher permeability such as an alluvium-filled sub-valley or highly fractured sandstones. The gradient in the vicinity of well BG-C-2 is about 10 feet per 2,000 feet, or 0.005.

Aquifer parameters for BG-C-1 were derived from a slug test. This test was necessary because the yield of this well was too low to sustain a pumping test. The method employed was that of Bouwer and Rice (1976). Details of the method and a plot of the results are provided in Appendix E. According to the slug test, the hydraulic conductivity in the immediate vicinity of well BG-C-1 is about 5.1 feet per day (1.8×10^{-3} cm/sec).

Aquifer parameters at well BG-C-2 were derived from a pump test according to the Cooper-Jacob Method (1946) from the water level data generated during 4 hours of monitored drawdown and recovery. Plots of the data and a discussion of testing methodology are provided in Appendix E. The pump test yielded an average value of transmissivity of 1,100 square feet per day and an average value of hydraulic conductivity of 68 feet per day.

4.1.25.1.3 Analytical Results

Groundwater

During each of the first three quarterly rounds of water sampling, one groundwater sample was collected from each background monitoring well (BG-C-1 and -2 located in Figure 4.1.25-1 and Plate 2). In the fourth round, only well BG-C-2 was sampled. Analyses performed for the groundwater samples were purgeable halocarbons (8010), purgeable aromatics (8020), semivolatile organics (8270), ICP metals (6010), arsenic (7060), lead (7420), mercury (7471), selenium (7740), TFH-diesel and -gas (California method), water quality parameters, and COD.

Bis(2-ethylhexyl) phthalate was detected in BG-C-1 at 14 ug/l in the first round. No arsenic, lead, mercury, or selenium was detected in background wells during this investigation. In the first sampling round, TFH-gas was detected at 0.10 mg/kg in BG-C-1 and at 2.0 mg/kg in BG-C-2. TFH-gas and -diesel were not detected in background wells BG-C-1 and -2 in the second and third sampling rounds. In the fourth round, TFH-diesel was detected in well BG-C-2 at 0.070 mg/l and bis(2-ethylhexyl)phthalate at 16 ug/l. Toluene was detected in the third round sample at BG-C-1 at 3 ug/l but was not detected in the second column confirmation.

The background wells are several miles apart and therefore their general water quality data are discussed separately.

Major anion and cation concentrations at BG-C-1 are generally similar to other sites near the flightline at Beale AFB except it had lower sodium and chloride and higher magnesium and bicarbonate. In the first, second, and third sampling rounds, water quality parameters had the following ranges. TDS ranged from 116 to 206 mg/kg. Sodium ranged from 10.7 to 11.3 mg/l. Nitrite plus nitrate (expressed as nitrate) ranged from 5.9 to 16.9 mg/l. Sulfate ranged from 3.4 to 4.4 mg/l, lower than at most sites at Beale AFB. Groundwater at BG-C-1 is a calcium-magnesium bicarbonate type. COD was below the detection limit.

Major anion and cation concentrations at BG-C-2 are generally similar to other monitoring wells in the southern part of Beale AFB. In the four sampling rounds, TDS ranged from 150 to 261 mg/l. Sodium ranged from 35.6 to 36.9 mg/l. Nitrite plus nitrate (expressed as nitrate) ranged from 11.7 to 16.3 mg/l and sulfate from 11.2 to 17.8 mg/l. Groundwater at background well 2 was a sodium bicarbonate type. COD was below the detection limit in the first three rounds. However, in the fourth round, COD was 62.6 mg/l in the original fourth round sample and 15.0 mg/l in the field replicate while not being detected in the equipment wash blank.

Soils

ICP metal concentrations in 31 soil samples from the background soil borings at Sites 2, 3, 6, 13, 15, and 19 were averaged. The mean average and standard deviation for concentrations of each metal were computed and are presented in Table 4.1.25-2.

Table 4.1.25-2
ICP METAL CONCENTRATIONS
BASEWIDE BACKGROUND AVERAGES

ICP Metal[a]	Mean Average (mg/kg)	Standard Deviation (mg/kg)	Range of 2 Standard Deviations About the Mean (mg/kg)	No. Detected/ No. of Samples
Aluminum	14,186	1,720	10,746-17,626	31/31
Barium	149	48	53-245	31/31
Beryllium	--[b]	--	--	1/31
Calcium	5,003	562	3,879-6,127	31/31
Cobalt	25	15	0-55	31/31
Chromium	31	8	15-46	31/31
Copper	44	12	21-67	31/31
Iron	25,843	3,925	17,993-33,692	31/31
Magnesium	5,480	674	4,133-6,827	31/31
Manganese	815	214	387-1,243	31/31
Nickel	23	4	15-31	31/31
Lead	--[b]	--	--	1/31
Potassium	551	210	131-970	28/31
Sodium	234	96	42-426	31/31
Vanadium	70	18	33-107	31/31
Zinc	57	7	43-70	31/31

[a] Only ICP metals detected at least once in background borings are presented in this table.
[b] Beryllium was detected in only one sample at 0.62 mg/kg and lead was detected in only one sample at 24.2 mg/kg. Because these elements were detected in only 1 of 31 samples, calculation of a mean is not valid.

Bis(2-ethylhexyl) phthalate was detected in BG-C-1 at 14 ug/l in the first round. No arsenic, lead, mercury, or selenium was detected in background wells during this investigation. In the first sampling round, TFH-gas was detected at 0.10 mg/kg in BG-C-1 and at 2.0 mg/kg in BG-C-2. TFH-gas and -diesel were not detected in background wells BG-C-1 and -2 in the second and third sampling rounds. In the fourth round, TFH-diesel was detected in well BG-C-2 at 0.070 mg/l and bis(2-ethylhexyl)phthalate at 16 ug/l. Toluene was detected in the third round sample at BG-C-1 at 3 ug/l but was not detected in the second column confirmation.

The background wells are several miles apart and therefore their general water quality data are discussed separately.

Major anion and cation concentrations at BG-C-1 are generally similar to other sites near the flightline at Beale AFB except it had lower sodium and chloride and higher magnesium and bicarbonate. In the first, second, and third sampling rounds, water quality parameters had the following ranges. TDS ranged from 116 to 206 mg/kg. Sodium ranged from 10.7 to 11.3 mg/l. Nitrite plus nitrate (expressed as nitrate) ranged from 5.9 to 16.9 mg/l. Sulfate ranged from 3.4 to 4.4 mg/l, lower than at most sites at Beale AFB. Groundwater at BG-C-1 is a calcium-magnesium bicarbonate type. COD was below the detection limit.

Major anion and cation concentrations at BG-C-2 are generally similar to other monitoring wells in the southern part of Beale AFB. In the four sampling rounds, TDS ranged from 150 to 261 mg/l. Sodium ranged from 35.6 to 36.9 mg/l. Nitrite plus nitrate (expressed as nitrate) ranged from 11.7 to 16.3 mg/l and sulfate from 11.2 to 17.8 mg/l. Groundwater at background well 2 was a sodium bicarbonate type. COD was below the detection limit in the first three rounds. However, in the fourth round, COD was 62.6 mg/l in the original fourth round sample and 15.0 mg/l in the field replicate while not being detected in the equipment wash blank.

Soils

ICP metal concentrations in 31 soil samples from the background soil borings at Sites 2, 3, 6, 13, 15, and 19 were averaged. The mean average and standard deviation for concentrations of each metal were computed and are presented in Table 4.1.25-2.

TABLE 4.1.25-3

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR BACKGROUND MONITORING WELLS

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	BG-C-1GW BAFB-0468 02/23/89	BG-C-2GW BAFB-0458 02/15/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	193	195
Temperature	E170.1	N/A	deg C	NS	NS	21.0	20.5
pH	E150.1	N/A	pH	5-9	NS	7.01	7.34
Alkalinity - Total	SM403	1.0	mg/l	20	NS	98.4	72.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	120.0	88.8
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	206	191
Chloride	E325.3	1.0	mg/l	250	250	3.0	7.5
Fluoride	E340.2	0.050	mg/l	2	1.4	0.16	0.49
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	6.1	16.3
Sulfate	E375.4	1.0	mg/l	250	250	3.8	17.8
TPH-Gas	TPH-GA	0.10	mg/l	NS	NS	0.10	2.0
Calcium	SW6010	1.00	mg/l	NS	NS	17.9	6.91
Magnesium	SW6010	1.00	mg/l	NS	NS	9.63	2.52
Potassium	SW6010	1.00	mg/l	NS	NS	1.30	ND
Sodium	SW6010	1.00	mg/l	NS	NS	10.7	35.6
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	0.0380
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	14	8 BJ

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.25-3

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR BACKGROUND MONITORING WELLS

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	BG-C-1GW BAFB-0555 05/30/89	BG-C-2GW BAFB-0554 05/30/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	200	298
Temperature	E170.1	N/A	deg C	NS	NS	21.0	21.0
pH	E150.1	N/A	pH	5-9	NS	7.01	7.88
Alkalinity - Total	SM403	1.0	mg/l	20	NS	100.2	94.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	122.2	115.2
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	199	239
Chloride	E325.3	1.0	mg/l	250	250	2.5	8.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.16	0.46
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	5.9	11.7
Sulfate	E375.4	1.0	mg/l	250	250	4.4	11.5
Calcium	SW6010	1.00	mg/l	NS	NS	18.8	6.68
Magnesium	SW6010	1.00	mg/l	NS	NS	9.77	2.51
Potassium	SW6010	1.00	mg/l	NS	NS	1.00	1.10
Sodium	SW6010	1.00	mg/l	NS	NS	11.1	36.9
Toluene	SW8020	1	ug/l	14,300	100	2	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 J	6 J

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.25-3

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR BACKGROUND MONITORING WELLS

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	BG-C-1GW BAFB-0604 08/25/89	BG-C-2GW BAFB-0603 08/25/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	195	200
Temperature	E170.1	N/A	deg C	NS	NS	21.8	21.0
pH	E150.1	N/A	pH	5-9	NS	7.79	6.94
Alkalinity - Total	SM403	1.0	mg/l	20	NS	109.0	84.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	133.0	102.5
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	116	150
Chloride	E325.3	1.0	mg/l	250	250	3.9	7.9
Fluoride	E340.2	0.050	mg/l	2	1.4	0.15	0.42
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	16.9	15.3
Sulfate	E375.4	1.0	mg/l	250	250	3.4	11.9
Calcium	SW6010	1.00	mg/l	NS	NS	18.9	6.67
Magnesium	SW6010	1.00	mg/l	NS	NS	10.2	2.51
Sodium	SW6010	1.00	mg/l	NS	NS	11.3	36.4
Toluene	SW8020	1	ug/l	14,300	100	3	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	8 BJ	6 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	10

NOTES: Results reported for detected analytes only.
NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: Values represent most stringent standard, criteria or action level. See Appendix I.
* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)

e: equipment wash blank
f: field replicate
R: resample

TABLE 4.1.25-3

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR BACKGROUND MONITORING WELLS

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	BG-C-2GW BAFB-0714 11/29/89	BG-2-2GW[f] BAFB-0715 11/29/89	BG-C-2GW[c] BAFB-0716 11/29/89	BG-C-2GW[b] BAFB-0717 11/29/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	195	195	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	20.0	20.0	NT	NT
pH	E150.1	N/A	pH	5-9	NS	8.26	8.26	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	20	NS	NT	83.6	18.0	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	102.0	22.0	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	261	NT	NT	NT
Chloride	E325.3	1.0	mg/l	250	250	7.3	NT	NT	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.51	NT	NT	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	13.4	NT	NT	NT
Sulfate	E375.4	1.0	mg/l	250	250	11.2	NT	NT	NT
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	62.6	15.0	ND	NT
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	0.070	NT	NT	NT
Calcium	SW6010	1.00	mg/l	NS	NS	6.61	NT	NT	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	2.33	NT	NT	NT
Sodium	SW6010	1.00	mg/l	NS	NS	36.0	NT	NT	NT
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	ND	270(430)	490(530)
Diethylphthalate	SW8270	10	ug/l	NS	NS	6 BJ	7 BJ	5 BJ	NT
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	12 B	13 B	11 B	NT
Di-n-Butylphthalate	SW8270	10	ug/l	NS	NS	14 B	15 B	12 B	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	16	17	12	NT

NOTES: Results reported for detected analytes only.

NT: analyte not tested
ND: analyte not detected.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
e: equipment wash blank
f: field replicate
R: resample

a: Values represent most stringent standard, criteria or action level. See Appendix I.

* The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

Detection limits are for dilution = 1.0 and represent target detection limits. Actual detection limits for each analysis are given in Appendix A.

TABLE 4.1.25-3

BEALE AFB: WATER DATA 1ST ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR BACKGROUND MONITORING WELLS

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels[a] Federal	State	BG-C-1GW BAFB-0468 02/23/89	BG-C-2GW BAFB-0458 02/15/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	193	195
Temperature	E170.1	N/A	deg C	NS	NS	21.0	20.5
pH	E150.1	N/A	pH	5-9	NS	7.01	7.34
Alkalinity - Total	SM403	1.0	mg/l	20	NS	98.4	72.8
Bicarbonate	SM403	1.0	mg/l	NS	NS	120.0	88.8
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	206	191
Chloride	E325.3	1.0	mg/l	250	250	3.0	7.5
Fluoride	E340.2	0.050	mg/l	2	1.4	0.16	0.49
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	6.1	16.3
Sulfate	E375.4	1.0	mg/l	250	250	3.8	17.8
TFH-Gas	TFH-GA	0.10	mg/l	NS	NS	0.10	2.0
Calcium	SW6010	1.00	mg/l	NS	NS	17.9	6.91
Magnesium	SW6010	1.00	mg/l	NS	NS	9.63	2.52
Potassium	SW6010	1.00	mg/l	NS	NS	1.30	ND
Sodium	SW6010	1.00	mg/l	NS	NS	10.7	35.6
Zinc	SW6010	0.0200	mg/l	0.110	0.012	ND	0.0380
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	14	8 BJ

NOTES:

Results reported for detected analytes only.
Detection limits for dilution = 1.0.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: values represent most stringent standard, criteria or action level. See Appendix I.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
r: resample
NT: analyte not tested
ND: analyte not detected
e: equipment wash blank
f: field replicate

* The Federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

TABLE 4.1.25-3

BEALE AFB: WATER DATA 2ND ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR BACKGROUND MONITORING WELLS

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels[a] Federal	State	BG-C-1GW BAFB-0555 05/30/89	BG-C-2GW BAFB-0554 05/30/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	200	298
Temperature	E170.1	N/A	deg C	NS	NS	21.0	21.0
pH	E150.1	N/A	pH	5-9	NS	7.01	7.88
Alkalinity - Total	SM403	1.0	mg/l	20	NS	100.2	94.4
Bicarbonate	SM403	1.0	mg/l	NS	NS	122.2	115.2
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	199	239
Chloride	E325.3	1.0	mg/l	250	250	2.5	8.0
Fluoride	E340.2	0.050	mg/l	2	1.4	0.16	0.46
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	5.9	11.7
Sulfate	E375.4	1.0	mg/l	250	250	4.4	11.5
Calcium	SW6010	1.00	mg/l	NS	NS	18.8	6.68
Magnesium	SW6010	1.00	mg/l	NS	NS	9.77	2.51
Potassium	SW6010	1.00	mg/l	NS	NS	1.00	1.10
Sodium	SW6010	1.00	mg/l	NS	NS	11.1	36.9
Toluene	SW8020	1	ug/l	14,300	100	2	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	6 J	6 J

NOTES:
Results reported for detected analytes only.
Detection limits for dilution = 1.0.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: values represent most stringent standard, criteria or action level. See Appendix I.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
r: resample
NT: analyte not tested
ND: analyte not detected
e: equipment wash blank
f: field replicate
* The Federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

TABLE 4.1.25-3

BEALE AFB: WATER DATA 3RD ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR BACKGROUND MONITORING WELLS

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels[a] Federal	State	BG-C-1GW BAFB-0604 08/25/89	BG-C-2GW BAFB-0603 08/25/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	900	195	200
Temperature	E170.1	N/A	deg C	NS	NS	21.8	21.0
pH	E150.1	N/A	pH	5-9	NS	7.79	6.94
Alkalinity - Total	SM403	1.0	mg/l	20	NS	109.0	84.0
Bicarbonate	SM403	1.0	mg/l	NS	NS	133.0	102.5
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	116	150
Chloride	E325.3	1.0	mg/l	250	250	3.9	7.9
Fluoride	E340.2	0.050	mg/l	2	1.4	0.15	0.42
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	16.9	15.3
Sulfate	E375.4	1.0	mg/l	250	250	3.4	11.9
Calcium	SW6010	1.00	mg/l	NS	NS	18.9	6.67
Magnesium	SW6010	1.00	mg/l	NS	NS	10.2	2.51
Sodium	SW6010	1.00	mg/l	NS	NS	11.3	36.4
Toluene	SW8020	1	ug/l	14,300	100	3	ND
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l	NS	NS	8 BJ	6 BJ
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	ND	10

NOTES:
Results reported for detected analytes only.
Detection limits for dilution = 1.0.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values.
a: values represent most stringent standard, criteria or action level. See Appendix I.
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
r: resample
NT: analyte not tested
ND: analyte not detected
e: equipment wash blank
f: field replicate
* The Federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.

TABLE 4.1.25

BEALE AFB: WATER DATA 4TH ROUND SAMPLING 1989

ANALYTICAL RESULTS TABLE FOR SITE 25

Parameter	Method	Detection Limit	Units	Standards, Criteria and Action Levels (a) Federal	State	BG-C-2GW BAFB-0714 11/29/89	BG-2-2GW BAFB-0715 11/29/89	BG-C-2GW BAFB-0716 11/29/89	BG-C-2GW BAFB-0717 11/29/89
Specific Conductivity	E120.1	1.0	umhos/cm	NS	NS	195	195	NT	NT
Temperature	E170.1	N/A	deg C	NS	NS	20.0	20.0	NT	NT
pH	E150.1	N/A	pH	NS	NS	8.26	8.26	NT	NT
Alkalinity - Total	SM403	1.0	mg/l	NS	NS	NT	83.6	18.0	NT
Bicarbonate	SM403	1.0	mg/l	NS	NS	NT	102.0	22.0	NT
Total Dissolved Solids	E160.1	3.0	mg/l	500	500	261	NT	NT	NT
Chloride	E325.3	1.0	mg/l	250	250	7.3	NT	NT	NT
Fluoride	E340.2	0.050	mg/l	2	1.4	0.51	NT	NT	NT
Nitrate + Nitrite	E353.3	0.050	mg/l	10*	45	13.4	NT	NT	NT
Sulfate	E375.4	1.0	mg/l	250	250	11.2	NT	NT	NT
Chemical Oxygen Demand (COD)	E410.4	7.0	mg/l	NS	NS	62.6	15.0	ND	NT
TFH-Diesel	TFH-DI	0.050	mg/l	NS	NS	0.070	NT	NT	NT
Calcium	SW6010	1.00	mg/l	NS	NS	6.61	NT	NT	NT
Magnesium	SW6010	1.00	mg/l	NS	NS	2.33	NT	NT	NT
Sodium	SW6010	1.00	mg/l	NS	NS	36.0	NT	NT	NT
Methylene chloride	SW8010	5	ug/l	NS	NS	ND	ND	270(430)	490(530)
Diethylphthalate	SW8270	10	ug/l			6 BJ	7 BJ	5 BJ	NT
N-Nitrosodiphenylamine (1)	SW8270	10	ug/l			12 B	13 B	11 B	NT
Di-n-Butylphthalate	SW8270	10	ug/l			14 B	15 B	12 B	NT
bis(2-Ethylhexyl)Phthalate	SW8270	10	ug/l	NS	NS	16	17	12	NT

NOTES:
Results reported for detected analytes only.
Detection limits for dilution = 1.0.
NS: No standard criteria or action level currently exists.
(): values listed in () are 2nd column confirmation values
B: analyte detected in blank
J: estimated value, below quantification limit
b: field blank (ambient condition blank)
r: resample
NT: analyte not tested
ND: analyte not detected
e: equipment wash blank
f: field replicate
a: Values represent most stringent standard, criteria or action level. See Appendix I.
*: The federal standard for Nitrate + Nitrite is given as 10 mg/l as Nitrogen which is equal to the State of California Standard of 45 mg/l for Nitrate + Nitrite given as Nitrate.
Detection limits based on contract limits; actual detection limits for each analysis are given in Appendix A.

results. It is unknown what the source of the TFH-gas is. It could be related to rinsing the bailer with hexane prior to sampling, but the second, third, and fourth rounds of sampling did not detect TFH-gas. The other detected analyte, bis(2-ethylhexyl) phthalate, was detected in both samples in the first round and from BG-C-2 in the fourth round but was also detected in one of the corresponding method blanks. Bis(2-ethylhexyl)phthalate was detected in the original, field replicate and equipment wash blank samples from BG-C-2 in the fourth quarter. Phthalate compounds were detected in samples from throughout the base and many of the laboratory method blanks, and probably represent false positive results.

In the fourth quarter samples from BG-C-2, methylene chloride was not detected in the normal sample or field replicate, but it was detected in the equipment wash blank at 270 ug/l (430 ug/l in the second column) and the ambient condition blank at 490 ug/l (530 ug/l in the second column). This has been traced to methylene chloride contaminated distilled water used for the blanks and occurred in several blank samples during the Stage 2-1 investigation.

No groundwater QC samples were collected during the first three rounds of background water sampling. N-nitrosodiphenylamine was detected below the LOQ in both the sample and the method blank for background wells BG-C-1 and BG-C-2 in the third sampling round. In the fourth quarter original, field replicate and equipment wash blank samples from BG-C-2, diethylphthalate was detected below the LOQ in the sample and the associated method blank, and N-nitrosodiphenylamine and di-n-butylphthalate were detected in the samples and associated method blanks.

Thallium was detected in six background soils samples but is not included in the table. These and all thallium results are false positive results due to an interference problem (primarily with titanium) in the ICP metals analysis. Analysis of thallium by ICP suffers from spectral interferences from titanium. The interferences occur on both sides of the spectral bandwidth, and are difficult if not impossible to correct for when the concentration of thallium is low compared to the concentrations of the interferents.

4.1.25.2.3 Analytical Results Obtained under Out-of-Control Conditions

No out-of-control conditions existed for analyses of background groundwater samples.

4.1.25.2.4 Corrective Actions Applied to Out-of-Control Events

No corrective actions were required.

4.1.25.3 Significance of Findings

Groundwater level and quality data are believed to represent conditions at the background wells at the time of measurement and sample collection, with the exception of the suspected false positive result for TFH-gas in the first sampling round and the phthalates in most samples.

The source of the elevated COD in the fourth round samples from BG-C-2, after the first three rounds were non-detects, is unknown. The reason may be related to irrigating the nearby golf course with gray water. The significance of the isolated TFH-diesel detection at BG-C-2 in the fourth round is unknown.

A statistical range of two standard deviations above and below the ICP metal value mean averages in 31 background samples was arbitrarily used to assess whether detected ICP metals at a particular site were high or low. This statistical range was compared with individual metal concentrations obtained at potentially contaminated areas. Naturally occurring metal concentrations may exceed this arbitrarily selected range.

In the background soil samples, lead was only detected in the surface sample in the background boring at Site 3, the Fire Protection Training Area. Although the background boring is 300 feet from the underground fuel storage tanks, leaded fuel may have been spilled in the vicinity of the background boring location at some time in the past. Beryllium was only detected in the 40-foot-deep sample from background boring 2-C-7 at Site 2. The beryllium concentration of 0.62 mg/kg, the analytical detection limit, is believed to represent the natural concentration of beryllium in that sample.

4.1.25.4 Baseline Risk Assessment

No risk assessment activities were performed as part of Stage 2-1.

4.2 PRIORITIZATION OF SITES FOR REMEDIAL ALTERNATIVES

This section presents discussion of prioritization of IRP sites, definition of individual sites grouped together as operable units, and preliminary identification of actions or additional data required at individual sites. The considerations are based on information collected in Stage 2-1 (CH2M HILL), Phase II, Stage 1 (AeroVironment), and other sources.

4.2.1 Relative Severity of Contamination

The IRP sites at Beale AFB have been prioritized, and are rank listed in Table 4.2.1-1. It should be noted that risk assessment activities have not been conducted which is why relative toxicity, and other related criteria, were not considered. This ranking was accomplished by considering the following criteria, which are presented in descending order of importance. Not all criteria were applicable at each site.

The ranking criteria considered:

- If contamination was present and, if so, which media were affected? Groundwater contamination was considered the most serious, surface water and sediments second, soil in the vadose zone third, and air fourth.

- If contamination was present, what was the level compared to regulatory standards and criteria? Primary or secondary MCL values were considered for groundwater. California DHS TTLC values or LUFT cleanup standards were used for comparison with soil contaminant concentrations. Many contaminants do not have specific standards or criteria at this time. All contaminants, however, must be considered during future risk assessment activities.

- What is the proximity of the site to known or potential receptors?

- What is the relative mobility of the contaminant in the environment?

- What is the physical setting of the site, especially with respect to relative permeability of the soil and proximity to surface water?

Table 4.2.1-1
RANKING OF IRP SITES
BASED ON SEVERITY OF CONTAMINATION

Site Number	Site Name	Ranking
13	Landfill No. 1	1
1	West Drainage Ditch	2
2	Photo Wastewater Treatment Plant	3
5	SR-71 Shelters Drainage Area	4
21	JP-7 Above Ground Fuel Storage Tanks	5
3	Fire Protection Training Area	6
18	Bulk Fuel Storage Area	7
23	Ninth Transportation Refueling/Maintenance Shop	8
6	Landfill No. 2	9
19	Photo Waste Emergency Holding Basin	10
24	Landfill No. 4	11
15	Landfill No. 3	12
20	Grease Pit	13
16	Explosive Ordnance Disposal Area	14
11	Aircraft Ground Equipment Maintenance Area	15
8	J-57 Test Cell	16
10	J-58 Test Cell	17
14	Transformer Drainage Pit	18
4	Battery Shop Dry Well	19
9	Entomology Building 2560	20
22	Abandoned Underground Storage Tanks	(Unranked)
7	Army Biological Production Area	(Unranked)
12	Entomology Building 440	(Unranked)
17	Best Slough	(Unranked)

- What is the history or longevity, and estimated volume of the source at the site?

The listing presented in Table 4.2.1-1 ranks all sites addressed in Stage 2-1, except Site 22. Site 22 was not ranked with the other sites because, although the site has potential for contamination, no samples were collected or analyses performed. Therefore, no data were available for comparison with data from other sites. Site 22 is addressed later in Section 4.2 with discussion of additional data needs. Site 24 also had no samples collected. This site is included in the rank listing because, unlike Site 22, Site 24 can be directly compared to other sites for which data exist.

Sites 7, 12, and 17, which have previously been recommended for No Further Action, have not been included in the ranking.

Sites 8, 10, and 14 have been included in the ranking, but no RI activities were conducted during Stage 2-1. Ranking of these sites is based entirely on previously collected, limited data.

The rank prioritization of IRP sites at Beale AFB with supporting reasons based on Stage 2-1 and previous work is:

Site 13:

- Volatile organic compounds detected in groundwater and soil
- TCE detected in groundwater at up to 300 times MCL (5 ug/l)
- Proximity to off base domestic well (2,200 feet)
- TCE is a mobile compound in water
- Contaminants appear to be widespread in groundwater
- Site has existed since the 1940s and contaminants may have been entering groundwater over 40 years

Site 1: West Drainage Ditch

- Volatile organic compounds detected in surface water and groundwater

- o TFH-diesel and -gas detected in surface water and sediments
- o TCE detected in groundwater above MCL (5 ug/l)
- o Proximity to base water supply wells
- o Potential for stream and groundwater transport off base
- o TCE and dissolved fuel hydrocarbons are mobile in water
- o Sediment contamination exists throughout length of sample collection area
- o Long history of flightline runoff

Site 2: Photo Wastewater Treatment Plant

- o TCE detected in soil and groundwater (first round) in adjacent boring and well (2-C-2SB and 2-C-1) (at levels below TTLC and MCL)
- o Cyanide detected in sludges, surface soils, vadose zone soils and groundwater (second and third rounds)
- o Dioxins detected in sludge pond sediments (at a level below TTLC)
- o Proximity to domestic well (3000 feet)
- o Long term documented operations

Site 5: SR-71 Shelters Drainage Area

- o TCE detected in groundwater (only in third round, not in first round samples)
- o TFH detected in surface water
- o TFH detected in surface soil samples
- o Contributing source to Site 1
- o Proximity to base boundary
- o Long history of fuel discharges from SR-71s

Site 21: JP-7 Above Ground Fuel Storage Tanks

- o TFH-gas detected in groundwater (only in first round, not confirmed in the third round samples)
- o TFH detected in ditch sediments
- o TFH inferred in surface water based on ditch sediment contamination and Stage 2-1 observations of surface water sheen
- o Probable contributing source to Site 1
- o Proximity to base boundary

Site 3: Fire Protection Training Area

- o TFH-diesel and -gas detected in soil
- o Heavy metal detected in soil (below TTLC)
- o Large volume of contaminated soil
- o No detected groundwater contamination
- o Documented history of activities

Site 18: Bulk Fuel Storage Area

- o Surface soil contaminated with TFH-diesel, -gas, and heavy metals (all below TTLC)
- o Potentially large volume of contaminated soil

Site 23: Ninth Transportation Refueling/Maintenance Shop

- o TFH-gas and diesel detected in groundwater (suspect results not confirmed in multiple rounds)
- o TFH detected in soil, both on site and in ditch draining away from site
- o Inferred surface water transport from Site 23

Site 6: Landfill No. 2

- o Tentative volatile organics in soil (below LOQ)

- Large waste volume, waste composition unknown
- Documented operation history of landfill

Site 19: Photo Waste Emergency Holding Basin

- Soil contamination detected in EHB clay bottom
- No detected soil contamination above action levels beneath EHB
- Lead, zinc, and manganese detected in groundwater (but probably not from this site)
- TCE, carbon tetrachloride, toluene, ethylbenzene, and xylele detected in groundwater (but probably not from this site)
- Surface water had very low pH (4.15) and high metals concentrations, but only in the fourth round (probably not from this site)

Site 24: Landfill No. 4

- Based on time of operation relative to Landfills No. 1 and No. 2, both of which have at least tentative volatile organics in soil
- Unknown waste type
- Upgradient of Sites 2 and 13, possible groundwater contamination source

Site 15: Landfill No. 3

- No detected groundwater contamination
- Sporadic TFH in soil (possible false positives)
- Contamination detected in ambient downwind air sample
- Contamination detected in landfill gas sample
- Active landfill

Site 20: Grease Pit

- Oil and grease, phenol, and metals detected in sediments (all below respective available TTLC values)
- No contamination detected beneath pit in one angled soil boring
- No groundwater data at Site 20 but, groundwater in area is contaminated with TCE (Site 13)

Site 16: Explosive Ordnance Disposal Area

- Metals and TFH-diesel detected in sediments from scrap metal trench (all below respective available TTLC values)
- TFH-gas detected in groundwater (fourth round only)
- RDX was detected and TNT tentatively detected (fourth round only)
- Active facility but low use area

Site 11: Aircraft Ground Equipment Maintenance Area

- TFH detected in surface soil (upper 3 to 5 feet)
- No detected groundwater contamination

Site 8: J-57 Test Cell

- Oil and grease, petroleum hydrocarbons, BETX, and solvents detected previously in shallow soils
- No detected groundwater contamination

Site 10: J-58 Test Cell

- Oil and grease, petroleum hydrocarbons, BETX, and solvents detected previously in shallow soils
- No detected groundwater contamination

Site 14: Transformer Drainage Pit

- Oil and grease detected in two shallow soil samples, PCB detected in one shallow soil sample

Site 4: Battery Shop Dry Well

- Low pH (3.6) in one soil sample
- No detected groundwater contamination

Site 9: Entomology Building 2560

- Single chlordane detection in shallow soil (Phase II, Stage 1) not confirmed in Stage 2-1
- Curbed concrete cap has been placed over rinse area
- Isolated contamination, low use area

4.2.2 Definition of Operable Units

EPA defines an operable unit as "A discrete part of a remedial action that can function independently as a unit and contributes to preventing or minimizing a release or threat of release." For the IRP, the operable units are the individual sites of concern (as opposed to media-specific operable units). For the most part, the sites are relatively independent and can be addressed separately. In some cases, evaluations may need to consider multiple sites because of waste-stream connections or proximity of sites.

Sites 1, 5, and 21 are considered an operable unit. Fuel hydrocarbons from Sites 5 and 21 migrate through surface water to Site 1. The source of fuel hydrocarbons at Site 5 was fuel leakage from the SR-71 aircraft fuel tanks. Most of this fuel was retained in an oil/water separator near the head of the storm drain from the site, but some escaped and was washed into the storm drain system. The source of fuel hydrocarbons at Site 21 is minor spills or leaks near the fuel tanks. An oil/water separator or other method of retaining fuel does not exist at the head of the drainage ditch from Site 21. Fuel hydrocarbons are carried from Site 21 downstream towards Site 1.

Surface water from Sites 5 and 21, and the flightline in general, is channelled into three 66-inch diameter corrugated metal pipes (CMP). Water in these pipes flows to the

west and discharges through a concrete headwall at Site 1. It is likely that any attenuation of TFH from the surface water is by adsorption onto soil lining the ditch. This is evidenced by the TFH-diesel and -gas detected in ditch soil samples collected at Site 21 and downstream of the headwall at Site 1. Conclusive evidence about the nature of fuel hydrocarbon adsorption onto natural sediments occurring in the West Side Drainage ditch were not available. Literature reviewed (AFESC, 1981a and AFESC, 1981b) indicated that adsorption characteristics were dependent on clay mineralogy and hydrocarbon type. The literature did indicate that non-polar compounds adsorbed onto clay will be released to the water with the sediments acting as a source when the relative TFH concentrations in water is lower than that in the sediments.

The source of TCE contamination in groundwater at Sites 1 and 5 or the TFH-gas at Site 21 is not known. These source(s) may be located both in the flightline area and at Site 1. No TCE or TFH was detected in the background well at Site 1, but TCE was detected in three shallow downgradient wells at Site 1. TCE was not detected in two deep downgradient wells at Site 1. TCE was only detected in the third quarter at Site 5 in the southern well (5-C-1) at 66 ug/1. TFH was only detected in the first round at 0.20 mg/1 at Site 21. The TFH-gas source at Site 21 may be from a spill or from any individual or combination of underground tanks or piping in the flightline area.

Other groups of IRP sites at Beale AFB are closely grouped, but are not interpreted to act as operable units. Sites 2, 13, and 20, though in effect surrounding each other (Site 2 encompasses Sites 13 and 20), have had completely independent waste streams. Groundwater sampled from Site 13 had detected TCE which indicates that TCE contamination is widespread at low concentrations in that area, but the source is unknown. Because of the proximity of these sites they could, however, be considered as an operable unit with respect to groundwater mitigation.

The area of Site 22, although categorized as a single site for IRP purposes, actually encompasses several other IRP sites. If a portion of the tanks indicated on the Camp Beale plans leaked fuel either during or after their active use, they could constitute a widespread hydrocarbon source. Because of the large area and small potential point sources, Site 22 is, by itself, considered an operable unit. At the conclusion of Stage 2-1 monitoring well installation, no monitoring wells were situated downgradient from most of the

area comprising Site 22. Therefore little groundwater data are available to assess whether abandoned tanks at Site 22 have impacted the groundwater.

4.2.3 Identification of Additional Data Needs with Further Remedial Investigations

Discussion is provided in this section, in the proposed rank order described in Section 4.2.1, of additional data required to further define the nature and extent of contamination at specific IRP sites on Beale AFB. The additional data are necessary before accurate evaluation of remedial actions or risk assessment can be completed. However, preliminary consideration (or exclusion) of some remedial action alternatives and preliminary risk assessment activities may be initiated based on the available data. As remedial actions are considered and risk assessment progresses, additional data needs may become evident.

The recommended actions for Beale AFB IRP sites are:

Site 13: Landfill No. 1

- Sampling and analysis of water from the domestic well (about 2,200 feet to the west) has been conducted. The domestic well water was found to contain TCE. Water samples should continue to be collected periodically from water faucets or hose bibs at the residence. Beale AFB has provided drinking water to the residents supplied by this domestic well since August 1990.

- Additional monitoring wells are required to further delineate the upgradient, lateral, vertical, and downgradient extent of the TCE plume. A background well should be located east of the wastewater treatment plant. Three to five additional monitoring wells should be positioned laterally and downgradient of existing wells (Sites 2, 13, and off base well) which have had TCE detected. Two new deep monitoring wells should be installed immediately outside the landfill downgradient of 13-C-1 to form a three well cluster. They should be screened in the next two lower permeable zones below where 13-C-1 is screened to evaluate the vertical extent of contamination and the vertical groundwater gradient.

- Monitor existing groundwater wells for purgeable hydrocarbons, volatile aromatics, and fuel hydrocarbons.

Site 1: West Drainage Ditch

- Cease discharge of fuel hydrocarbons to the stream water. Beale AFB has reduced discharge of fuel hydrocarbons significantly with the Flightline Drainage Upgrade Project which will be completed in January 1991. The outfall structure at Site 1 has been upgraded to include a cement apron and weir which will detain floating petroleum products.

- Sample and analyze the base water supply wells for purgeable halocarbons, purgeable aromatics, and fuel hydrocarbons to determine if contamination has affected the Beale AFB water system.

- Install and sample additional downgradient groundwater monitoring wells to define the extent of the plume and to assess proximity of the TCE plume to the base water supply wells.

- Additional downstream sediment sampling to determine the approximate boundary of sediment contamination with TFH.

- Additional sediment sampling at greater depths than conducted in Stage 2-1 to determine the approximate lower boundary of soil contamination beneath the stream bed.

- Monitor existing groundwater wells.

Site 2: Photo Wastewater Treatment Plant

- Monitor existing groundwater wells.

- The photo laboratory now has a closed loop water system and no longer discharges to the PWTP which is being decommissioned. Beale AFB discontinued use of the sludge ponds in April 1990. Beale is going through RCRA closure for the ponds under a Federal Facilities Compliance Agreement with the USEPA.

Site 5: SR-71 Shelters Draining Area

- Further reduce discharge of fuel products to the surface water system. As part of the Flightline Drainage Upgrade Project, Beale has modified the oil/water separator and associated berms at Site 5 to more effectively capture runoff from a larger area. Oil absorbent booms have been installed around the oil/water separator. The SR-71 aircraft were removed from Beale AFB in 1990, which reduces discharge of fuel products.

- Sample existing wells and analyze for purgeable aromatics and halocarbons in addition to the fuel hydrocarbons because it is known that compounds detected in groundwater at Site 1 have been used in the flightline area. Additional sampling may confirm the TCE found in one groundwater sample at Site 5.

- Install and sample a background (upgradient) well to estimate the upgradient extent of groundwater contamination.

Site 21: JP-7 Above Ground Fuel Storage Tanks

- Monitor existing groundwater well.

- Auger borings along the ditch to determine lower bounds of TFH contamination.

Site 3: Fire Protection Training Area

- Monitor existing groundwater wells.

- Auger boring to groundwater in FPTA No. 1 to determine vertical extent of soil contamination.

- Auger boring to groundwater at underground storage tanks to determine vertical extent of soil contamination.

Site 18: Bulk Fuel Storage Area

- Install background (upgradient) well.

- Monitor existing groundwater wells.

- Auger borings below the bermed tank areas and along the railroad tracks near 18-C-1SB, -2SB, and -3SB to determine lower bounds of TFH and heavy metal contamination. Borings below the tank areas should be located near the highest concentrations in surface soil samples.

Site 23: Ninth Transportation Refueling/Maintenance Shop

- Continue to reduce discharge of fuel hydrocarbons to surface water.

- Conduct additional groundwater sampling and analysis for purgeable halocarbons, semivolatile organics, and fuel hydrocarbons.

- Determine areal extent of soil contamination beneath pavement by 20-foot-deep soil borings.

Site 6: Landfill No. 2

- Install and sample one additional downgradient (west side of site) monitoring well.

- Monitor existing groundwater wells.

Site 19: Photo Waste Emergency Holding Basin

- File TPCA exemption request.

- Either close the EHB, or if it is to remain for occasional use, remove clay and install impermeable (synthetic) liner. The EHB is currently not in use as the photographic laboratory now has a closed loop water treatment system.

- Monitor existing groundwater wells.

Site 24: Landfill No. 4

- Auger angled soil borings beneath the exposed trench.

- Install downgradient (west side of site) monitoring wells.

Site 15: Landfill No. 3

- Monitor groundwater as required by landfill permit.
- No further IRP action.

Site 20: Grease Pit

- Coordinate remedial actions with other operable unit Sites 2 and 13.
- No further IRP action.

Site 16: Explosive Ordnance Disposal Area

- Monitor groundwater in existing well.
- Install two additional monitoring wells positioned to determine groundwater flow direction at the site. One well should be located northwest of the trench and the other south of the trench.
- No further IRP action.

Site 11: Aircraft Ground Equipment Maintenance Area

- Monitor groundwater in the existing well.
- No further IRP action.

Site 8: J-57 Test Cell

- Conduct additional soil sampling to determine vertical and lateral extent of soil contamination.
- Investigate existing well (which had no water in it during the Stage 2-1 investigation despite a general rise in water levels in the flightline area) and monitor groundwater. Install a new well if necessary.

Site 10: J-58 Test Cell

- Conduct additional soil sampling to determine lateral and vertical extent of soil contamination.
- Monitor existing well.

Site 14: Transformer Discharge Pit

- Drill one soil boring to determine vertical extent of contamination.

Site 4: Battery Shop Dry Well

- Monitor groundwater to serve as upgradient data for flightline.
- Backfill or cap dry well.
- No further IRP action.

Site 9: Entomology Building 2560

- No further IRP action.

Site 22: Abandoned Underground Storage Tanks

- Excavate at all UST locations that indicate positive or tentative buried metal detections. Use of a magnetometer may facilitate more precise field location of where to dig.
- Remove any tanks discovered in the excavation operation.
- Sample and analyze soil beneath any tanks.
- Beale AFB has removed 21 post Camp Beale tanks and achieved soil cleanup in the area south of Warren Shingle Boulevard from A to C Streets prior to construction of a navigation school.
- On the basis of "potholing" program, evaluate the need to investigate additional Camp Beale tanks (tanks not included in Stage 2-1).

Site 7: Army Biological Production Area

- No further IRP action.

Site 12: Entomology Building 440

- No further IRP action.

Site 17: Best Slough

- No further action.

V. ALTERNATIVE REMEDIAL MEASURES

Feasibility studies to determine remedial alternatives were not included in the scope of Stage 2-1 activities. Some of the IRP sites at Beale AFB have previously, or are currently being recommended for no further action. These sites have not undergone a feasibility study. They are recommended for no further action based on a lack of evidence of environmental impacts. Sites recommended for no further action and sites recommended for additional IRP activities are discussed in Section VI.

VI. RECOMMENDATIONS

6.1 CRITERIA FOR RECOMMENDATIONS

Previously presented in Section 4.2 is a prioritization of Beale IRP sites for future actions. This prioritization was conceptually based on the presence or absence of contaminants, the potential migration pathways, comparison of contaminant concentrations to ARARs, proximity to potential receptors, and other criteria. Also included in Section 4.2 are generalized recommended actions for the IRP sites.

The discussion of recommendations in this section is based on the level of understanding of the nature and extent of contamination at each site and, therefore, whether additional investigations are necessary in accordance with the RI/FS process described in Section I. Recommendations are made on a site specific basis, in the order of site numbering, not the prioritized order presented in Section 4.2.

Recommendations fall into one of three categories: Category 1, sites requiring no further action; Category 2, sites requiring further actions in the form of additional remedial investigation, risk assessment, or feasibility study; and Category 3, sites for which a remedial action has been selected.

At this time, the majority of sites at Beale AFB (19 of 24) are Category 2 sites, even though several sites have apparently limited contamination either by areal extent or by concentrations compared to ARARs. It is probable that many of these sites would have been Category 1 sites if risk assessment activities had been included as part of Stage 2-1. However, because no risk assessment activities have been conducted, these sites cannot be recommended for no further action. In addition to Sites 7, 12, and 17, which were identified as no action sites in previous studies, Site 9 (Entomology Building 2560) and Site 20 (Grease Pit) have been added to the no action list.

None of the Beale AFB IRP sites are Category 3 sites at this time. Feasibility studies have not been initiated and, therefore, no remedial actions have been selected. Most of the sites for which additional actions have been recommended have had sufficient data collected to begin the feasibility study process. Additional data will probably need to be collected, but this can be accomplished as part of the FS process.

Table 6-1 presents the 24 IRP sites and the current recommended categorization for each site. Recommendations are further discussed in the following subsection on a site-specific basis.

6.2 SITE-SPECIFIC RECOMMENDATIONS

6.2.1 SITE 1: WEST DRAINAGE DITCH

Site 1 is a Category 2 site; additional activities needed. It is also considered to be in an operable unit with Sites 5 and 21. Therefore actions taken at Site 1 should be coordinated with activities at the other two sites.

Additional remedial investigation activities are required to further define the extent of groundwater contamination, to define the depth to which ditch sediments have been impacted, and the downstream distance of these impacts in surface water and sediments.

Groundwater monitoring needs to continue in order to establish whether TCE contamination is above or below state action levels. Previous studies detected TCE above the action level but, Stage 2-1 samples from the first round of sampling detected TCE at approximately the action level.

A preliminary risk assessment (RA) needs to be completed which addresses the contamination present in sediments, surface water, and groundwater. The results of this risk assessment should be used to help define the level of information still needed.

A preliminary feasibility study should be initiated to determine potentially feasible alternatives for mitigation of contamination at the site. The FS should also be used to help define the level of additional activities.

The most important recommendation at this time for Site 1 is to continue to work toward cessation of discharge of contaminants to the ditch. Until this occurs, contamination impacts at the site cannot be adequately defined and final site mitigation is not possible. The base should continue to address the handling of contaminated stormwater from the flightline areas, including collection, treatment, and disposal options. Beale AFB has reduced discharge of fuel hydrocarbons significantly with the Flightline Drainage

Table 6-1
RECOMMENDED ACTIONS

	SITE	Recommendation[a] Category	Recommended[b] Stage 2-2 Actions
*1.	West Drainage Ditch	2	RI/M/RA/FS
**2.	Photowaste Water Treatment Plant, Injection Well, and Sludge Basins	2	M/RA/FS
3.	Fire Protection Training Areas	2	RI/M/RA/FS
4.	Battery Shop Dry Well	2	M
*5.	SR-71 Shelters Drainage Area	2	M/RA/FS
6.	Landfill No. 2	2	M/RA
7.	Army Biological Production Area	1	NO ACTION
8.	J-57 Test Cell	2	RI/M
9.	Entomology Building 2560	1	NO ACTION
10.	J-58 Test Cell	2	RI/M/RA
11.	Aircraft Ground Equipment Maintenance Area	2	M/RA
12.	Entomology Building 440	1	NO ACTION
**13.	Landfill No. 1	2	RI/M/RA/FS
14.	Transformer Drainage Pit	2	RI
15.	Landfill No. 3	2	M
16.	Explosive Ordnance Disposal (EOD) Area	2	RI/M
17.	Best Slough	1	NO ACTION
18.	Bulk Fuel Storage Facility	2	RI/M
19.	Photowaste Emergency Holding Basin	2	M
**20.	Grease Pit (Sanitary Treatment Plant)	1	NO ACTION
*21.	JP-7 Aboveground Fuel Storage Tanks (Flightline)	2	RI/M
22.	Abandoned Underground Storage Tanks	2	RI
23.	Ninth Transportation Refueling/ Maintenance Shop	2	RI/M
24.	Landfill No. 4	2	RI

* Sites 1, 5, and 21 are considered an operable unit and all actions taken on these sites should be coordinated.

** Sites 2, 13, and 20 are not considered an operable unit but are in geographic proximity. Some actions taken at these sites may be coordinated.

[a] Category 1: No Further Action.
Category 2: Additional Activities Needed. The activities may include Remedial Investigation, Monitoring, Risk Assessment or Feasbility Study.

[b] RI: Remedial Investigation
M : Monitoring
RA: Risk Assessment
FS: Feasibility Study

Upgrade Project which will be completed in January 1991. The outfall structure at Site 1 has been upgraded to include a cement apron and weir which will detain floating petroleum products.

6.2.2 SITE 2: PHOTO WASTEWATER TREATMENT PLANT

Site 2 is a Category 2 site; additional activities needed. Site 2 is in proximity to Sites 13 and 20 and, although these sites are not considered an operable unit, actions taken at Site 2 should be coordinated with activities at the other two sites. The PWTP is no longer used and is being decommissioned. The photo laboratory now has a closed loop water treatment system and does not discharge to the PWTP.

No additional RI activities are recommended for Site 2 at this time. Wastes, surface spill areas, and subsurface soils have been sufficiently characterized to allow feasibility studies to begin.

Monitoring of groundwater needs to be continued to establish a pattern of contamination. This should be accomplished in coordination with groundwater monitoring at Site 13.

A preliminary risk assessment should be completed to evaluate contaminants present in the groundwater, sludge, and soil. The risk assessment results should be used to help define the level of groundwater data needed and whether or not additional activities need to be taken at the sludge ponds, spill areas, or injection well heads.

A preliminary feasibility study needs to be initiated to determine potentially feasible alternatives for mitigation, if necessary, of sludge, soil contamination, and groundwater contamination. The FS should also be used to help define the level of additional activities.

Based on the results of sludge sampling and analysis during Stage 2-1, the base has fenced the sludge ponds to restrict access by personnel and non-avian wildlife. Until the risk assessment and FS have been completed, it is recommended that this controlled access be continued and that exposure to soils and fugitive dust in the area of the plant be minimized as an added precaution. Beale AFB discontinued use of the sludge ponds in April 1990, and is going through RCRA closure for the ponds under a Federal Facilities Compliance Agreement with the USEPA.

6.2.3 SITE 3: FIRE PROTECTION TRAINING AREA

Site 3 is a Category 2 site; additional activities needed.

For FPTA No. 1, contamination was detected through the total sampling depth of approximately 20 feet BGS. Additional sampling needs to be conducted to determine the vertical extent of the contamination. At FPTA No. 2, contamination appears to be limited to near surface depths and additional remedial investigation does not appear to be warranted at this time. The overflow basin area had mercury detected to the total depth of sampling but additional sampling is not necessary at this time. Contaminants were also present in the deepest samples collected at the underground storage tank area. Additional sampling below this depth (approximately 50 feet BGS) will be necessary. It is possible, however, that the actual depth below 50 feet to which contaminants extend may have no effect on the feasible alternative selection, especially since no groundwater contamination has been detected to date.

Groundwater monitoring at Site 3 should be continued. Soils have been impacted at the site and it is reasonable to assume that there is potential for groundwater contamination even though it has not been detected to date.

Risk assessment activities should be initiated for Site 3. Contaminants are present but may not be entering exposure pathways other than exposure to personnel training at the site. Risk assessment linked to feasibility study will determine if soil mitigation actions are necessary and, if so, what actions are most appropriate. Risk assessment should also be used to help determine if additional activities are necessary.

Preliminary feasibility studies should be initiated to determine potential remedial alternatives for impacted soil. The FS should also be used to help determine if additional activities are necessary.

At a minimum, the base should consider removal of the underground storage tanks at Site 3. This should also include associated piping which may be a contributing source of soil contaminants. If the base elects to remove the underground storage tanks in the near future, recommended sampling of soils below the 50-foot depth can be completed after tank removal, in conjunction with soil sampling from immediately

below the tanks. By this method, the locations of leaks (if present) can be pinpointed and a deep boring can be drilled at the point of highest contamination.

If this is accomplished, the base should consider whether it is environmentally and economically preferable to replace the tanks, change to above-ground tanks, or eliminate tanks at the site. If the site is going to be used for fire training in the future, the base should consider site modifications and/or procedural changes that will help minimize potential impacts.

6.2.4 SITE 4: BATTERY SHOP DRY WELL

Site 4 is a Category 2 site; additional activities needed.

No further remedial investigation activities are recommended for Site 4. Potential contamination appears to be minimal in soils and has not been detected in groundwater to date.

Monitoring of groundwater from the one well at Site 4 is recommended, not so much to look for contaminants entering the groundwater from Site 4, but to serve as an upgradient well for the flightline area.

Although the dry well is no longer used as a disposal site, the base should consider abandonment of the dry well. Although various abandonment alternatives need to be considered, it is proposed that this be accomplished without the formal risk assessment/feasibility study process.

6.2.5 SITE 5: SR-71 SHELTERS DRAINAGE AREA

Site 5 is a Category 2 site; additional activities needed. It is also considered to be in an operable unit with Sites 1 and 21. Actions taken at Site 5 should be coordinated with actions taken at the other two sites.

No further remedial investigation activities are recommended for Site 5 at this time other than the installation of an appropriate background well. Soil contamination has been adequately characterized to initiate risk assessment and FS activities.

Groundwater monitoring at the site is recommended, including the installation of a background well to determine upgradient groundwater conditions. Contaminants were detected in the groundwater at this site (TCE in well 5-C-1), and also exist in the groundwater at the other operable unit sites

(Sites 1 and 21). Additional data are needed to establish contaminant concentrations versus action levels. If groundwater contamination is confirmed through monitoring, additional wells may be needed to define the extent of the contamination.

Risk assessment activities should be initiated in coordination with the other operable unit sites. RA results should be used to help determine if additional activities are needed.

Preliminary feasibility study activities should also be initiated in coordination with other operable unit sites. FS results should help define if additional data are needed.

As with Site 1, the most important recommendation is to continue to minimize discharge of contaminants. This will prevent further impacts to the soil and eliminate one source of contamination entering the storm drain that discharges at Site 1. The base should continue to improve methods of handling, treating, and disposing of contaminated stormwater and fuel leakage from the shelters. As part of the Flightline Drainage Upgrade Project, Beale has modified the oil/water separator and associated berms at Site 5 to more effectively capture runoff from a larger area. Oil absorbent booms have been installed around the oil/water separator. The SR-71 aircraft were removed from Beale AFB in 1990, which reduces discharge of fuel products.

6.2.6 SITE 6: LANDFILL NO. 2

Site 6 is a Category 2 site; additional activities needed.

Additional groundwater monitoring is recommended, even though contamination has not been detected to date. This is because there is a potential for landfill leachate to enter the groundwater. As part of this monitoring it is recommended that an additional downgradient well be installed north of well 6-A-1 and monitored.

A risk assessment for this site should be initiated and used to help determine if additional data are needed or if a feasibility study should be conducted. If the landfill has been closed in an appropriate manner, it may be determined that no additional activities other than monitoring are needed.

6.2.7 SITE 7: ARMY BIOLOGICAL PRODUCTION AREA

Site 7 is a Category 1 site; no further action. It was determined at the conclusion of Phase II, Stage 1 that no further actions were required for Site 7 because no contaminants were detected. A No Further Action Decision Document has been prepared and is given in Appendix J of this report.

6.2.8 SITE 8: J-57 TEST CELL

Site 8 is a Category 2 site; additional activities needed.

No activities were conducted at Site 8 during Stage 2-1. Previously, contaminants were detected in soils and it was recommended that additional remedial investigation activities be conducted to determine the extent of contamination.

Groundwater contamination was not detected during the previous investigation. However, during Stage 2-1, water level measurements were attempted at Site 8 on a quarterly basis. On each occasion, the existing well was found to be dry. Because groundwater levels at the base are generally rising, this makes the sampling of the well during previous investigations suspect. This well should be modified or a new well drilled in order to provide appropriate groundwater samples. Monitoring needs to be conducted to determine if impacts exist.

Although risk assessment activities could be initiated with available information, the data are so limited that it would be advantageous to conduct the RA after additional sampling and analysis.

6.2.9 SITE 9: ENTOMOLOGY BUILDING 2560

Site 9 is a Category 1 site; no further action.

No further remedial investigation activities are recommended for Site 9 because Stage 2-1 did not detect contaminants reported during previous studies.

Because the existence of contaminants could not be confirmed, it is proposed that a no action decision document be prepared for the site.

6.2.10 SITE 10: J-58 TEST CELL

Site 10 is a Category 2 site; additional activities needed.

No activities were conducted at Site 10 during Stage 2-1. Previously, contaminants were detected in soils and it was recommended that additional remedial investigation activities be conducted to determine the extent of contamination.

Groundwater contamination was not detected during the previous investigation, but monitoring needs to be conducted to confirm this finding.

Although risk assessment activities could be initiated with available information, the data are so limited that it would be preferable to conduct the RA after additional sampling and analysis.

6.2.11 SITE 11: AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA

Site 11 is a Category 2 site; additional activities needed.

No further remedial investigation activities are currently recommended for Site 11. Soil contamination has been adequately characterized and groundwater contamination has not been detected to date.

Groundwater monitoring is recommended, even though contamination has not been detected, primarily to provide groundwater data upgradient of the flightline area. Although groundwater contamination has not been detected to date, the Air Force may want to consider installing and sampling a well downgradient at Site 11.

Risk assessment activities should be conducted and used to determine if additional data need to be collected and if remedial actions need to be considered.

As with the other active sites on base, it is recommended that the base continue to consider ways to minimize ongoing or potential impacts.

6.2.12 SITE 12: ENTOMOLOGY BUILDING 440

Site 12 is a Category 1 site; no further action. It was determined at the conclusion of Phase II, Stage 1 that no further actions were required for Site 12 because no con-

taminants were detected. A No Further Action Decision Document has been prepared and is given in Appendix J of this report.

6.2.13 SITE 13: LANDFILL NO. 1

Site 13 is a Category 2 site; additional activities needed. Although not considered part of an operable unit, this site is in proximity to Sites 2 and 20. Any actions taken at Site 13, especially those related to groundwater, should be coordinated with actions at the other two sites.

Additional remedial investigation activities need to be initiated at Site 13 as soon as possible. Near the area of highest groundwater contamination, contaminants were detected in soils beneath a landfill trench. Additional soil investigation is not recommended at this time but, additional study of the wastes and soils may be required after initial risk assessment and feasibility study steps. Exploration into the landfill trenches is not recommended at this time because of safety concerns and the possibility that additional contaminants may be released to the subsurface.

Groundwater in the area is contaminated with chlorinated solvents at concentrations up to 300 times the state action levels. The extent of the groundwater contamination is not known and potential receptors are approximately 2,000 feet downgradient. Monitoring well 13-C-6 was installed approximately 1,000 feet downgradient from Site 13 and contained TCE at concentrations slightly above state action levels. Additional groundwater monitoring wells need to be installed downgradient from the site to determine the horizontal and vertical extent of contamination. Two deep monitoring wells should be drilled immediately downgradient of 13-C-1 and screened in the next two lower permeable zones below where 13-C-1 is screened. This will form a three well cluster at the point of highest detected contamination and provide data on vertical groundwater gradients. An additional upgradient well should also be installed because existing upgradient wells all contain contaminants.

In addition to new monitoring wells, existing monitoring wells need to be monitored to establish area-wide concentrations and variations of contaminants. Many of the areas away from the highest contamination location have contaminants near the state action levels.

Off base domestic supply wells downgradient from Site 13 have been sampled and contaminants similar to those at Site 13 were identified in one of the two wells sampled. This monitoring needs to be continued, a well inventory for off

base wells should be conducted, and other local wells considered for inclusion in the monitoring. Since August 1990, the USAF has provided drinking water for residences where contaminants have been detected.

Risk assessment activities should be initiated for Site 13. Although additional data regarding the extent of contamination needs to be collected, sufficient data are available to perform preliminary RA. The results of the RA should be used to help define additional data collection needs.

A feasibility study should also be initiated for Site 13. Sufficient information exists to begin evaluation of waste and soil contamination mitigation. Feasibility study activities can also be started for the groundwater. Although the extent is not fully known, sufficient information is available to preliminarily evaluate mitigation alternatives. The results of the FS should be used to determine if additional remedial investigation activities are needed, especially with respect to wastes and soils.

6.2.14 SITE 14: TRANSFORMER DRAINAGE PIT

Site 14 is a Category 2 site; additional activities needed.

No activities were conducted at Site 14 during Stage 2-1. Previously, contaminants were detected in soils and it was recommended that additional remedial investigation activities be conducted to determine the vertical extent of contamination. Because the horizontal extent of contamination had been adequately characterized in previous studies, one boring through the area of known contamination should be adequate to estimate vertical extent. Some soil was removed by Beale AFB in 1990, and the berms around the site taken down.

If contamination is confirmed to be restricted to a very small area, it is possible that a risk assessment and feasibility study of the site may not be necessary.

6.2.15 SITE 15: LANDFILL NO. 3

Site 15 is a Category 2 site; additional activities needed.

No additional remedial activities are recommended at this time other than ongoing monitoring. The site has been adequately characterized, and contamination has not been identified.

Additional groundwater monitoring is recommended, even though contamination has not been detected to date. This is because the site is an active disposal facility, there is a potential for landfill leachate to enter the groundwater, and monitoring is part of the activities required under the operating permit.

Because this site is an active disposal facility for non-hazardous wastes and is subject to State of California permits, and because no significant contamination has been identified in the subsurface, it is proposed that this site be removed from the IRP list without further risk assessment or feasibility study. The fact that this site is permitted to accept only non-hazardous wastes and contamination has not been identified means that the IRP/CERCLA approach is probably not applicable to this site.

6.2.16 SITE 16: EXPLOSIVE ORDNANCE DISPOSAL AREA

Site 16 is a Category 2 site: additional activities needed.

Additional remedial investigation activities are recommended in the form of installation of two additional wells and groundwater monitoring. Soil in the trench contains various metals, but the bottom of the trench is close to bedrock and additional vadose zone characterization would not be practical. However, only one well currently exists at the site and the direction of groundwater flow is not known. Additional wells are needed to determine groundwater flow direction and to confirm the TFH-gas and explosive compounds found in the fourth quarter.

6.2.17 SITE 17: BEST SLOUGH

Site 17 is a Category 1 site; no further action.

At the end of Phase II, Stage 1, it was concluded that no further action was needed at this site. State regulatory agencies requested a geophysical scan of the area, which was completed during Stage 2-1. The geophysical survey did not locate buried drums and, therefore, no further action is recommended. A No Further Action Decision Document has been prepared and is included in Appendix J of this report.

6.2.18 SITE 18: BULK FUEL STORAGE FACILITY

Site 18 is a Category 2 site; additional activities needed.

Additional remedial investigation activities are needed to determine the depth of soil contamination under the tank farms and at the railroad siding. Borings should be drilled in areas of highest surface soil contamination to determine vertical extent.

Installation of an upgradient background well and a second downgradient well for the AVGAS tanks (north of the present well) is needed. Groundwater monitoring should continue at these wells because potential exists for contaminants to enter the groundwater.

Additional data are required before risk assessment and the feasibility study can be adequately addressed.

As with other active facilities on base, it is recommended that the base continue to evaluate and implement handling procedures to help minimize ongoing or potential contamination.

6.2.19 SITE 19: PHOTO WASTE EMERGENCY HOLDING BASIN

Site 19 is a Category 2 site; additional activities needed.

No further remedial investigations are recommended at this time. The EHB is currently not in use. The photo laboratory now has a closed loop water treatment system and no longer discharges to the PWTP or the EHB. Soils within the basin have been characterized, and soil sampling beneath the basin encountered contamination inconsistently and at or near detection limits. Groundwater samples from the site did contain contamination in the form of TCE and carbon tetrachloride. These compounds are not known to be part of the waste stream previously held in the basin and, therefore, may be from some other source. Additional wells southeast of the site should be installed to better define groundwater flow paths and the vertical and horizontal extent of groundwater contamination in the area.

Groundwater monitoring is recommended because the basin does contain some contaminant components, and migration to groundwater is a possibility.

The base should also apply to the Regional Water Quality Control Board for an exemption from the Toxic Pits Cleanup

Act on the basis that the basin does not contain hazardous wastes.

6.2.20 SITE 20: SANITARY TREATMENT PLANT GREASE PIT

Site 20 is a Category 1 site; no further action. Although this site is not considered part of an operable unit, it is in proximity to Sites 2 and 13. Monitoring actions taken at the other two sites should be sufficient to monitor groundwater in the vicinity of Site 20.

No further remedial investigation activities are recommended for Site 20. Contaminants were detected in the pit but not in the soils beneath the pit.

Groundwater monitoring in the area of Site 20 is recommended because TCE has been detected throughout the area. This monitoring can, however, be accomplished in conjunction with Sites 2 and 13.

The base should consider other methods to dispose of the sanitary treatment plant grease skimmings. If another method is implemented, a feasibility study should be conducted to determine the most appropriate closure method.

6.2.21 SITE 21: JP-7 ABOVE GROUND FUEL STORAGE TANKS (FLIGHTLINE)

Site 21 is a Category 2 site; additional activities needed. This site is also considered part of an operable unit with Sites 1 and 5. Any actions taken at Site 21 should be coordinated with actions at the other two sites.

Additional remedial investigation activities are recommended at Site 21 to determine the depth of soil contamination. Additional groundwater monitoring for both TFH and volatile organic (8010/8020) compounds should be conducted as TFH-gas was detected in the first round sample and the well is downgradient from the flightline area where fuels and volatile organic chemicals are used. Because groundwater contamination may have originated from underground storage tanks in the area, it is recommended that new monitoring wells be installed not just at Site 21, but also along the flightline area where underground tanks are located.

Groundwater monitoring should continue at the existing well and new wells in the area. Longer screen lengths should be considered to help assure that the static water level is maintained within the screened interval. Surface water

runoff from the site and the adjacent ditch should also be sampled and analyzed to characterize contaminant loadings. Visual observation of hydrocarbon sheen was noted for surface water flowing to the site from areas to the east.

Until additional data are collected regarding the extent of contamination, initiation of the risk assessment and feasibility study are not warranted.

As with other active facilities on base, the base should continue to consider and implement methods to help minimize ongoing or potential contaminant releases.

6.2.22 SITE 22: ABANDONED UNDERGROUND STORAGE TANKS

Site 22 is a Category 2 site; additional activities needed. This "site" actually covers a substantial area of the base, including other IRP sites. As such, it is difficult to address in the typical RI/FS approach. As investigation continues for the abandoned tanks, and if contamination is encountered, this site may need to be divided into separate areas, so that specific problems can be addressed.

The next recommended step for this site is to continue to explore the locations of positive geophysical results (suspected tank locations). A magnetometer should be used to help relocate the suspected tanks and a backhoe used to determine if the tanks are actually still present. If tanks are encountered they should be removed, inspected, and the soils beneath the tanks sampled to determine if fuel hydrocarbons are present.

Beale AFB has removed 21 post Camp Beale tanks and achieved soil cleanup in the area south of Warren Shingle Boulevard from A to C Streets prior to construction of a navigation school.

After determining the status of tanks at all suspected locations identified in Stage 2-1, a determination can then be made regarding the approach for remaining suspected locations. If no abandoned tanks are encountered for the Stage 2-1 locations, additional investigations may be unnecessary. If tanks are located and impacts observed, additional studies may be warranted.

No monitoring, risk assessment, or feasibility study activities are recommended until additional information is collected.

6.2.23 SITE 23: NINTH TRANSPORTATION REFUELING/MAINTENANCE SHOP

Site 23 is a Category 2 site; additional activities needed.

Additional remedial investigation activities are recommended to define the horizontal extent of contaminants in the soil beneath the site. Stage 2-1 sampling did encounter soil contamination but this was limited to the upper 15 feet of soil. Borings drilled to approximately 20 feet should be sufficient to characterize the horizontal extent of contaminants, unless field observations indicate a need for deeper drilling.

Monitoring of groundwater should continue for both TFH and volatile organic (8010/8020) compounds. Contaminants in the soil have potential to move to groundwater and low concentrations of contaminants may be present in the groundwater at the existing well. Although groundwater contamination has not been detected to date, the Air Force may want to consider other downgradient monitoring wells as the soil is contaminated.

Risk assessment and feasibility study activities are not recommended until additional information is collected.

The recommendations given here for Site 23 may be affected by the planned construction of the base commissary. Construction should not proceed until the site, or at least the portion of the site under the proposed building footprint, has been adequately characterized and, if necessary, cleaned up. Some characterization has been conducted as part of pre-construction site studies. Results of this characterization need to be considered for future IRP actions.

6.2.24 SITE 24: LANDFILL NO. 4

Site 24 is a Category 2 site; additional activities needed.

This site was only recently added to the IRP list and a records search and site inspection was completed in Stage 2-1. Remedial investigation activities need to be initiated to determine trench locations and if the soil or groundwater beneath the site are contaminated.

Visual observation of the site confirmed that at least one trench is present. Base personnel have stated that parallel trenches may be present. It is recommended that a geophysical scan of the site be conducted to determine trench loca-

tions. Once trenches are confirmed, angled borings should be drilled under the trenches and soil samples collected and analyzed. As a first step to groundwater monitoring, two downgradient wells should be installed to the west of the trenches and monitored. These recommendations assume that, should trenches be confirmed, the site will be subject to California SWAT requirements.

No other activities are recommended until this remedial investigation is conducted.

6.2.25 BACKGROUND SAMPLING AND ADDITIONAL RECOMMENDATIONS

Background wells installed during Stage 2-1 should continue to be sampled and analyzed. A third background well should be constructed on the golf course approximately 2,000 feet southwest of BG-C-2 to better evaluate groundwater flow directions in the southern part of the base and nitrate concentrations in groundwater. Monitoring wells should be installed and sampled along the western base boundary to determine if contamination is moving off base. Additionally, all surface water flowing off the base should be sampled and analyzed on a regular basis to determine contaminant loadings, if any, and risks to potential receptors down stream.

Large diameter (6-inch casing) pump test wells should be constructed near the base boundary on the north and south parts of the base downgradient from Sites 1 and 13, respectively. Smaller diameter piezometers should be constructed nearby as observation wells with well screens at the midpoint of the pump test well screens. Long-term pump tests should be conducted at these wells to better evaluate aquifer properties in these areas. These wells could potentially be used as extraction wells later.

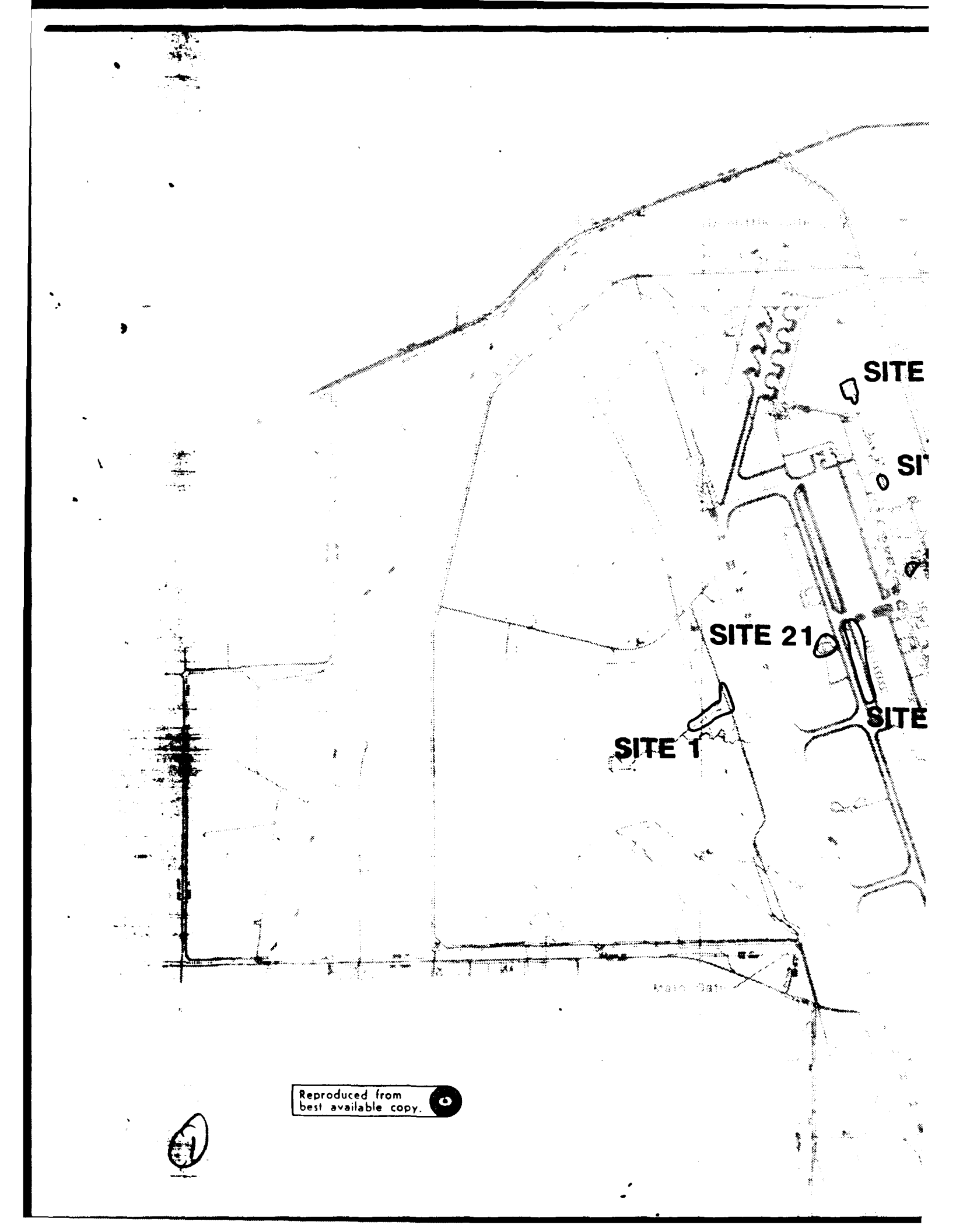
Community relations activities should be initiated upon or before the release of this report. A fact sheet should be prepared and distributed, information repository established at a convenient off base location, and a public meeting should be planned.

A majority of the IRP sites at Beale AFB involve fuel hydrocarbons as the primary contaminants of concern. Eventual mitigation of these sites will not be determined until risk assessments and feasibility studies are completed at the various sites. It is almost certain, however, that cleanup of hydrocarbon contaminated soils will be necessary at some of these sites. For this reason it is recommended that

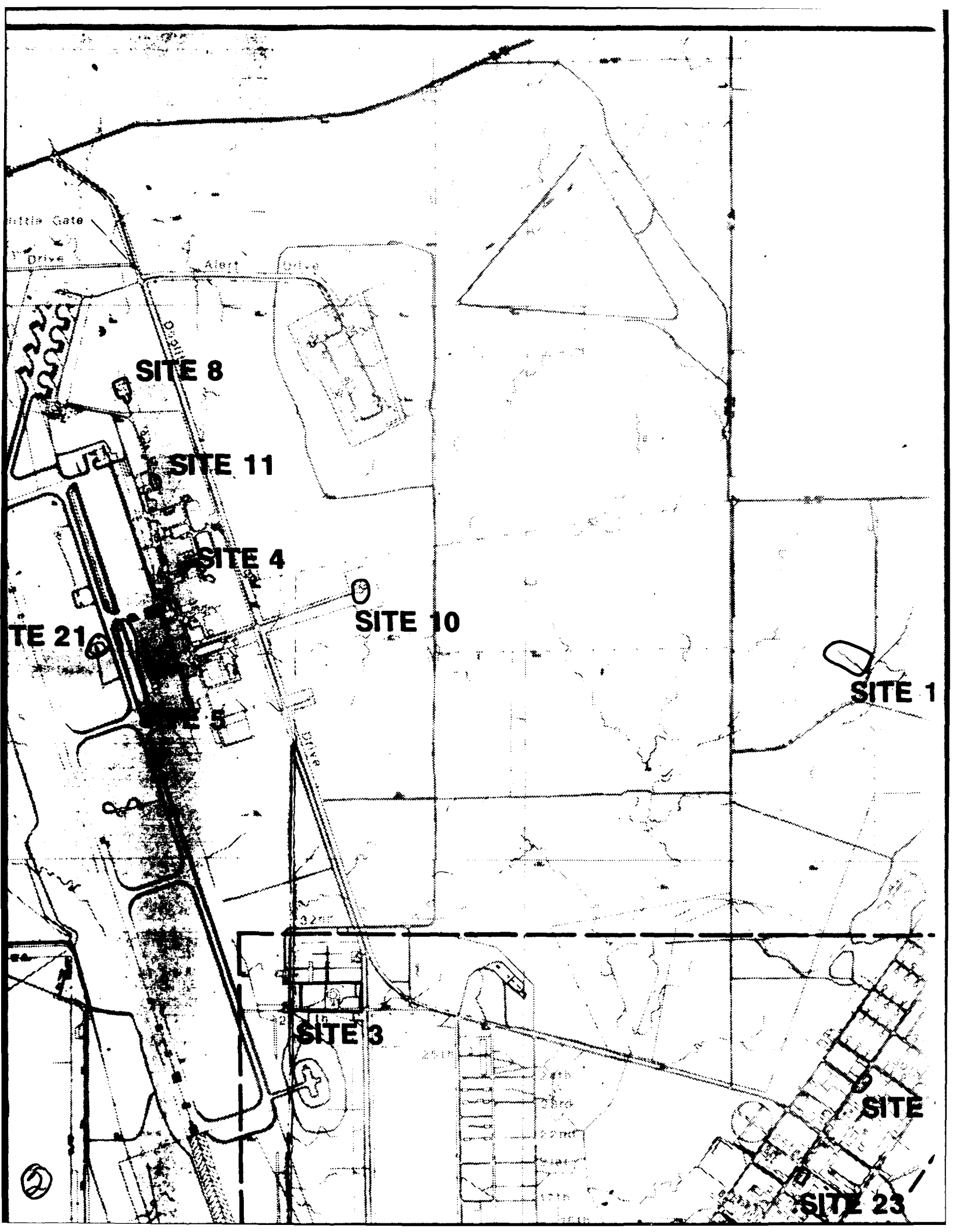
Beale AFB develop and obtain permits for a soil treatment area where hydrocarbon contaminated soils can be landfarmed to reduce the contaminant levels using biological treatment.

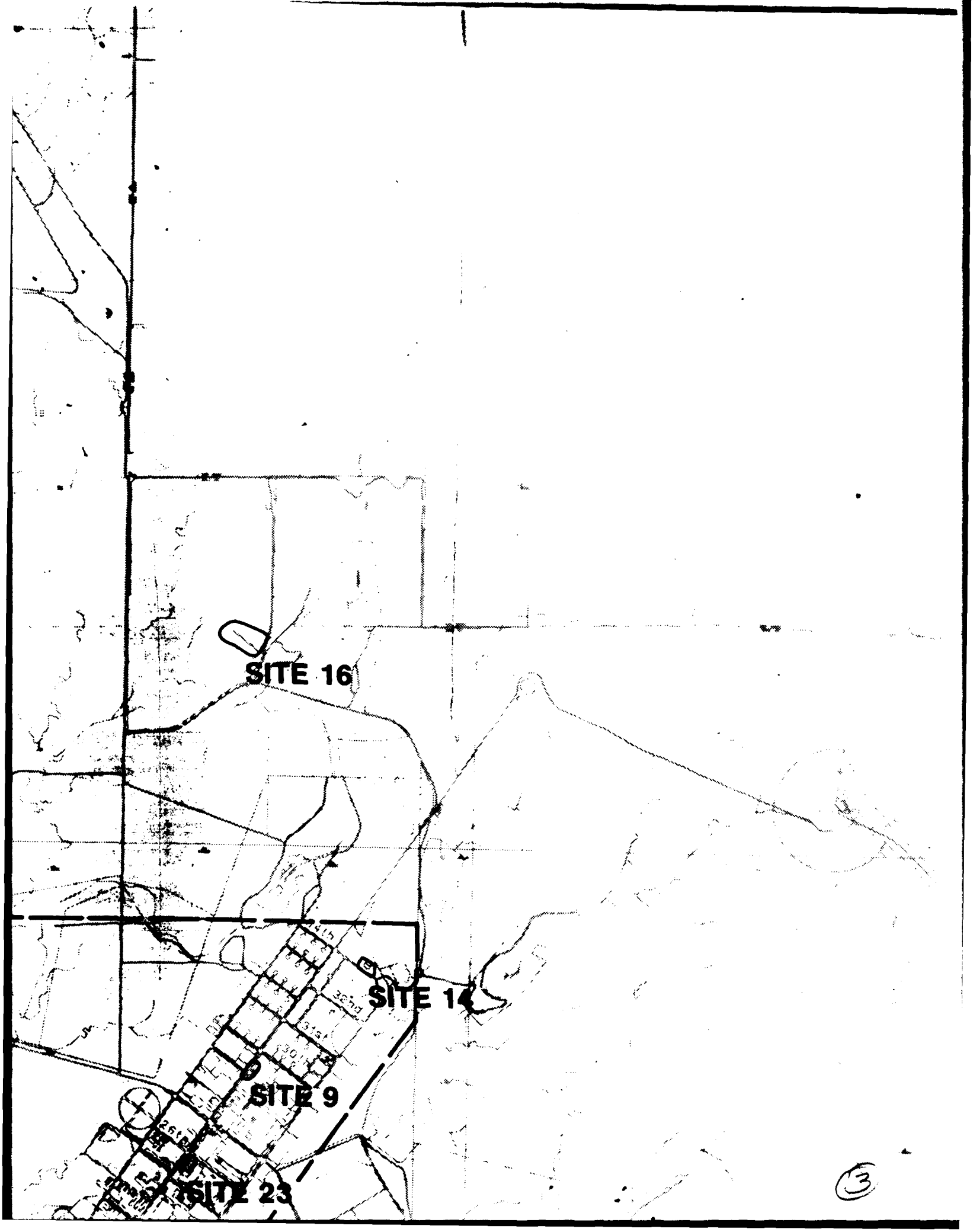
This facility would have to be specially prepared area with a liner, vadose zone monitors, a perimeter containment system, and wet weather cover, and would have to be permitted through the RWQCB and the DHS. Although this would represent an initial expenditure to construct and ongoing operation and maintenance costs, it is believed that these costs would be substantially less than other mitigation alternatives. The treatment area would also be useful not only for mitigation of existing IRP sites, but would also serve as a means to cleanup soils contaminated by future leaks and spills.

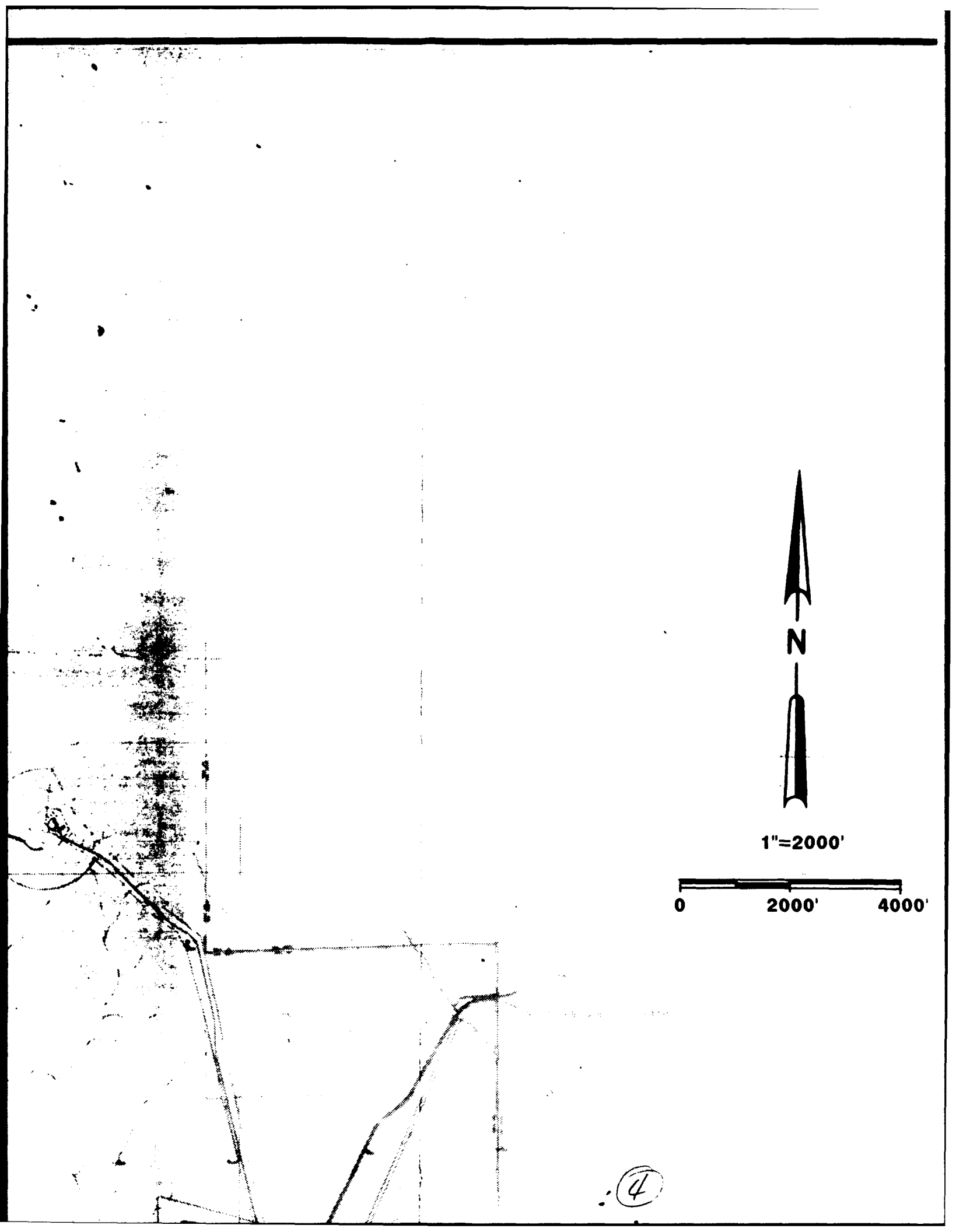
Implementation of a bio-treatment facility at Beale AFB may also be beneficial to other local bases. Mather AFB in Sacramento is scheduled for closure and may need to treat contaminated soils. McClellan AFB, also in Sacramento, may also need to treat soils but is in a more densely populated area than Beale and has much less available land area. The option of a bio-treatment facility operating at Beale AFB with soils trucked in from the other local bases should be considered if economically and technically feasible.

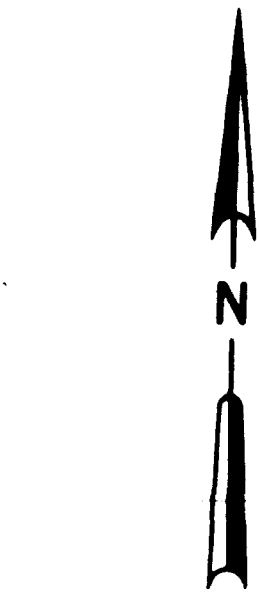


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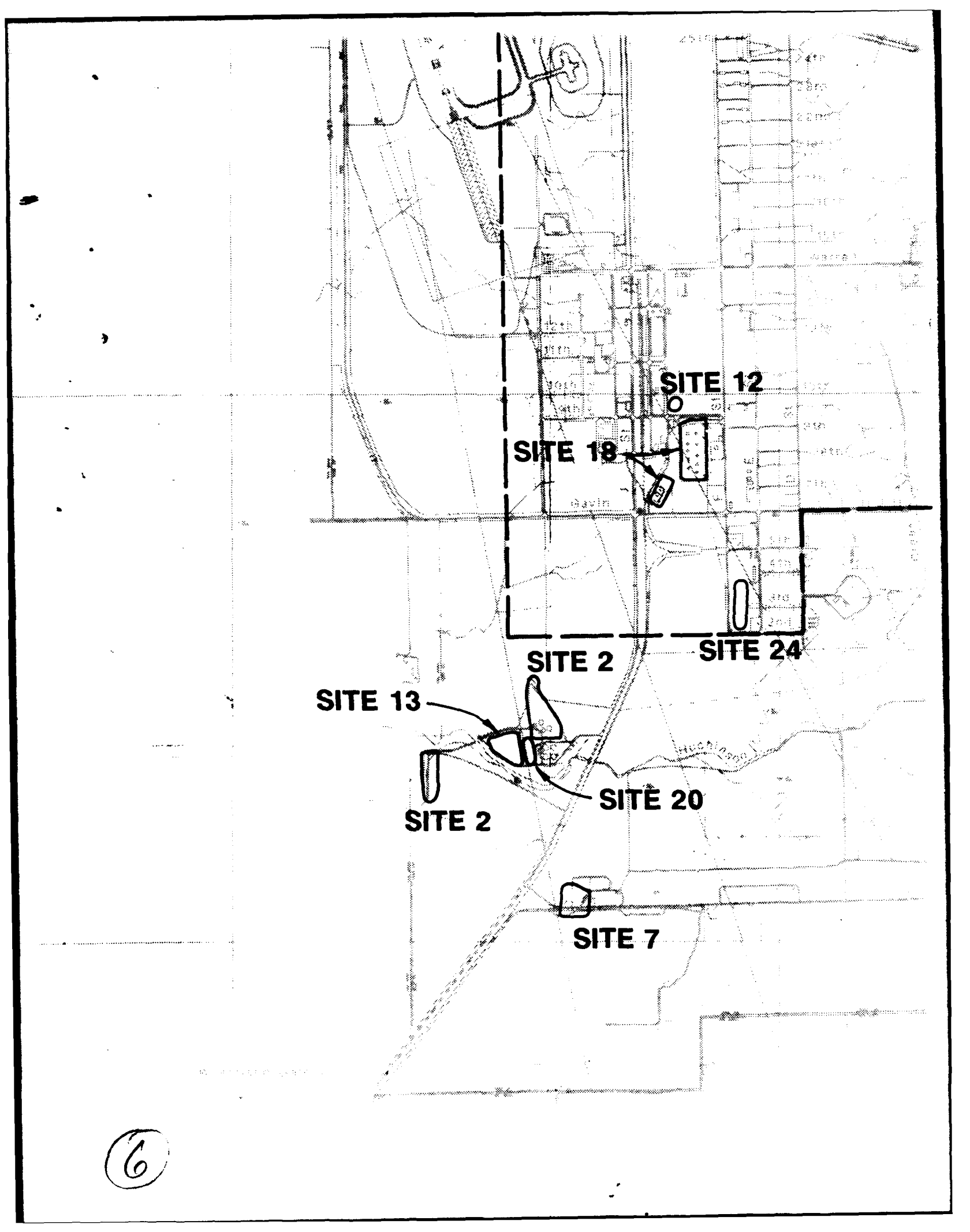

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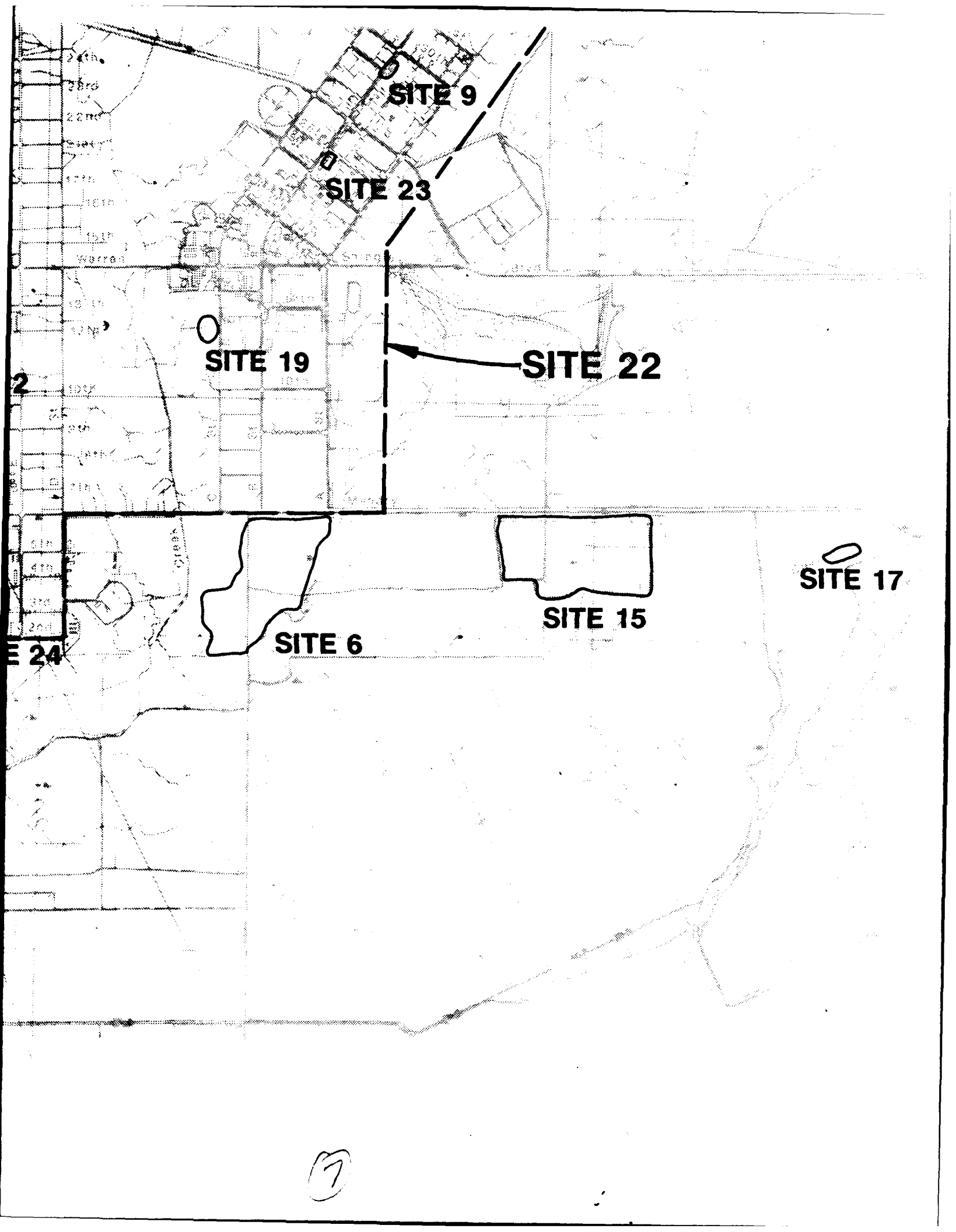


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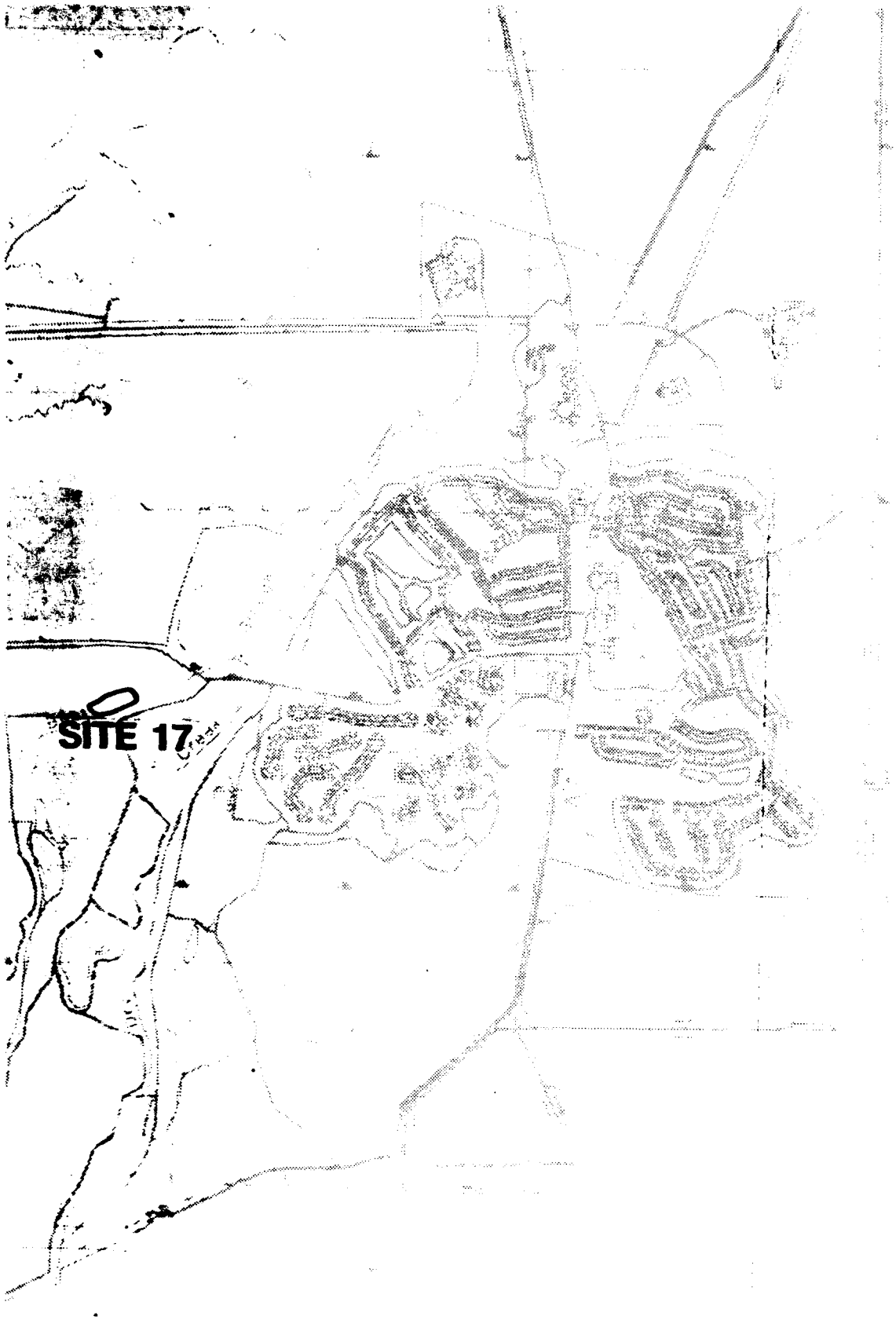
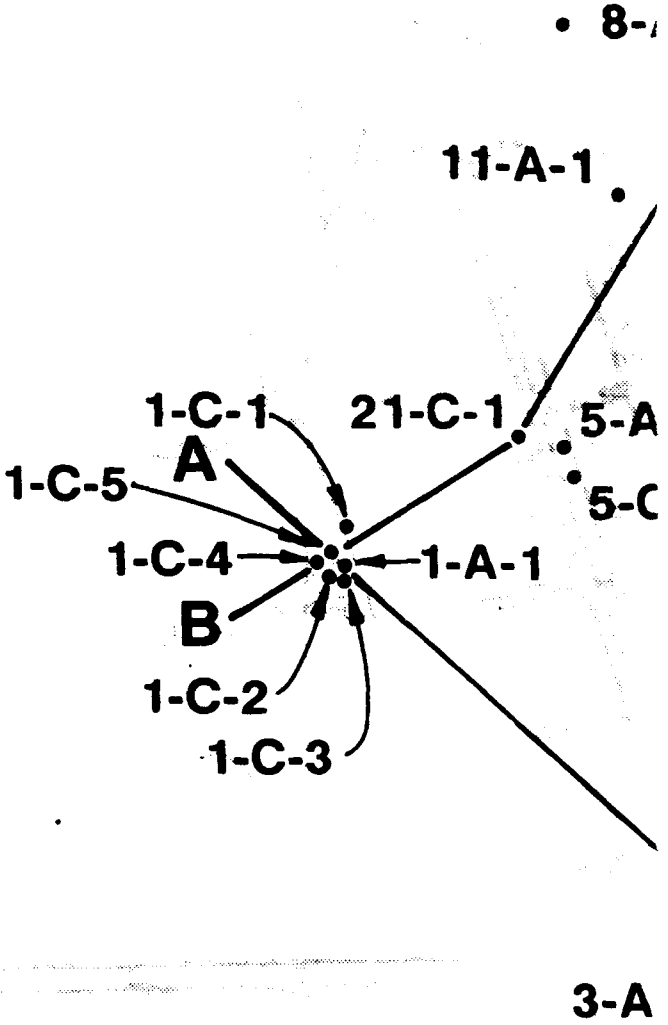

SITE 17

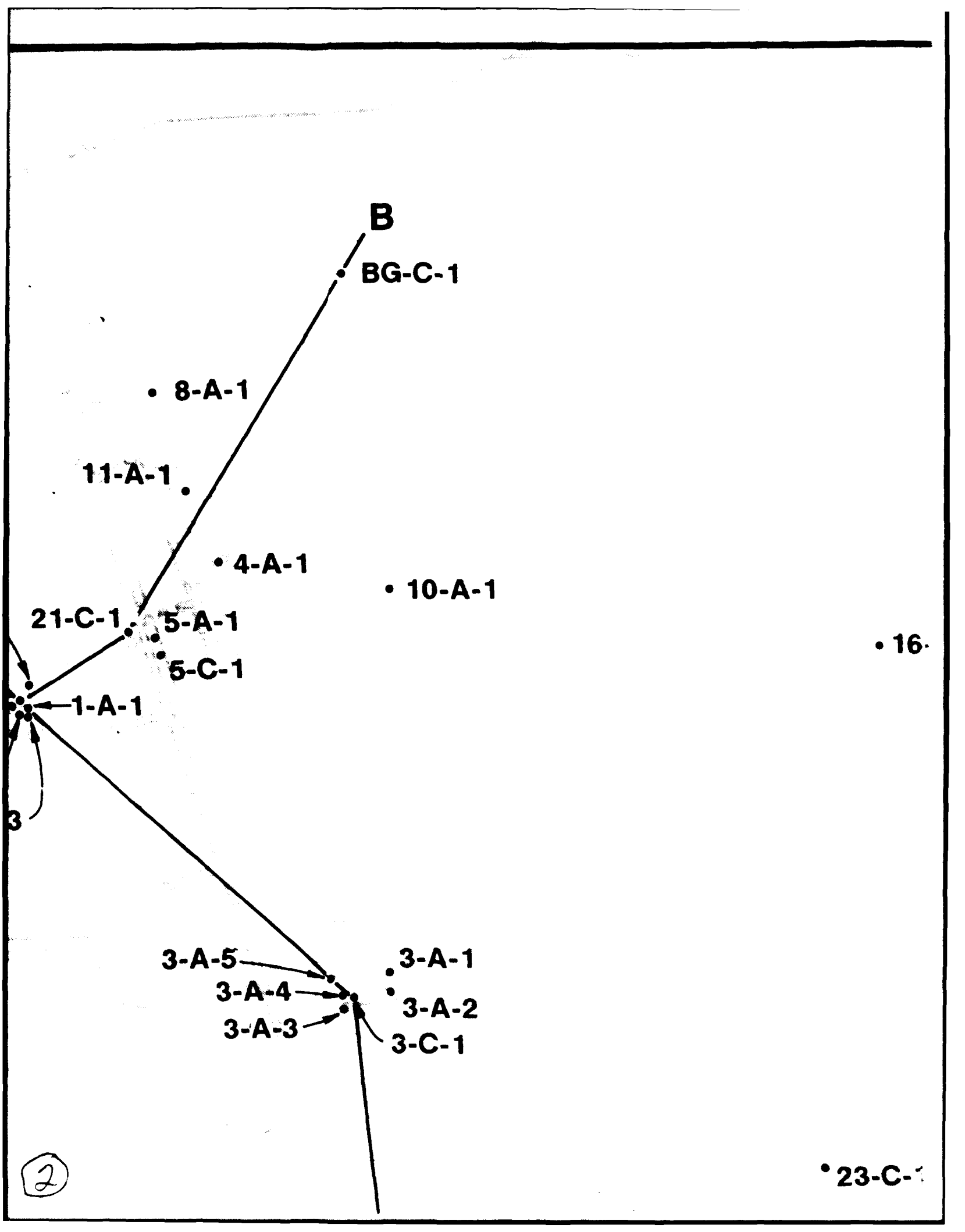
PLATE 1
IRP SITES AT BEALE AFB, CALIFORNIA

CH2M HILL

9

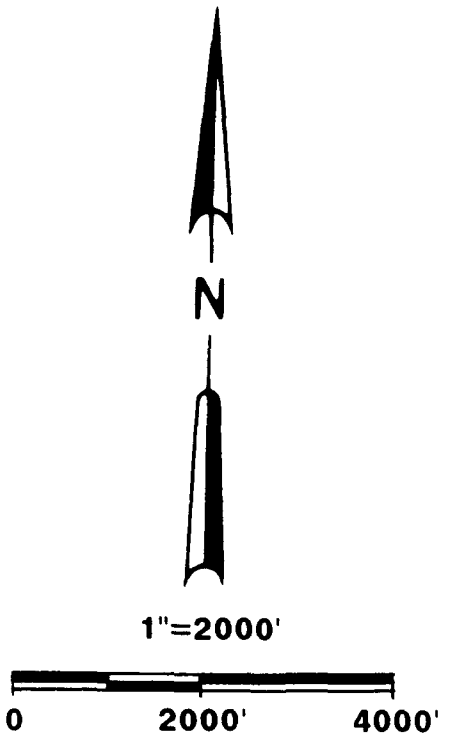


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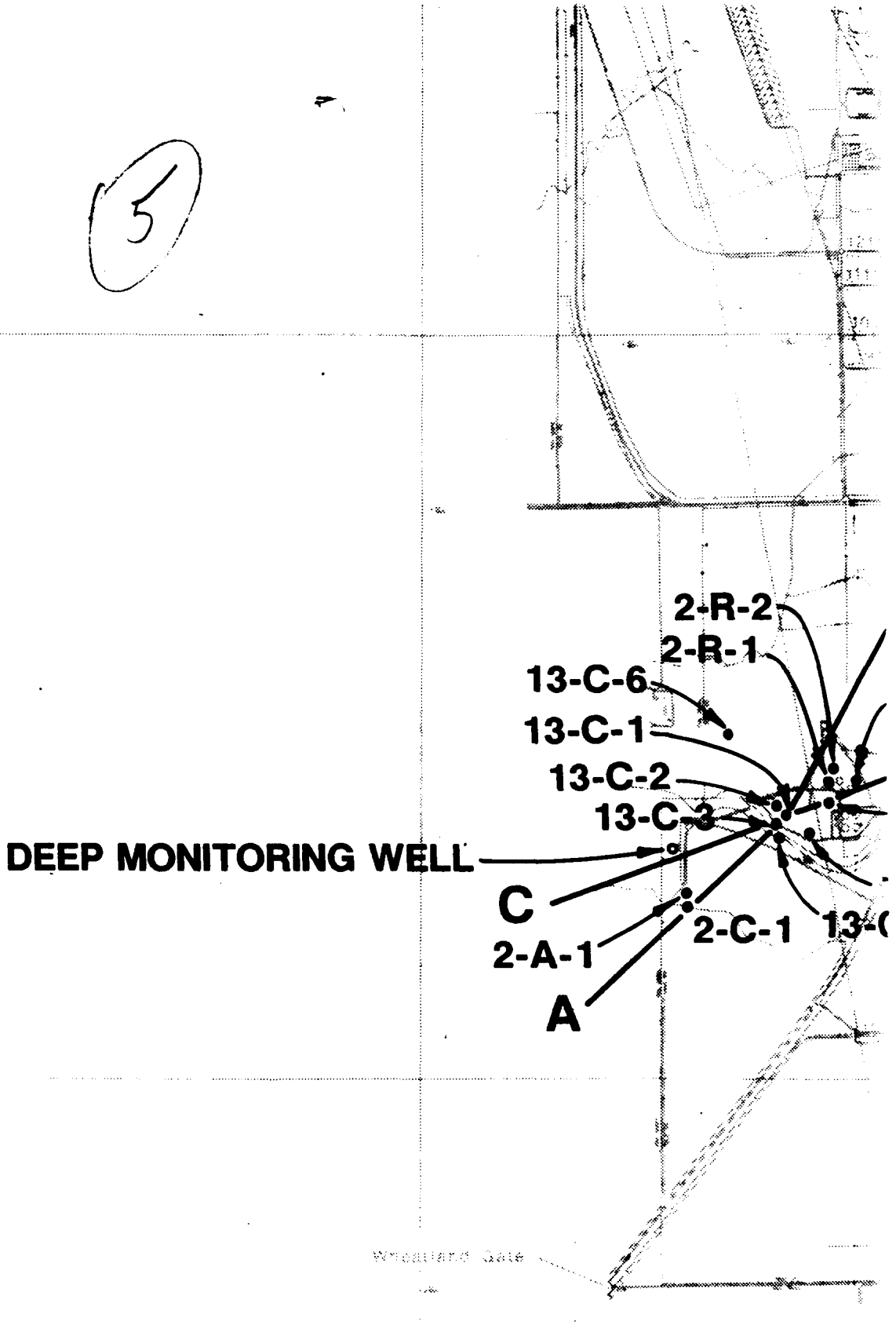

B
BG-C-1
8-A-1
11-A-1
4-A-1
10-A-1
21-C-1
5-A-1
5-C-1
16
1-A-1
3
3-A-5
3-A-4
3-A-3
3-A-1
3-A-2
3-C-1
2
23-C-1

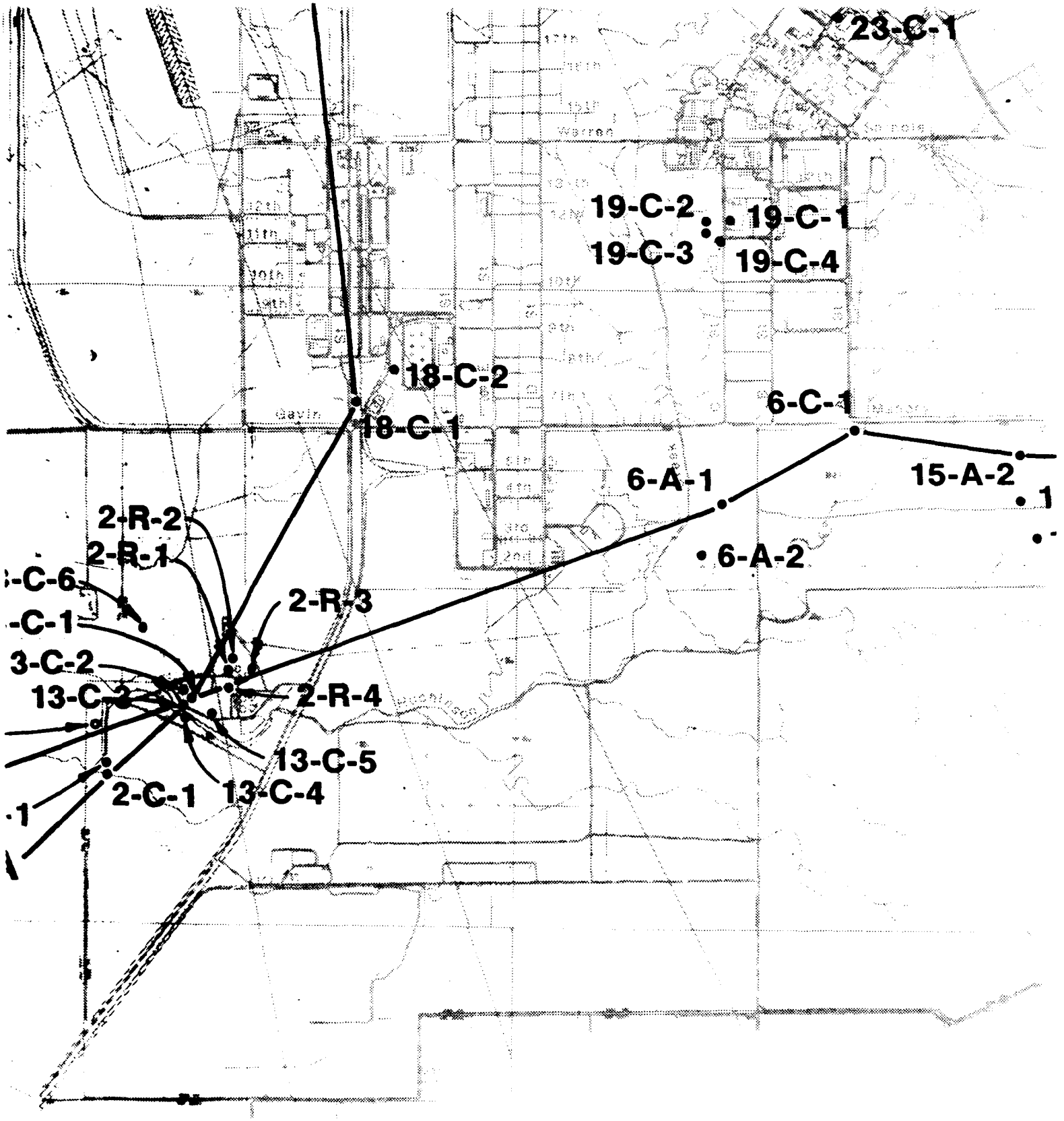
• 16-C-1

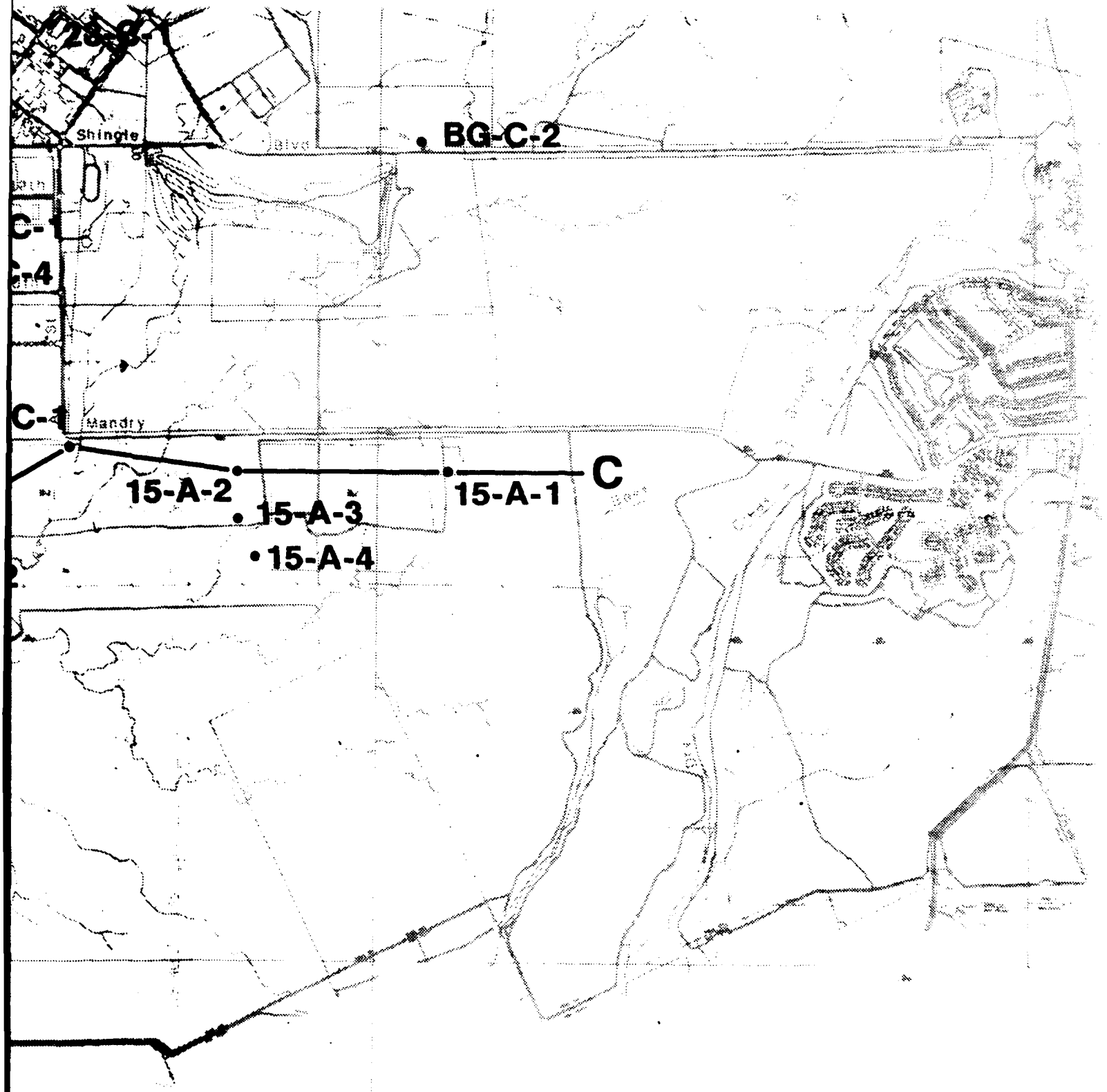
• 23-C-1


N
1"=2000'
0
2000'
4000'

5


2-R-2
2-R-1
13-C-6
13-C-1
13-C-2
13-C-3
DEEP MONITORING WELL
C
2-A-1
A
2-C-1
13-(


23-C-1
19-C-2
19-C-1
19-C-3
19-C-4
18-C-2
18-C-1
6-C-1
6-A-1
15-A-2
6-A-2
2-R-2
2-R-1
2-R-3
2-R-4
13-C-5
13-C-4
2-C-1


Shingle
BG-C-2
C-1
C-4
C-1
Mandry
15-A-2
15-A-3
15-A-4
15-A-1
C

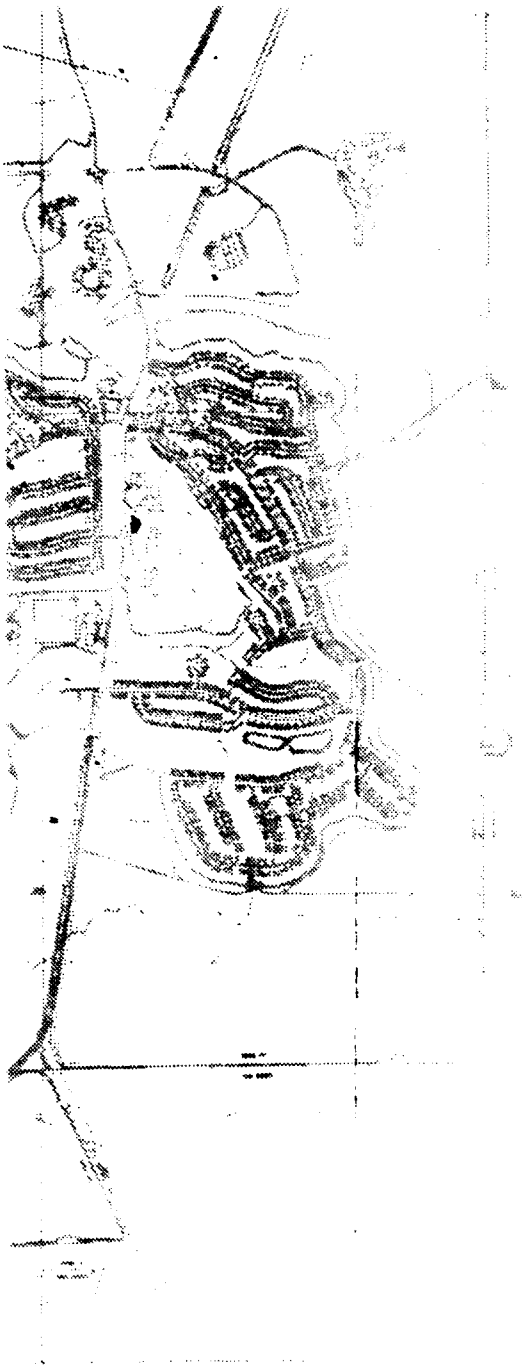
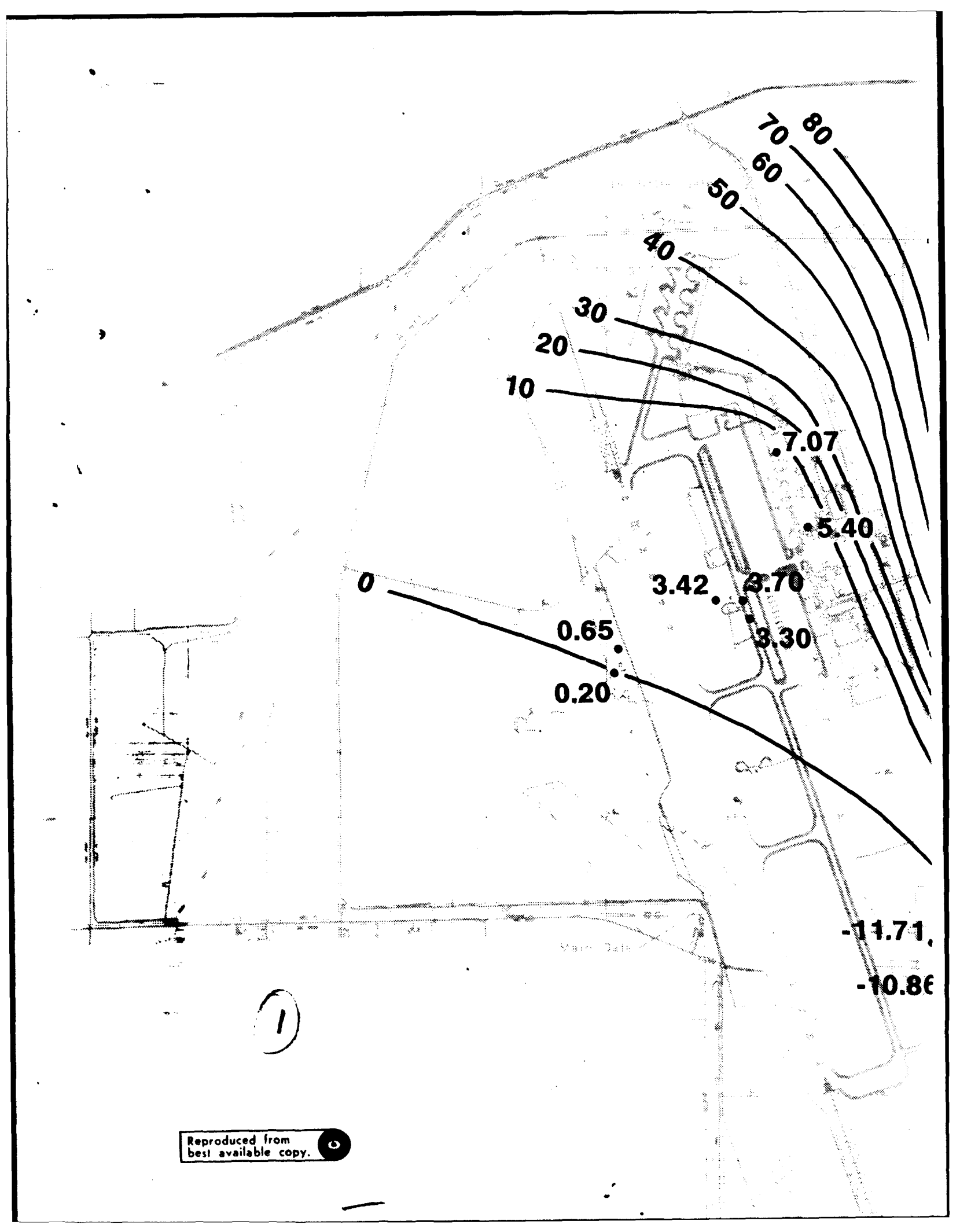


PLATE 2
WELL AND CROSS SECTION LOCATIONS
BEALE AIR FORCE BASE

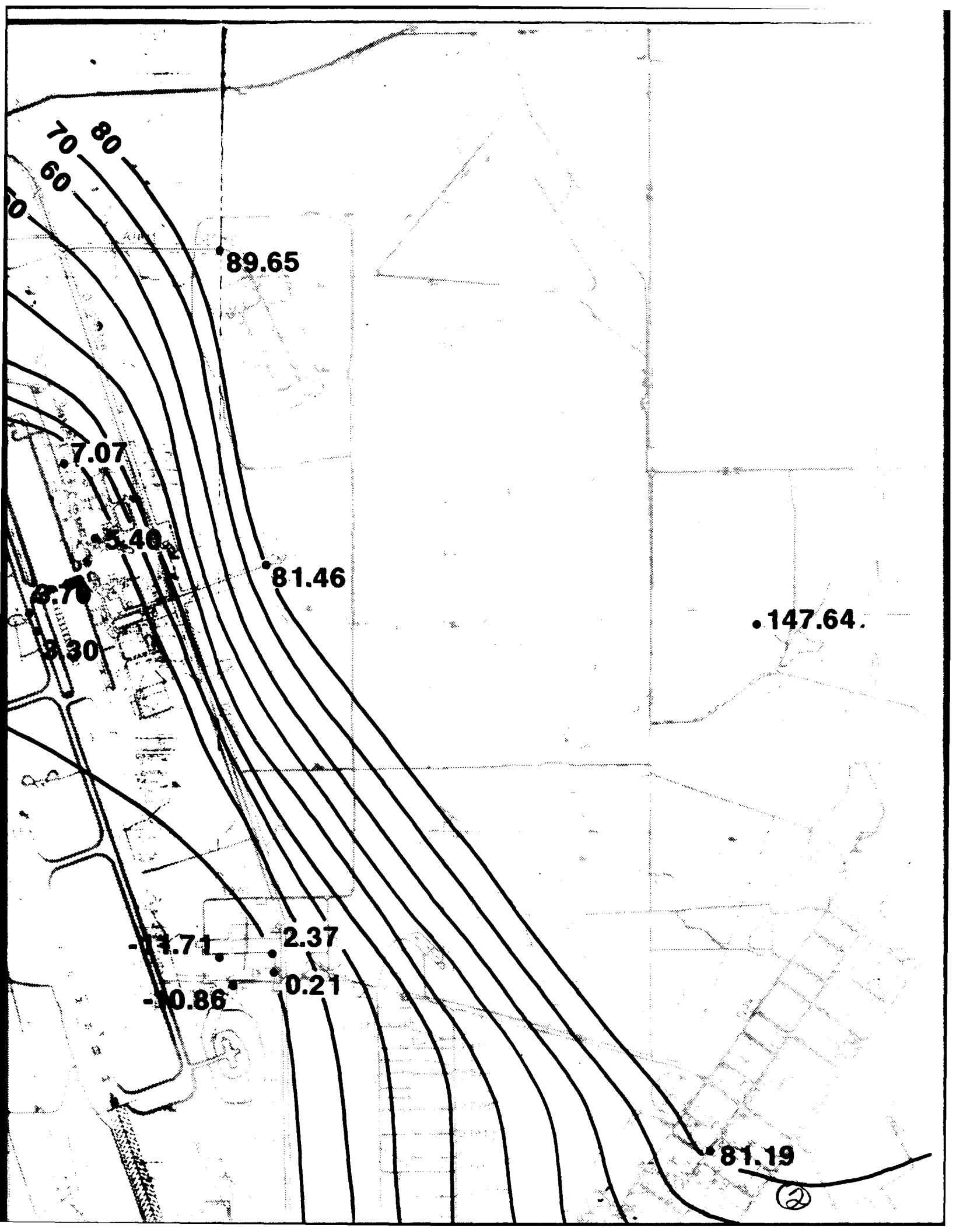
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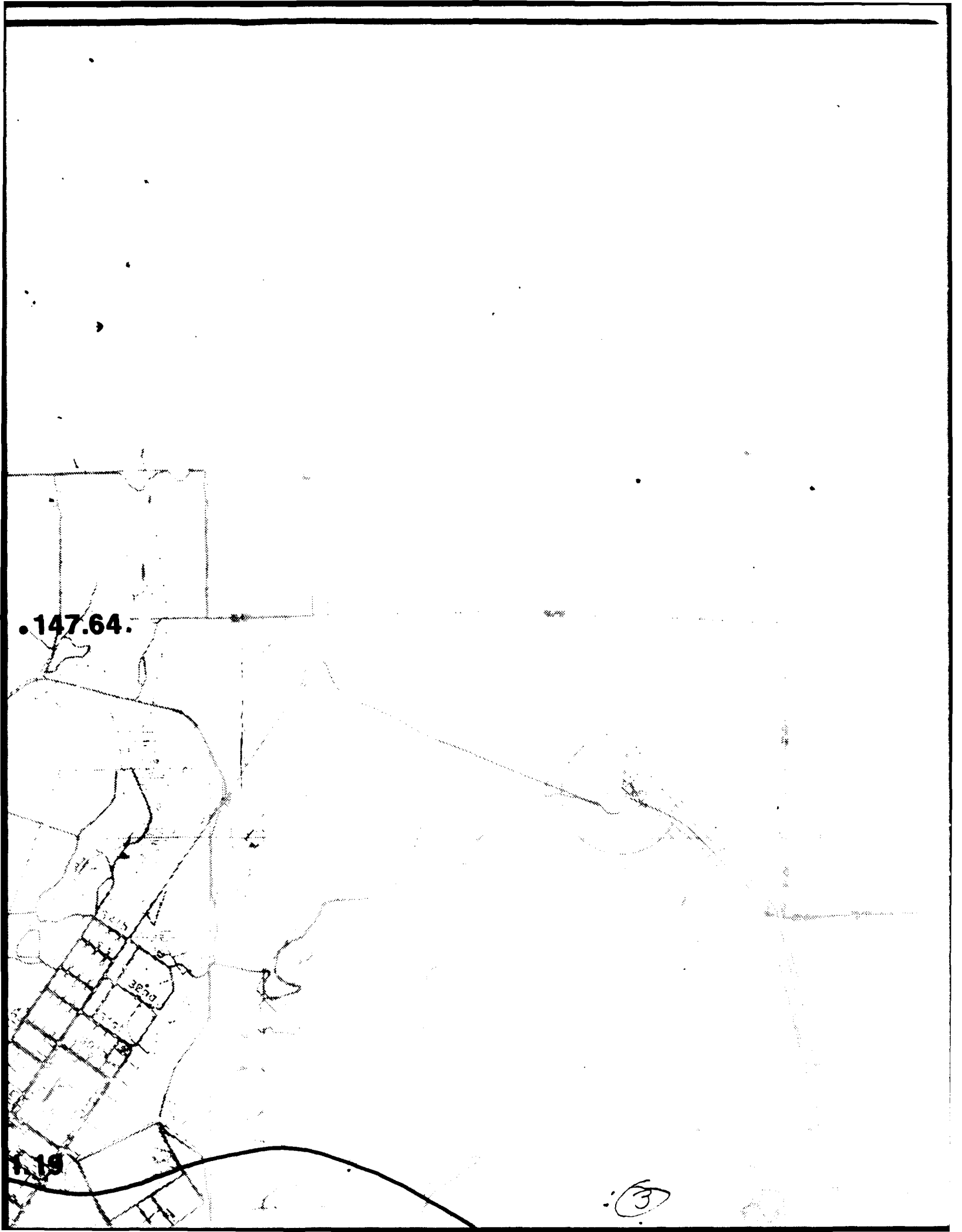
CH2M HILL

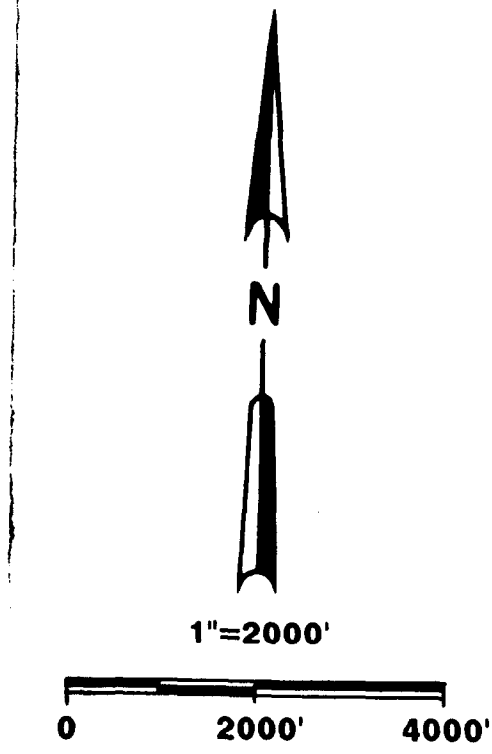


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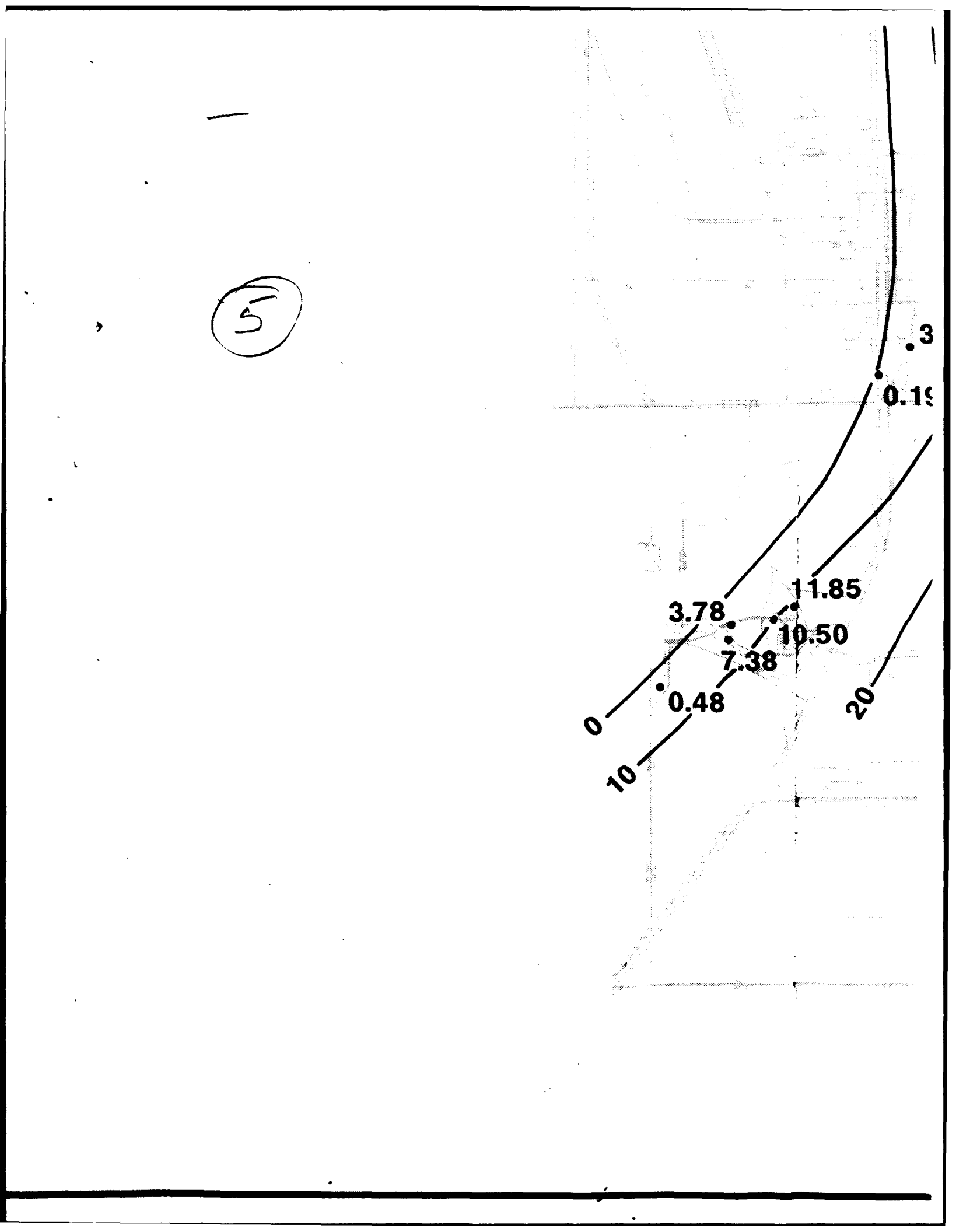
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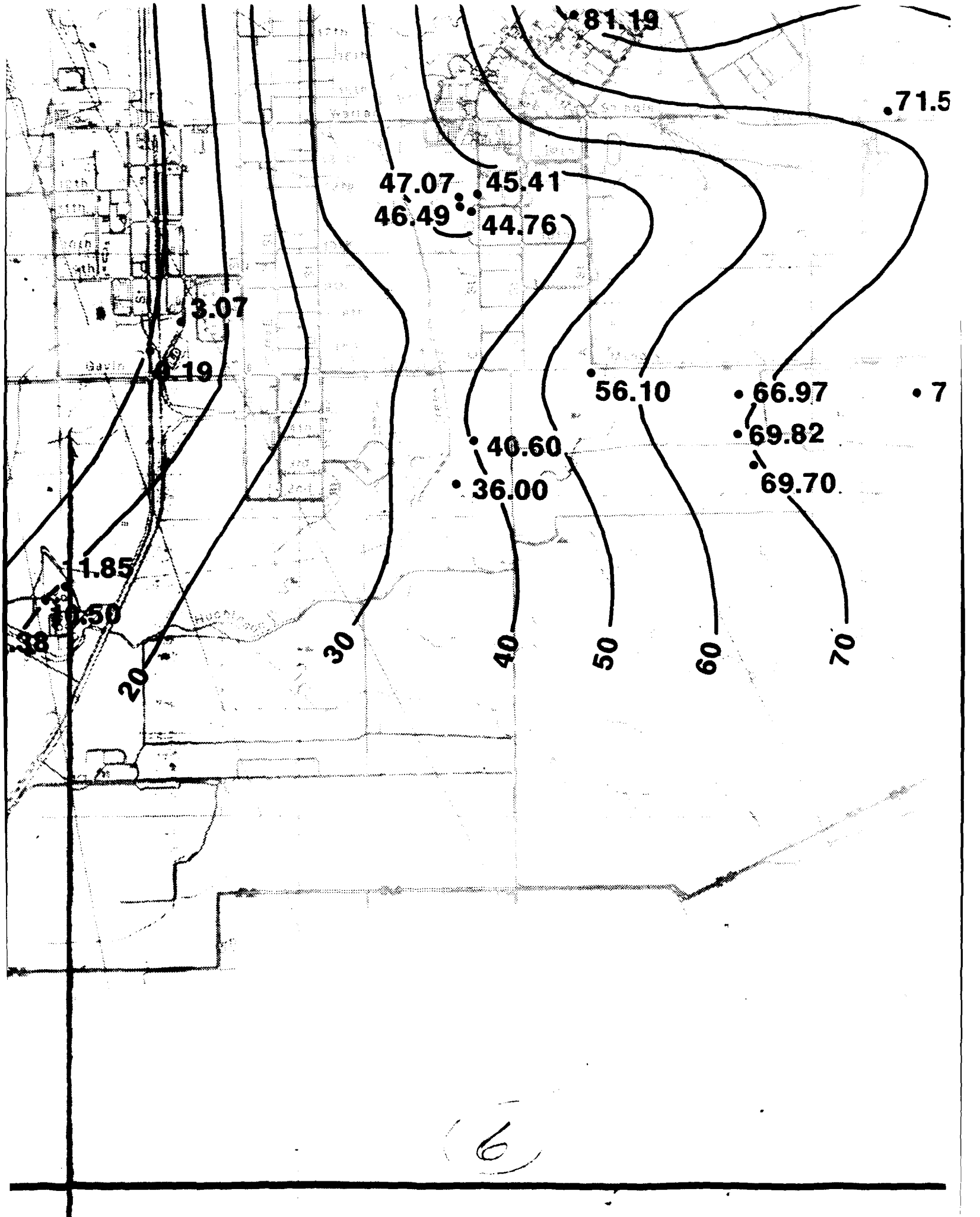

70
80
60
89.65
7.07
5.40
81.46
147.64
2.37
0.21
81.19
2

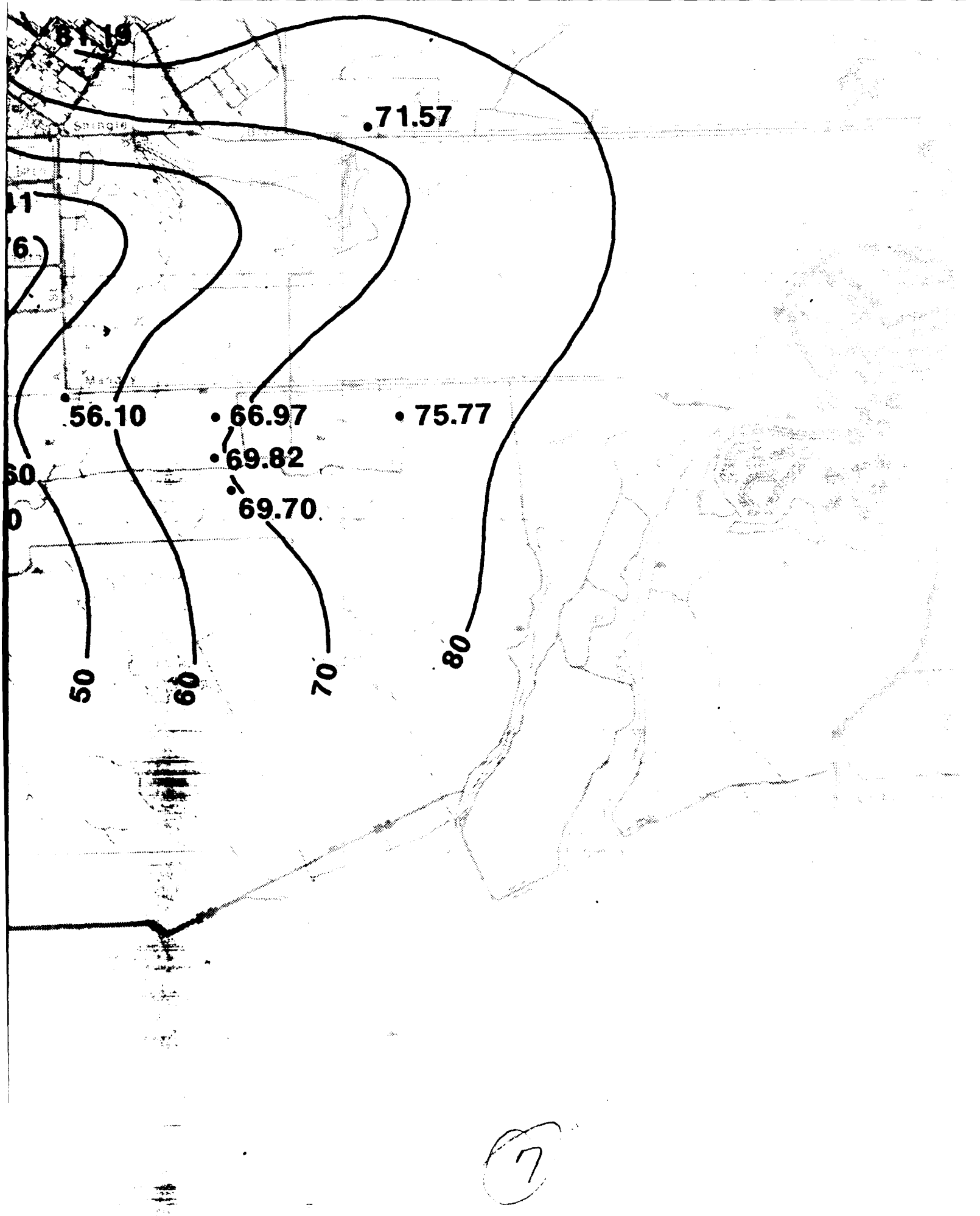

.147.64.
1.19



4


5
3
0.19
11.85
3.78
10.50
7.38
0.48
0
10
20


81.19
71.5
47.07
45.41
46.49
44.76
3.07
19
56.10
66.97
7
40.60
69.82
36.00
69.70
1.85
50
30
40
50
60
70
20


81.19
71.57
56.10
66.97
75.77
69.82
69.70
50
60
70
80

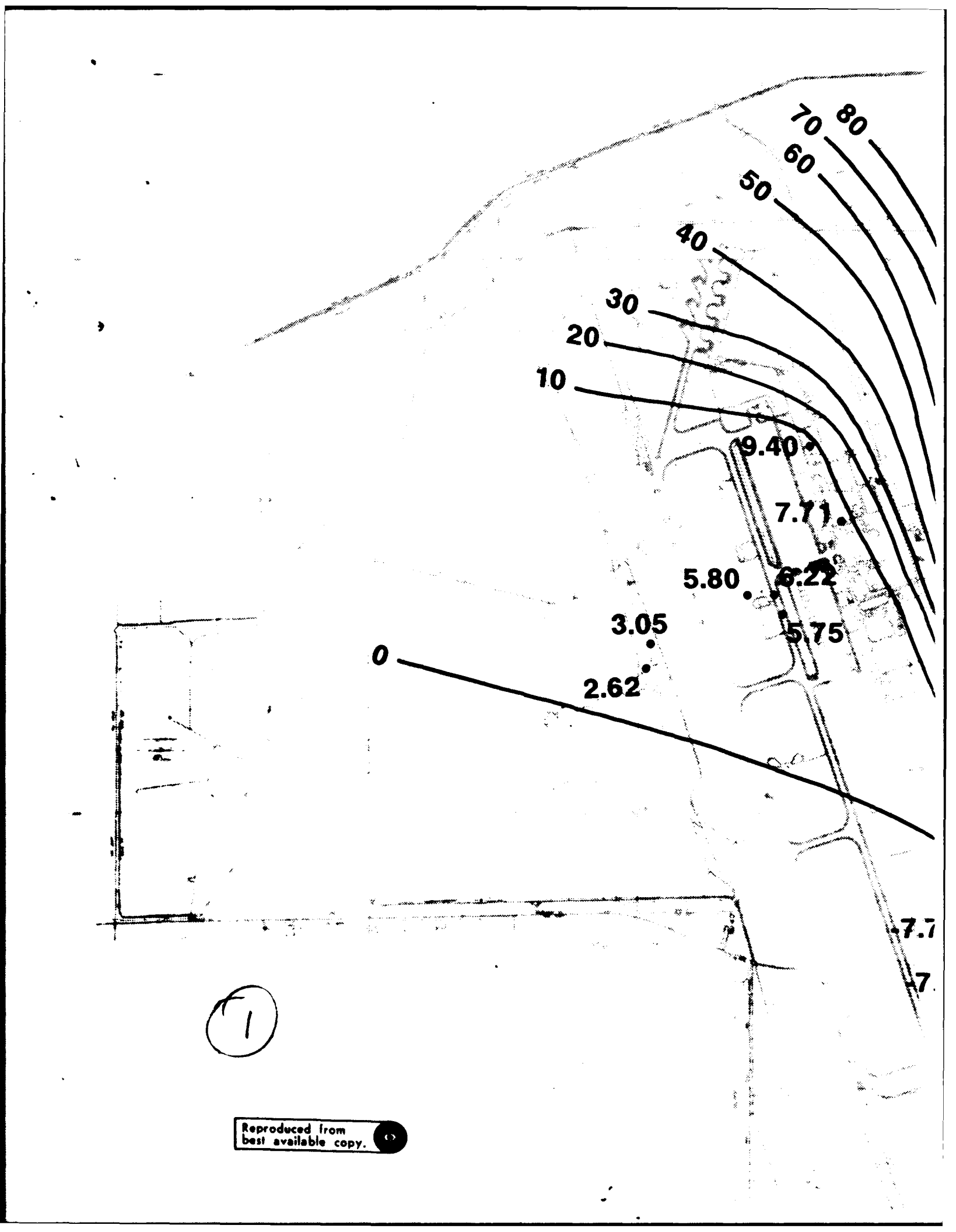


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PLATE 3
GROUNDWATER ELEVATION CONTOUR MAP
MARCH 27, 28, 1989
BEALE AIR FORCE BASE

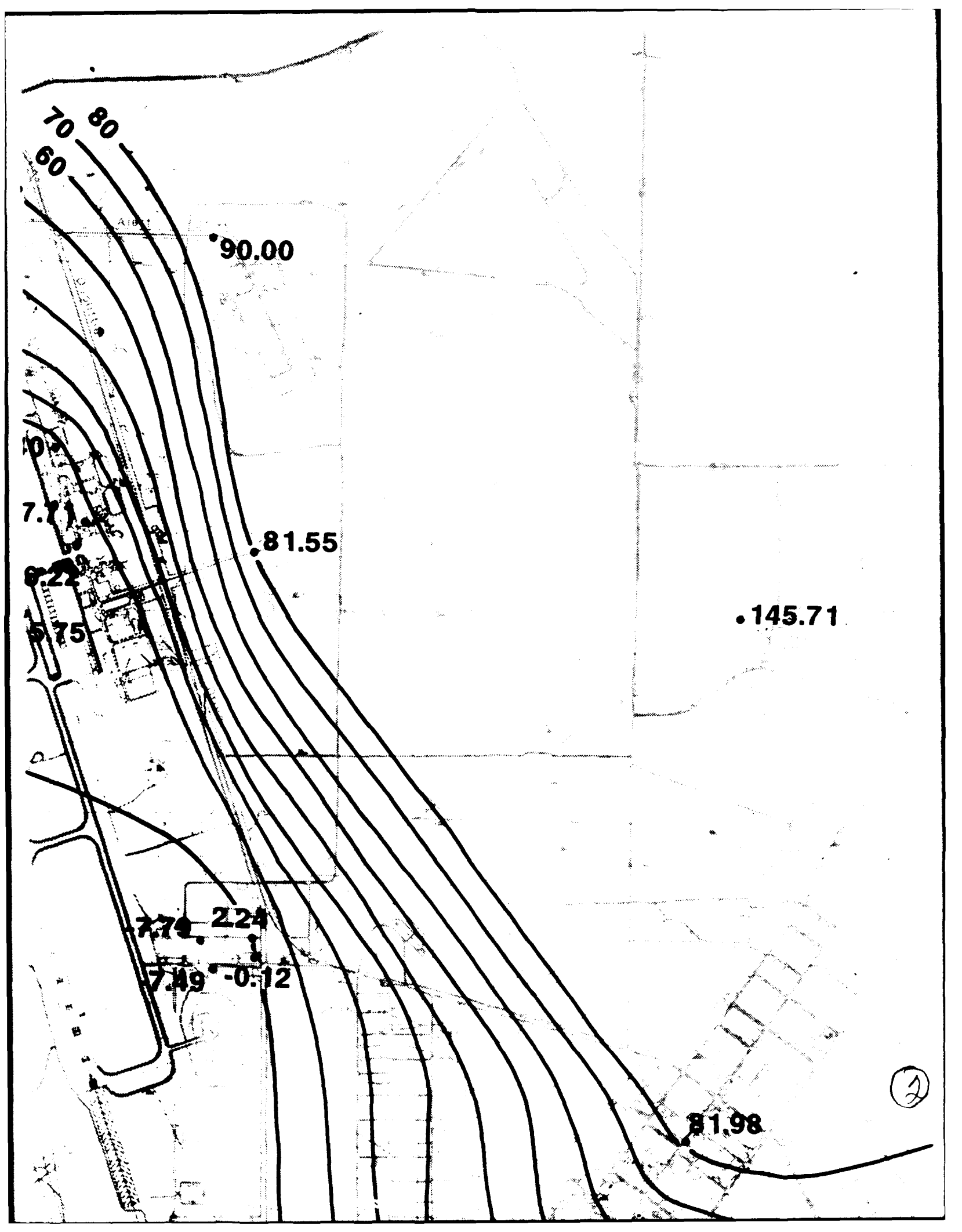
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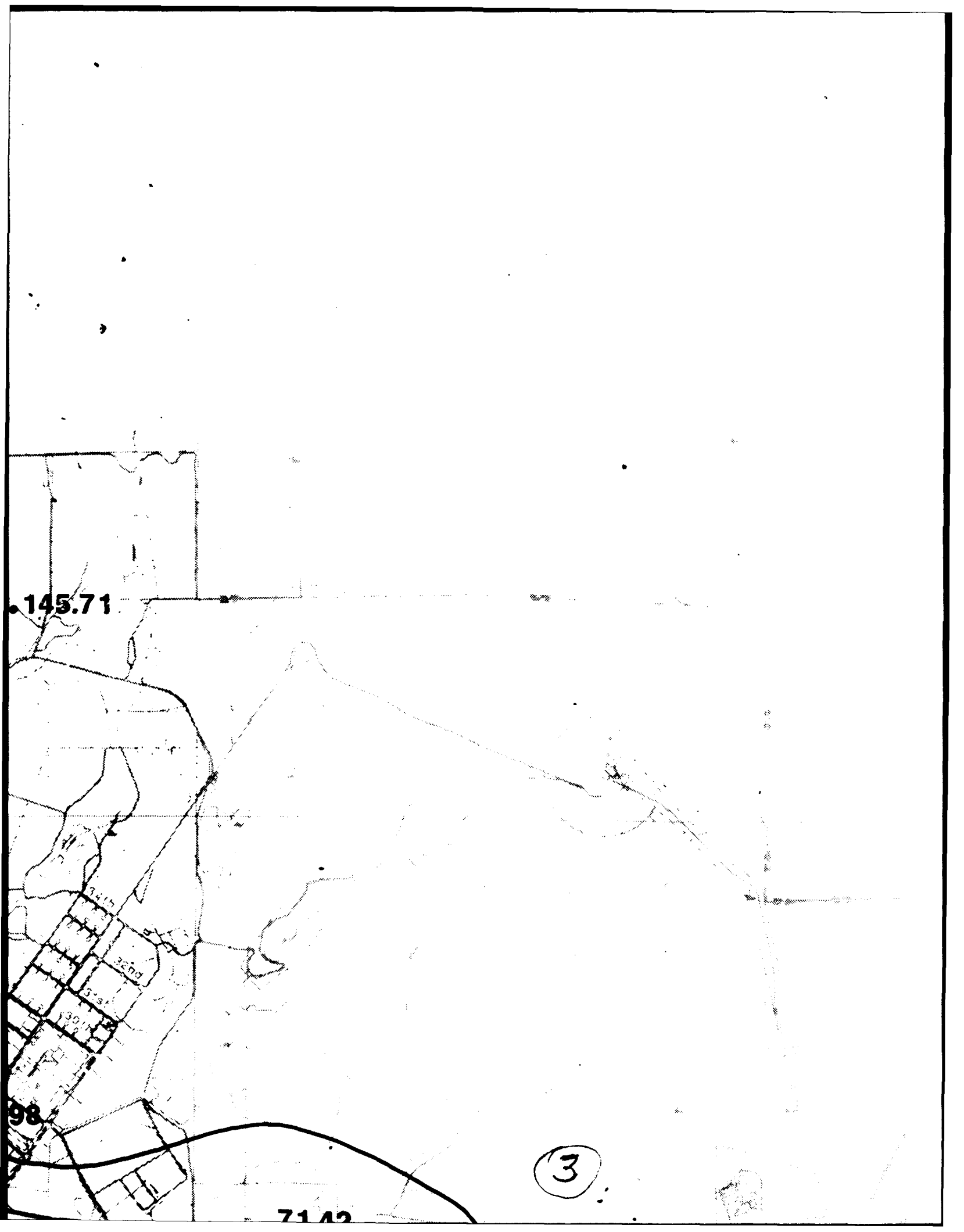
CH2M HILL

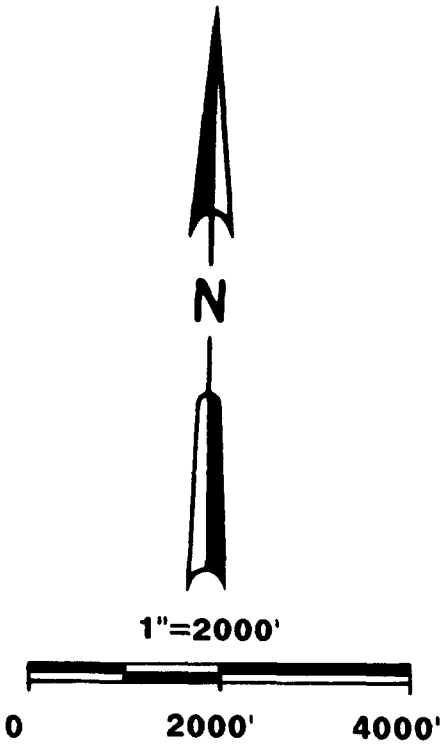


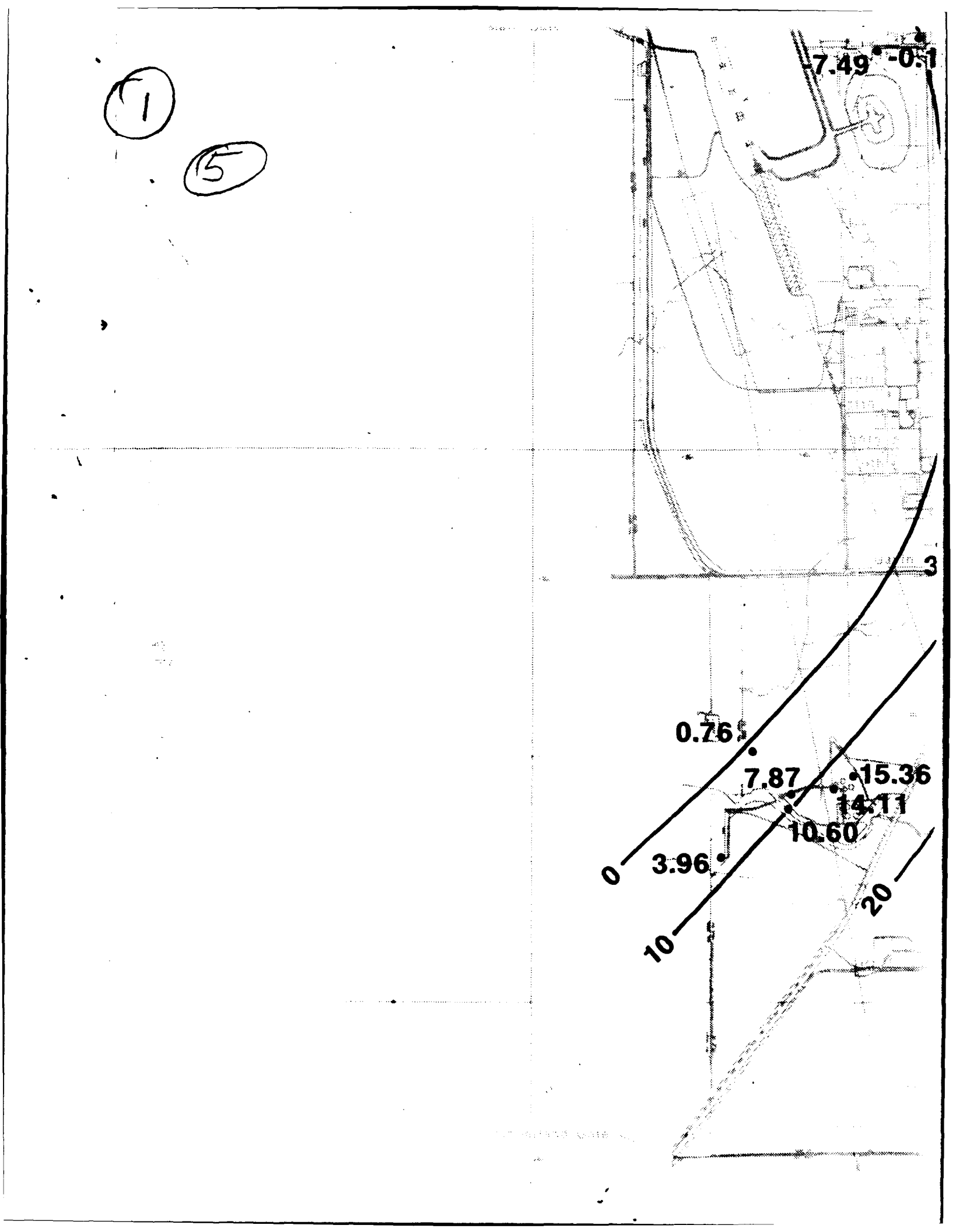
(1)

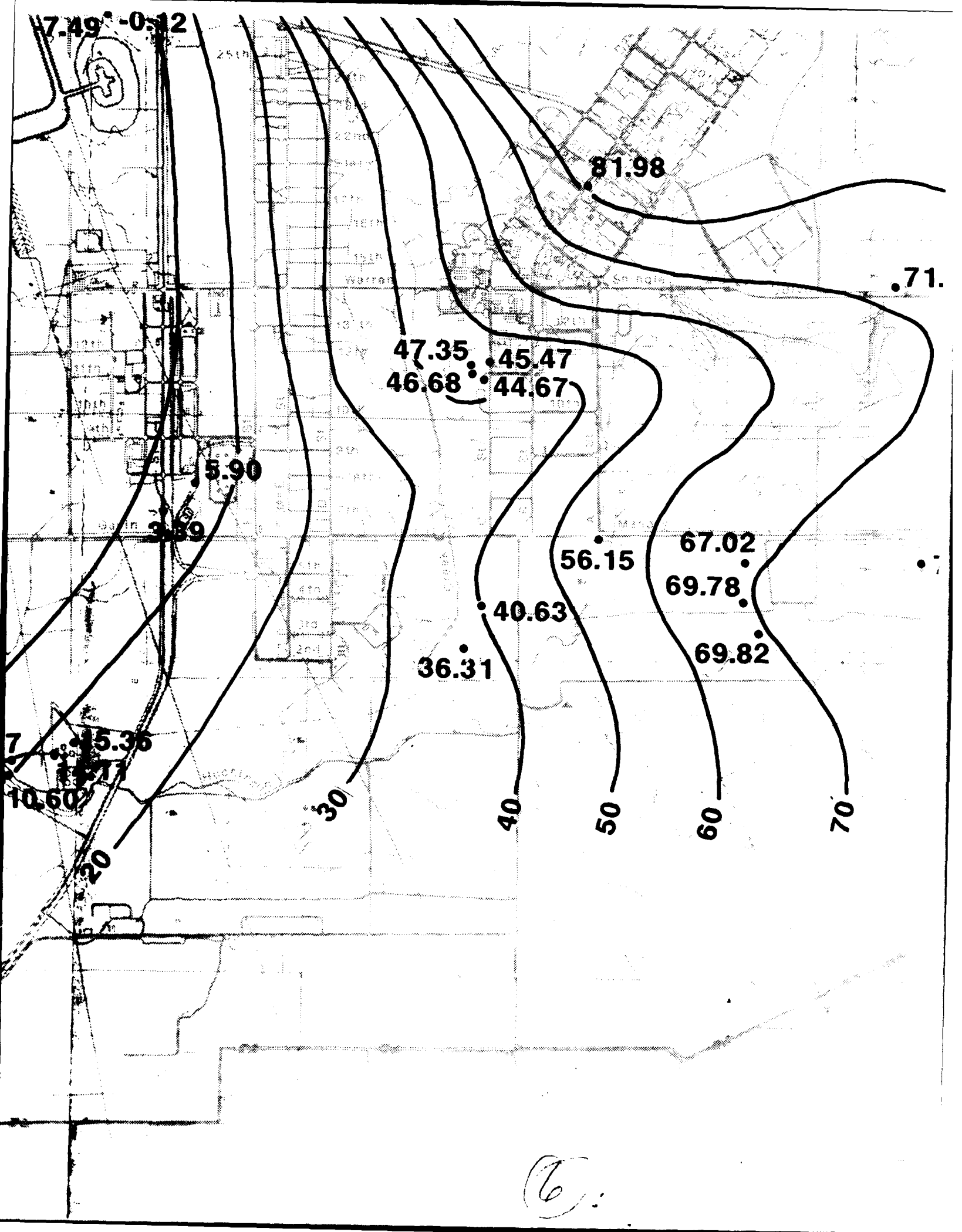
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70
80
60
90.00
81.55
145.71
2.24
-0.12
81.98
2


145.71
3415
3600
3430
3300
98
3
7142


N
1"=2000'
0
2000'
4000'


-7.49
-0.1
3
0.76
7.87
15.36
14.11
10.60
3.96
0
10
20


7.49
-0.12
81.98
.71
47.35
45.47
46.68
44.67
5.90
56.15
67.02
69.78
40.63
36.31
69.82
5.36
10.60
30
40
50
60
70
20

6

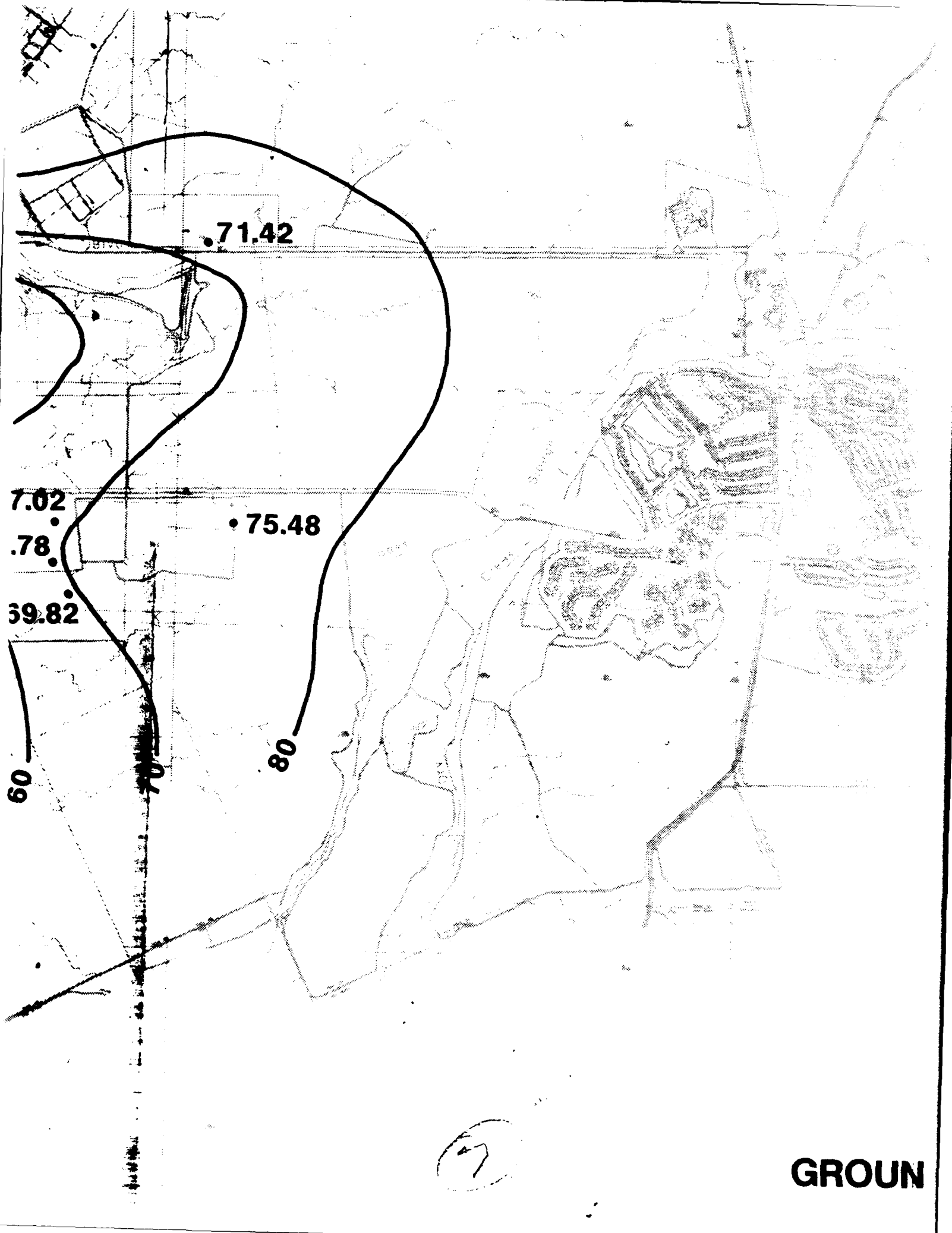

71.42
7.02
75.48
.78
39.82
60
70
80
GROUN



PLATE 4
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 8, 9,10, 1989
BEALE AIR FORCE BASE

CH2M HILL

(8)