

## 5.8 SWMU 11: CHEMICAL MUNITIONS STORAGE AREA (AREA 10)

### 5.8.1 Site Description and Waste Generation

SWMU 11 (Storage Area 10) is a highly secured area located in the northwest portion of the installation (Figures 5.0-1 and 5.8-1). It is used to store chemical agents until demilitarization. The storage area has operated since the mid 1940s (NUS 1987). Within this SWMU, 27 M55 rocket storage igloos and 7 chemical munitions storage igloos are included in a RCRA Part B Permit.

According to a TEAD-S employee (Russell, 1992) as stated in the RCRA Part B Permit conditions, all hazardous waste at SWMU 11 is stored in steel arch igloos. These igloos have sloped concrete floors that drain toward a catchment basin. Liquids are stored in plastic drums which are stored inside catchment basins. No floor drains are present in these igloos. Each igloo is inspected weekly for leaking munitions except for the igloos containing the M55 nerve agent filled rockets. Daily to weekly air samples are collected from these igloos to detect leaking munitions.

### 5.8.2 Site Hydrogeology

SWMU 11 is located on fairly flat topography and is underlain by Quaternary alluvial deposits. Since no drilling occurred inside the site, the subsurface lithology has been estimated from the logs (Appendix A) and some sieve analyses of soil samples from the boreholes of five monitoring wells (S-3, S-45-90, S-46-90, S-74-90, S-75-90) installed downgradient of the site.

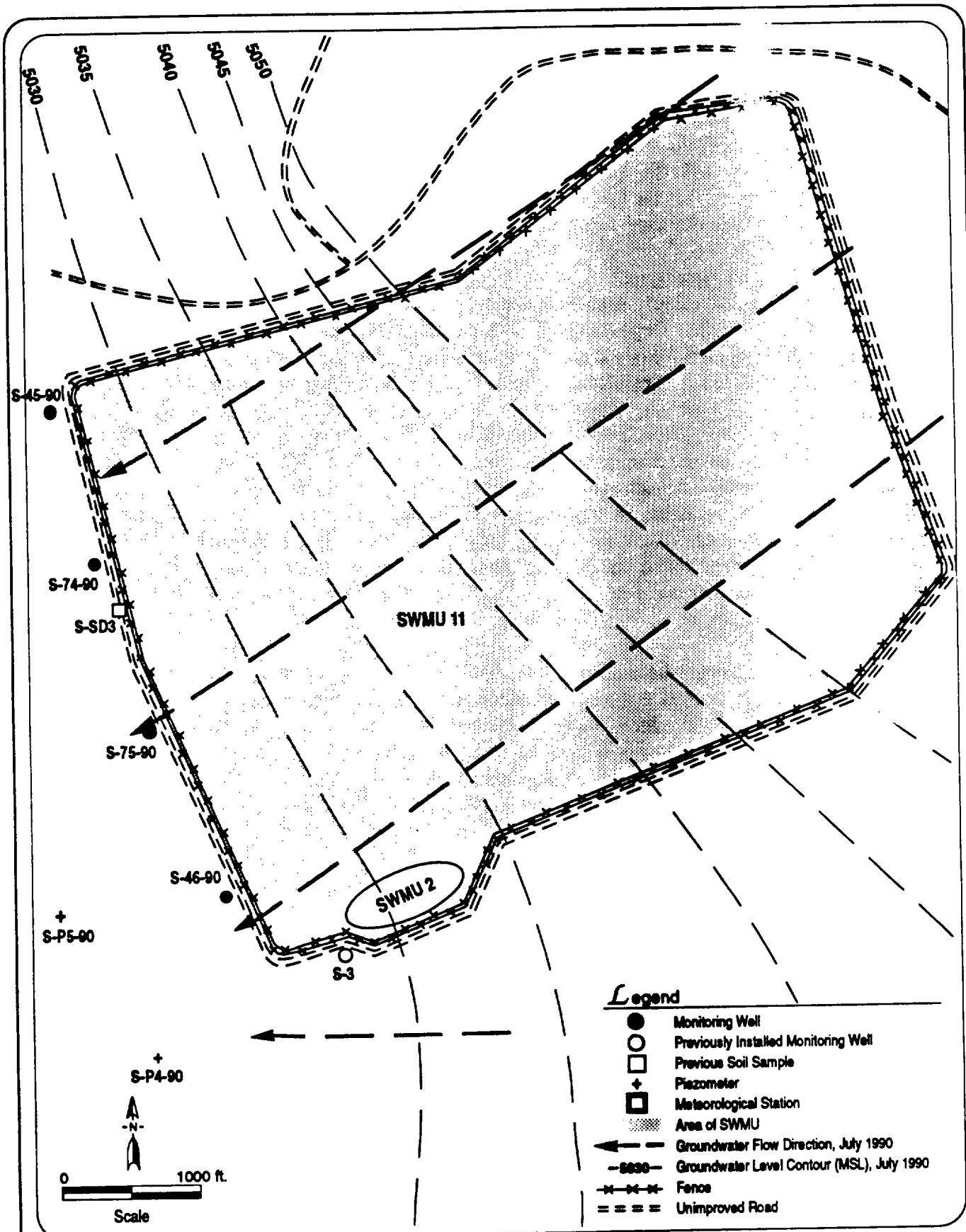
The near-surface soil is composed of loose to medium-dense, very pale brown to brown, silty sand and sandy silt with a trace of organic material (SM, ML). The unsaturated zone is composed of approximately 10 to 20 ft of loose to stiff, light gray to very dark grayish-brown, sandy gravel, silty gravel, silty sand, sandy silt, and clayey silt (GM, GP, SM, ML). Beds of gravelly sand (SP, SC) are also common.

The saturated zone, from about 15 to 25 ft, is composed of dense, pale yellow to dark brown, sandy gravel, gravelly sand, silty sand, and clayey silt (GP, SP, SM, ML). The screened interval was 20 ft in well S-3, from 24 to 44 ft, and is 10 ft in the rest of the wells, from 21 to 31 ft in well S-45-90, 15 to 25 ft in wells S-46-90 and S-75-90, and 19 to 29 ft in well S-74-90. All four monitoring wells installed west of SWMU 11 and previously installed well S-3 are downgradient wells.

The depth to groundwater in July 1990 was 23 ft below ground surface, or 5,028 ft msl, in well S-3; 22 ft below ground surface, or 5,026 ft msl in well S-45-90; 24 ft below ground surface, or 5,027 ft msl, in well S-74-90; 20 ft below ground surface, or 5,027 ft msl, in well S-75-90; and 19 ft below ground surface, or 5,027 ft msl, in well S-46-90. Groundwater in this area flows to the west-southwest (Plate 3).

### 5.8.3 Previous Sampling and RFI-Phase I Sampling Results

Previous sampling at SWMU 11 includes the collection of groundwater samples at well S-3, which was installed to monitor SWMU 2, in the southwest corner of SWMU 11, and collection



Source:  
 EBASCO Field Measurement  
 Basic Information Maps 1985

**Figure 5.8-1**  
**Site Map**  
**SWMU 11 - Chemical Munitions Storage Area (Area 10)**  
 Tooele Army Depot - South Area  
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of one sediment sample along the western boundary of SWMU 11. The other four monitoring wells were installed west and downgradient of SWMU 11 during the RFI-Phase I. RFI-Phase I groundwater samples from these wells were analyzed for the full suite of analytes listed in Table 3.10-3, Section 3.10.10. Table 5.8-1 lists the previous detections in soil and groundwater and Table 5.8-2 summarizes the RFI-Phase I groundwater detections at SWMU 11. Figures 5.8-2 through 5.8-6 illustrate detected analytes and concentrations.

#### 5.8.4 Contamination Assessment

Low concentrations of volatile organic compounds were detected in samples from monitoring wells S-3 and S-46-90. Depending on groundwater flow directions, these wells may be downgradient from both SWMUs 2 and 11, as well as of other areas to the east. The water table in this area is relatively flat, resulting in relatively slow groundwater flow in possibly variable directions.

Organic compounds detected in these wells included methylene chloride, chloroform, and 1,1-dichloroethane. The low concentration detection of methylene chloride is most likely associated with laboratory contamination of the sample. Chloroform is also a possible decontamination product of GB stabilizer, VX, VX stabilizer DIPC, and HD (Department of Army 1988). The presence of other chlorinated solvents in these wells is not clearly related to activities at SWMU 2 or 11. As discussed in Section 5.2, unidentified sources may exist upgradient to the east of these SWMUs.

Petroleum hydrocarbons, 2,4,6-trinitrotoluene, and IMPA detected during previous investigations at monitoring well S-3 were not detected using analyses for volatile and semivolatile organics and agent breakdown products during the RFI-Phase I. The occurrence of petroleum hydrocarbons in this groundwater is unlikely to be explained by the disposal of munitions in this pit. Furthermore, these petroleum hydrocarbons were not identified in analyses of volatile organics and semivolatile organics during the RFI-Phase I. The compound 2,4,6-trinitrotoluene, however, is an explosive that could be related to a release to groundwater from SWMU 2. The detection limit of the RFI-Phase I method for IMPA was lower than that of the previous investigations and the previous detections are qualified as noncertified results. Therefore, previous detections of IMPA at well S-3 are suspect.

Semivolatile organic compounds were identified only in wells S-3 and S-75-90. The detected compounds were phthalates that probably result from the use of PVC well casing or of rubber gloves for sampling.

Several inorganic analytes were detected in the sediment sample collected near the western boundary of SWMU 11. All wells at SWMU 11 are included in groundwater quality zone II. A wide concentration range of inorganic analytes is typical of zone II. Inorganic groundwater quality data from each well was compared to concentrations typical of this zone to determine whether any analytes were detected at elevated concentrations. Chloride was detected at an

TABLE 5.8-1

Summary of Previous Analytical Investigations for  
SWMU 11: Chemical Munitions Storage Area (Area 10)

Analytical Groups and Analytes Detected	SOIL (µg/l)	GROUNDWATER (µg/l)		
	*S-SD3 0.5 ft 1982	1982	1987	1988
<b>Volatile Organics:</b> Unknowns <sup>c</sup>	NA			21
<b>Semivolatile Organics:</b> Butylbenzyl phthalate (BBZP)	NA	NA	2.0 <sup>a</sup> (3.0)	LT (10)
<b>Agent Breakdown Products:</b> Isopropylmethyl phosphonic acid (IMPA)	NA	NA	NA	13,000 (470)
<b>Explosives:</b> 2,4,6 - Trinitrotoluene (246 TNT)	LT (u)	LT (1.0)	LT (6.3)	3.3 (0.78)
<b>Metals (total or total/dissolved):</b>				
Antimony (Sb)	NA	NA	LT(7.0)	6.5/LT (3.0)
Arsenic (As)	10 (4.0)	12 (4.0)	31 (2.5)	21/20 (5.0)
Barium (Ba)	NA	NA	21 (3.4)	NA
Copper (Cu)	LT (u)	LT (6.0)	25 (21)	11/3.3 (1.8)
Cyanides - Total (TCYN)	NA	12 (5.0)	LT (u)	NA
Lead (Pb)	LT (u)	LT (30)	LT (1.5)	2.7/LT (2.5)
Nickel (Ni)	LT (4)	7.0 (4.0)	66 (65)	LT (9.6)

S-87

\* Soil leach concentration

a Probably due to laboratory contamination

c The identity or concentrations of these compounds cannot be conclusively determined and reporting limits have not been established.

NA Not analyzed

LT Less than

u Detection limit unavailable

( ) Detection limit

µg/g microgram per gram

µg/l microgram per liter

References: 1982 data - Ertec 1982  
1987 data - EA Engineering 1988  
1988 data - Weston 1991

TABLE 5.8-1

**Summary of Previous Analytical Investigations for  
SWMU 11: Chemical Munitions Storage Area (Area 10)**

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Analytical Groups and Analytes Detected	SOIL (µg/l)	GROUNDWATER (µg/l)		
	*S-SD3 (0.5 ft)	S-3		
	1982	1982	1987	1988
<i>Metals (total or total/dissolved), Cont'd:</i>				
Silver (Ag)	LT (40)	LT (8.0)	0.18 (0.14)	0.70/0.70 (0.19)
Sodium (Na)	1000 (1000)	1,400,000 (100)	740,000 (450)	2,100,000/3,300,000
Thallium (Tl)	NA	NA	2.7 (1.7)	LT (5.0)
Zinc (Zn)	7.0 (3.0)	63 (3.0)	20 (14)	70/19(17)
<i>Anions:</i>				
Bromide (Br)	NA	NA	2000 (240)	LT (50)
Chloride (Cl)	4000 (1000)	GT 72,000 (100)	3,200,000 (5000)	3,000,000 (750)
Fluoride (F)	LT (1000)	1800 (1000)	1200 (360)	LT (100)
Orthophosphate (PO <sub>4</sub> ORT)	NA	NA	70 (57)	NA
Sulfate (SO <sub>4</sub> )	2000 +(1000)	GT 72,000 (1000)	900,000 (4700)	840,000 (130000)
Nitrite (NO <sub>2</sub> )	LT (u)	LT (400)		
Nitrate (NO <sub>3</sub> )	2000 (1000)	LT (1000)		
Nitrate-nonspecific (NTT)	NA	NA	350 (+24)	LT (5000)

\* Soil leach concentration  
 NA Not analyzed  
 GT Greater than  
 u Detection limit unavailable  
 ( ) Detection limit  
 µg/g microgram per gram  
 µg/l microgram per liter

References: 1982 data - Ertec 1982  
 1987 data - EA Engineering 1988  
 1988 data - Weston 1991

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TABLE 5.8-1

Summary of Previous Analytical Investigations for  
SWMU 11: Chemical Munitions Storage Area (Area 10)

Page 3 of 3

Analytical Groups and Analytes Detected	SOIL ( $\mu\text{g/l}$ )	GROUNDWATER ( $\mu\text{g/l}$ )		
	*S-SD3 (0.5 ft) 1982	1982	S-3 1987	1988
<b>Radionuclides (pCi/l):</b>				
Gross alpha (ALPHAG)	LT (v)	LT (3.0)	LT 47 (v)	LT 67 (v)
Gross beta (BETAG)	LT (v)	9.0 $\pm$ 6.0 (6.0)	LT 53 (v)	LT 47 (v)
Uranium - Total	NA	NA	NA	12 (v)
<b>Petroleum Hydrocarbons:</b>	NA	NA	NA	560 (200)

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\* Soil leach concentration

NA Not analyzed

LT Less than

pCi/l picocurie per liter

v Detection limit for radionuclides varies for each sample

() Detection limit

 $\mu\text{g/g}$  microgram per gram $\mu\text{g/l}$  microgram per liter

References: 1982 data - Ertec, 1982

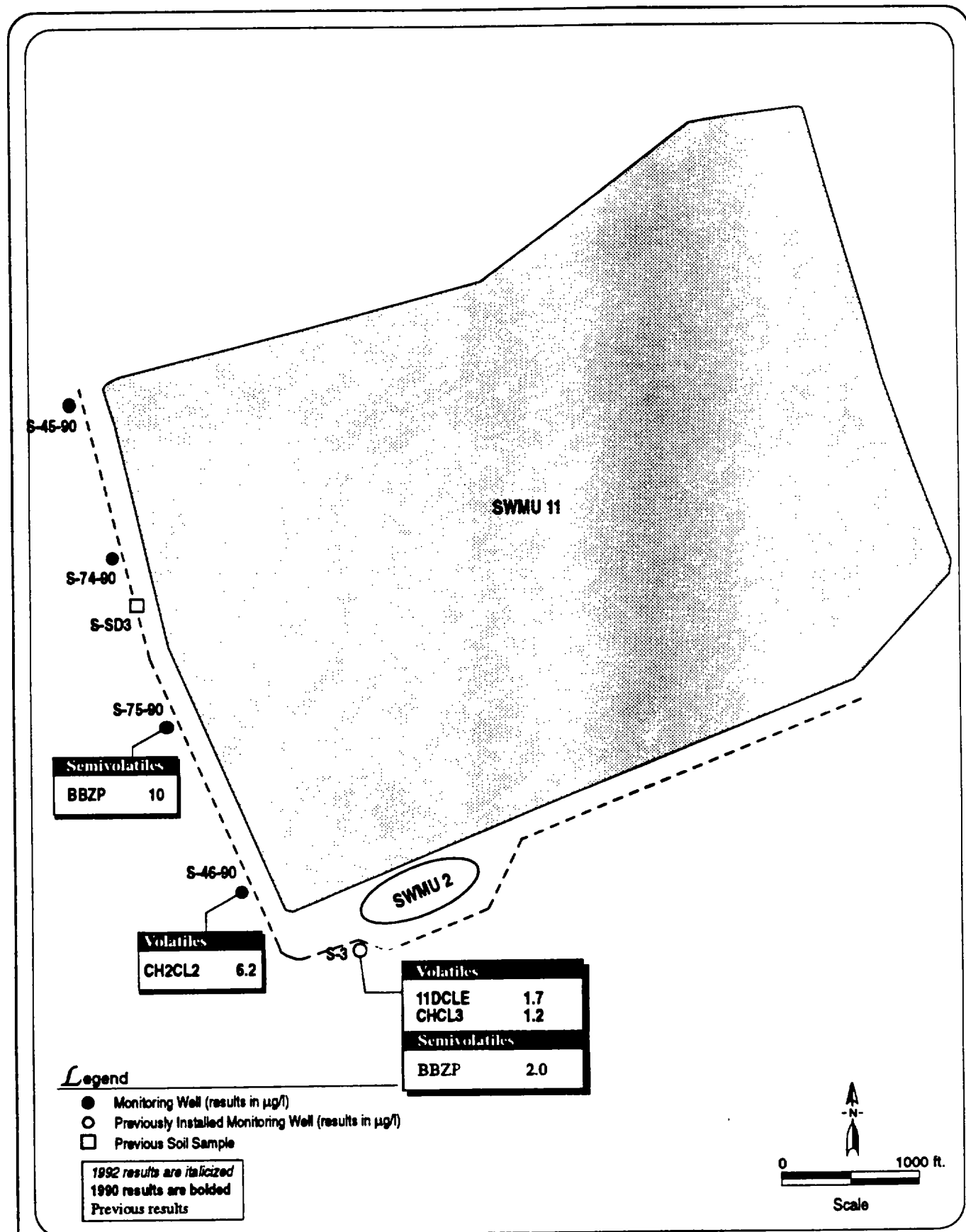
1987 data - EA Engineering 1988

1988 data - Weston 1989

GROUNDWATER ( $\mu\text{g/l}$ )

Analytical Groups and Analytes Detected	S-3	S-45-90	S-46-90	S-74-90	S-75-90
<b>Volatile Organics:</b>					
1,1-Dichloroethane (11DCLE)	1.7	LT 1.1	LT 1.1	LT 1.1	LT 1.1
Chloroform (CHCL3)	1.2	LT 0.83	LT 0.83	LT 0.83	LT 0.83
Methylene chloride (CH2CL2)	LT 5.4	LT 5.4	6.2	LT 5.4	LT 5.4
Unknowns			3.0		
<b>Semivolatile Organics:</b>					
Butylbenzyl phthalate (BBZP)	LT 10	LT 10	LT 10	LT 10	10
Unknowns	7.0	20	25	30	110
<b>Metals:</b>					
Arsenic (As)	28	18	17	16	3.1
Lead (Pb)	4.7	5.4	LT 1.3	14	LT 1.3
Mercury (Hg)	0.27	LT 0.24	LT 0.24	0.41	0.35
Selenium (Se)	LT 3.0	4.5	LT 9.1	6.8	LT 3.0
Sodium (Na)	1,600,000	450,000	2,000,000	1,000,000	460,000
Zinc (Zn)	40	LT 21	LT 21	LT 21	LT 21
<b>Anions:</b>					
Bromide (Br)	1100	770	2,200	1,500	1,000
Chloride (Cl)	4,200,000	1,100,000	9,500,000	3,300,000	LT 1,400,000
Fluoride (F)	LT 14,000	LT 14,000	LT 140,000	LT 14,000	2,400
<b>Radionuclides (pCi/l):</b>					
Gross alpha (ALPHAG)	71	LT 0.10	69	380	390
Gross beta (BETAG)	130	110	LT 0.30	LT 0.30	110
Uranium (U)	12	1.9	7.7	9.4	31

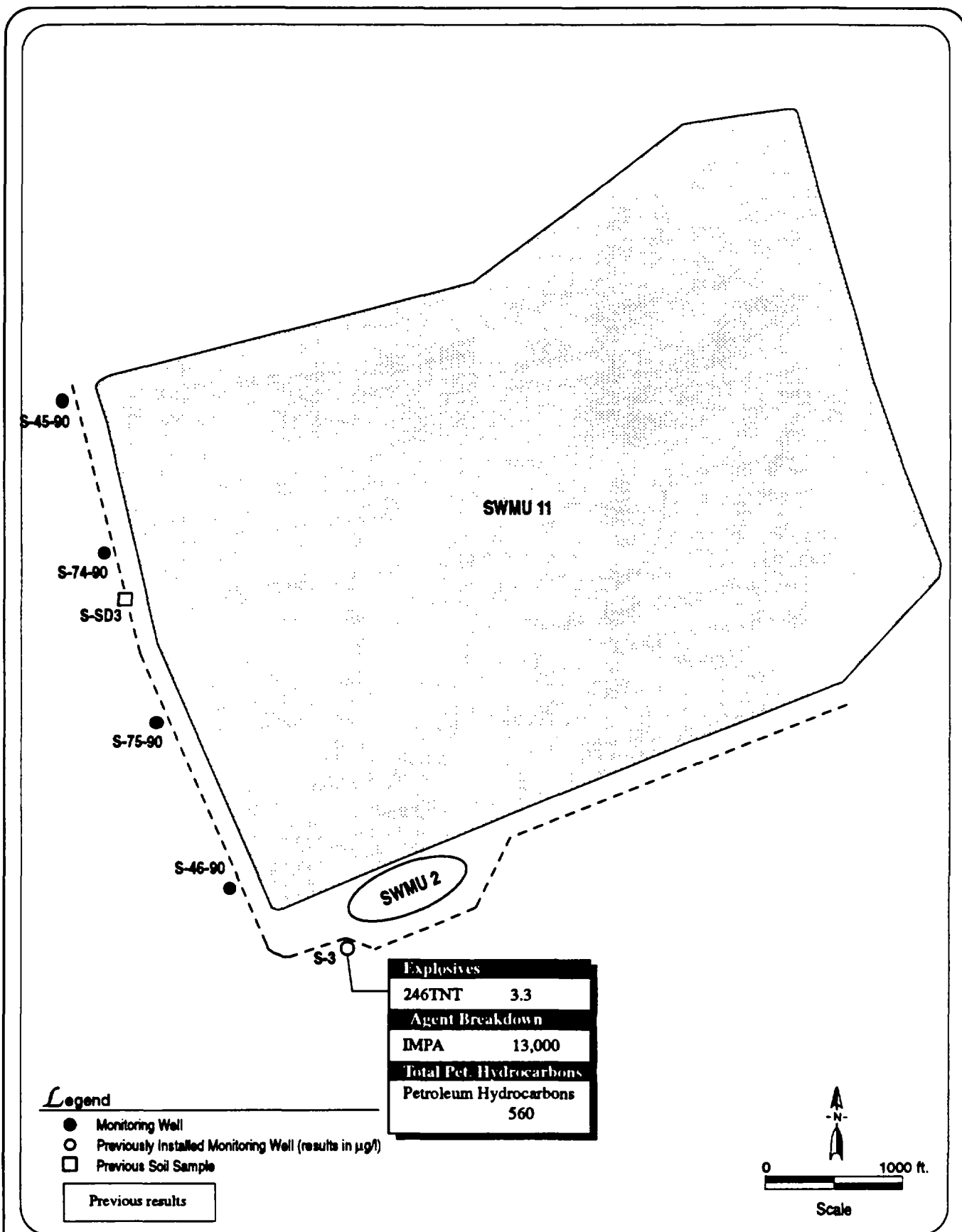
LT Less than  
pCi/l Picocurie per liter  
 $\mu\text{g/l}$  Microgram per liter



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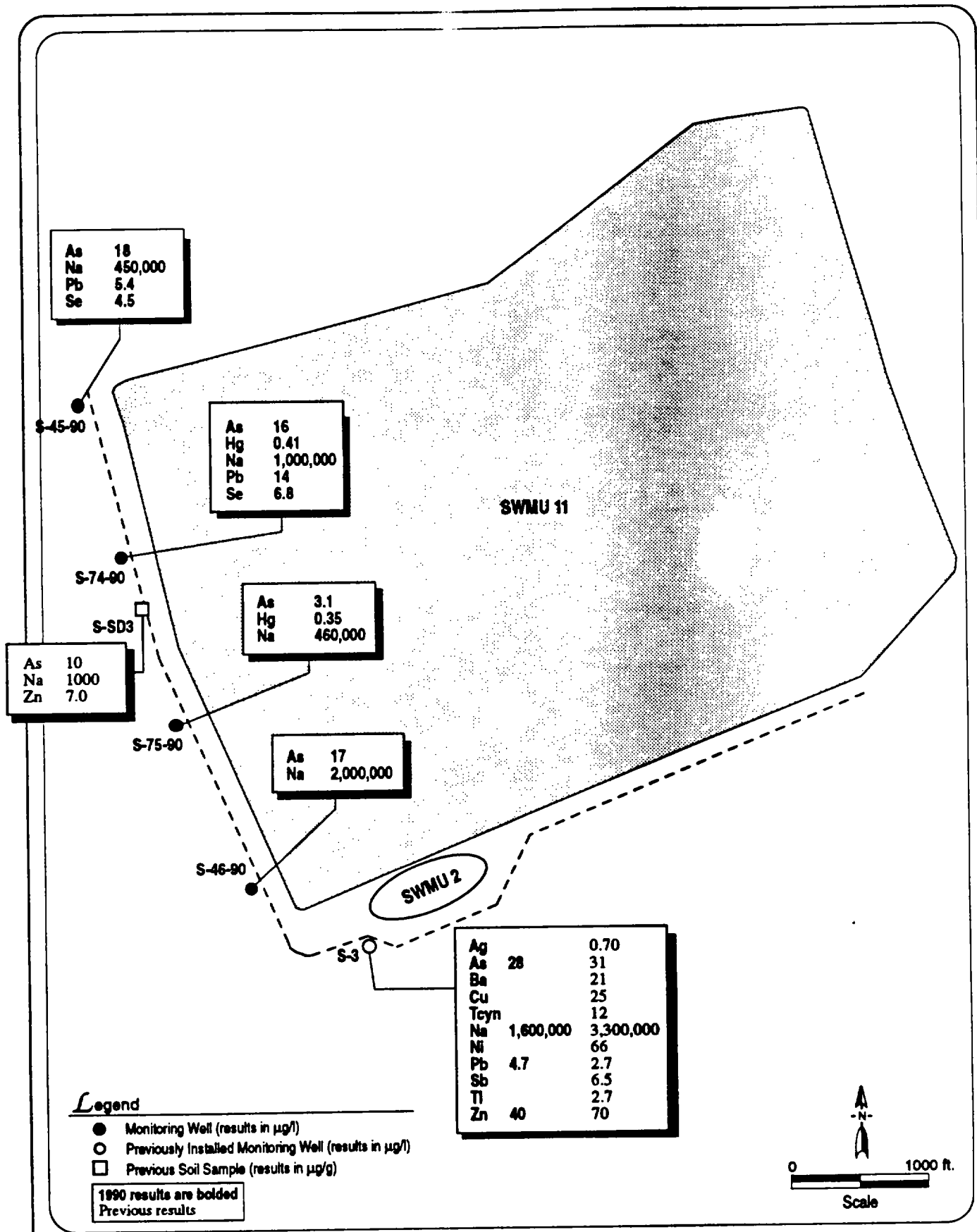
**Figure 5.8-2**  
**SWMU 11 - Chemical Munitions Storage Area (Area 10)**  
**Organics**





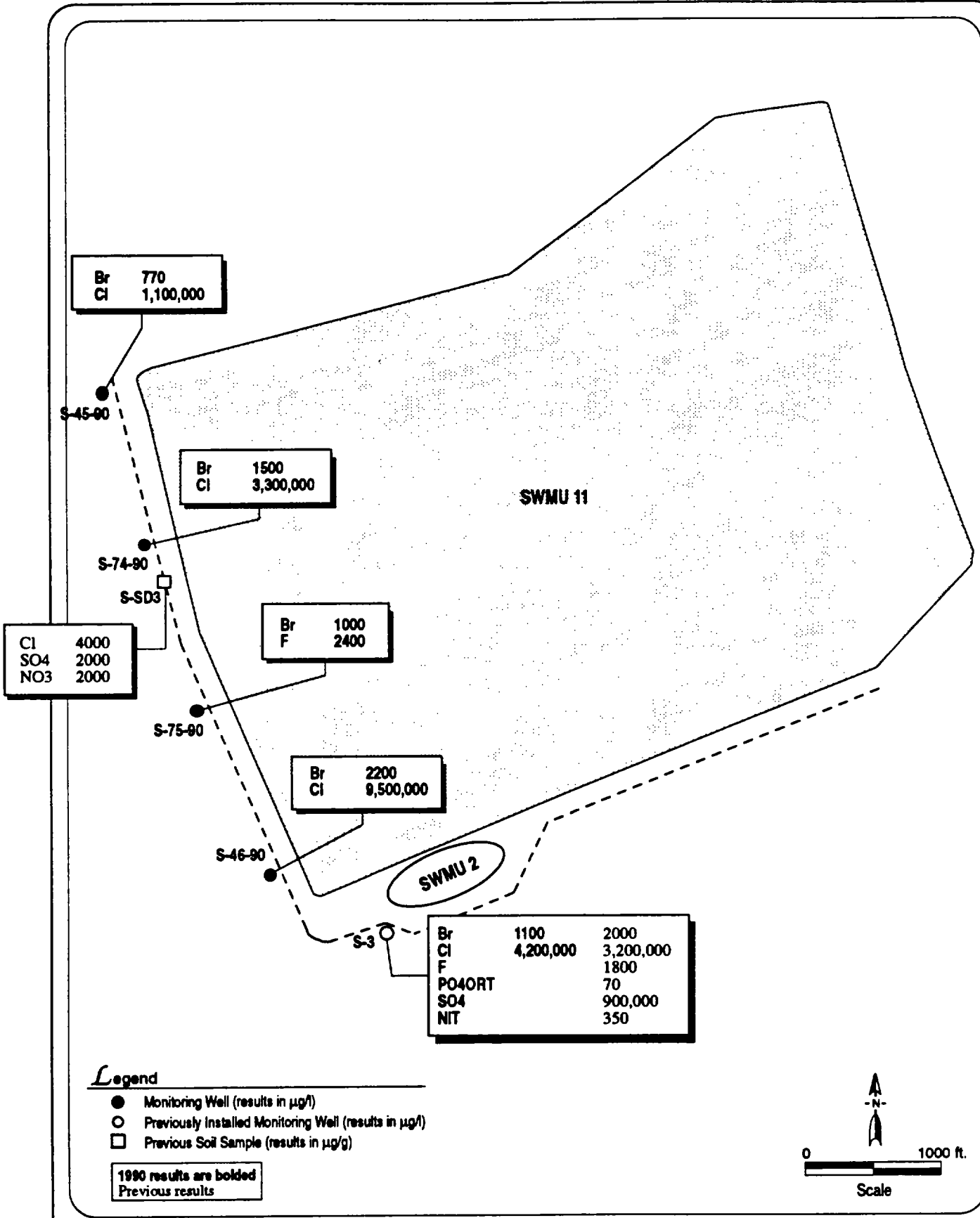
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**Figure 5.8-3**  
**SWMU 11 - Chemical Munitions Storage Area (Area 10)**  
 Explosives, Agent Breakdown Products,  
 Total Petroleum Hydrocarbons



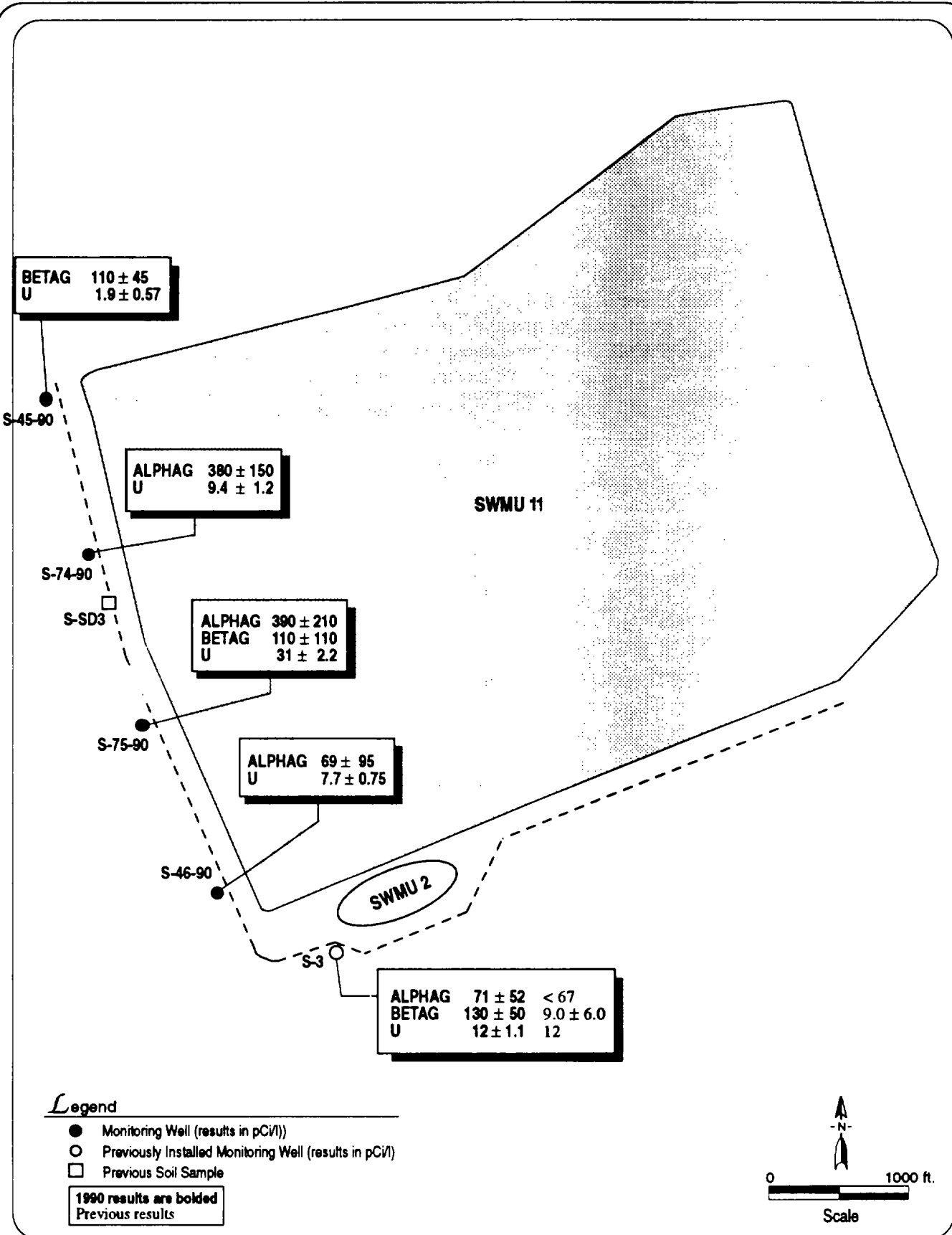
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**Figure 5.8-4**  
**SWMU 11 - Chemical Munitions Storage Area (Area 10)**  
**Metals and Cyanide**



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Figure 5.8-5  
SWMU 11 - Chemical Munitions Storage Area (Area 10)  
Anions



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**Figure 5.8-6**  
**SWMU 11 - Chemical Munitions Storage Area (Area 10)**  
**Radionuclides**

elevated level in downgradient well S-46-90. No other inorganic analytes were detected at elevated concentrations.

Sodium, a nontarget analyte, was the only inorganic detected above background levels established during the RFI-Phase I. This sodium concentration is not attributable to known uses of SWMU 11.

#### 5.8.5 Recommendations

Organic and inorganic concentrations in groundwater presented little evidence of a release from SWMU 11; however, a Phase II investigation is proposed to include further evaluation of igloo construction and sampling at areas of potential releases. The Phase II investigation will address all of the igloos in this SWMU, including those covered by the RCRA Part B Permit for agent munitions storage.