

5.6 SWMU 8: SURVEILLANCE TEST SITE

5.6.1 Site Description and Waste Generation

SWMU 8 was reportedly a 58-acre munitions testing area located adjacent to the active SWMU 31 demilitarization area (Figure 5.6-1). Employees remembered a wooden drop tower where munitions were tested. Munitions tested included M69 (napalm), M19 (incendiary mix) bombs, smoke pots, M15 white phosphorus grenades, and smoke grenades.

According to the Installation Assessment (USATHAMA 1979), surveillance testing included dropping munitions from a 9-meter high tower. The munitions included thermate bombs and M19 cluster bombs (M69 napalm and white phosphorous bombs clustered with M79 incendiary bombs). Smoke pots, M-15 white phosphorous grenades, and smoke grenades were tested in the same general area.

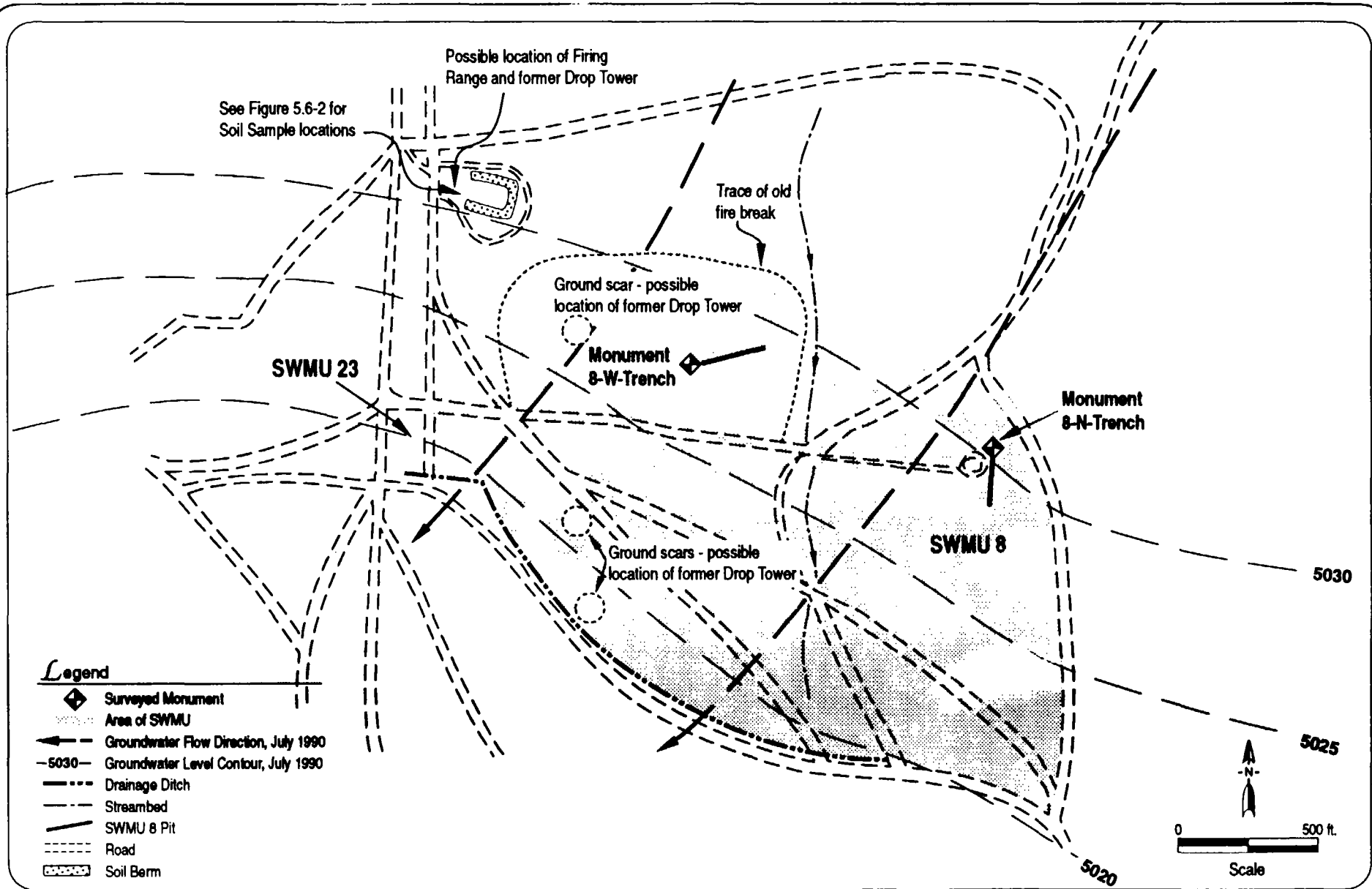
One possible location of the former drop tower is currently used as a firing range for target practice with small arms. The firing range area has been graded, and some of the earth has been mounded into backstops. This area was investigated during the RFI-Phase I. However, further evaluation of aerial photographs indicates three other more likely locations of the former drop tower (Figure 5.6-1). These areas are evident on a 1966 photograph of the area (EPIC 1986). Two possible locations appear as ground disturbances along a dead-end road leading south within the southern portion of the firebreak. This area overlaps with SWMU 31. Another possible location is in the northern portion of SWMU 8, also within the firebreak.

During the RFI-Phase I initial site visit in 1989, two pits in the same general area were documented to contain scrap metal, smoke canisters, rusty, small empty drums, smoke pots, smoke grenades, caustic soda drums, CS grenades and canisters, and cans labeled as thickener (napalm). These pits are now closed. Munitions debris are scattered on the ground along the road to the pits. USATHAMA personnel have also observed munitions debris in the streambed that crosses the eastern part of the SWMU 8 area shown in Figure 5.6-1.

5.6.2 Site Hydrogeology

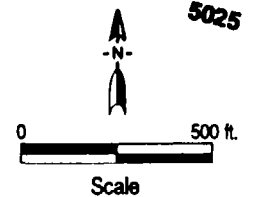
SWMU 8 is located on a gentle southward-sloping topographic surface. The drainage that extends south from SWMU 9 enters the eastern part of SWMU 8. Downslope from SWMU 8, this drainage appears to be disrupted by roads (EPIC 1986).

The site is underlain by Quaternary alluvial deposits. Details on subsurface lithology were extrapolated from the two closest monitoring wells (S-10, S-61-90) and from soil samples S-SS-08-01, S-SS-08-02, and S-SS-08-BK. Near-surface soil is light, yellowish-brown, organically rich (e.g., roots and rootlets) clayey silt with a trace of fine- to medium-grained sand (ML). Hard, light yellowish brown to brown, silty clay and clayey silt (CL, ML) make up the rest of the unsaturated zone, which is approximately 70 ft thick. Sandy gravels (GP) may be interbedded with the silts and clays in the unsaturated zone, as occurs in well S-61-90 to the southeast.



Legend

- Surveyed Monument
- Area of SWMU
- Groundwater Flow Direction, July 1990
- 5030 - Groundwater Level Contour, July 1990
- Drainage Ditch
- Streambed
- SWMU 8 Pit
- Road
- Soil Berm



Source:
 EBASCO Field Measurement
 Basic Information Maps 1985
 EPIC 1986

Figure 5.6-1
Site Map
SWMU 8 - Surveillance Test Site
 Tooele Army Depot - South Area
 Prepared by: Ebasco Services Incorporated

Bore logs from the saturated zone (from approximately 75 to 97 ft) describe this zone as light yellowish-brown to brown silty clay and silty sand (CL, SM). The depth to groundwater in July 1990 was estimated at 75 ft. The groundwater elevation is approximately 5,035 ft msl. Groundwater may flow to the south-southwest at SWMU 8.

5.6.3 Previous Sampling and RFI-Phase I Sampling Results

No soil or groundwater sampling was performed at SWMU 8 prior to the RFI-Phase I. During the RFI-Phase I, two soil samples were collected from the firing range area, and one background soil sample was collected approximately 100 ft south of the western edge of the southern berm of the firing range. The two soil samples from the firing range were analyzed for semivolatile organics, total petroleum hydrocarbons, explosives, and metals. The samples analyzed for semivolatile organics exceeded their holding times, and poor Tetryl recoveries indicated inaccuracy in the explosives method. The background soil sample was analyzed for metals only. Table 5.6-1 lists detections in SWMU 8 soil samples and Figure 5.6-2 illustrates sampling locations, detected compounds, and concentrations.

Four other soil samples were originally planned to be collected from the open disposal trenches during the RFI-Phase I. Because of the potential for nerve or blister agent contamination in the trenches, personnel from the Army Technical Escort Unit are required to collect the samples. The Army Technical Escort Unit was unavailable during the RFI-Phase I; therefore, sampling in the disposal trenches is scheduled for Phase II.

5.6.4 Contamination Assessment

There was no evidence of soil contamination at the firing range. Only sodium, a nontarget analyte, was detected above background levels. This sodium concentration was only slightly above background, and is not attributable to known uses of the firing range or drop tower areas. Since aerial photography shows that the firing range is not the likely location of the former drop tower, this area will be assumed to be uncontaminated, and the samples with semivolatile and explosives analytical problems will not be replaced.

5.6.5 Recommendations

Additional soil sampling is recommended in the newly identified ground scars and in the streambed just south of the road leading to the eastern trench. Two borings are proposed in each newly identified ground scar to be sampled at the 0- to 6-inch, 6- to 12-inch, and 2- to 3-ft depth intervals. Three soil borings should also be drilled in the streambed and sampled from the 0- to 6-inch and 2- to 3-ft depth intervals. Field reconnaissance of this area may be required to identify the appropriate sampling locations using the 1966 photograph, because few of the ground scars shown by the 1966 photograph appear clearly on more recent (1986) photographs. However, approximate sampling locations are presented in Figure 5.6-3. Samples should be analyzed for volatile and semivolatile organics, explosives, agent breakdown products, and metals. The results of the RFI-Phase II sampling in the area overlapping SWMUs 8 and 31 should be used to assign the area to only one of these units if a corrective measures study is required.

Since the trenches have been closed, four test pits will be excavated in the trenches so that samples can be collected below the buried wastes. A total of 24 samples will be collected

TABLE 5.6-1

Summary of RFI-Phase I Investigations for
SWMU 8: Surveillance Test Site

SOIL ($\mu\text{g/g}$)

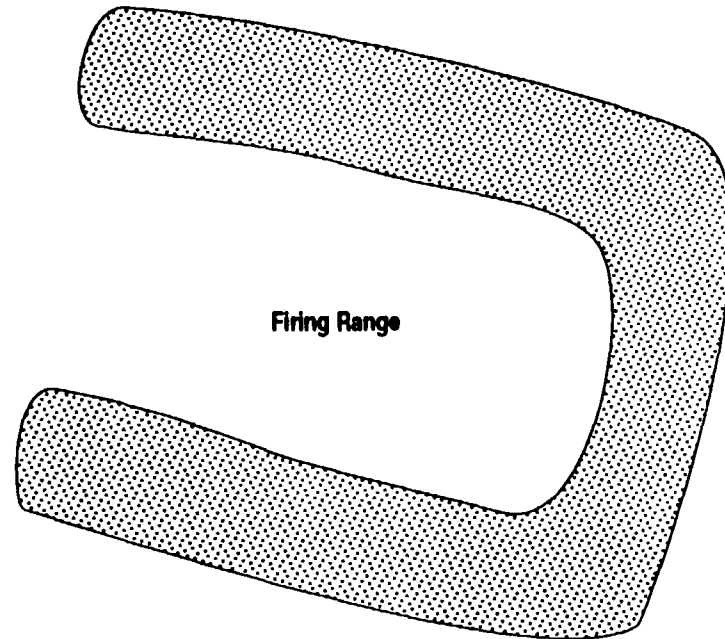
Analytical Groups and Analytes Detected	S-SS-08-01	S-SS-08-02	S-SS-08-BK ¹
<i>Semivolatile Organics:</i>			
Unknowns	4.5*	3.1*	
<i>Explosives: None detected</i>			
<i>Metals:</i>			
Arsenic (As)	16	15	15
Beryllium (Be)	0.28	0.33	0.34
Chromium (Cr)	25	26	26
Copper (Cu)	11*	21*	11*
Lead (Pb)	13	15	15
Silver (Ag)	LT 0.086	LT 0.086	0.095
Sodium (Na)	3500	2900	1900
Zinc (Zn)	53	65	69
<i>Petroleum Hydrocarbons:</i>			
None detected	LT 133	LT 133	

1 Metals analysis only

* Detected in associated method blank

LT Less than

$\mu\text{g/g}$ Microgram per gram

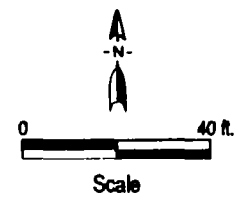


Stewie Upper Boundaries* for Soil Background Concentrations

Metal	Upper Bound (ppm)
Ag	1.9
As	41
Be	0.45
Cd	21
Cr	62
Cu	61
Hg	0.32
Na	3400
Ni	2.7
Pb	250
Sb	20
Se	5.8
Tl	34
Zn	240

ND = No detections
 * Upper bound soil background concentration determined statistically for all soil background samples

S-SS-08-02



S-SS-08-01

Na	3500
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Wooden Building Foundation

S-SS-08-BK

Legend

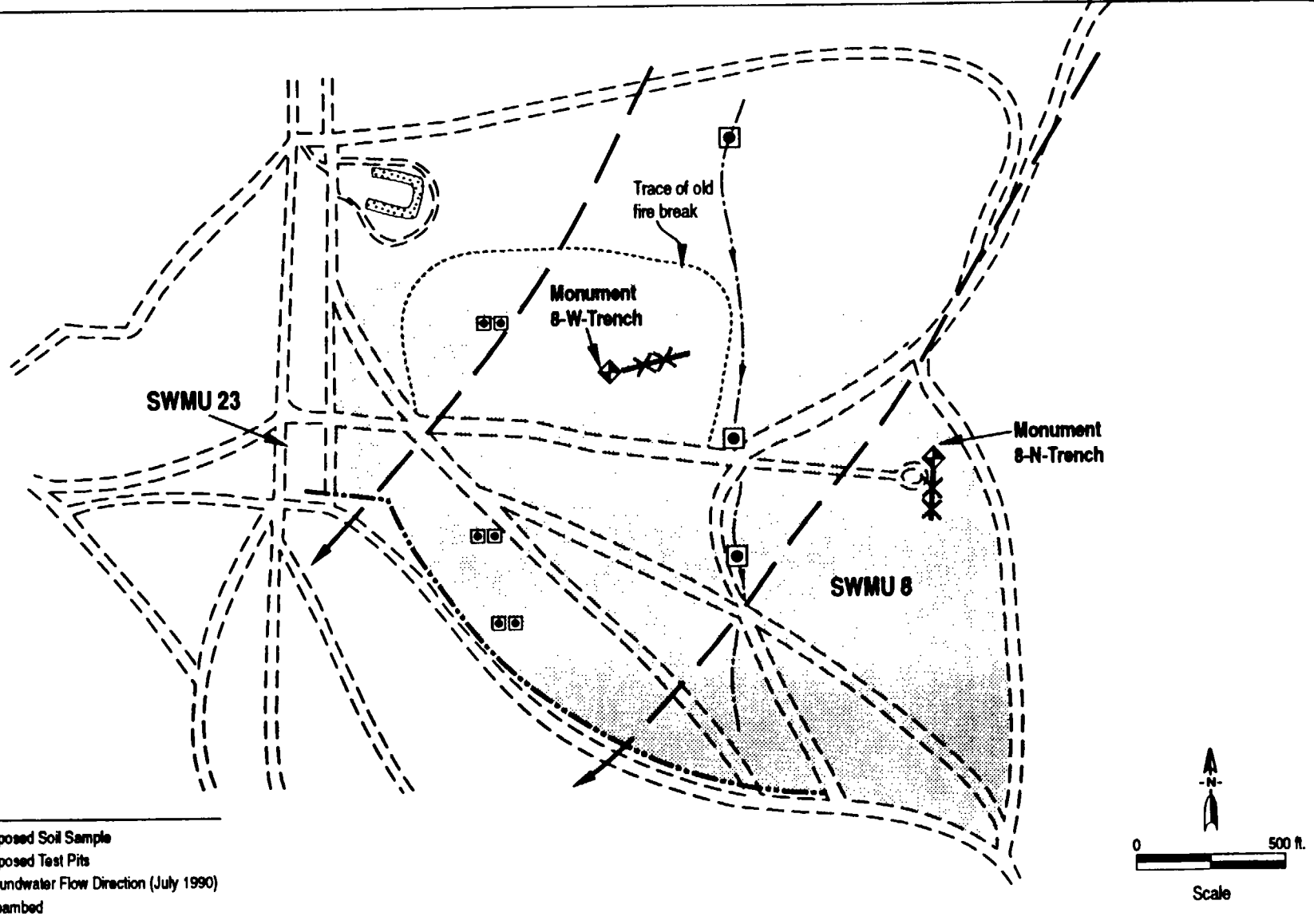
■ Soil Sample (results in µg/g)

1990 results are bolded

Tooele Army Depot - South Area
 Prepared by: Ebasco Services Incorporated

Figure 5.6-2
SWMU 8 - Surveillance Test Site
Soil Sample Locations
Metals

5-65



Legend

- ☐ Proposed Soil Sample
- X Proposed Test Pits
- ← Groundwater Flow Direction (July 1990)
- - - Streambed

Tooele Army Depot - South Area
Prepared by: Ebasco Services Incorporated

Figure 5.6-3
SWMU 8 - Surveillance Test Site
Proposed Sampling Locations

from the test pits located according to evidence of contamination. These samples will be analyzed for volatile and semivolatile organics, explosives, agent breakdown products, and metals. Select samples from the ground scar, ditch, and disposal areas should also be analyzed for pH, total organic carbon, and electrical conductance. Since the Phase I program included establishing surveyed map coordinates for these pits, the locations will be verified by a survey crew if necessary before excavation begins. During excavation, the trench contents should be inventoried to better identify potential hazards.

To support an ecological assessment of SWMU 8, biota data may be needed. A vegetation survey should be conducted to identify habitats in and near SWMU 8, and threatened and endangered species should be identified in consultation with the U.S. Fish and Wildlife Service. Game species that could be consumed by humans should also be identified. As for SWMUs 1 and 3, if the inventory of trench contents indicates a potential for exposure to hazardous wastes or if surface soil results indicate contamination, biota sampling should be considered. An explosive risk determination should also be conducted at SWMU 8.

5.7 SWMU 9: OLD AREA 2 (INCLUDING MUSTARD HOLDING AND PIT AREAS)

5.7.1 Site Description and Waste Generation

SWMU 9 includes the open storage part of the Area 2 chemical munitions safeguarding area and Old Area 2 located to the southwest of Area 2, which is identified as Site 27 in the EPIC (1982) study (Figure 5.7-1). According to the Installation Assessment (USATHAMA 1979), Area 2 was used to store munitions containing mustard, possibly V and VX, chemical agent identification sets, and war gas identification sets. Weston (1991) described Area 2 as 23 chemical ammunition storage buildings and an open area where 1-ton containers of mustard, GB, and VX were stored on rails. This open storage is included in SWMU 9.

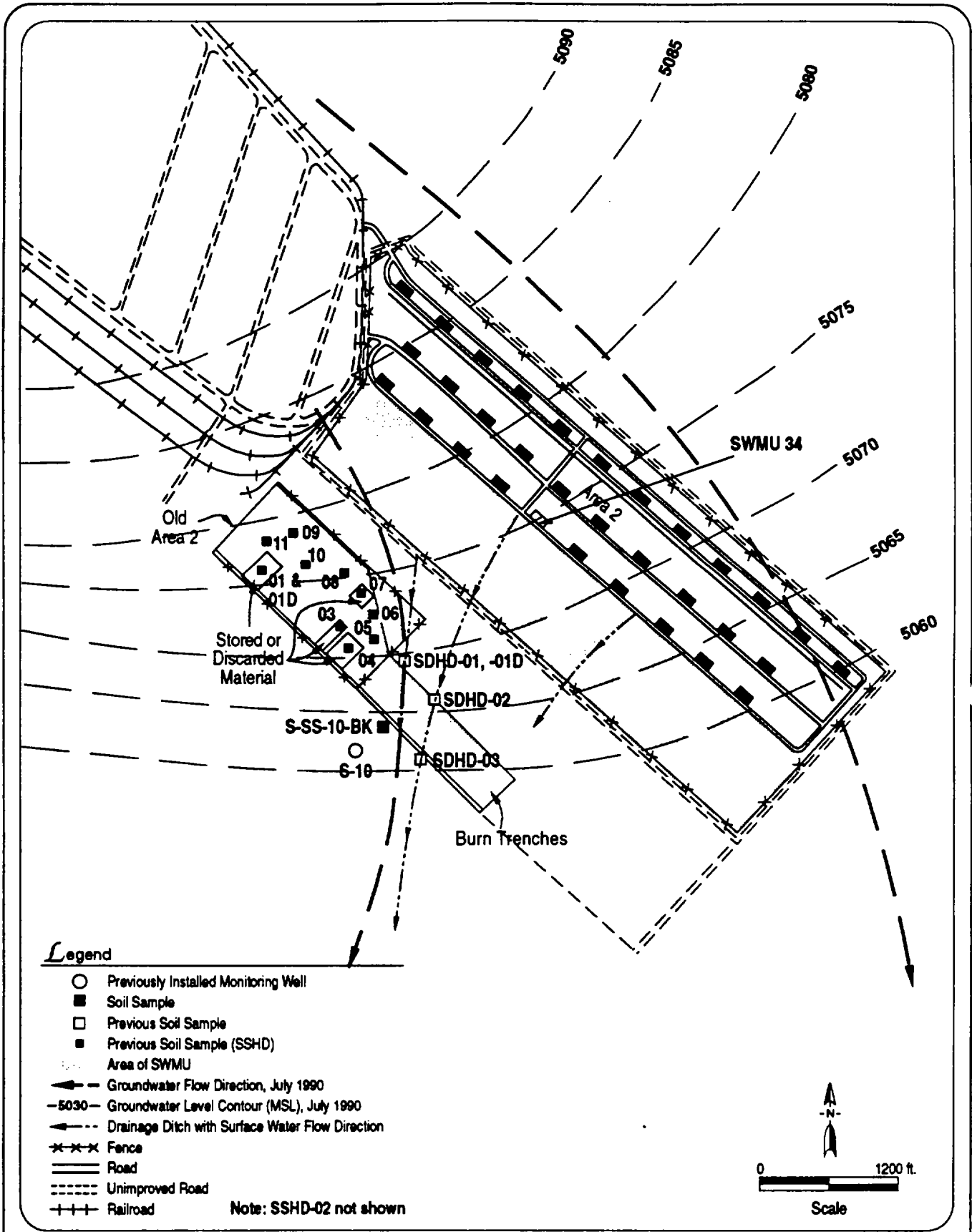
Old Area 2 is located southwest of Area 2 and was allegedly used to store M70 bombs, mustard, chemical agent identification sets, and a limited number of 1-ton containers of mustard and lewisite. EPIC (1982) described Site 27 (Old Area 2) in 1974 as a storage or disposal area consisting of many shallow trenches or linear, revetted storage sites with storage racks and small containers or objects. Possible agent canisters were present in four separate locations at the site. Trenches are also present to the east of the fenced portion of Old Area 2 in the 1974 airphoto. By 1981, some of the stored or discarded objects had been removed. By 1986, all of the stored containers had been removed. Presently, SWMU 9 is not used for open storage of any kind.

The Installation Assessment (USATHAMA 1979) stated that surveillance testing of CK, and CG occurred at Old Area 2; however, this testing involved only sampling the CK filled bombs and sending the samples to the chemical laboratory at Building 541, and the CG bombs were typically checked for leaks. Old Area 2 reportedly contained leaking H munitions (USATHAMA 1979) that were disposed of by burning. Weston (1991) identified the trenches to the east of Old Area 2 as burn trenches; however, it is not known if the leaking mustard munitions were burned in these trenches or at another location. The locations where leaks occurred were decontaminated with bleach and plowed into the earth. The locations of these areas are not documented. The area was fenced and toxic chemical warning signs were posted on the fence (USATHAMA 1979). Ertec (1982) indicates that GB, incendiary powder, and WP were stored at the former mustard holding area within SWMU 9, but it is unclear whether this area is part of Old Area 2 or Area 2. Also, the Installation Assessment (USATHAMA 1979) reports a VX spill in the southeast corner of former Storage Area 2 (Area 2), but the exact location of this area is unknown because the extent of the site appears to be differently defined in each previous study.

5.7.2 Site Hydrogeology

SWMU 9 is located on a southwest-sloping topographic surface and is underlain by Quaternary alluvial deposits. The subsurface lithology at this SWMU was extrapolated from the closest monitoring well (S-10).

The near-surface sediment is composed of loose, light, yellowish-gray, organically rich (e.g., roots and rootlets), clay and silty sand with a trace of gravel (CL, SW). The unsaturated zone is approximately 65 ft thick and is composed of light brown to gray, sandy gravel (GP, GM) with



Source:
Basic Information Maps 1985
Weston 1991

Figure 5.7-1
Site Map SWMU 9 - Old Area 2
(including Mustard Holding and Pit Areas) and
SWMU 34 - Building 4105 (Carbon Storage)
Tooele Army Depot - South Area
Prepared by: Ebasco Services Incorporated

some sandy clay (CL) interbeds. The saturated zone was logged from approximately 70 to 90 ft and is composed of pale brown, sandy clay (CL). The depth to groundwater, estimated from the July 1990 potentiometric surface map (Plate 3), is 70 ft below ground surface. The groundwater elevation at SWMU 9 is approximately 5,080 ft msl. Groundwater flows southeast to south from this SWMU.

5.7.3 Previous Sampling and RFI-Phase I Sampling Results

Previous sampling of SWMU 9 included the collection of soil samples from Old Area 2, sediment samples from drainages, and groundwater samples from monitoring well S-10.

Groundwater samples previously collected from well S-10 were analyzed for semivolatile organics, agent breakdown products, metals, anions, and radiological parameters. This well was resampled during the RFI-Phase I and analyzed for the full suite of analytes listed in Table 3.10-3, Section 3.10.10.

Previously collected soil and sediment samples from SWMU 9 included 11 from the mustard spill area in Old Area 2 and three from drainages southeast of Old Area 2. The spill area soil samples were collected from 1 to 3 ft, and the stream sediment samples were collected at a depth of 1 to 1.5 ft. These samples were analyzed for metals, semivolatile organics, and agent breakdown products. During the RFI-Phase I, one background soil sample was collected near well S-10. Table 5.7-1 lists the previous detections in soil, sediment, and groundwater samples for SWMU 9. Table 5.7-2 summarizes the RFI-Phase I groundwater detections and metals in the background soil sample. Historical and RFI-Phase I sampling locations, detected compounds, and their concentrations are presented in Figure 5.7-2 through 5.7-5.

5.7.4 Contamination Assessment

Benzyl alcohol and IMPA were previously detected in well S-10 at low concentrations, and phthalates were detected in this well at high levels. No organic compounds were identified at well S-10 during the RFI-Phase I. The RFI-Phase I detection limits for IMPA were lower than in previous investigations, and the previous data for this compound were qualified as noncertified by USATHAMA, casting doubt on its accuracy.

Well S-10 is included in water quality zone I. Several metals were previously measured at elevated concentrations in well S-10, but none of these high levels were repeated in the RFI-Phase I.

No organic compounds were detected in soil samples collected from Old Area 2 during previous investigations. However, chromium, copper, and nickel exceeded background soil concentrations established during the RFI-Phase I. The single detection of silver at SSHD-10 was only slightly elevated above the background concentration.

TABLE 5.7-1

**Summary of Previous Analytical Investigations for
SWMU 9: Old Area 2 (Including Mustard Holding and Pit Areas)**

SOIL ($\mu\text{g/g}$)

Analytical Groups and Analytes Detected	SSHD-01	SSHD-01D	SSHD-02	SSHD-03	SSHD-04	SSHD-05	SSHD-06	SSHD-07	SSHD-08
	(1-3 ft) 1988	(1-3 FT) 1988	(1-3 ft) 1988	(1-3 ft) 1988	(1-3 ft) 1988	(1-3 ft) 1988	(1-3 ft) 1988	(1-3 ft) 1988	(1-3 ft) 1988
Semivolatile Organics:	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis (2-ethylhexyl) phthalate (B2EHP)									
Benzyl alcohol (BZALC)									
Butylbenzyl phthalate (BBZP)									
Unknowns ^c									
Agent Breakdown Products:									
Isopropylmethyl phosphonic acid (IMPA)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals:									
Arsenic (As)	LT (5.7)	LT (5.7)	LT (5.7)	LT (5.7)	13/LT (5.7)	LT (5.7)	LT (5.7)	6.4 (5.7)	LT (5.7)
Barium (Ba)	LT (u)	LT (u)	LT (u)	LT (u)	LT (u)	LT (u)	LT (u)	LT (u)	LT (u)
Beryllium (Be)	LT (0.33)	LT (0.33)	LT (0.33)	LT (0.33)	0.34/LT (0.33)	LT (0.33)	0.30 (0.33)	LT (0.33)	0.32 (0.33)
Cadmium (Cd)	4.1 (0.70)	LT (0.70)	1.4 (0.70)	LT (0.70)	LT (0.70)	1.1 (0.70)	LT (0.70)	2.2 (0.70)	LT (0.70)
Chromium (Cr)	230 (2.5)	240 (2.5)	160 (2.5)	160 (2.5)	250/150 (2.5)	230 (2.5)	210 (2.5)	230 (2.5)	210 (2.5)
Copper (Cu)	21 (3.8)	75 (3.8)	100 (3.8)	58 (3.8)	61/120 (3.8)	100 (3.8)	110 (3.8)	95 (3.8)	110 (3.8)
Lead (Pb)	18 (4.8)	12 (4.8)	8.6 (4.8)	6.5 (4.8)	12/11 (4.8)	11 (4.8)	11 (4.8)	11 (4.8)	10 (4.8)
Nickel (Ni)	13 (4.8)	15 (4.8)	14 (4.8)	16 (4.8)	15 (4.8)	14 (4.8)	14 (4.8)	12 (4.8)	13 (4.8)

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

$\mu\text{g/g}$ Micrograms per gram
LT Less than
u Detection limit unavailable
() Detection limit

References: 1988 data - Weston 1991

TABLE 5.7-1

**Summary of Previous Analytical Investigations for
SWMU 9: Old Area 2 (Including Mustard Holding and Pit Areas)**

Page 2 of 6

SOIL ($\mu\text{g/g}$)

Analytical Groups and Analytes Detected	SSHD-01 (1-3 ft) 1988	SSHD-01D (1-3 ft) 1988	SSHD-02 (1-3 ft) 1988	SSHD-03 (1-3 ft) 1988	SSHD-04 (1-3 ft) 1988	SSHD-05 (1-3 ft) 1988	SSHD-06 (1-3 ft) 1988	SSHD-07 (1-3 ft) 1988	SSHD-08 (1-3 ft) 1988
Metals Cont'd:									
Silver (Ag)	LT (0.65)	LT (0.65)	LT (0.65)	LT (0.65)	LT (0.65)	LT (0.65)	LT (0.65)	LT (0.65)	LT (0.65)
Sodium (Na)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium (Tl)	LT (7.9)	LT (4.9)	LT (7.9)	LT (7.9)	LT (7.9)	LT (7.9)	LT (7.9)	LT (7.9)	LT (7.9)
Zinc (Zn)	LT (52)	73 (52)	62 (52)	LT (52)	LT (52)	LT (52)	LT (52)	LT (52)	LT (52)
Anions:									
Chloride (Cl)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride (F)									
Sulfate (SO ₄)									
Nitrite (NO ₂)									
Nitrate (NO ₃)									
Radionuclides (pCi/g):									
Gross alpha (ALPHAG)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)
Gross beta (BETAG)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)
Uranium - Total	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA Not analyzed
 LT Less than
 pCi/g picocurie per gram
 v Detection limit for radionuclides varies for each sample
 () Detection limit
 $\mu\text{g/g}$ microgram per gram

References: 1988 data - Weston 1991

TABLE 5.7-1

**Summary of Previous Analytical Investigations for
SWMU 9: Old Area 2 (Including Mustard Holding and Pit Areas)**

SOIL ($\mu\text{g/g}$)

Analytical Groups and Analytes Detected	SSHD-09 (1-3 ft) 1988	SSHD-10 (1-3 ft) 1988	SSHD-11 (1-3 ft) 1988	SDHD-01 (1-1.5 ft) 1988	SDHD-02 (1-1.5 ft) 1988	SDHD-03 (1-1.5 ft) 1988
Semivolatile Organics:	NA	NA	NA	NA	NA	NA
Bis (2-ethylhexyl) phthalate (B2EHP)						
Benzyl alcohol (BZALC)						
Butylbenzyl phthalate (BBZP)						
Unknowns ^c						
Agent Breakdown Products:						
Isopropylmethyl phosphonic acid (IMPA)	NA	NA	NA	NA	NA	NA
Metals:						
Arsenic (As)	LT (5.7)	LT (5.7)	LT (5.7)	LT (5.7)	LT (5.7)	LT (5.7)
Barium (Ba)	LT (u)	LT (u)	LT (u)	LT (u)	LT (u)	LT (u)
Beryllium (Be)	0.30 (0.33)	LT (0.33)	LT (0.33)	LT (0.33)	0.30 (0.33)	LT (0.33)
Cadmium (Cd)	1.1 (0.70)	LT (0.70)	LT (0.70)	LT (0.70)	LT (u)	1.5 (0.70)
Chromium (Cr)	180 (2.5)	180 (2.5)	120 (2.5)	170 (2.5)	290 (2.5)	180 (2.5)
Copper (Cu)	110 (3.8)	100 (3.8)	56 (3.8)	75 (3.8)	110 (3.8)	94 (3.8)
Lead (Pb)	12 (4.8)	8.3 (4.8)	7.5 (4.8)	6.9 (4.8)	9.0 (4.8)	9.4 (4.8)
Nickel (Ni)	13 (4.8)	14 (4.8)	11 (4.8)	11 (4.8)	13 (4.8)	13 (4.8)

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

NA Not analyzed

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

LT Less than

u Detection limit unavailable

() Detection limit

References: 1988 data - Weston 1991

TABLE 5.7-1

Summary of Previous Analytical Investigations for
 SWMU 9: Old Area 2 (Including Mustard Holding and Pit Areas)

SOIL (µg/g)

Analytical Groups and Analytes Detected	SSHD-09 (1-3 ft) 1988	SSHD-10 (1-3 ft) 1988	SSHD-11 (1-3 ft) 1988	SDHD-01 (1-1.5 ft) 1988	SDHD-02 (1-1.5 ft) 1988	SDHD-03 (1-1.5 ft) 1988
Metals Cont'd:						
Silver (Ag)	LT (0.65)	2.5 (0.65)	LT (0.65)	LT (0.65)	LT (0.65)	LT (0.65)
Sodium (Na)	NA	NA	NA	NA	NA	NA
Thallium (Tl)	LT (7.9)	LT (7.9)	LT (7.9)	LT (7.9)	LT (7.9)	LT (7.9)
Zinc (Zn)	LT (52)	LT (52)	LT (52)	LT (52)	LT (52)	LT (52)
Anions:						
Chloride (Cl)	NA	NA	NA	NA	NA	NA
Fluoride (F)						
Sulfate (SO ₄)						
Nitrite (NO ₂)						
Nitrate (NO ₃)						
Radionuclides (pCi/g):						
Gross alpha (ALHAG)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)
Gross beta (BETAG)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)	LT (v)
Uranium - Total	NA	NA	NA	NA	NA	NA

NA Not analyzed
 LT Less than
 pCi/g picocurie per gram
 v Detection limit for radionuclides varies for each sample
 () Detection limit
 µg/g microgram per gram

References: 1988 data - Weston 1991

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TABLE 5.7-1

Summary of Previous Analytical Investigations for
SWMU 9: Old Area 2 (Including Mustard Holding and Pit Areas)

GROUNDWATER (µg/l)

Analytical Groups and Analytes Detected	1982	S-10 1987	1988
Semivolatile Organics:			
Bis (2-ethylhexyl) phthalate (B2EHP)	NA	3.0 (3.0)	LT (10)
Benzyl alcohol (BZALC)	NA	5.0 (u)	LT (10)
Butylbenzyl phthalate (BBZP)	NA	2.0 ^a (3.0)	LT (10)
Unknowns ^c			380
Agent Breakdown Products:			
Isopropylmethyl phosphonic acid (IMPA)	NA	NA	3,700 (470)
Metals:			
Arsenic (As)	LT (4.0)	34 (2.5)	5.5/6.2 (5.0)
Barium (Ba)	NA	GT 200 (3.4)	NA
Beryllium (Be)	LT (0.40)	1.8 (0.83)	LT (0.10)
Cadmium (Cd)	LT (u)	LT (12)	LT (5.1)
Chromium (Cr)	LT (20)	88 (11)	LT (38)
Copper (Cu)	LT (6.0)	80 (21)	LT (1.8)
Lead (Pb)	LT (30)	20 (1.5)	LT (2.5)
Nickel (Ni)	LT (4.0)	82 (65)	13/18 (9.6)

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

GT Greater than
 LT Less than
 u Detection limit unavailable
 () Detection limit
 µg/l microgram per liter

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

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GROUNDWATER (µg/l)

Analytical Groups and Analytes Detected	S-10		
	1982	1987	1988
Metals Cont'd:			
Silver (Ag)	LT (8.0)	0.43 (0.14)	LT (0.20)
Sodium (Na)	31,000 (1000)	28,000 (450)	NA
Thallium (Tl)	NA	4.7 (1.7)	LT (5.0)
Zinc (Zn)	15 (3.0)	270 (14)	28/370 (17)
Anions:			
Chloride (Cl)	13000 (100)	23,000 (5000)	LT (130,000)
Fluoride (F)	LT (1000)	600 (360)	LT (5)
Sulfate (SO ₄)	GT 19,000 (1000)	40,000 (4730)	LT (130,000)
Nitrite (NO ₂)	LT (900)		
Nitrate (NO ₃)	8100 (1000)		
Nitrate-nonspecific (NIT)		8000 (+24)	LT (5000)
Radionuclides (pCi/l):			
Gross alpha (ALPHAG)	LT (3.0)	11 ± 6.0 (u)	LT 2.7 (v)
Gross beta (BETAG)	LT (6.0)	17 ± 6.0 (u)	2.9 ± 1.7 (v)
Uranium - Total	NA	NA	LT 0.30 (v)

NA Not analyzed
 GT Greater than
 LT Less than
 pCi/l picocurie per liter
 u Detection limit unavailable
 v Detection limit for radionuclides varies for each sample
 () Detection limit
 µg/l microgram per liter

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

5-75

TABLE 5.7-2

**Summary of RFI-Phase I Investigations for
SWMU 9: Old Area 2 (Including Mustard Holding and Pit Areas)**

SOIL (µg/g)

Analytical Group and Analytes Detected	S-SS-10-BK¹
Metals:	
Arsenic (As)	19
Beryllium (Be)	0.36
Chromium (Cr)	19
Copper (Cu)	23*
Lead (Pb)	14
Silver (Ag)	0.13
Sodium (Na)	1800
Zinc (Zn)	63

S-76

1 Metals analysis only
 * Detected in associated method blank
 µg/g Microgram per gram

GROUNDWATER (µg/l)

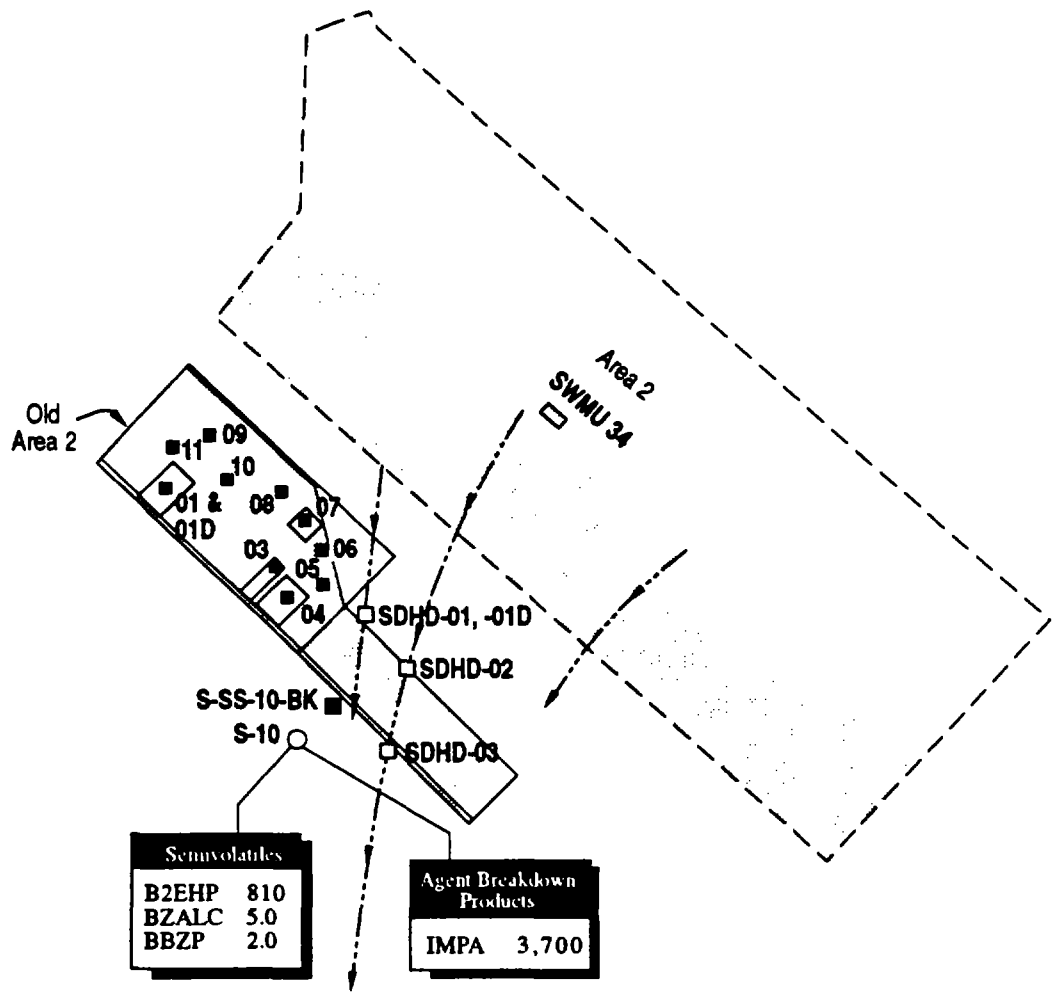
Analytical Group and Analytes Detected	S-10
Metals:	
Arsenic (As)	4.1
Chromium (Cr)	8.9
Sodium (Na)	31,000
Zinc (Zn)	70
Anions:	
Chloride (Cl)	23,000
Fluoride (F)	300
Radionuclides (pCi/l):	
Gross alpha (ALPHAG)	49*
Uranium (U)	9.1*

S-77

* Detected in associated method blank

pCi/l Picocurri per liter

µg/l Microgram per liter

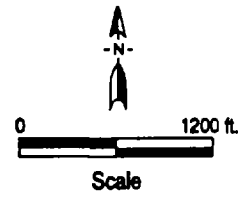


Legend

- Previously Installed Monitoring Well (results in µg/l)
- Soil Sample
- Previous Soil Sample
- Previous Soil Sample (SSHD)

Previous results

Note: SSHD-02 not shown

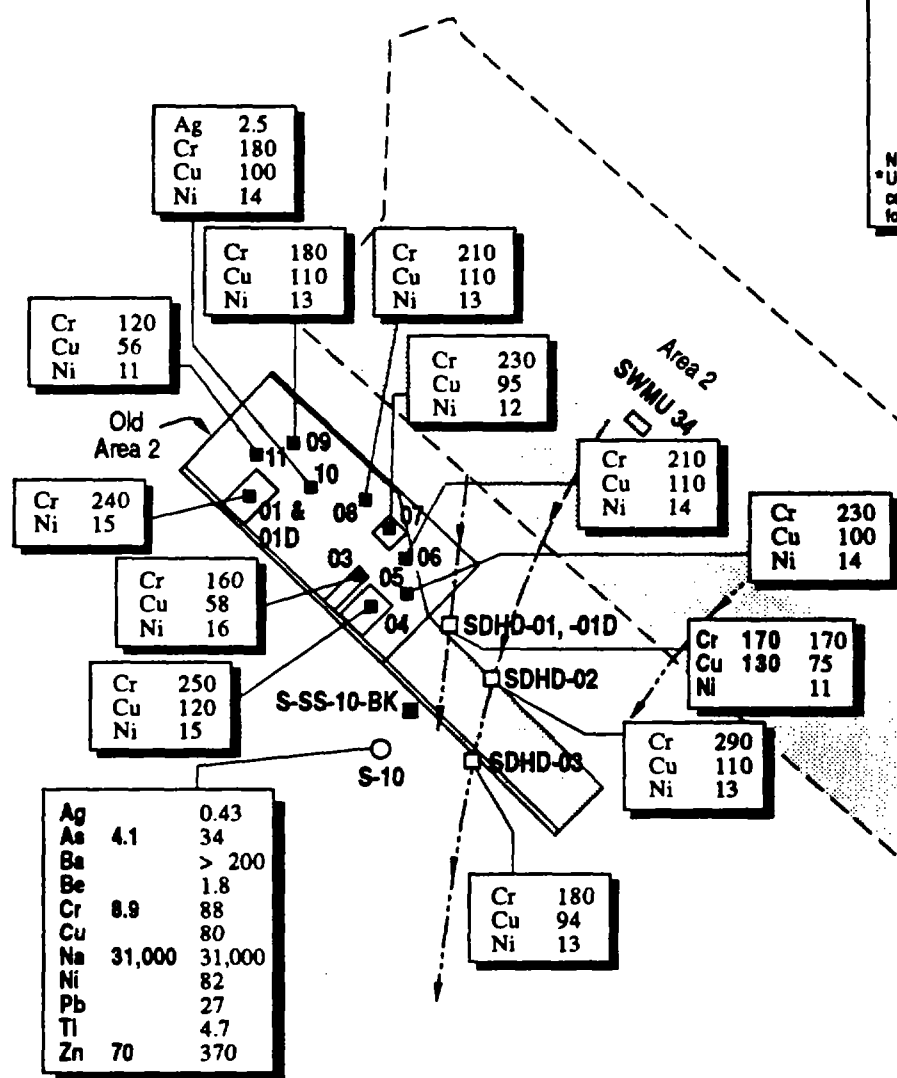


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Figure 5.7-2
SWMU 9 - Old Area 2
(Including Mustard Holding and Pit Areas) and
SWMU 34 - Building 4105 (Carbon Storage)
Organics and Agent Breakdown Products

Wide Upper Boundaries* for Background Concentrations	
Metal	Upper Bound /ppm
Ag	1.9
As	41
Be	0.45
Cd	21
Cr	62
Cu	61
Hg	0.32
Na	3400
Ni	2.7
Pb	250
Sb	20
Se	5.8
Tl	34
Zn	240

ND = No detections
 * Upper bound soil background concentration determined statistically for all soil background samples

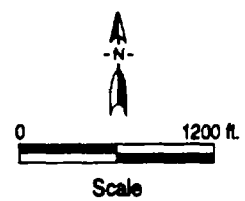


Legend

- Previously Installed Monitoring Well (results in µg/l)
- Soil Sample (results in µg/g)
- Previous Soil Sample (results in µg/g)
- Previous Soil Sample (SSHD)

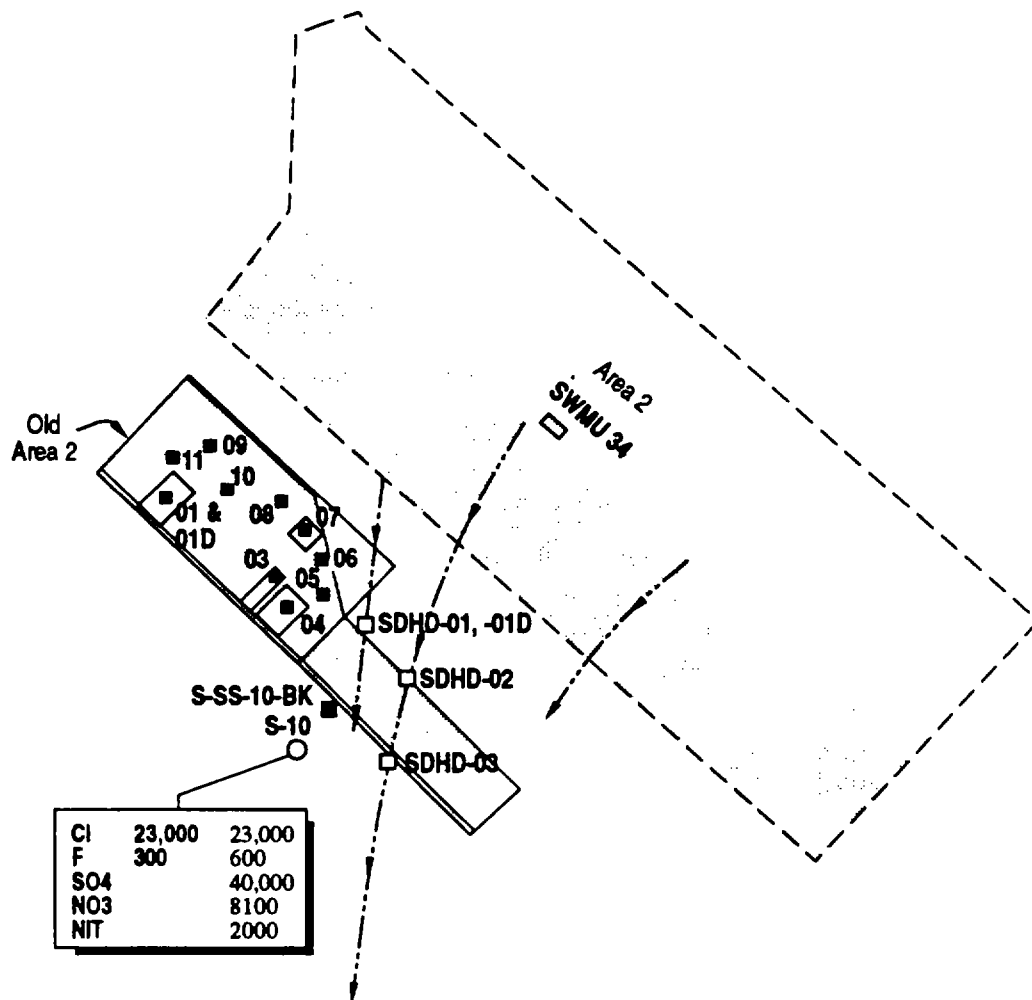
1990 results are bolded
 Previous results

Note: SSHD-02 not shown



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Figure 5.7-3
SWMU 9 - Old Area 2
(including Mustard Holding and Pit Areas) and
SWMU 34 - Building 4105 (Carbon Storage)
Metals

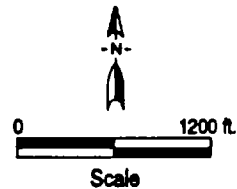


Legend

- Previously Installed Monitoring Well (results in µg/l)
- Soil Sample
- Previous Soil Sample
- Previous Soil Sample (SSHD)

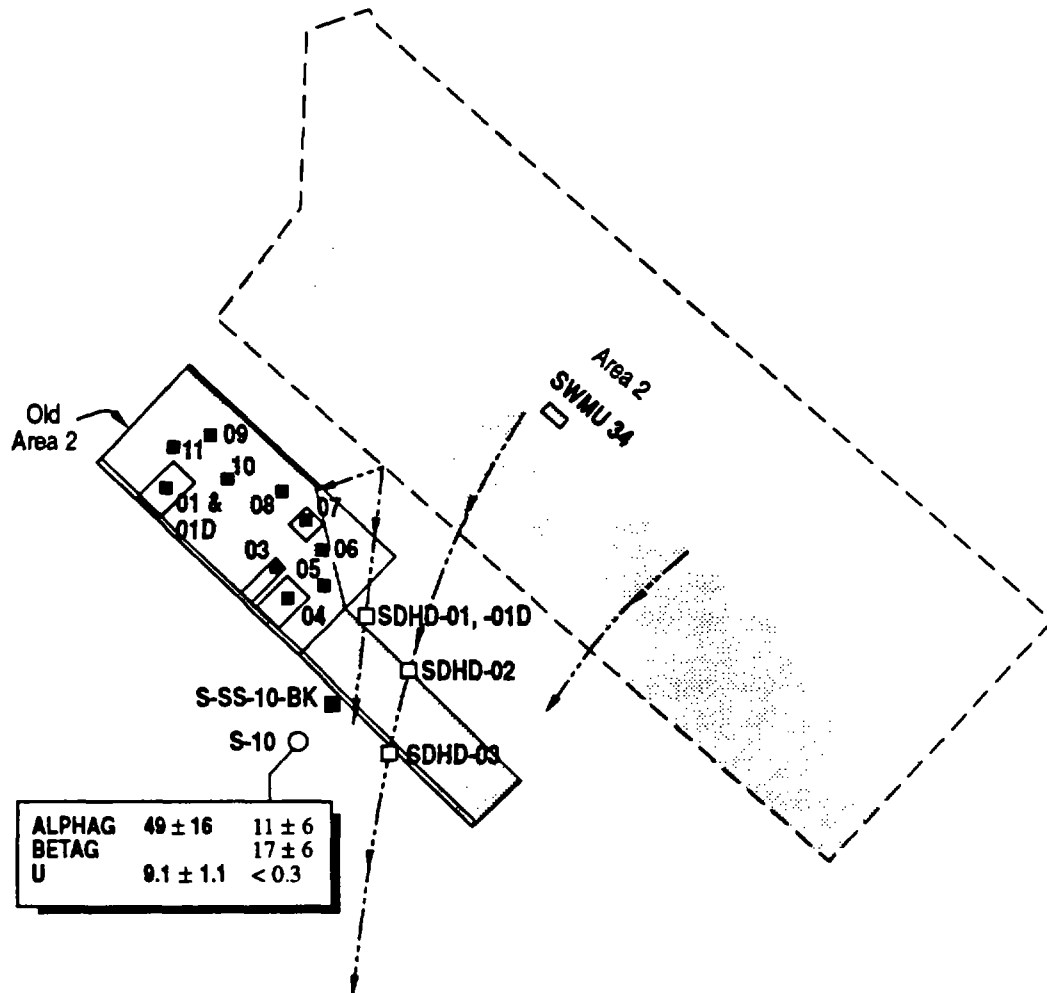
1990 results are bolded
Previous results

Note: SSHD-02 not shown



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Figure 5.7-4
SWMU 9 - Old Area 2
(Including Mustard Holding and Pit Areas) and
SWMU 34 - Building 4105 (Carbon Storage)
Anions

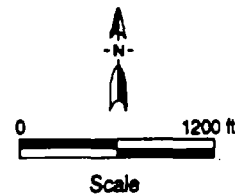


Legend

- Previous Installed Monitoring Well (results in pCi/l)
- Soil Sample
- Previous Soil Sample
- Previous Soil Sample (SSHD)

1990 results are bolded
Previous results

Note: SSHD-02 not shown



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Figure 5.7-5
SWMU 9 - Old Area 2
(including Mustard Holding and Pit Areas) and
SWMU 34 - Building 4105 (Carbon Storage)
Radionuclides

5.7.5 Recommendations

Since soil contamination has been found in Old Area 2, and since open storage of agent-filled containers occurred in the south part of Area 2, one upgradient and two additional downgradient wells are proposed. These wells should be analyzed for semivolatile organics, agent breakdown products, and metals. In addition, well S-10 should be resampled for analysis of agent breakdown products and metals. The semivolatile organics analysis should also be repeated to confirm or refute the relatively high level of phthalates detected in the RFI-Phase I. Slug tests should also be performed in the new wells to determine the aquifer characteristics.

Additional soil sampling is recommended at Old Area 2 to delineate the lateral and vertical extent of metal contamination. Twelve borings are proposed in this area as shown in Figure 5.7-6. Six borings should be drilled inside Old Area 2 to delineate the vertical extent of previously detected metal contamination, and six should be drilled around the outside of this area for defining lateral and vertical extent. Each boring should be sampled from 0- to 6-inch and 6- to 12-inch, 2- to 3-ft, and 4- to 5-ft intervals and analyzed for metals.

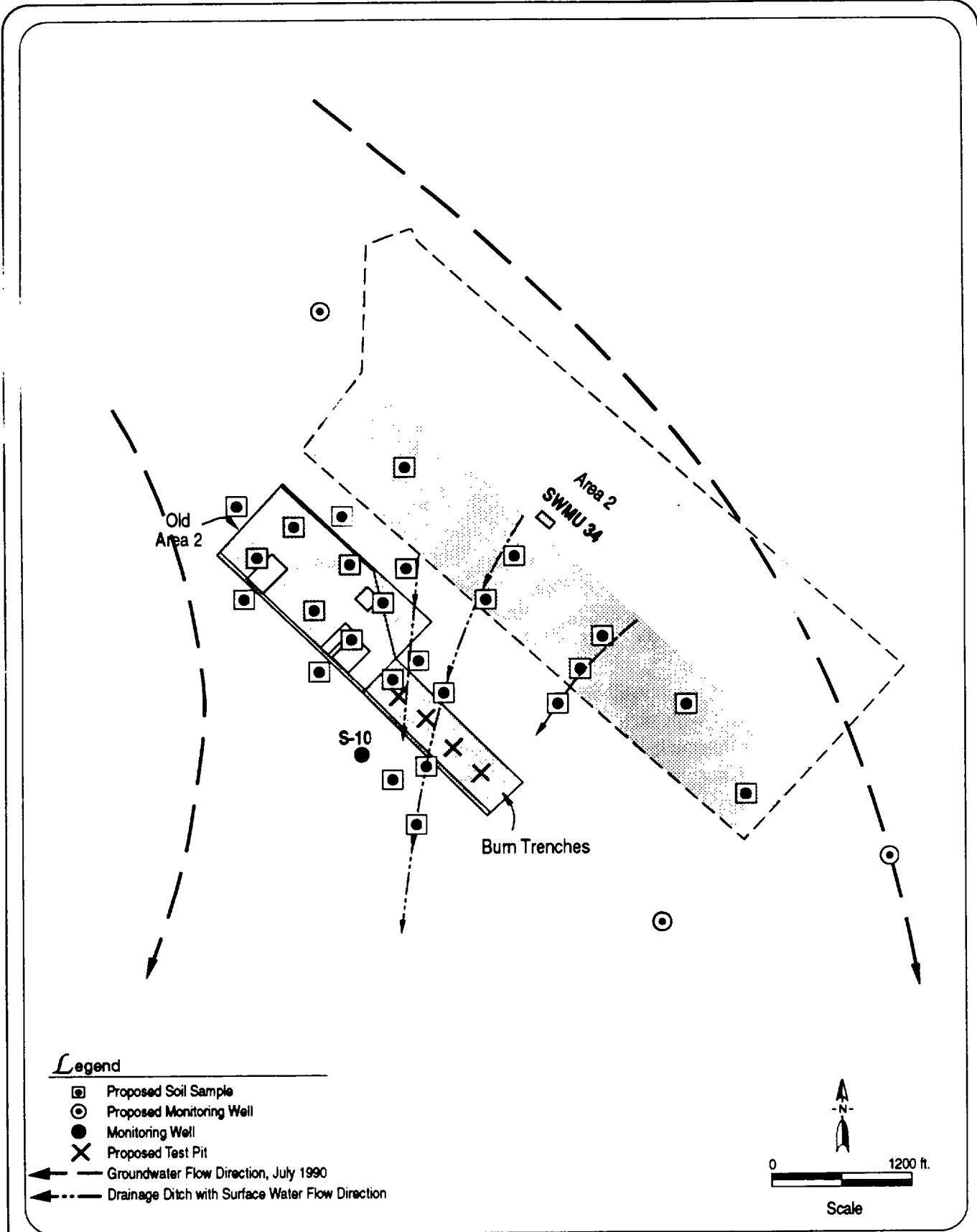
Four test pits should be excavated in the burning area to the east of Old Area 2. A total of 16 samples should be collected with at least one soil sample per pit located according to evidence of contamination. These samples should be analyzed for organics, explosives, agent breakdown products, and metals.

Previous sediment samples from the drainage ditches east of this area were collected from 1 to 1.5 ft since explosives are expected to degrade near the surface. Therefore, samples from the 0- to 6-inch interval should be collected and analyzed for metals at the same approximate locations as previously sampled, in addition to five additional locations to investigate possible metal contamination transport in the creek bedload.

Soil sampling is also recommended in the open part of Area 2, southwest of the ammunition storage buildings, to detect any releases of agent breakdown products or metals. Soil should be sampled at the five locations shown in Figure 5.7-6. At each proposed location, samples should be collected from 0- to 6-inch and 6- to 12-inch, 2- to 3-ft, and 4- to 5-ft intervals. The samples should be analyzed for agent breakdown products and metals. A representative number of samples from each of the above areas should be analyzed for pH, total organic carbon, and electrical conductance.

To support an ecological assessment of SWMU 9, biota data may be needed. A vegetation survey should be conducted to identify habitats in and near SWMU 9, and threatened and endangered species should be identified in consultation with the U.S. Fish and Wildlife Service. Game species that could be consumed by humans should also be identified.

An explosive risk determination will be conducted at this SWMU and if soil sampling results indicate contamination, biota sampling should be considered.



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Figure 5.7-6
SWMU 9 - Old Area 2
(Including Mustard Holding and Pit Areas) and
SWMU 34 - Building 4105 (Carbon Storage)
Proposed Sampling Locations