REVISED FINAL

PHASE II RCRA FACILITY INVESTIGATION REPORT FOR 16 SOLID WASTE MANAGEMENT UNITS

AT

FORT STEWART, GEORGIA
VOLUME I OF III

REGULATORY AUTHORITY
RESOURCE CONSERVATION AND RECOVERY ACT
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Prepared by:
Science Applications International Corporation
800 Oak Ridge Turnpike
Oak Ridge, Tennessee 37831

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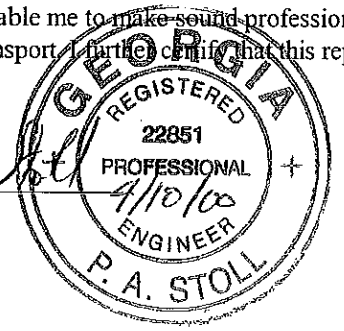
The undersigned certifies that I am a qualified groundwater scientist who has received a baccalaureate or postgraduate degree in the natural sciences or engineering and have sufficient training and experience in groundwater hydrology and related fields, as demonstrated by state registration and completion of accredited university courses, to enable me to make sound professional judgments regarding groundwater monitoring and contaminant fate and transport. I further certify that this report was prepared by myself or a subordinate working under my direction.



4/10/00

Patricia Stoll, P.E.
Technical Manager
SAIC

DOCUMENT 5

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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ACRONYMS

ADA	Air Defense Artillery
ADD	average daily dose
amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirement
Army	U.S. Army
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
AT123D	Analytical Transient 1-, 2-, 3-Dimensional
AUF	area use factor
AWQC	Ambient Water Quality Criteria
BAF	bioaccumulation factor
BCF	bioconcentration factor
bgs	below ground surface
BHC	benzene hexachloride
BN	battalion
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Corrective Action Plan
CB	chemical/biological
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMCOC	contaminant migration chemical of concern
CMCOPC	contaminant migration constituent of potential concern
COC	contaminant of concern
COPC	contaminant of potential concern
CSM	Conceptual Site Model
DAF	dilution attenuation factor
DEH	Directorate of Engineering and Housing
DF	dilution factor
DO	dissolved oxygen
DOL	Directorate of Logistics
DPT	direct-push technology
DPW	Directorate of Public Works
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Organization
ECOPC	ecological contaminant of potential concern
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
EPRE	ecological preliminary risk evaluation
EP Tox	Extraction Procedure Toxicity
ERA	Ecological Risk Assessment
ESV	ecological screening value
FR	Federal Register
FSMR	Fort Stewart Military Reservation
GAF	gastrointestinal absorption factor
GEPD	Georgia Environmental Protection Division
GSSL	generic soil screening level
HAZWRAP	Hazardous Waste Remedial Actions Program
HELP	Hydrologic Evaluation of Landfill Performance

ACRONYMS (continued)

HHCOC	human health chemical of concern
HHCOPC	human health contaminant of potential concern
HHPRE	human health preliminary risk evaluation
HI	hazard index
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQ	hazard quotient
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
ILCR	incremental lifetime cancer risk
IRA	Interim Removal Action
IWTP	Industrial Wastewater Treatment Plant
LAS	Land Application System
LOAEL	lowest observed adverse effect level
MCL	maximum contaminant level
MOGAS	motor gasoline
NFA	no further action
NGTC	National Guard Training Center
NGVD	National Geodetic Vertical Datum
NOAEL	no observed adverse effect level
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
OB	open burn
OD	open detonation
ODAST	One-dimensional Analytical Solute Transport
OWS	oil/water separator
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PETN	pentaerythrite tetranitrate
PID	photoionization detector
POL	petroleum, oil, and lubricants
POTW	publicly owned treatment works
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCSR	Quality Control Summary Report
RBC	risk-based concentration
RBCA	Risk-based Corrective Action
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
Redox	oxidation-reduction
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SESOIL	Seasonal Soil Compartment Model
SMCL	secondary maximum contaminant level

ACRONYMS (continued)

SPT BN	Support Battalion
SRC	site-related contaminant
SSL	soil screening level
SQB	sediment quality benchmark
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAC	Tactical Air Command
TC	toxicity characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TEF	toxicity equivalence factor
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
TRV	toxicity reference value
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
WQS	water quality standard

EXECUTIVE SUMMARY

This report summarizes the results of the Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the 16 Solid Waste Management Units (SWMUs) at Fort Stewart, Georgia. The 16 SWMUs include: Camp Oliver Landfill, SWMU 2; TAC-X Landfill, SWMU 3; Inactive EOD Area in Red Cloud Range, Hotel Area, SWMU 9; Inactive EOD Area North of Garrison Area, SWMU 10; Inactive EOD Area Located Approximately Three Miles Northeast of Garrison Area, SWMU 11; Active EOD Containing Open Detonation Unit and Open Burn Unit, SWMU 12A; Old Fire Training Area, SWMU 14; DRMO Hazardous Waste Storage Area, SWMU 17; Industrial Wastewater Treatment Plant, SWMU 18; Old Sludge Drying Beds, SWMU 19; Old Radiator Shop/Paint Booth, SWMU 24B; Motorpools, SWMUs 27A through 27V; Evans Army Heliport POL Storage Facility, SWMU 29; DEH Asphalt Tanks, SWMU 31; Supply Diesel Tank, SWMU 32; DEH Equipment Wash Rack, SWMU 34; and NGTC Equalization Basin, SWMU 37. Four of the 16 sites—Old Sludge Drying Beds, SWMU 19; Old Radiator Shop/Paint Booth, SWMU 24B; Motorpools, SWMUs 27A through 27V; and NGTC Equalization Basin, SWMU 37—had not been investigated previously and were investigated as Phase I RFIs. This report has been prepared by Science Applications International Corporation (SAIC) for the U.S. Army Corps of Engineers (USACE), Savannah District, under Contract DACA21-95-D-0022, Delivery Order No. 0009. The RFI was conducted in accordance with USACE Guidance EM 200-1-3 and the Georgia Environmental Protection Division (GEPD)–approved Sampling and Analysis Plan (SAP) (SAIC 1997).

The 16 SWMUs investigation consisted of 38 SWMU sites (including 22 motorpool sites) as designated under Hazardous Waste Permit HW-045. The sites were divided into 45 distinct geographic areas for investigation. Seven (SWMUs 2, 3, 9, 10, 11, 12A, and 29) of the 38 SWMUs are located outside the garrison area. The remaining 31 (SWMUs 14, 17, 18, 19, 24B, 27A through 27V, 31, 32, 34, and 37) are located within the garrison area.

OBJECTIVES AND SCOPE OF THE INVESTIGATION

The specific objectives of the Phase I and Phase II RFIs for the 16 SWMUs at Fort Stewart, Georgia, as defined in the Phase II RFI SAP (SAIC 1997) (approved by the GEPD in October 1997) are listed below.

Phase I RFI

- Determine if contamination of the environment has occurred.
- Determine whether contaminants, if present, constitute a threat to human health or the environment.
- Determine the need for future action and/or no further action (NFA).

Phase II RFI

- Determine the horizontal and vertical extent of contamination.
- Determine whether contaminants present a threat to human health or the environment.

- Determine the need for future action and/or NFA.

- Gather data necessary to support a Corrective Action Plan (CAP), if warranted.

The information provided in this report is based upon data collected previously during the Phase I RFI (if available) and data collected as part of the Phase II field sampling and analysis. At some of the sites, the Phase II sampling program incorporated an observational approach to sampling, as defined in the Phase II RFI SAP (SAIC 1997). This observational approach used field screening techniques to determine the horizontal and vertical extent of contamination at the SWMU and to identify suitable locations for installation of permanent monitoring wells. The scope of the fieldwork for the Phase I and Phase II sites included the activities listed below.

Phase I Sites

- Collection of direct-push soil samples using a push probe.

- Collection of direct-push groundwater samples using a push probe.

- Installation of permanent groundwater monitoring points or monitoring wells to confirm the nature of potential contamination at a specific push-probe location.

- Collection of surface water and sediment samples at SWMUs at which surface water and sediment were available.

- Surveying of the positions of all sample locations.

Phase II Sites

- Collection of direct-push soil samples using a push probe.

- Collection of direct-push groundwater samples using a push probe, including vertical-profile probes.

- Installation of permanent groundwater monitoring wells both upgradient and downgradient of the site.

- Groundwater sampling at existing monitoring wells (if available) and sampling of newly installed wells around the SWMUs.

- Collection of surface water and sediment samples at SWMUs at which surface water and sediment were available.

- Surveying of the positions of all sample locations.

Nature and Extent of Contamination

Site-related contaminants (SRCs) were identified for each site by comparing the analytical results obtained from soil, groundwater, surface water, and sediment against the reference background criteria. Contaminants with concentrations above the reference background criteria were identified as SRCs. The results of the chemical analyses on surface soil, subsurface soil, and groundwater were screened against the reference

background criteria for the Fort Stewart Military Reservation. Surface water and sediment were screened against site-specific background criteria.

In general, reference background samples were collected from each medium at locations upgradient or upstream of each site so as to be representative of naturally occurring conditions at sites under investigation. Upgradient or upstream samples were not collected at sites under a Phase I RFI (i.e., SWMUs 19, 24B, 27A through 27V and 37). The reference background concentrations for surface soil, subsurface soil, and groundwater were calculated as two times the average concentration of all of the locations selected to be in the background data set. If a chemical was not detected at a site, then one-half the detection limit was used as the concentration when calculating the reference mean background concentration. Surface water and sediment background samples were collected during the Phase II RFI and applied to the SWMUs on a site-specific basis.

Inorganics were considered to be SRCs if their concentrations were above the reference background concentrations, while organics were considered SRCs if they were simply detected because organic constituents are considered to potentially be man-made. SRCs from the nature and extent of contamination evaluation were further evaluated as potential concerns based upon fate and transport characteristics and upon their potential risk to human health and ecological receptors. A summary of SRCs by medium for each SWMU is presented in Table ES-1.

Fate and Transport Analysis

Fate and transport analysis was performed on each SWMU. This analysis included developing a site-specific Conceptual Site Model (CSM) identifying potential contaminant release and migration pathways and determining the potential for SRCs in surface soil, subsurface soil, and/or sediment to migrate to groundwater.

The maximum concentrations of the SRCs determined from nature and extent analysis were compared to U.S. Environmental Protection Agency (EPA) Generic Soil Screening Levels (GSSLs). Generally, if contaminant concentrations in soil fall below the GSSLs and there are no significant ecological receptors of concern, then no further study or action is warranted. SRCs were identified as contaminant migration constituents of potential concern (CMCOPCs) if they were detected at concentrations that exceeded their respective GSSLs. To evaluate leaching of CMCOPCs from soil to groundwater at the 16 SWMUs, groundwater concentrations of CMCOPCs were compared to maximum contaminant levels (MCLs). If an MCL for a chemical was not available, the groundwater concentration was compared to the risk-based concentration, as established by EPA Region III (EPA 1999b). A summary of the results of the fate and transport analysis (CMCOPCs) is presented in Table ES-2.

A weight-of-evidence approach was used to evaluate each CMCOPC identified based on leaching to groundwater. In some instances, the potential impact of CMCOPCs to groundwater, and possibly to surface water, was evaluated (modeled concentrations were compared to risk-based criteria) in a human health baseline risk assessment. CMCOPCs that indicated a potential risk to human health (i.e., that exceeded risk-based screening criteria) from modeling were identified as contaminant migration chemicals of concern, and remedial levels were developed based on protection of groundwater. SWMUs for which a human health baseline risk assessment was performed are identified in Table ES-2.

Human Health Preliminary Risk Evaluation

A human health preliminary risk evaluation (HHPRE) using a Step i risk evaluation approach based on guidance from GEPD was performed for each SWMU to determine the potential human health risks associated with the maximum concentrations of identified SRCs. The Step i risk evaluation involves the components listed below.

- For inorganics, compare detected concentrations to naturally occurring background levels to determine if detected inorganics are naturally occurring or are associated with past activities at the site.

- Identify potential migration and exposure pathways associated with the site and identify potential exposure scenarios to determine appropriate action levels.

- Identify available risk-based action levels for each contaminant detected above background levels or develop levels if they do not exist.

- Compare sample concentrations to action levels to determine if site conditions warrant further evaluation.

Chemicals that exceeded action levels were identified as human health contaminants of potential concern (HHCOPCs). A summary of the HHPRE results (HHCOPCs) is presented in Table ES-2.

A weight-of-evidence approach was used to evaluate each HHCOPC identified in the preliminary risk assessment. In some instances, HHCOPCs were evaluated further in a human health baseline risk assessment. HHCOPCs and/or CMCOPCs (see previous section) that either had hazard indices of 0.1 or incremental lifetime cancer risks of 1×10^{-6} were identified as human health contaminants of concern. Remedial levels were developed that were protective of the most sensitive receptor population, based on a minimum risk level of 3.0 for the total hazard index and 1×10^{-4} for the total incremental lifetime cancer risk. SWMUs for which a human health baseline risk assessment was performed are identified in Table ES-2.

Ecological Preliminary Risk Evaluation

An ecological preliminary risk evaluation (EPRE) based on guidance from GEPD was performed to determine the potential risk to ecological receptors associated with the maximum concentrations of the identified SRCs. The EPRE compared measured concentrations of detected substances to conservative ecological screening values to identify substances detected at the facility that pose a potential hazard to ecological receptors and that are identified as ecological contaminants of potential concern (ECOPCs). A summary of the results of the EPRE (ECOPCs) is presented in Table ES-2.

A weight-of-evidence approach was used to evaluate each ECOPC identified in the preliminary risk evaluation. In some instances, ECOPCs were evaluated further in a supplemental preliminary risk evaluation (SPRE). The SPRE presented a comparison of more realistic exposure estimates to toxicity reference values based on the lowest observed adverse effects levels. The exposure estimates were calculated using measured concentrations and more realistic exposure assumptions such as diets, absorption efficiencies, and area use factors. SWMUs for which an SPRE was performed are identified in Table ES-2.

Conclusions and Recommendations

A weight-of-evidence approach was used with the results from the fate and transport evaluation, HHPRE, human health baseline risk assessment (if performed), EPRE, and SPRE (if performed) to determine the recommendation for each SWMU. The recommendations fell into the following three categories:

- **No Further Action:** NFA was recommended for a SWMU if: (1) the contaminant levels in soil, groundwater, surface water, and sediment were below the reference background criteria, fate and transport values (GSSLs), and/or human health or ecological screening criteria or (2) significant uncertainty was evident, indicating minimal potential risk of migration to groundwater and/or a surface water body and/or to human health and ecological receptors.

- **Additional Investigation (Phase II RFI or additional monitoring):** A Phase II RFI or additional monitoring was recommended if the nature and extent of potential contaminants had not been determined, and further investigation or additional monitoring was required to evaluate extent or potential migration in the future.

- **Corrective Action Plan:** A CAP was recommended if the nature and extent of contamination at a SWMU was determined by the Phase II RFI, there was a potential risk of migration of contaminants to groundwater and/or surface water bodies or a potential risk to human health and ecological receptors, or institutional controls need to be applied to protect the health and safety of humans coming in contact with the site (i.e., inactive EOD areas). Such a site requires a CAP to evaluate appropriate remedial actions to eliminate or minimize these potential risks.

The recommendations for each SWMU are presented in Table ES-3.

Table ES-1. Summary of Site-related Contaminants

SWMU	Type of Investigation	Site-related Contaminants				
		Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment
2	Phase II	2 VOCs, 14 pest., 1 SVOC, and 6 metals	1 VOC, 3 pest., 1 SVOC, and 3 metals	3 VOCs and 3 metals	None	alpha-Chlordane
3	Phase II	4 pest., BEHP, As, Cr, and Pb	2 VOCs, BEHP, 3 pest., Cr, and Cd	3 VOCs, 3 pest., Ba, Cd, Cr, Pb, and Hg	1 SVOC, As, Ba, Cr, and Pb	6 VOCs, As, Ba, Cr, Pb, Hg, and Se
9	Phase I[a]	As, Cr, and Ag	NC	NC	NP	NP
10	Phase II	As, Ba, Cr, and Pb	NC[b]	None	Cd, Cr, and Hg	As, Ba, and Pb
11	Phase II	As, Ba, Cr, Pb, and Ag	NC[b]	None	NP	NP
12A	Phase II	3 SVOCs, 4 exp., and 16 metals	Al, As, Ba, Cr, Fe, Pb, and V	BEHP, 1 exp., and 8 metals	RDX, Pb, Mn, and Hg	1 SVOC, 1 exp., and 9 metals
14	Phase I	2 VOCs, BEHP, and Hg	5 VOCs, Cr, and Hg	1 VOC, Pb, and Hg	NP	NP
17	Phase II	1 VOC	3 VOCs	3 VOCs and Pb	None	None
18	Phase II	1 VOC, Pb, and Hg	5 VOCs, 2 SVOCs, Ba, Cr, Pb, and Hg	9 VOCs, Ba, Cd, and Pb	1 SVOC and Ba	(6 VOCs, 4 SVOCs, As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)[c]
19	Phase I	4 VOCs, 7 pest., and 5 metals	6 VOCs, 9 pest., and 5 metals	BEHP, 7 pest., and 3 metals	NP	NP
24B	Phase I	1 VOC, 10 SVOCs, and 6 metals	2 VOCs	1 VOC, 11 SVOCs, and Hg	NP	NP
27A (Bldg. 1339A)	Phase I	None	2 VOCs and 3 SVOCs	2 VOCs and BEHP	NP	NP
27A (Bldg. 1339B)	Phase I	BEHP and Pb	2 VOCs	1 VOC	NP	NP
27A (Bldg. 1322)	Phase I	3 VOCs and Pb	3 VOCs	Acetone	NP	NP
27B	Phase I	None	1 VOC	ND	NP	NP
27C	Phase I	1 VOC	2 VOCs and 1 SVOC	4 VOCs	NP	NP
27D	Phase I	3 VOCs	1 VOC	None	NP	NP
27E (Bldg. 1628)	Phase I	None	1 VOC	None	NP	NP

Note: Footnotes appear on page ES-8.

Table ES-1. Summary of Site-related Contaminants (continued)

SWMU	Type of Investigation	Site-related Contaminants				
		Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment
27E (Bldg. 1720)	Phase I	NC	2 VOCs and BEHP	1 SVOC	NP	NP
27F (NW Bldg. 1340)	Phase I	NC	3 VOCs and Pb	10 VOCs and 4 SVOCs	NP	NP
27F (NE Bldg. 1340)	Phase I	3 VOCs	8 VOCs and 4 SVOCs	None	NP	NP
27G	Phase I	NC	3 VOCs	1 SVOC	NP	NP
27H (Bldg. 1071)	Phase I	NC	2 VOCs, 11 SVOCs, Pb, and Hg	1 VOC and 9 SVOCs	NP	NP
27H (Bldg. 1056)	Phase I	NC	1 VOC, 1 SVOC, Cd, and Pb	2 VOCs and 4 SVOCs	NP[d]	NP[d]
27I (Block 9900)	Phase I	NC	1 VOC and Pb	None	NC	1 VOC and Pb
27I (Block 10300)	Phase I	NC	None	None	Pb	None
27J (Bldg. 10535)	Phase I	None	None	1 VOC and 1 SVOC	NP	NP
27J (Bldg. 10531)	Phase I	1 VOC and 1 SVOC	NC	2 SVOCs	NP	NP
27K	Phase I	NC	4 VOCs	1 VOC	NP	NP
27L (Block 10200)	Phase I	None	1 VOC and 1 SVOC	8 VOCs and 2 SVOCs	Acetone	None
27M (Block 10100)	Phase I	1 VOC and Pb	2 SVOCs and Pb	1 VOC	NC	Pb
27N (Block 9800)	Phase I	NC	2 SVOCs and Pb	None	NC	5 SVOCs
27O (Block 9700)	Phase I	Pb	None	1 SVOC	1 VOC	Pb
27P (Block 9500)	Phase I	1VOC and 1 SVOC	1 VOC, 6 SVOCs, and Pb	None	NC	1 VOC and Pb

Note: Footnotes appear on page ES-8.

Table ES-1. Summary of Site-related Contaminants (continued)

SWMU	Type of Investigation	Site-related Contaminants				
		Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment
27Q (Block 9400)	Phase I	Pb	None	None	NC	Pb
27R	Phase I	None	1 VOC and 2 SVOCs	None	NP	NP
27S	Phase I	NC	6 VOCs	None	NP	NP
27T	Phase I	4 SVOCs	None	1 VOC and 1 SVOC	NC	4 VOCs, 9 SVOCs, and Cd
27U	Phase I	1 VOC and Pb	2 VOCs and Pb	4 VOCs	NP	NP
27V	Phase I	1 VOC and Pb	1 VOC and Pb	None	NP	NP
29	Phase II	8 VOCs and Ag	16 VOCs and 14 SVOCs	3 VOCs, 3 SVOCs, As, Ba, and Cr	NP	NP
31	Phase II and IRA	None	6 VOCs and 17 SVOCs	4 VOCs	NP	NP
32	Phase II	2 VOCs, Ba, Cd, Cr, Pb, and Hg	2 VOCs, Pb, and Hg	4 VOCs and 2 SVOCs	NP	NP
34	Phase II	4 VOCs, 2 SVOCs, Ba, Cd, Pb, and Hg	1 VOC, Ba, Cd, Cr, and Pb	3 VOCs	NP	NP
37	Phase I	1 VOC and Hg	2 VOCs and Hg	4 VOCs	NP	(4 VOCs, Ba, Cd, Cr, Pb, Hg, and Se)[c]

[a]Phase II RFI was not required at this time. The Phase II RFI will be conducted upon closure of the Red Cloud Range, Hotel Area.
[b]Per the GEPD–approved SAP, subsurface soil was not collected because subsurface soil sampling in an EOD area requires approval by the Secretary of the Army.
[c]Results from sediment within the NGTC Equalization Basin.
[d]Sediment was collected; however, the oil/water separator does not discharge to the drainage ditch.
BEHP = Bis(2-ethylhexyl)phthalate.
NA = Not applicable.
NC = Not collected based on field screening results or because no medium (i.e., surface water) was available during the RFI.
ND = Not detected.
NP = No pathway exists.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

Table ES-2. Summary of CMCOPCs, HHCOPCs, and ECOPCs

SWMU	CMCOPCs		HHCOPCs					ECOPCs				HHBRA or SPRE Performed?
	Soil	Sediment	Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Surface Soil	Groundwater	Surface Water	Sediment	
2	2 pest., Ar, Ca, and Hg	None	As and Cr	None	None	None	None	4,4'-DDE, Cd, Cr, and Pb	1 VOC, Pb, and Hg	None	None	HHBRA and SPRE
3	None	As	As	None	1 pest. and Hg	1 SVOC, As, Cr, and Pb	As	Pb and Cr	2 pest., Ba, Cd, Pb, and Hg	1 SVOC, Ba, and Pb	2 VOCs, As, Ba, and Se	HHBRA and SPRE
9[a]	NA[a]	NA[a]	NA[a]	NC[a]	NC[a]	NP	NP	NA[a]	NC[a]	NP	NP	
10	NA[b]	NA[b]	NA[b]	NC	NA[b]	NA[b]	NA[b]	NA[b]	NA[b]	NA[b]	NA[b]	
11	NA[b]	NA[b]	NA[b]	NC	NA[b]	NA[b]	NA[b]	NA[b]	NA[b]	NP	NP	
12A	Ar, Cd, Cr, Pb, Ag, 1 SVOC, and 2 exp.	None	As and Pb	As	BEHP	Hg	None	1 SVOC, Cd, Cr, and Pb	BEHP	Pb and Hg	Ba	HHBRA and SPRE
14	1 VOC	NA	None	None	None	NP	NP	None	Pb, Hg, and 1 VOC	NP	NP	
17	None	None	None	None	1 VOC	None	None	None	1 VOC and Pb	None	None	HHBRA
18	Cr and Hg	(1 VOC, 1 SVOC, Ar, Ba, Cd, Cr, Hg, and Se)[c]	None	None	3 VOCs and Pb	1 SVOC	As	Pb	4 VOCs, Ba, and Pb	Ba and BEHP	None	HHBRA and SPRE
19	2 pest.	NA	None	None	BEHP, 2 pest., and As	NP	NP	Cd, Pb, and 1 pest.	BEHP, 5 pest., Ba, and Hg	NP	NP	HHBRA and SPRE
24B	1 VOC, 3 SVOCs, and Pb	NA	4 SVOCs, As, and Pb	None	1 VOC, 9 SVOCs, and Hg	NP	NP	NP	Hg and 9 SVOCs	NP	NP	
27A (Bldg. 1339A)	None	NA	None	None	BEHP	NP	NP	None	1 VOC and BEHP	NP	NP	
27A (Bldg. 1339B)	None	NA	None	None	Benzene	NP	NP	Pb	Xylenes	NP	NP	
27A (Bldg. 1322)	None	NA	None	None	Acetone	NA	NA	Pb	None	NP	NP	HHBRA

Note: Footnotes appear on page ES-11.

Table ES-2. Summary of CMCOPCs, HHCOPCs, and ECOPCs (continued)

SWMU	CMCOPCs		HHCOPCs					ECOPCs				HHBRA or SPRE Performed?
	Soil	Sediment	Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Surface Soil	Groundwater	Surface Water	Sediment	
27B	None	NP	None	None	None	NP	NP	None	None	NP	NP	
27C	None	NP	None	None	None	NP	NP	None	2 VOCs	NP	NP	
27D	None	NP	None	None	None	NP	NP	None	None	NP	NP	
27E (Bldg. 1628)	None	NP	None	None	None	NP	NP	None	None	NP	NP	
27E (Bldg. 1720)	None	NP	NA	None	None	NP	NP	NA	1 SVOC	NP	NP	
27F (NW Bldg. 1340)	None	NP	NA	None	4 VOCs and 4 SVOCs	NP	NP	NA	2 VOCs and 4 SVOCs	NP	NP	
27F (NE Bldg. 1340)	1 VOC	NP	None	None	None	NP	NP	None	None	NP	NP	
27G	None	NP	NA	None	1 SVOC	NP	NP	NA	None	NP	NP	HHBRA
27H (Bldg. 1071)	2 SVOCs	NP	NC	1 SVOC	1 VOC and 7 SVOCs	NP	NP	NC	8 SVOCs	NP	NP	
27H (Bldg. 1056)	None	NP	NC	None	3 SVOCs	NP	NP	NC	2 SVOCs	NP	NP	
27I (Block 9900)	None	None	NC	None	None	NC	None	NC	None	NC	Pb	
27I (Block 10300)	None	NA	NC	None	None	Pb	None	NC	None	Pb	None	
27J (Bldg. 10535)	None	NP	None	None	None	NP	NP	None	1 VOC and 1 SVOC	NP	NP	
27J (Bldg. 10531)	None	NP	None	NC	1 SVOC	NP	NP	None	2 SVOCs	NP	NP	
27K	None	NP	NA	None	None	NP	NP	NA	None	NP	NP	
27L (Block 10200)	None	None	None	None	4 VOCs and 2 SVOCs	Acetone	None	None	2 VOCs and 1 SVOC	None	None	
27M (Block 10100)	1 VOC	None	None	None	1 VOC	NC	None	Pb	None	NC	Pb	
27N (Block 9800)	None	None	NA	None	None	NC	1 SVOC	NA	None	NC	None	HHBRA

Note: Footnotes appear on page ES-11.

Table ES-2. Summary of CMCOPCs, HHCOPCs, and ECOPCs (continued)

SWMU	CMCOPCs		HHCOPCs					ECOPCs				HHBRA or SPRE Performed?
	Soil	Sediment	Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Surface Soil	Groundwater	Surface Water	Sediment	
27O (Block 9700)	None	None	None	NA	None	None	None	Pb	1 SVOC	None	Pb	
27P (Block 9500)	None	None	None	None	None	NC	None	None	None	NC	Pb	
27Q (Block 9400)	None	None	None	NA	None	NC	None	Pb	None	NC	Pb	
27R	None	NP	None	None	None	NP	NP	None	None	NP	NP	
27S	None	NP	NA	None	None	NP	NP	NA	None	NP	NP	
27T	None	Cd	1 SVOC	None	None	NA	4 SVOCs	None	1 SVOC	NA	Cd	HHBRA
27U	None	NP	None	None	Benzene	NP	NP	Pb	None	NP	NP	
27V	None	NP	None	None	None	NP	NP	None	None	NP	NP	
29	7 VOCs	NP	None	None	1 VOC, 2 SVOCs, and As	NP	NP	None	1 VOC, 2 SVOCs, and Ba	NP	NP	HHBRA
31	1 VOC and 1 SVOC	NP	None	None	Acetone	NP	NP	None	Xylenes	NP	NP	HHBRA
32	1 VOC	NP	None	None	Acetone	NP	NP	Cd, Pb, and Cr	1 VOC and 1 SVOC	NP	NP	HHBRA
34	2 VOCs	NP	None	None	Acetone	NP	NP	Cd and Pb	1 VOC	NP	NP	HHBRA
37	1 VOC	1 VOC[b] and Cd	None	None	Benzene	NP	NP	None	Xylenes	NP	NA	

[a]Phase II RFI was not required at this time. The Phase II RFI will be conducted upon closure of the Red Cloud Range, Hotel Area.
[b]With the concurrence of GEPD, fate and transport analysis and human health and ecological preliminary risk assessments were deemed unnecessary. SRCs were determined solely on comparison to background criteria (see Table ES-1).
[c]Results from sediment within the NGTC Equalization Basin.
BEHP = Bis(2-ethylhexyl)phthalate.
HHBRA = Human health baseline risk assessment.
NA = Not applicable.
NC = Sample not collected based on field screening results or because no medium (i.e., surface water) was available during the RFI.
NP = No pathway exists.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

Table ES-3. SWMU-specific Recommendations

SWMU	Recommendation
2	CAP
3	CAP
9	CAP
10	CAP
11	CAP
12A	Long-term compliance monitoring and CAP
14	NFA
17	NFA
18	Long-term monitoring and CAP
19	NFA
24B	Phase II RFI
27A (Building 1339A)	NFA
27A (Building 1339B)	NFA
27A (Building 1322)	NFA
27B	NFA
27C	NFA
27D	NFA
27E (Building 1628)	NFA
27E (Building 1720)	NFA
27F (NW Building 1340)	Phase II RFI
27F (NE Building 1340)	NFA
27G	NFA
27H (Building 1071)	Phase II RFI
27H (Building 1056)	Phase II RFI
27I (Block 9900)	NFA
27I (Block 10300)	NFA
27J (Building 10535)	NFA
27J (Building 10531)	Phase II RFI
27K	NFA
27L (Block 10200)	Phase II RFI
27M (Block 10100)	NFA
27N (Block 9800)	NFA
27O (Block 9700)	NFA
27P (Block 9500)	NFA
27Q (Block 9400)	NFA
27R	NFA
27S	NFA
27T	Phase II RFI
27U	NFA
27V	NFA
29	CAP
31	NFA
34	NFA
32	NFA
37	NFA

1.0 INTRODUCTION

This report summarizes the results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for 16 Solid Waste Management Units (SWMUs), at Fort Stewart, Georgia. The 16 SWMUs include: Camp Oliver Landfill, SWMU 2; Tactical Air Command (TAC)-X Landfill, SWMU 3; Inactive Explosive Ordnance Disposal (EOD) Area in Red Cloud Range, Hotel Area, SWMU 9; Inactive EOD Area North of Garrison Area, SWMU 10; Inactive EOD Area Located Approximately Three Miles Northeast of Garrison Area, SWMU 11; Active EOD Containing Open Detonation (OD) Unit and Open Burn (OB) Unit, SWMU 12A; Old Fire Training Area, SWMU 14; Defense Reutilization and Marketing Organization (DRMO) Hazardous Waste Storage Area, SWMU 17; Industrial Wastewater Treatment Plant (IWTP), SWMU 18; Old Sludge Drying Beds, SWMU 19; Old Radiator Shop/Paint Booth, SWMU 24B; Motorpools, SWMUs 27A through 27V; Evans Army Heliport Petroleum, Oil, and Lubricants (POL) Storage Facility, SWMU 29; Directorate of Engineering and Housing (DEH) Asphalt Tanks, SWMU 31; Supply Diesel Tank, SWMU 32; DEH Equipment Wash Rack, SWMU 34; and National Guard Training Center (NGTC) Equalization Basin, SWMU 37. Four of the 16 sites—Old Sludge Drying Beds, SWMU 19; Old Radiator Shop/Paint Booth, SWMU 24B; Motorpools, SWMUs 27A through 27V; and NGTC Equalization Basin, SWMU 37—had not been previously investigated and were investigated as Phase I RFIs. This report has been prepared by Science Applications International Corporation (SAIC) for the U.S. Army (Army) Corps of Engineers (USACE)–Savannah District under Contract DACA21-95-D-0022, Delivery Order No. 0009. The RFI was conducted in accordance with USACE Guidance EM 200-1-3.

1.1 OBJECTIVES AND SCOPE OF THE INVESTIGATION

The specific objectives of the Phase I and Phase II RFIs for the 16 SWMUs at Fort Stewart, Georgia, as defined in the Phase II RFI Sampling and Analysis Plan (SAP) (SAIC 1997) [approved by the Georgia Environmental Protection Division (GEPD) in October 1997] are listed below.

Phase I RFI

- Determine if contamination of the environment has occurred.
- Determine whether contaminants, if present, constitute a threat to human health or the environment.
- Determine the need for future action and/or no further action (NFA).

Phase II RFI

- Determine the horizontal and vertical extent of contamination.
- Determine whether contaminants present a threat to human health or the environment.
- Determine the need for future action and/or NFA.
- Gather data necessary to support a Corrective Action Plan (CAP), if warranted.

The information provided in this report is based upon data collected previously during the Phase I RFI (if available) and data collected as part of the Phase II field sampling and analysis. At some of the sites, the

Phase II sampling program incorporated an observational approach to sampling, as defined in the Phase II RFI SAP (SAIC 1997). This observational approach used field screening techniques to determine the horizontal and vertical extent of contamination at the SWMU and to identify suitable locations for installation of permanent monitoring wells. The scope of the fieldwork for the Phase I and II sites included the activities listed below.

Phase I Sites

- Collection of direct-push soil samples using a push probe.
- Collection of direct-push groundwater samples using a push probe.
- Collection of surface water and sediment samples at SWMUs where surface water and/or sediment was available.
- Surveying of the positions of all sample locations.

Phase II Sites

- Collection of direct-push soil samples using push probes.
- Collection of direct-push groundwater samples using push probes, including vertical-profile probes.
- Installation of permanent groundwater monitoring wells both upgradient and downgradient of the site.
- Groundwater sampling at existing monitoring wells (if available) and sampling of newly installed wells around the SWMUs.
- Collection of surface water and sediment samples at SWMUs where surface water and/or sediment was available.
- Surveying of the positions of all sample locations.

1.2 REPORT ORGANIZATION

This Phase II RFI Report consists of three volumes: 12 chapters of text in Volume I, 7 appendices in Volume II, and a final appendix in Volume III. Chapter 1.0 describes the purpose of this investigation, summarizes the scope of work performed, and presents the organization of the report. General information is presented in Chapters 2.0 through 8.0. Chapter 2.0 describes the Fort Stewart Military Reservation (FSMR) Installation and discusses the history of the FSMR and FSMR regulator history. Chapter 3.0 presents the regional setting of the FSMR, including the demographics, topography, regional geology and hydrogeology, surface drainage, soils, and ecology. Chapter 4.0 summarizes the investigation activities and methodologies used in completing the Phase II RFI fieldwork. Chapter 5.0 describes the results of the background interpretation for surface soil, subsurface soil, groundwater, surface water, and sediment and their relationship to each site. Chapter 6.0 identifies general considerations affecting contaminant fate and transport. Chapter 7.0 presents the general methodology for the human health preliminary risk evaluation (HHPRE), and Chapter 8.0 presents the general methodology for the ecological preliminary risk evaluation (EPRE).

SWMU–specific information corresponding to Chapters 2.0 through 8.0 is presented in Chapters 9.0 and 10.0, including site-specific conclusions on nature and extent of contaminants, fate and transport, HHPRE, and EPRE. Chapter 9.0, identified by a gray tab, designates in sequential order the SWMUs that are recommended for NFA because contaminant levels in soil, groundwater, sediment, and surface water are below reference background criteria or the sites do not pose a risk to human health and the environment based on human health and ecological risk assessments. Chapter 10.0, identified by a blue tab, designates in sequential order the SWMUs that are recommended for additional investigation or a CAP. Secondary tabs are used to separate the individual SWMUs behind the gray or blue tab. Chapter 11.0 presents conclusions and recommendations identifying the SWMUs being recommended for NFA or SWMUs that indicate risk to human health or environment and are recommended for additional investigation or a CAP. References are presented in Chapter 12.0.

Volume II of this report contains nine appendices. Appendix A contains the direct-push technology and boring logs. Appendix B contains monitoring well construction diagrams. Appendix C is the Quality Control Summary Report. Appendix D provides a comparison of metal data from the Phase I and Phase II RFIs. Appendix E contains the geotechnical laboratory test results. Appendix F is the background data summary. Appendix G contains the chain-of-custody forms.

Volume III of this report contains five appendices. Appendix H provides the analytical data results. In addition, the analytical data are provided in electronic format (i.e., on CDs). Appendix I presents the methodology for the human health baseline risk assessment. Appendix J contains the toxicity profiles for contaminants of potential concern (COPCs). Appendix K presents Fate and Transport Input Data and Model Description. Appendix L presents the revised response to GEPD comments received on the final Phase II RFI Report for 16 SWMUs submitted in February 1999 and the meeting minutes for the comment response meeting with GEPD held on September 14, 1999.

10.8 SWMU 24B: Old Radiator Shop/Paint Booth

10.8.1 History and Description of SWMU 24B, Old Radiator Shop/Paint Booth

SWMU 24B, the Old Radiator Shop/Paint Booth, is located in the southern portion of the garrison area on the eastern side of Tilton Avenue in Building 1056, which used to be the Radiator Shop (Figure 10.8-1). The operational history of the site is vague. The Paint Booth was located in Building 1056, and the area is currently used as an equipment repair and storage area. Prior to use as a paint booth, the area to be investigated at Building 1056 reportedly housed the old Radiator Shop. In 1993, long-time Building 1056 workers were interviewed regarding their knowledge of the history of former operations at this facility. One employee reported an old paint booth to have been located in the northern corner of the building, but to have been out of use for about 18 years. Other employees indicated that they did not know what materials were used in the old paint booth and were not aware of a radiator shop having been located in the building.

Other research into former operations at Building 1056 has indicated that a drainpipe led from the building and discharged into a ditch. It is unknown whether the drainpipe was originally discharging to a ditch running parallel to Building 1056 or to the ditch on the west side of Tilton Avenue. It was reported that DEH installed a pipe under Tilton Avenue that connected the drainpipe in Building 1056 to the industrial pipe located on the west side of Tilton Avenue (Geraghty and Miller 1992); therefore, discharge was no longer routed to the ditch. The Fort Stewart Plumbing/Mechanical and Electrical Department was not able to determine when the piping from Building 1056 was connected to the IWTP drainage system or where the connection was located. There is a cut in the asphalt across Tilton Avenue that is visible approximately 15 feet southeast of the northwestern corner of Building 1056. It is believed that this is the location of the connection.

If the facility was previously used as a radiator repair shop, the wastes most likely to have been generated would be the same as those generated under current operations as an engine/equipment repair facility. These wastes include caustic-waste cleaning solution, sodium hydroxide, water-based fluorescein dye solution, and spent recirculation water from the wet-curtain spray paint booth.

No sampling was performed at the site prior to, or as part of, the Phase I RFI site characterization activities in 1993.

10.8.2 Summary of Investigative Activities

Five surface soil, four subsurface soil, and six groundwater samples were collected using DPT techniques during the Phase I RFI at this site. The associated boring logs are presented in Appendix A. All surface soil, subsurface soil, and groundwater samples were analyzed for VOCs, SVOCs, and RCRA metals.

10.8.3 Physical Characteristics of the Site

10.8.3.1 Topography

The site is generally level and covered with concrete or gravel around the building. The site is heavily congested with stored equipment (e.g., motors, metal boxes). The surface elevation of the site is approximately 85.5 feet amsl.

10.8.3.2 Surface drainage

There are no surface water/sediment migration pathways at the site. Former drain lines from the facility might have discharged to a ditch alongside Building 1056 that is no longer present or a ditch alongside Tilton Avenue. However, based on current site conditions, there are no current surface water/sediment pathways.

10.8.3.3 Soils

The soils present across the site consist of alternating layers of sand and silty to clayey sands, as indicated in the DPT logs (Appendix A).

10.8.3.4 Hydrogeology

Groundwater was encountered at approximately 2.92 feet to 5.70 feet bgs at the site.

10.8.3.5 Ecology

As stated in Section 8.2, SWMU 24B is classified as an "industrialized area." The site lies within an industrialized area of the garrison area (Figure 10.8-1), and its ecological habitat consists of small patches of grasses amongst buildings and structures.

10.8.4 Nature and Extent of Contamination

10.8.4.1 Surface soil

Five surface soil samples were collected from five DPT locations. The results of the surface soil analyses are presented in Table 10.8-1 and Figure 10.8-2.

VOCs. Toluene was detected in three out of five surface soil samples at concentrations ranging from 0.101 mg/kg at SS1 to 0.142 mg/kg at SS2. Toluene is considered to be an SRC in surface soil.

SVOCs. Ten SVOCs were detected in surface soil. The SVOCs were detected in only SS1, SS2, and SS3 soil samples. Benzo(*a*)anthracene concentrations ranged from 2.89 mg/kg at SS1 to 9.38 mg/kg at SS3. Benzo(*a*)pyrene concentrations ranged from 4.39 mg/kg at SS1 to 8.95 mg/kg at SS3. Benzo(*b*)fluoranthene concentrations ranged from 5.23 mg/kg at SS1 to 16 mg/kg at SS3. Benzo(*g,h,i*)perylene concentrations ranged from 3.07 mg/kg at SS2 to 4.69 mg/kg at SS3. Benzo(*k*)fluoranthene was detected in only SS1 at a concentration of 3.56 mg/kg. Chrysene concentrations ranged from 2.36 mg/kg at SS2 to 12.6 mg/kg at SS3. Fluoranthene concentrations ranged from 3.93 mg/kg at SS1 to 11.6 mg/kg at SS3. Indeno(*1,2,3-cd*) pyrene concentrations ranged from 3.25 mg/kg at SS2 to 4.57 mg/kg at SS3. Phenanthrene was detected in only SS3 at a concentration of 3.48 mg/kg. Pyrene concentrations ranged from 5.21 mg/kg at SS1 to 16.8 mg/kg at SS3. Benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, benzo(*g,h,i*)perylene, benzo(*k*)fluoranthene, chrysene, fluoranthene, indeno(*1,2,3-cd*)pyrene, phenanthrene, and pyrene are considered to be SRCs in surface soil.

RCRA Metals. Arsenic, barium, cadmium, chromium, lead, and mercury were detected in surface soil samples above the reference background criteria. Barium was detected at SS1 and SS2 at concentrations of 230 mg/kg and 24 mg/kg, respectively. Cadmium was detected at SS1 and SS2 at concentrations of 6.1 mg/kg and 3 mg/kg, respectively. Lead was detected above the reference background criterion in three out of five surface soil samples at concentrations ranging from 25.8 mg/kg at SS3 to 690 mg/kg at SS1. Chromium was detected above the reference background criterion in three out of five surface soil samples at concentrations ranging

from 6.9 mg/kg at GP2 to 18.3 mg/kg at SS1. Arsenic and mercury were detected in SS1 at concentrations of 2.7 mg/kg and 0.13 mg/kg, respectively. Arsenic, barium, cadmium, chromium, lead, and mercury are considered to be SRCs in surface soil.

10.8.4.2 Subsurface soil

Four subsurface soil samples were collected using DPT techniques. The results of the subsurface soil analyses are presented in Table 10.8-2 and Figure 10.8-2.

VOCs. Methylene chloride and toluene were detected in subsurface soil samples. Methylene chloride was detected in GP5 at a concentration of 0.0289 mg/kg. Toluene was detected at a concentration of 0.0442 mg/kg in GP5. Methylene chloride and toluene are considered to be SRCs in subsurface soils.

SVOCs. No SVOCs were detected in subsurface soils.

RCRA Metals. Barium, cadmium, chromium, lead, and selenium were detected in subsurface soils. Barium, chromium, and lead were detected in three out of four subsurface soil samples. Cadmium was detected in two out of four subsurface soil samples. Selenium was detected in GP5 only. None of the subsurface soil concentrations were detected above the reference background criteria; therefore, RCRA metals are not considered to be SRCs in subsurface soils.

10.8.4.3 Groundwater

Six groundwater samples were collected using DPT techniques. The groundwater samples were analyzed for VOCs, SVOCs, and total and dissolved RCRA metals. The results of the groundwater analyses are presented in Table 10.8-3 and Figure 10.8-3.

VOCs. Only one VOC, benzene, was detected in groundwater. Benzene was detected at a concentration of 2.4 µg/L at GP6 and is considered to be an SRC in groundwater.

SVOCs. Eleven SVOCs were detected in groundwater: 1,2-dichlorobenzene; 4-chloro-3-methylphenol; benzo(*a*)anthracene; benzo(*a*)pyrene; benzo(*b*)fluoranthene; benzo(*g,h,i*)perylene; bis(2-ethylhexyl)phthalate; chrysene; fluoranthene; indeno(*1,2,3-cd*)pyrene; and pyrene. The most common occurrence of SVOCs (eight out of 11) was in groundwater samples collected at GP4 and GP6; the same SVOCs were detected at both sampling locations. Benzo(*a*)anthracene was detected at concentrations of 13.7 µg/L at GP4 and 17.3 µg/L at GP6. Benzo(*a*)pyrene was detected at concentrations of 12.6 µg/L at GP4 and 14.3 µg/L at GP6. Benzo(*b*)fluoranthene was detected at concentrations of 23 µg/L at GP4 and 27.5 µg/L at GP6. Benzo(*g,h,i*)perylene was detected at concentrations of 7 µg/L at GP4 and 9.4 µg/L at GP6. Chrysene was detected at concentrations of 18.4 µg/L at GP4 and 22.8 µg/L at GP6. Fluoranthene was detected at concentrations of 18 µg/L at GP4 and 19 µg/L at GP6. Indeno(*1,2,3-cd*)pyrene was detected at concentrations of 6.5 µg/L at GP4 and 8.2 µg/L at GP6. Pyrene was detected at concentrations of 35 µg/L at GP6 and 41.7 µg/L at GP4. The remaining three SVOCs were detected in groundwater samples collected from three other locations: 4-chloro-3-methylphenol was detected at concentrations of 16 µg/L at GP1 and 18.2 µg/L at GP5; bis(2-ethylhexyl)phthalate at 22 µg/L at GP2; and 1,2-dichlorobenzene at 7.4 µg/L at GP3. Bis(2-ethylhexyl)phthalate and benzo(*a*)pyrene were detected above their respective MCLs. These 11 SVOCs are considered to be SRCs in groundwater.

RCRA Metals. Barium, chromium, mercury, and selenium were detected in the groundwater; however, only mercury was detected above the reference background criterion. Mercury was detected at a concentration of 0.89 µg/L at GP5 and is considered to be an SRC in groundwater.

10.8.4.4 Surface water

No surface water samples were collected during the Phase I RFI because no surface water pathway exists at this site.

10.8.4.5 Sediment

No sediment samples were collected during the Phase I RFI because no surface water/sediment pathway exists at this site.

10.8.4.6 Site-related contaminant summary

The SRCs and their maximum concentrations by medium are summarized in Table 10.8-4.

10.8.5 Fate and Transport Considerations

The potential for soil contaminants to migrate (i.e., their leachability) to groundwater was evaluated by comparing the maximum concentrations of surface soil and subsurface soil SRCs to their respective GSSLs.

Of the SRCs identified in soil, methylene chloride, benzo(*a*)anthracene, benzo(*b*)fluoranthene, benzo(*a*)pyrene, and lead exceeded their respective GSSLs (Table 10.8-5) and are considered to be CMCOPCs in soil based on leaching to groundwater. Benzo(*a*)anthracene, benzo(*a*)pyrene, and benzo(*b*)fluoranthene were also detected in groundwater above their respective RBCs/MCLs; however, methylene chloride was not detected in groundwater.

10.8.6 Human Health Preliminary Risk Evaluation of SWMU 24B

SRCs were identified for the following media: surface soil, subsurface soil, and groundwater. Evaluation of the potential risks resulting from exposure to these constituents and the identification of HHCOPCs are addressed in this section.

10.8.6.1 Exposure evaluation

The exposure evaluation addresses what human receptor populations, both on-site and off-site, might be exposed to contaminants present at the site. The exposure evaluation also addresses how contaminants might migrate and the potential exposure pathways for the various receptors.

Receptor Assessment

This is an active, secured site within the garrison area. The potential receptor populations include:

- occupational populations (individuals working on the site),
- construction workers, and
- off-site occupational receptors.

Land use at this site is not likely to change; therefore, future receptor populations are likely to be the same as the current ones.

Migration and Exposure Pathway Analysis

The site is covered by concrete and structures, with a small weedy/grassy area to the north and northeast. To the west of the site is a gravel parking area between the building and Tilton Avenue.

Potential migration pathways for surface soils include leaching into groundwater and release of volatile compounds into the air. Given the concrete, gravel, and vegetative cover at the site, release of fugitive dust is not a significant exposure pathway. Bioaccumulation into wildlife is also not a viable migration pathway.

Groundwater at the site does not discharge into any nearby surface waters; therefore, contaminants in groundwater would not migrate into surface waters.

The potential migration and exposure pathways for the various receptors are presented in Figure 10.8-4. The on-site resident scenario is not considered to be a viable scenario for this site; however, in accordance with RBCA guidance, it is used to derive screening values. The exposure pathways associated with this scenario are presented to show what pathways would be associated with an on-site resident exposure scenario.

10.8.6.2 Risk evaluation

The results of the human health risk screening are given below.

SRCs for surface soils include one volatile organic (toluene), 10 SVOCs (all PAHs), and six metals. The maximum concentrations of benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, indeno(*1,2,3-cd*)pyrene, arsenic, and lead exceeded their respective screening values for soil ingestion (Table 10.8-6). None of the remaining SRCs had concentrations that exceeded their respective screening concentrations for ingestion of soil.

The maximum concentration for benzo(*a*)pyrene (8.95 mg/kg) was more than two orders of magnitude greater than its screening value for soil ingestion (0.088 mg/kg). The maximum concentration for benzo(*b*)fluoranthene (16.0 mg/kg) was more than an order of magnitude greater than its screening value for soil ingestion (0.88 mg/kg). The maximum concentration for benzo(*a*)anthracene (9.38 mg/kg) was more than an order of magnitude greater than its screening value for soil ingestion (0.88 mg/kg). The remaining compounds had maximum concentrations that were within an order of magnitude of their respective screening values. Benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, indeno(*1,2,3-cd*)pyrene, arsenic, and lead are HHCOPCs in surface soil.

SRCs for subsurface soils include two volatile organics (methylene chloride and toluene). The concentrations of these contaminants were below their respective screening values (Table 10.8-6); therefore, there are no HHCOPCs in subsurface soil.

SRCs for groundwater include one volatile organic (benzene), 11 SVOCs (two semivolatile chlorinated solvents, a phthalate, and eight PAHs), and mercury. Maximum concentrations of benzene; 1,2-dichlorobenzene; bis(2-ethylhexyl)phthalate; benzo(*a*)anthracene; benzo(*a*)pyrene; benzo(*b*)fluoranthene; benzo(*g,h,i*) perylene; indeno(*1,2,3-cd*)pyrene; chrysene; and mercury exceeded their screening values (Table 10.8-6) and are HHCOPCs in groundwater. With the exception of 4-chloro-3-methylphenol, for which no screening value was available, the concentrations of the remaining contaminants were below their respective screening values. 4-Chloro-3-methylphenol is an HHCOPC by default.

The maximum concentration of benzo(*a*)pyrene (14.3 µg/L) was more than three orders of magnitude above its screening value (0.0092 µg/L). The maximum concentrations of benzo(*a*)anthracene, benzo(*b*)fluoranthene, and benzo(*g,h,i*)perylene were more than two orders of magnitude above their respective screening values. The maximum concentrations of indeno(*1,2,3-cd*)pyrene and mercury were more than an order of magnitude above their respective screening values. Benzene; 1,2-dichlorobenzene; bis(2-ethylhexyl)phthalate; chrysene; and mercury were within an order of magnitude of their screening values.

10.8.6.3 Uncertainties

Not all of the PAHs had screening values; therefore, surrogate screening values (i.e., screening values for PAHs with similar structures) were used. For example, the screening value for anthracene was used for phenanthracene. The use of surrogate values introduces uncertainty into the assessment, given that minor differences in molecular structure can affect the toxicity of a compound. Therefore, the actual screening value for this chemical might be greater or less than the value used. Additional uncertainties have been addressed in Section 7.5 of the HHPRE (Chapter 7.0).

10.8.7 Ecological Preliminary Risk Evaluation of SWMU 24B

The EPRE was conducted in accordance with GEPD (1996) guidance (see Chapter 8,0). At sites where surface water, sediment, or groundwater was collected, an ESV comparison was conducted. If ECOPCs for aquatic biota were identified in surface water, sediment, or groundwater based on the ESV comparison (Step i), then further evaluation was required for those media. If no ECOPCs were identified based on the Step i screening of those media, then those ECOPCs were not considered further. At sites where surface soil was collected, substances detected in surface soil were evaluated in EPRE Steps ii through v because there are no ESVs for surface soil. The results of the five steps of the EPRE are presented below.

10.8.7.1 Ecological screening value comparison (Step i)

There is no surface water or sediment at the site.

One RCRA metal, mercury, was detected in groundwater at concentrations exceeding the reference background criterion. Benzene (VOC) and 11 SVOCs were detected in groundwater. The results of the ESV comparison for groundwater are presented in Table 10.8-7. The ECOPCs identified by the ESV comparison for groundwater were mercury and nine SVOCs. Benzo(*b*)fluoranthene, benzo(*g,h,i*)perylene, chrysene, indeno(*1,2,3-cd*)pyrene, 4-chloro-3-methylphenol, and pyrene do not have ESVs, so they are ECOPCs by default (GEPD 1997a). Benzo(*a*)anthracene, benzo(*a*)pyrene, bis(2-ethylhexyl)phthalate, and mercury are ESVs because they were detected at concentrations exceeding ESVs.

The site is an industrial area with no vegetated or exposed surface soil; therefore, surface soil was not evaluated in the EPRE.

10.8.7.2 Preliminary problem formulation (Step ii)

The ecological habitat for the site is described in Section 10.8.3.5. The preliminary assessment endpoints, ecological receptors, and surrogate species representative of those receptors selected for evaluation in the preliminary risk calculation are described in Section 8.2.

10.8.7.3 Preliminary effects (Step iii)

In the EPRE, TRVs were required for raccoons ingesting water in drainage ditches. The derivation of TRVs is discussed in Section 8.3. The TRVs derived for raccoons are presented in Table 8-5.

10.8.7.4 Preliminary exposure (Step iv)

Ecological receptors at the site are probably exposed by ingestion of drinking water if groundwater discharges to nearby surface water bodies. There is no ecological habitat at the site, so receptors are not exposed to substances in surface soil, surface water, and/or sediment. Because there is no habitat for ecological receptors, analytes detected in surface soil were not evaluated further. The exposure parameters for the surrogate species, raccoons, are presented in Table 8-7.

10.8.7.5 Preliminary risk calculation (Step v)

The preliminary risk calculation (Step v) uses HQs, the ratios of the measured maximum concentrations and the TRVs, to evaluate the potential for risk. The HQs of ECOPCs with consistent modes of toxicity and effects endpoints are added to calculate an HI. Metals are assumed to have distinct modes of toxicity and effects endpoints; therefore, HIs are calculated for only VOCs and SVOCs when no individual ECOPC has an HQ greater than one and HQs are calculated for more than one chemical. ECOPCs with HQs and HIs less than one indicate little to no likelihood of risk to the ecological receptors. An ERA using site-specific data is indicated for those ECOPCs with calculated HQs or HIs exceeding one (GEPD 1996).

Groundwater. The preliminary risk calculations for raccoons potentially exposed to ECOPCs detected in groundwater at the site are presented in Table 10.8-8. This table shows the maximum detected concentrations, ADDs, TRVs, and HQs for the receptors. There are no ECOPCs present in groundwater at concentrations resulting in ADDs exceeding the TRV for the surrogate species. The HI calculated for SVOCs does not exceed one. An HI was not calculated for the surrogate species exposed to RCRA metals in groundwater because they are assumed to have dissimilar mechanisms of toxicity.

10.8.8 Conclusions and Risk Management and Site Recommendations for SWMU 24B

10.8.8.1 Conclusions

Nature and Extent of Contamination

- Toluene (VOC) and 10 SVOCs were detected in surface soil. Arsenic, barium, cadmium, chromium, lead, and mercury were detected in surface soil samples above the reference background criteria.

- Two VOCs (methylene chloride and toluene) were detected in subsurface soil samples. No SVOCs were detected in subsurface soil samples. No metals were detected above the reference background criteria in subsurface soil samples.

- Benzene (VOC) and 11 SVOCs were detected in groundwater. Mercury was detected at one location above the reference background criterion. Bis(2-ethylhexyl)phthalate and benzo(*a*)pyrene were detected above their respective MCLs. The majority of the SVOCs were detected in GP4 and GP6.

Fate and Transport

- Methylene chloride, benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, and lead exceeded their GSSLs and are considered to be CMCOPCs in soil based on leaching to groundwater.

Human Health Preliminary Risk Evaluation

- HHCOPCs for surface soils include the following compounds: benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, indeno(*1,2,3-cd*)pyrene, arsenic, and lead.

- None of the subsurface soil SRCs exceeded their respective screening values for ingestion of soil; therefore, there are no HHCOPCs in subsurface soil.

- The following contaminants are considered to be HHCOPCs for groundwater: benzene; 1,2-dichlorobenzene; bis(2-ethylhexyl)phthalate; benzo(*a*)anthracene; benzo(*a*)pyrene; benzo(*b*)fluoranthene; benzo(*g,h,i*)perylene; chrysene; indeno(*1,2,3-cd*)pyrene; and mercury. 4-Chloro-3-methylphenol was also included as an HHCOPC because it did not have a published screening value.

Ecological Preliminary Risk Evaluation

- The ECOPCs in groundwater at the site are mercury and nine SVOCs. These ECOPCs are potential hazards to aquatic biota if groundwater discharges to nearby surface water bodies. However, as stated in Section 10.8.6.1, groundwater at this site does not discharge into any nearby surface water bodies.

- There are no ECOPCs in groundwater or surface soil for terrestrial receptors.

10.8.8.2 Risk management and site recommendations

- PAHs (a subset of SVOCs) in surface soil are commonly associated with asphalt or burned fuels. The absence of PAHs in the surface soil sample collected from GP2, which is located adjacent to SS2, where PAHs were found, indicates that PAHs are not uniformly present across the site, but are found in isolated spots.

- The extent of potential surface soil contamination was not determined during the Phase I investigation. Three surface soil samples will be collected along Tilton Avenue and analyzed for SVOCs and RCRA metals. The locations of the surface soil samples are presented in Figure 10.8-6.

- Metals were found in surface soils, particularly at SS1 and SS2, but not in adjacent GP2. The presence of metals at SS1, located alongside Tilton Avenue, might be related to past discharges from the SWMU to the previous ditch if effluent/waste from the Old Paint Booth discharged to this area. The extent of metal contamination in the area alongside Tilton Avenue is unknown; therefore, three additional surface soil samples should be taken in this area.

- Only one VOC, benzene, was detected at one location (GP6) and at a concentration below its MCL. The extent of VOC contamination has been adequately defined.

- SVOCs in groundwater, primarily at GP4 and GP6, indicate that a past release from the facility might have occurred.

- The extent of potential groundwater contamination was not determined by the Phase I RFI; therefore, the vertical and horizontal extent of groundwater contamination at this site must be determined. At a minimum, four groundwater screening samples will be collected using DPT techniques and analyzed for VOCs and SVOCs to evaluate the horizontal extent of potential contamination and to estimate the groundwater direction. At a minimum, one vertical-profile boring will be installed adjacent to the DPT location having the most elevated concentration of VOCs and SVOCs. The field screening results of VOCs and SVOCs from the four DPT and vertical-profile samples will be used to locate a minimum of four shallow monitoring wells (one upgradient and three downgradient) and potentially three deep monitoring wells (one upgradient and two downgradient). At a minimum, four shallow wells are recommended to account for potential physical obstructions (i.e., buildings) in the area. The deep monitoring wells will be installed only if vertical contamination is indicated. The field screening results and recommended locations of monitoring wells will be presented to GEPD for its concurrence prior to installation. At each well, two soil samples will be collected following the same procedures outlined in the revised final SAP for Phase II RFIs of the 16 SWMUs (SAIC 1997). Surface soil samples (0 foot to 2 feet bgs) will be collected at each monitoring well location and three additional locations to evaluate the potential risk to ecological receptors. All wells will be sampled using low-flow techniques. The proposed sampling locations are presented in Figure 10.8-6. The soil and groundwater samples obtained during well installation will be analyzed for VOCs, SVOCs, and RCRA metals. Geotechnical samples will be collected to support the fate and transport analysis if it is required.

- The information obtained from the additional sampling proposed above will be provided as an addendum to this report to be submitted to GEPD before July 21, 2000. The addendum to the Phase II RFI Report will address any additional human health and/or ecological risk assessments required.

Table 10.8-1. Summary of Analytes Detected in Surface Soil, SWMU 24B

Station	Reference Background Criteria	24B-GP2	24B-GP3	24B-SS1	24B-SS2	24B-SS3
Sample ID		241211	241311	247111	247211	247311
Date		01/20/98	01/20/98	02/24/98	02/24/98	02/24/98
Depth (feet)		1 to 4	1 to 4	0 to 1	0 to 1	0 to 1
Sample Type		Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (mg/kg)						
Toluene	0.00			**0.101**	**0.142**	**0.126**
Semivolatile Organic Compounds (mg/kg)						
Benzo(*a*)anthracene	0.00			**2.89**	**3.03**	**9.38**
Benzo(*a*)pyrene	0.00			**4.39**	**4.54**	**8.95**
Benzo(*b*)fluoranthene	0.00			**5.23**	**9.01**	**16**
Benzo(*g,h,i*)perylene	0.00			**3.78**	**3.07**	**4.69**
Benzo(*k*)fluoranthene	0.00			**3.56**		
Chrysene	0.00			**2.58**	**2.36**	**12.6**
Fluoranthene	0.00			**3.93**	**4.26**	**11.6**
Indeno(*1,2,3-cd*)pyrene	0.00			**3.48**	**3.25**	**4.57**
Phenanthrene	0.00					**3.48**
Pyrene	0.00			**5.21**	**6.82**	**16.8**
Metals (mg/kg)						
Arsenic	2.10			**2.7**	0.87	0.34
Barium	14.70	9.5		**230**	**24**	7
Cadmium	0.18			**6.1**	**3**	0.18
Chromium	6.21	**6.9**		**18.3**	**15**	3.1
Lead	8.81	2.6	1.1	**690**	**154**	**25.8**
Mercury	0.03			**0.13**		

Bold indicates concentrations above background criteria.

Table 10.8-2. Summary of Analytes Detected in Subsurface Soil, SWMU 24B

Station	Reference Background Criteria	24B-GP1	24B-GP4	24B-GP5	24B-GP6
Sample ID		241111	241411	241511	241611
Date		01/16/98	01/20/98	01/06/98	01/20/98
Depth (feet)		2 to 4	2 to 4	2 to 4	3 to 5
Sample Type		Grab	Grab	Grab	Grab
Volatile Organic Compounds (mg/kg)					
Methylene chloride	0.00			**0.0289**	
Toluene	0.00			**0.0442**	
Metals (mg/kg)					
Barium	17.00	2.6	4.2	5.5	
Cadmium	0.24		0.11	0.07	
Chromium	11.60	1.5	2.8	1.1	
Lead	11.10	1.7	1.6	10.9	
Selenium	1.12			0.23	

Bold indicates concentrations above reference background criteria.

Table 10.8-3. Summary of Analytes Detected in Groundwater, SWMU 24B

Station	Reference Background Criteria	MCL	24B-GP1	24B-GP2	24B-GP3	24B-GP4	24B-GP5	24B-GP6
Sample ID			244111	244211	244311	244411	244511	244611
Date			01/16/98	01/20/98	01/20/98	01/20/98	01/16/98	01/20/98
Sample Type			Grab	Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (µg/L)								
Benzene	0.00	5						**2.4**
Semivolatile Organic Compounds (µg/L)								
1,2-Dichlorobenzene	0.00	600			**7.4**			
4-Chloro-3-methylphenol	0.00		**16**				**18.2**	
Benzo(*a*)anthracene	0.00					**13.7**		**17.3**
Benzo(*a*)pyrene	0.00	0.2				***12.6***		***14.3***
Benzo(*b*)fluoranthene	0.00					**23**		**27.5**
Benzo(*g,h,i*)perylene	0.00					**7**		**9.4**
Bis(2-ethylhexyl)phthalate	0.00	6		***22***				
Chrysene	0.00					**18.4**		**22.8**
Fluoranthene	0.00					**18**		**19**
Indeno(*1,2,3-cd*)pyrene	0.00					**6.5**		**8.2**
Pyrene	0.00					**41.7**		**35**
Metals (µg/L)								
Barium	71.72	2,000	45.2		6.5	8.8	29	18.4
Chromium	3.56	100	1.4	0.76	0.75	0.75		2.7
Mercury	0.14	2					**0.89**	
Selenium	1.90	50						1.9

Bold indicates concentrations above reference background criteria.
Boxed *italic* concentrations above MCLs.

Table 10.8-4. Summary of Site-related Contaminants, SWMU 24B

Analyte	Maximum Concentration (mg/kg)			Maximum Concentration (µg/L)	
	Surface Soil	Subsurface Soil	Sediment	Groundwater	Surface Water
Volatile Organic Compounds					
Benzene	ND	ND	NP	2.4	NP
Methylene chloride	ND	0.0289	NP	ND	NP
Toluene	0.142	0.0442	NP	ND	NP
Semivolatile Organic Compounds					
1,2-Dichlorobenzene	ND	ND	NP	7.4	NP
4-Chloro-3-methylphenol	ND	ND	NP	18.2	NP
Benzo(*a*)anthracene	9.38	ND	NP	17.3	NP
Benzo(*a*)pyrene	8.95	ND	NP	14.3	NP
Benzo(*b*)fluoranthene	16	ND	NP	27.5	NP
Benzo(*g,h,i*)perylene	4.69	ND	NP	9.4	NP
Benzo(*k*)fluoranthene	3.56	ND	NP	ND	NP
Bis(2-ethylhexyl)phthalate	ND	ND	NP	22	NP
Chrysene	12.6	ND	NP	22.8	NP
Fluoranthene	11.6	ND	NP	19	NP
Indeno(*1,2,3-cd*)pyrene	4.57	ND	NP	8.2	NP
Phenanthrene	3.48	ND	NP	ND	NP
Pyrene	16.8	ND	NP	41.7	NP
Metals					
Arsenic	2.7	ND	NP	ND	NP
Barium	230	BRBC	NP	BRBC	NP
Cadmium	6.1	BRBC	NP	ND	NP
Chromium	18.3	BRBC	NP	BRBC	NP
Lead	690	BRBC	NP	ND	NP
Mercury	0.13	BRBC	NP	0.89	NP
Selenium	ND	BRBC	NP	BRBC	NP

BRBC = Below reference background criteria.
ND = Not detected.
NP = No pathway exists.

Table 10.8-5. GSSL Screening of Site-related Contaminants in Soil, SWMU 24B

Site-related Contaminant	Maximum Concentration	GSSL[a]	CMCOPC?
Volatile Organic Compounds (mg/kg)			
Methylene chloride	0.0289	0.02	Yes
Toluene	0.142	12	No
Semivolatile Organic Compounds (mg/kg)			
Benzo(*a*)anthracene	9.38	2	Yes
Benzo(*a*)pyrene	8.95	8	Yes
Benzo(*b*)fluoranthene	16	5	Yes
Benzo(*g,h,i*)perylene[b,c]	4.69	394[c]	No
Benzo(*k*)fluoranthene	3.56	49	No
Chrysene	12.6	160	No
Fluoranthene	11.6	4,300	No
Indeno(*1,2,3-cd*)pyrene	4.57	14	No
Phenanthrene[b,d]	3.48	80.4[d]	No
Pyrene	16.8	4,200	No
Metals (mg/kg)			
Arsenic	2.7	29	No
Barium	230	1,600	No
Cadmium	6.1	8	No
Chromium	18.3	38	No
Lead[e]	690	400[e]	Yes
Mercury	0.13	2	No

[a]GSSL = EPA GSSL with a DAF of 20 for inorganics and volatile and semivolatile organics. A DAF of 20 inorganics was used because area of potential contamination is less than 0.5 acre; unless otherwise indicated, GSSL is taken from Soil Screening Guidance: Technical Background Document (EPA 1996a).

[b]EPA-suggested GSSL is not available; GSSL is calculated following Soil Screening Guidance: Technical Background Document (EPA 1996a). GSSLs are back-calculated from MCL, if available; otherwise, GSSLs are back-calculated based on EPA Region III RBCs corresponding to 10^{-6} risk or HQ = 1 (SAIC 1999a).

[c]An RBC was not available for benzo(*g,h,i*)perylene; therefore, an RBC was calculated based on a TEF of 0.01 (see Section 7.3) and was used to develop the GSSL.

[d]The RBC for pyrene was used to develop the GSSL for phenanthrene.

[e]A screening level of 400 mg/kg is used for lead based on Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (EPA 1994e).

Table 10.8-6. Human Health Risk Screening for Surface Soil, Subsurface Soil, and Groundwater, SWMU 24B

SURFACE SOIL						
Analyte	**Results > Detection Limit**	**Minimum Detect**	**Maximum Detect**	**EPA Region III Residential**	**HHCOPC?**	**Justification**
Volatile Organic Compounds (mg/kg)						
Toluene	3/5	0.101	0.142	1,600	No	Max Detect < Risk Criteria
Semivolatile Organic Compounds (mg/kg)						
Benzo(*a*)anthracene	3/5	2.89	9.38	0.88	Yes	Max Detect > Risk Criteria
Benzo(*a*)pyrene	3/5	4.39	8.95	0.09	Yes	Max Detect > Risk Criteria
Benzo(*b*)fluoranthene	3/5	5.23	16	0.88	Yes	Max Detect > Risk Criteria
Benzo(*g,h,i*)perylene[a]	3/5	3.07	4.69	8.8[a]	No	Max Detect < Risk Criteria
Benzo(*k*)fluoranthene	1/5	3.56	3.56	8.8	No	Max Detect < Risk Criteria
Chrysene	3/5	2.36	12.6	88	No	Max Detect < Risk Criteria
Fluoranthene	3/5	3.93	11.6	310	No	Max Detect < Risk Criteria
Indeno(*1,2,3-cd*)pyrene	3/5	3.25	4.57	0.88	Yes	Max Detect > Risk Criteria
Phenanthrene[b]	1/5	3.48	3.48	235[b]	No	Max Detect < Risk Criteria
Pyrene	3/5	5.21	16.8	230	No	Max Detect < Risk Criteria
Metals (mg/kg)						
Arsenic	3/5	0.34	2.7	0.43	Yes	Max Detect > Risk Criteria
Barium	4/5	7	230	550	No	Max Detect < Risk Criteria
Cadmium	3/5	0.18	6.1	7.8	No	Max Detect < Risk Criteria
Chromium	4/5	3.1	18.3	23	No	Max Detect < Risk Criteria
Lead	5/5	1.1	690	400	Yes	Max Detect > Risk Criteria
Mercury	1/5	0.13	0.13	2.3	No	Max Detect < Risk Criteria

SUBSURFACE SOIL						
Analyte	**Results > Detection Limit**	**Minimum Detect**	**Maximum Detect**	**EPA Region III Residential**	**HHCOPC?**	**Justification**
Volatile Organic Compounds (mg/kg)						
Methylene chloride	1/4	0.0289	0.0289	85	No	Max Detect < Risk Criteria
Toluene	1/4	0.0442	0.0442	1,600	No	Max Detect < Risk Criteria

Note: Footnotes appear on page 10.8-15.

Table 10.8-6. Human Health Risk Screening for Surface Soil, Surface Soil, and Groundwater, SWMU 24B (continued)

GROUNDWATER						
Analyte	**Freq. of Detection**	**Minimum Detect**	**Maximum Detect**	**Human Health Criteria**	**HHCOPC?**	**Justification**
Volatile Organic Compounds (µg/L)						
Benzene	1/6	2.4	2.4	0.36	Yes	Max Detect > Risk Criteria
Semivolatile Organic Compounds (µg/L)						
1,2-Dichlorobenzene	1/6	7.4	7.4	6.4	Yes	Max Detect > Risk Criteria
4-Chloro-3-methylphenol	2/6	16	18.2	None	Yes	HHCOPC by Default
Benzo(*a*)anthracene	2/6	13.7	17.3	0.092	Yes	Max Detect > Risk Criteria
Benzo(*a*)pyrene	2/6	12.6	14.3	0.0092	Yes	Max Detect > Risk Criteria
Benzo(*b*)fluoranthene	2/6	23	27.5	0.092	Yes	Max Detect > Risk Criteria
Benzo(*g,h,i*)perylene[a]	2/6	7	9.4	0.92[a]	Yes	Max Detect > Risk Criteria
Bis(2-ethylhexyl)phthalate	1/6	22	22	4.8	Yes	Max Detect > Risk Criteria
Chrysene	2/6	18.4	22.8	9.2	Yes	Max Detect > Risk Criteria
Fluoranthene	2/6	18	19	150	No	Max Detect < Risk Criteria
Indeno(*1,2,3-cd*)pyrene	2/6	6.5	8.2	0.092	Yes	Max Detect > Risk Criteria
Pyrene	2/6	35	41.7	110	No	Max Detect < Risk Criteria
Metals (µg/L)						
Mercury	1/6	0.89	0.89	0.37	Yes	Max Detect > Risk Criteria

[a]An RBC was not available for benzo(*g,h,i*)perylene; therefore, an RBC was calculated based on a TEF of 0.01 (see Section 7.3).
[b]The RBC for pyrene was used for phenanthrene.

Table 10.8-7. Ecological Screening Value Comparison for Analytes Detected in Groundwater, SWMU 24B

Analyte	SWMU 24B Maximum	ESV	ECOPC Aquatic Biota?	Justification
Volatile Organic Compounds (µg/L)				
Benzene	2.4	53	No	Max Detect < ESV
Semivolatile Organic Compounds (µg/L)				
1,2-Dichlorobenzene	7.4	15.8	No	Max Detect < ESV
4-Chloro-3-methylphenol	18.2	No ESV	Yes	ECOPC by Default
Benzo(*a*)anthracene	17.3	0.027[a]	Yes	Max Detect > ESV
Benzo(*a*)pyrene	14.3	0.014[a]	Yes	Max Detect > ESV
Benzo(*b*)fluoranthene	27.5	No ESV	Yes	ECOPC by Default
Benzo(*g,h,i*)perylene	9.4	No ESV	Yes	ECOPC by Default
Bis(2-ethylhexyl)phthalate	22	0.3	Yes	Max Detect > ESV
Chrysene	22.8	No ESV	Yes	ECOPC by Default
Fluoranthene	19	39.8	No	Max Detect < ESV
Indeno(*1,2,3-cd*)pyrene	8.2	No ESV	Yes	ECOPC by Default
Pyrene	41.7	No ESV	Yes	ECOPC by Default
Metals (µg/L)				
Mercury	0.89	0.0123	Yes	Max Detect > ESV

[a]Chronic National Ambient Water Quality Criteria or Tier II values as reported in Suter and Tsao (1996), Table 1 or Table 3.
ESV = EPA Region IV ESVs (EPA 1996d) and, where indicated, alternative values for analytes without ESVs. Cells with double borders indicate concentrations exceeding ESV or, when there is no ESV, compounds that become ECOPCs by default.

Table 10.8-8. Preliminary Risk Calculations for ECOPCs in Groundwater, SWMU 24B

ECOPC	C_{Max} (µg/L)	Raccoon		
		ADD (mg/kg/d) = C_{Max} × 0.001 × IR_W	TRV (mg/kg/d)	HQ = ADD/TRV
Semivolatile Organic Compounds				
4-Chloro-3-methylphenol	18.2	1.46E-03	No TRV	--
Benzo(*a*)anthracene	17.3	1.38E-03	3.54E+00	3.91E-04
Benzo(*a*)pyrene	14.3	1.14E-03	2.66E-01	4.30E-03
Benzo(*b*)fluoranthene	27.5	2.20E-03	3.54E+00	6.22E-04
Benzo(*g,h,i*)perylene	9.4	7.52E-04	3.54E+00	2.13E-04
Bis(2-ethylhexyl)phthalate	22	1.76E-03	4.87E+00	3.62E-04
Chrysene	22.8	1.83E-03	3.54E+00	5.16E-04
Indeno(*1,2,3-cd*)pyrene	8.2	6.56E-04	3.54E+00	1.85E-04
Pyrene	41.7	3.34E-03	2.66E-01	1.25E-02
			HI=	5.89E-03
Metals				
Mercury[a]	0.89	7.12E-05	6.46E-01	1.10E-04

[a]Assumes mercuric sulfide for raccoon.

0.001 (mg/µg) = Conversion from mg/L to µg/L.

ADD = Average daily dose (mg/kg/d).

C_{Max} = Maximum detected concentration (µg/L).

HQ = Hazard quotient; HI = hazard index = sum of HQs.

IR_W = Raccoon water ingestion rate (L/kg/d) = 0.080.

TRV = NOAEL (mg/kg/d).

-- = Cannot be calculated due to the lack of data.

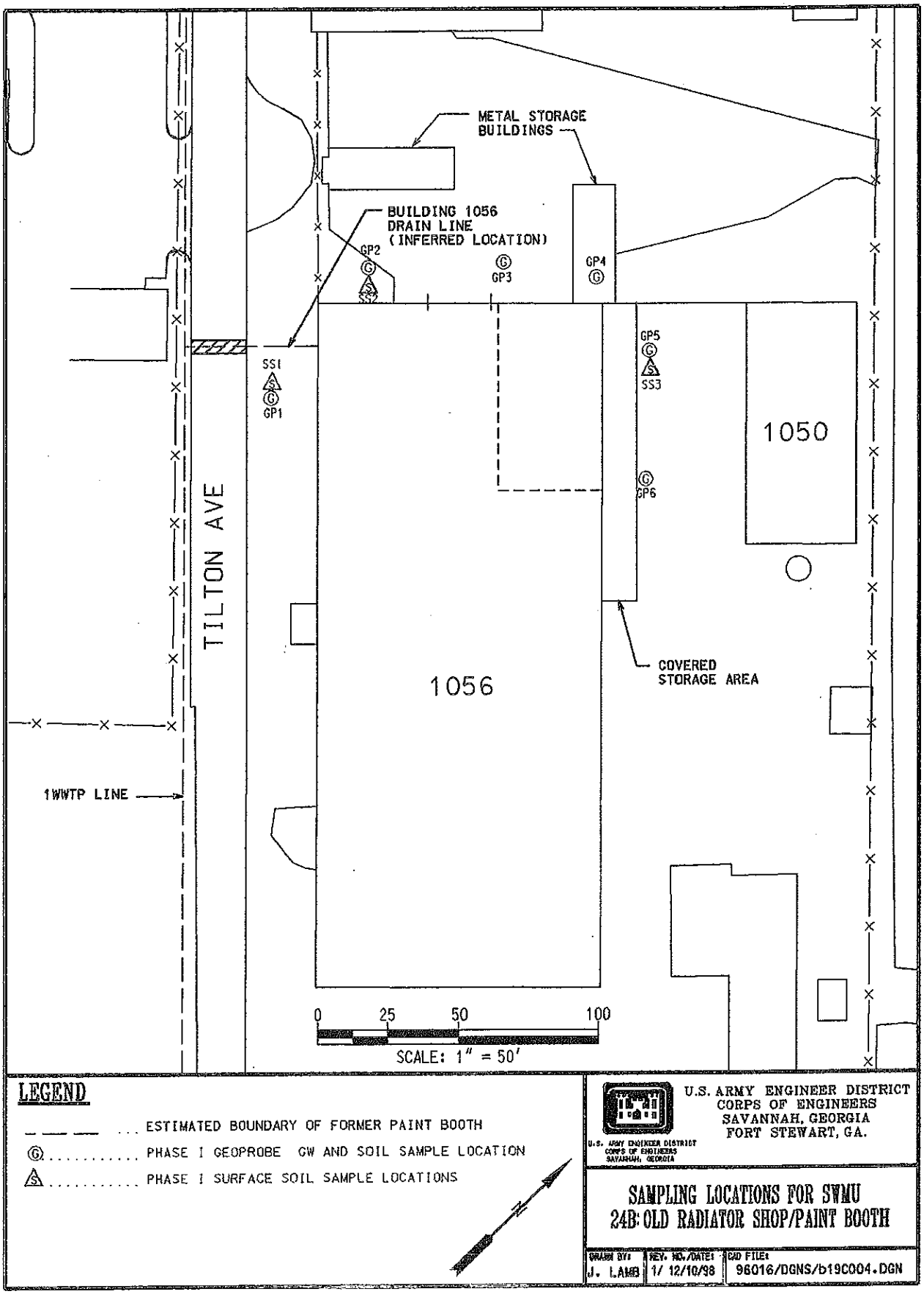

Figure 10.8-1. Sampling Locations, SWMU 24B

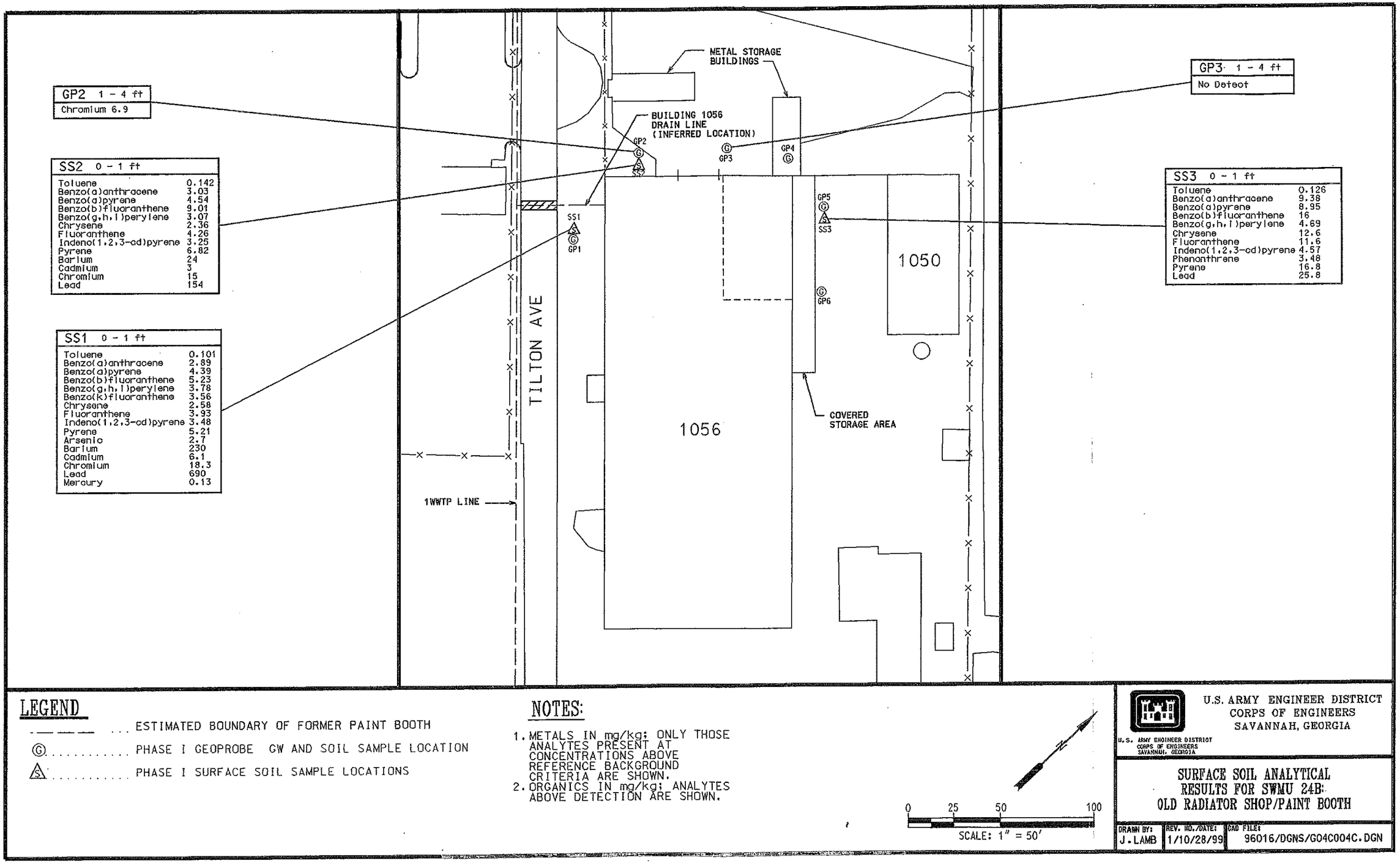

Figure 10.8-2. Summary of Analytical Results in Surface Soil, SWMU 24B

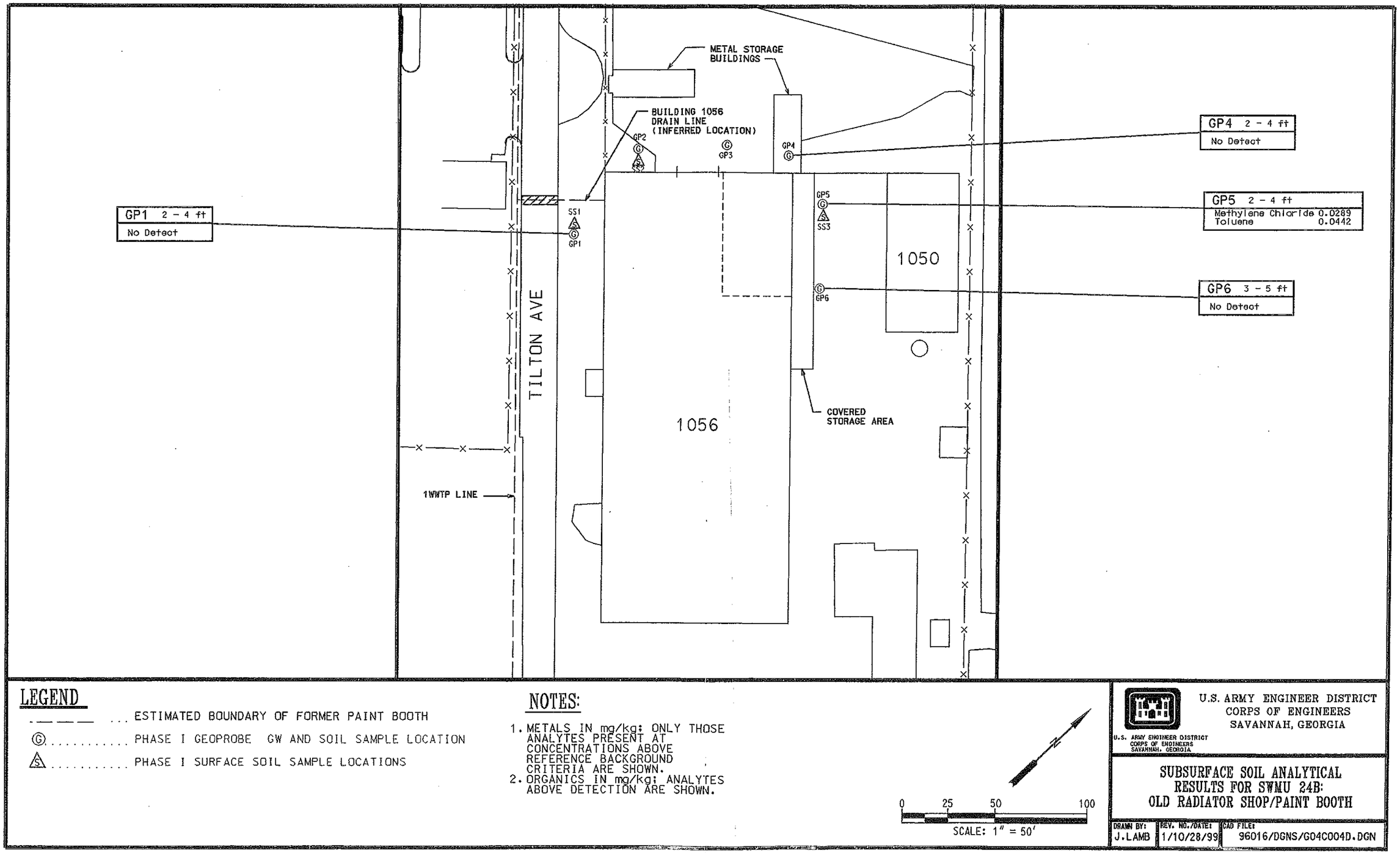

Figure 10.8-3. Summary of Analytical Results in Subsurface Soil, SWMU 24B

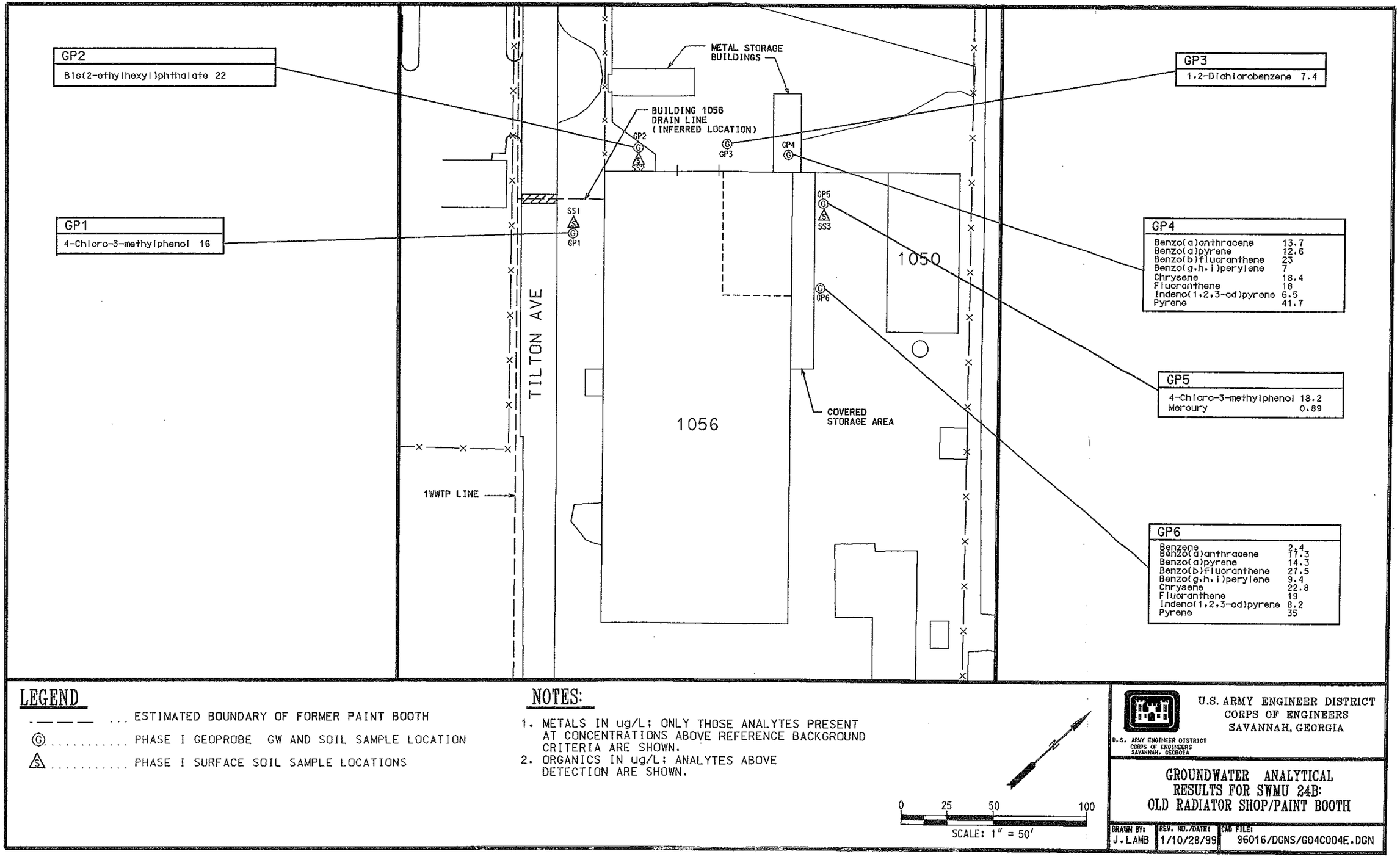

Figure 10.8-4. Summary of Analytical Results in Groundwater, SWMU 24B

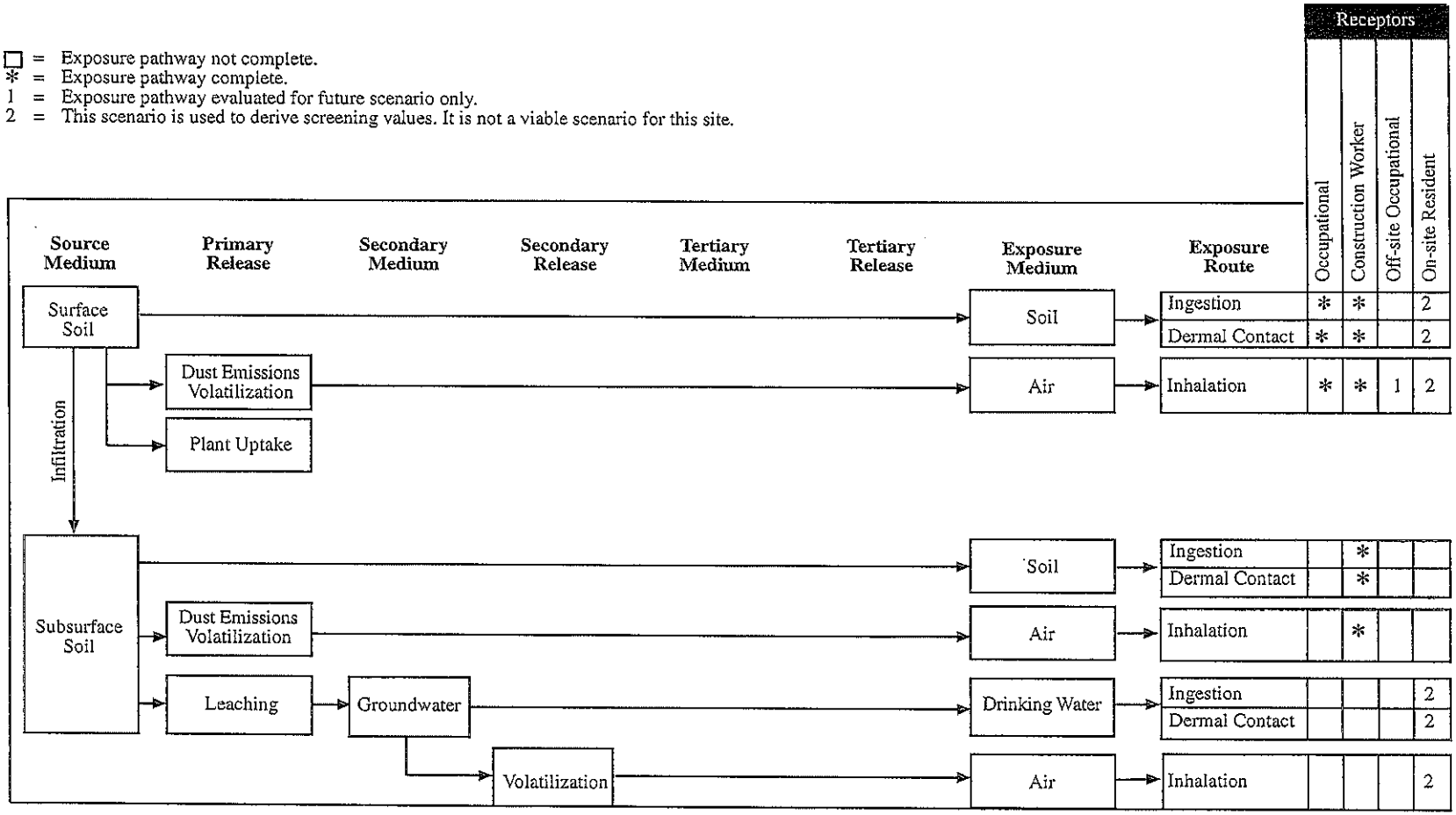

Figure 10.8-5. Potential Migration and Exposure Pathways, SWMU 24B

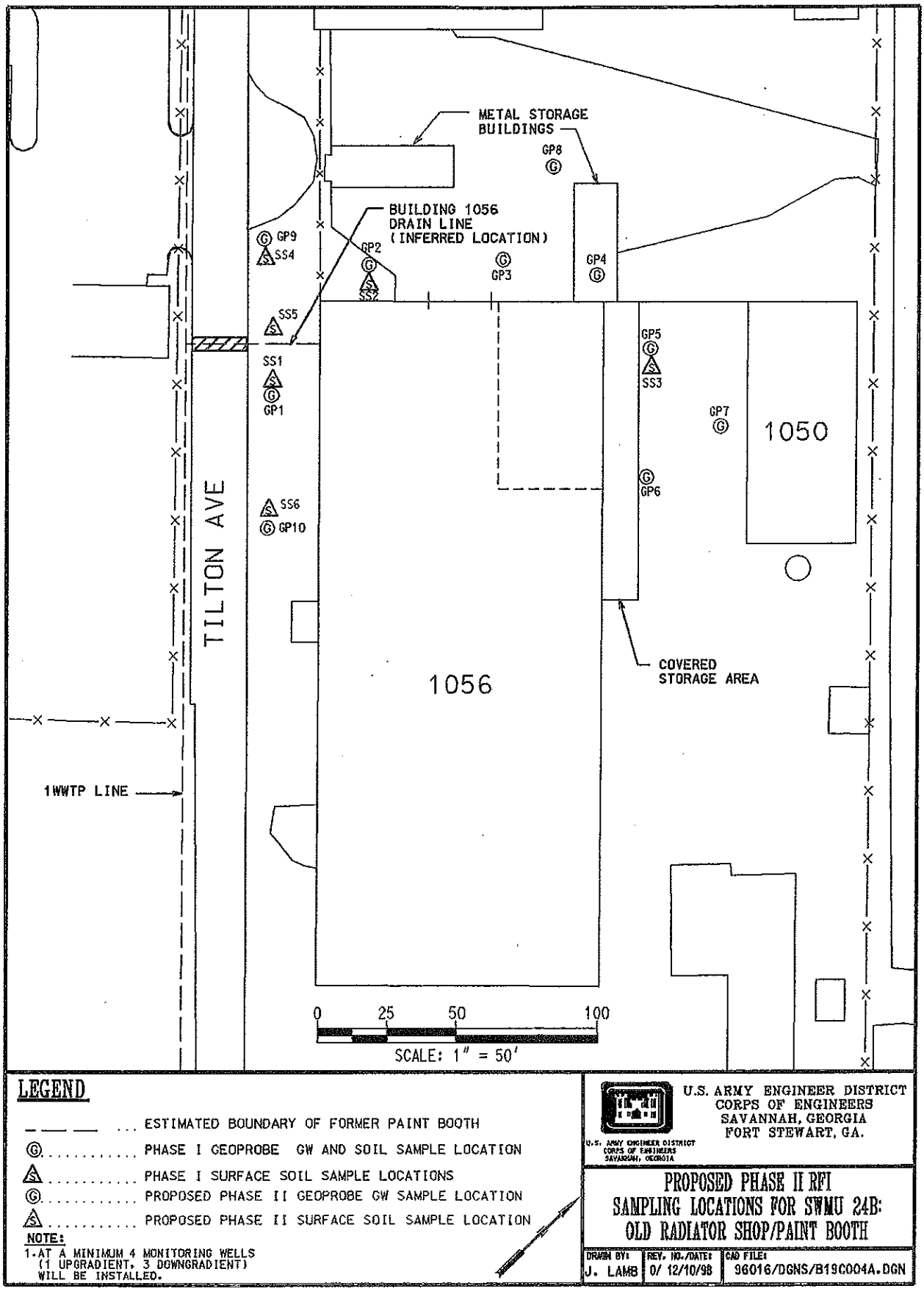

Figure 10.8-6. Proposed Phase II RFI Sampling Locations, SWMU 24B