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ADDENDUM FOR SWMU 27F: 3D ENGINEER BRIGADE, NORTHWEST OF BUILDING 1340

3d Inf Div (Mech)

TO THE

REVISED FINAL PHASE II RCRA FACILITY INVESTIGATION REPORT FOR 16 SOLID WASTE MANAGEMENT UNITS AT FORT STEWART, GEORGIA

Prepared for

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT

Contract No. DACA21-95-D-0022
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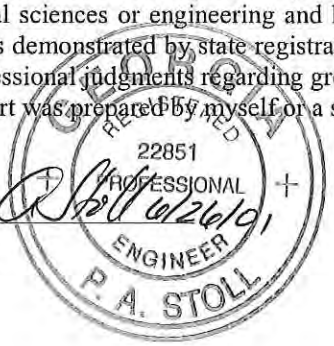
June 2001

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.



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

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ATTACHMENTS

TABLES

FIGURES

ACRONYMS

ADD	average daily dose
amsl	above mean sea level
AT123D	Analytical Transient 1-, 2-, 3-Dimensional
AUF	area use factor
bgs	below ground surface
CAP	Corrective Action Plan
CMCOPC	contaminant migration contaminant of potential concern
COC	constituent of concern
COPC	contaminant of potential concern
DO	dissolved oxygen
DPT	direct-push technology
ECOPC	ecological contaminant of potential concern
EPA	U.S. Environmental Protection Agency
EPRE	ecological preliminary risk evaluation
ERA	Ecological Risk Assessment
ESV	ecological screening value
FSMR	Fort Stewart Military Reservation
GEPD	Georgia Environmental Protection Division
GSSL	generic soil screening level
HHBRA	human health baseline risk assessment
HHCOC	human health constituent of concern
HHCOPC	human health contaminant of potential concern
HHPRE	human health preliminary risk evaluation
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
IWTP	Industrial Wastewater Treatment Plant
LOAEL	lowest observed adverse effect level
MCL	maximum contaminant level
NFA	no further action
NOAEL	no observed adverse effect level
NTU	nephelometric turbidity unit
OWS	oil/water separator
PAH	polycyclic aromatic hydrocarbon
PID	photoionization detector
RBC	risk-based concentration
RBCA	Risk-based Corrective Action
RCRA	Resource Conservation and Recovery Act
Redox	oxidation-reduction potential
RFI	RCRA Facility Investigation
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SRC	site-related contaminant
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TRV	toxicity reference value
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

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1.0 INTRODUCTION

This addendum to the revised final Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report for 16 Solid Waste Management Units (SWMUs) dated April 2000 presents the results for the Phase II RFI performed in October 1999 and the supplemental Phase II RFI performed in November 2000 and January 2001 for SWMU 27F, northwest of Building 1340 [see Section 10.9 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000)]. A Phase I RFI was performed at SWMU 27F, northwest of Building 1340 in January 1998, and the results are presented in Section 10.9 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). The results of the Phase I RFI indicated that additional investigation of the site was required to evaluate the nature and extent of potential soil and groundwater contamination.

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.

1.1 OBJECTIVES AND SCOPE OF THE INVESTIGATION

The specific objectives of this Phase II RFI for SWMU 27F, northwest of Building 1340 at Fort Stewart, Georgia, as defined in the conclusions and recommendations in Section 10.9.8.2 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000) and Phase II RFI Sampling and Analysis Plan (SAP) (SAIC 1997) [approved by the Georgia Environmental Protection Division (GEPD) in October 1997] are listed below.

- Determine the horizontal and vertical extent of groundwater contamination.
- Determine whether soil and groundwater contaminants present a threat to human health or the environment.
- Determine the need for future action and/or no further action (NFA).
- Gather data necessary to support a Corrective Action Plan (CAP), if warranted.

The information provided in this addendum report is based upon data collected previously during the Phase I RFI (January 1998) and as part of the Phase II RFI (October 1999) field sampling and analysis. The scope of the fieldwork for the Phase II sites included the activities listed below.

- Collection of direct-push groundwater samples using a push probe.
- Collection of soil samples during monitoring well installation.
- Installation of permanent groundwater monitoring wells both upgradient and downgradient of the site.
- Groundwater sampling at newly installed monitoring wells around the SWMU.
- Surveying of the positions of all sample locations.

1.2 ADDENDUM REPORT ORGANIZATION

This report is an addendum to the revised final Phase II RFI Report for 16 SWMUs that was issued in April 2000. General procedures and/or methodology for field investigation, fate and transport analysis, human health risk assessment, and ecological risk assessment (ERA) are presented in the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000) and are referenced in the appropriate addendum sections. The revised final Phase II RFI Report for 16 SWMUs consists of three volumes: 12 chapters of text in Volume I, seven appendices in Volume II, and five appendices in Volume III. The contents of each volume are described below.

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 the FSMR's regulator history. Chapter 3.0 presents the regional setting of the FSMR, including the demographics, topography, regional geology and hydrogeology, surface drainage, soil, 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).

Chapter 9.0 designates, in sequential order, the SWMUs that are recommended for NFA and for which, therefore, additional investigation and/or evaluation is not required. Chapter 10.0, in which SWMU 27F, northwest of Building 1340 is addressed (Section 10.9), designates, in sequential order, the SWMUs that are recommended for additional investigation or a CAP. Chapter 11.0 presents general conclusions and recommendations related to the SWMUs being recommended for NFA or SWMUs that indicate risk to human health or the environment and being recommended for additional investigation or a CAP. References are presented in Chapter 12.0.

Volume II of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000) contains seven appendices. Appendix A contains the direct-push technology (DPT) and boring logs. Appendix B contains monitoring well construction diagrams. Appendix C is the Quality Control Summary Report. Appendix D provides a comparison of metals 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 the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000) contains five appendices. Appendix H provides the analytical data results. The analytical data are also provided in electronic format (i.e., on CDs). Appendix I presents the methodology for the human health baseline risk assessment (HHBRA). Appendix J contains the toxicity profiles for contaminants of potential concern (COPCs). Appendix K presents the fate and transport input data and model descriptions. Appendix L presents the revised responses 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.

The results of the Phase I RFI for SWMU 27F, northwest of Building 1340 are presented in Section 10.9 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). This addendum follows the same organization as that of the revised final Phase II RFI Report for 16 SWMUs.

2.0 HISTORY AND DESCRIPTION OF SWMU 27F, 3D ENGINEER BRIGADE, NORTHWEST OF BUILDING 1340

SWMU 27F, northwest of Building 1340, is one of two oil/water separators (OWSs) that support vehicle maintenance activities of the 3d Engineer Brigade and one of 32 OWSs distributed across 29 sites that support vehicle maintenance facilities within the garrison area (Figure 1). The OWS is located along the northwestern boundary of the motorpool area, approximately 200 feet northwest of Building 1340 (Figure 2). The OWS receives wastewater from an adjacent, covered maintenance pad. Maintenance activities for military vehicles are performed at the maintenance pad. Floor drains from the maintenance pad are piped to the OWS. The effluent from the OWS discharges to the Industrial Wastewater Treatment Plant (IWTP), and the oil is pumped out of the holding unit and burned at the Central Energy Plant.

SWMU 27F, northwest of Building 1340 is regulated under a RCRA Permit [HW-045 (S&T)] issued to Fort Stewart in August 1987 for storage and treatment of hazardous waste. A detailed regulatory history of Fort Stewart is presented in Section 2.2 of the revised final Phase II RFI Report (SAIC 2000). A Phase I RFI was conducted in January 1998, and the results are discussed in the following section.

3.0 PHASE I RCRA FACILITY INVESTIGATION

A Phase I RFI was conducted at SWMU 27F, northwest of Building 1340 in January 1998. DPT techniques were used to collect four soil and groundwater samples at the site. The locations of the soil and groundwater sampling are presented in Figure 2. The four soil samples were collected based on field headspace screening for volatile organic compounds (VOCs). The soil and groundwater samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), and lead.

3.1 SURFACE SOIL

Based on field headspace screening for VOCs [i.e., no photoionization detector (PID) detections in the 0-foot to 2-foot interval], no surface soil samples were collected for analysis during the Phase I RFI.

3.2 SUBSURFACE SOIL

Four subsurface soil samples were collected (Figure 3). The soil samples were selected for analysis based on field headspace screening for VOCs. Analytical results for the Phase I RFI are summarized in Table 1 and Figure 3.

VOCs. VOCs were detected at levels above the analytical detection limit in subsurface soil samples. Acetone was detected at three of the four sample locations. Acetone was detected at concentrations ranging from 0.0382 mg/kg at GP4 to 0.111 mg/kg at GP1. Ethylbenzene and total xylenes were each detected in only one subsurface sample (GP3) at concentrations of 0.0137 mg/kg and 0.0784 mg/kg, respectively. The site-related contaminants (SRCs) for subsurface soil based on the Phase I RFI include the following VOCs: acetone, ethylbenzene, and total xylenes.

SVOCs. SVOCs were not detected in subsurface soil samples at concentrations above the analytical detection limits; therefore, there are no SRCs in subsurface soil based on the Phase I RFI.

Lead. Lead was detected at a concentration of 11.4 mg/kg in one subsurface soil sample collected from GP1, which minimally exceeds the reference background criterion of 11.1 mg/kg. Lead is considered to be an SRC for subsurface soil based on the Phase I RFI.

3.3 GROUNDWATER

With the use of DPT techniques, groundwater samples were collected from the four locations at the site. Groundwater samples were analyzed for VOCs, SVOCs, and lead. The results of the groundwater analyses are presented in Table 2 and Figure 3.

VOCs. A wide range of VOCs was detected in the groundwater samples. Groundwater from GP3, east of the OWS, accounted for the majority of the VOCs. Benzene was detected at two of the four locations, with concentrations of 3.6 µg/L at GP4 and 67.2 µg/L at GP3. Benzene exceeded its maximum contaminant level (MCL) at GP3. Total xylenes were detected at two of the four locations, with concentrations of 5.3 µg/L at GP4 and 255 µg/L at GP3. Ethylbenzene was detected at two of the four locations, with concentrations of 2.4 µg/L at GP4 and 69.5 µg/L at GP3. The VOCs 1,1,1-trichloroethane; 1,1,2-trichloroethane; 1,1-dichloroethane; acetone; methylene chloride; styrene; and toluene were detected at only GP3 at concentrations of 3.6 µg/L, 2.7 µg/L, 3 µg/L, 62.6 µg/L, 42 µg/L, 3 µg/L, and 39 µg/L, respectively. Methylene chloride exceeded its MCL at GP3. Organic SRCs in groundwater based on the Phase I RFI include the following VOCs: toluene; total xylenes; 1,1,1-trichloroethane; 1,1,2-trichloroethane; 1,1-dichloroethane; acetone; benzene; ethylbenzene; methylene chloride; and styrene.

SVOCs. SVOCs that were detected above analytical detection limits in groundwater samples include 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, naphthalene, and phenanthrene (see Figure 3). Naphthalene, phenanthrene, and 2-methylnaphthalene were detected at only GP3 at concentrations of 569 µg/L; 379 µg/L; and 1,440 µg/L, respectively. Bis(2-ethylhexyl)phthalate was detected at GP1 at a concentration of 6.7 µg/L, which slightly exceeds its MCL of 6.0 µg/L. SVOCs that are SRCs for groundwater based on the Phase I RFI include 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, naphthalene, and phenanthrene.

Lead. Lead concentrations were below reference background levels (see Figure 3); therefore, lead is not an SRC in groundwater based on the Phase I RFI.

3.4 SURFACE WATER

No surface water samples were collected at SWMU 27F, northwest of Building 1340 during the Phase I RFI because no surface water pathway exists.

3.5 SEDIMENT

No sediment samples were collected at SWMU 27F, northwest of Building 1340 during the Phase I RFI because no sediment pathway exists.

3.6 CONCLUSIONS AND RECOMMENDATIONS OF THE PHASE I RFI

Acetone, ethylbenzene, total xylenes, and lead were identified as SRCs in subsurface soil. However, none of these constituents were identified as contaminant migration contaminants of potential concern (CMCOPCs) or human health contaminants of potential concern (HHCOPCs). Toluene; total xylenes; 1,1,1-trichloroethane; 1,1,2-trichloroethane; 1,1-dichloroethane; acetone; benzene; ethylbenzene; methylene chloride; styrene; 2-methylnaphthalene; bis(2-ethylhexyl)phthalate; naphthalene; and phenanthrene were identified as SRCs in groundwater. Benzene, methylene chloride, and bis(2-ethylhexyl)phthalate were detected above their respective MCLs. 1,1,2-Trichloroethane; acetone; benzene; methylene chloride; 2-methylnaphthalene; bis(2-ethylhexyl)phthalate; naphthalene; and phenanthrene were identified as HHCOPCs in groundwater. Benzene, total xylenes, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, naphthalene, and phenanthrene were identified as ecological contaminants of potential concern (ECOPCs) based on the potential hazards to aquatic biota if groundwater discharges to nearby surface water bodies. Therefore, the Phase I RFI [see page 10.9-6, Section 10.9.8.2 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000)] concluded that the vertical and horizontal extent of potential groundwater contamination had not been determined and recommended that additional groundwater screening and shallow and potentially deep groundwater monitoring wells be installed at the site (upgradient and downgradient).

4.0 SUMMARY OF PHASE II RCRA FACILITY INVESTIGATION

The extent of potential soil and groundwater contamination was not determined by the Phase I RFI; therefore, a Phase II RFI was conducted in October 1999. During the Phase II RFI, DPT techniques were used to collect 14 groundwater screening samples to determine the horizontal and vertical extent of groundwater contamination. The DPT groundwater screening samples were analyzed for VOCs. Two vertical-profile borings were installed at the groundwater screening locations that indicated the highest levels of contamination to investigate the vertical extent of contamination. The vertical-profile samples were analyzed for VOCs. The results of the groundwater screening were used to locate 11 monitoring wells (eight shallow and three deep) at the site. One shallow and one deep monitoring well were installed upgradient (background). In addition, a recovery well (MW12) was installed to recover potential free product identified on a clay lens encountered at approximately 8 feet below ground surface (bgs). No soil or groundwater samples were collected at this location. Boring logs and monitoring well diagrams are presented in Appendices A (page A.18-1) and B (page B.8-1), respectively, of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). The Phase II RFI sampling locations are shown in Figure 4. Monitoring well construction details are presented in Table 3. Two soil samples were collected at each well, following the procedures outlined in the revised final SAP for Phase II RFIs of 16 SWMUs (SAIC 1997). The soil samples were analyzed for VOCs, SVOCs, and RCRA metals.

Geotechnical samples were collected from the monitoring wells, and the results are presented in Table 4. All of the monitoring wells were developed until the turbidity was less than or equal to 10 nephelometric turbidity units (NTUs). Monitoring well development data are presented in Table 5. All wells were sampled using low-flow techniques. Groundwater samples collected from the monitoring wells were analyzed for VOCs, SVOCs, and RCRA metals. Conductivity, pH, temperature, dissolved oxygen (DO), oxidation-reduction potential (Redox), and turbidity were measured in the field during sampling, and the results are presented in Table 6.

5.0 PHYSICAL CHARACTERISTICS OF THE SITE

5.1 TOPOGRAPHY

The topography of the site is essentially flat. The surface elevation is approximately 68 feet above mean sea level (amsl). The OWS is located in a small, grassy area that extends to the northwestern boundary of the motorpool's fence line, where a fenced storage area is located. The other three sides are comprised of a concrete vehicle parking area/road or the maintenance pad.

5.2 SURFACE DRAINAGE

There are no surface drainage features around the OWS (Figure 2) that directly receive potential surface water runoff. In addition, the effluent from the OWS discharges to the IWTP; therefore, there are no surface water/sediment migration pathways at this site. However, there is a man-made drainage ditch approximately 450 feet south (downgradient) from the site (Figure 2). This drainage ditch is approximately 6 feet to 8 feet deep and 20 feet wide and is heavily vegetated. The drainage ditch receives miscellaneous drainage and surface water runoff from the northwestern side of the garrison area and discharges into Mill Creek approximately 2,400 feet to the west.

5.3 SOIL

The soil across the site consists of alternating layers of sand and silty to clayey sands, as indicated in cross sections A-A' and B-B' (Figures 5 and 6, respectively).

5.4 HYDROGEOLOGY

Groundwater was encountered at approximately 12 feet to 14 feet bgs in the monitoring wells during the Phase II RFI. The shallow and deep surficial groundwater flow direction across the site is to the south (Figures 7 and 8, respectively). The hydraulic gradients of the shallow and deep surficial groundwater are 0.0008 foot/foot and 0.0009 foot/foot, respectively. Both the shallow and deep surficial groundwater flow may intercept the man-made drainage ditch located approximately 450 feet to the southwest.

5.5 ECOLOGY

As stated in Section 8.2 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000), SWMU 27F, northwest of Building 1340 is classified as an "industrialized area with managed grassland." The site is located within the industrialized area and comprises approximately 0.01 acre (see Figure 2). The surface of this SWMU is primarily concrete and contains man-made structures; however, a small area of managed grass does exist between the concrete and the fence line.

6.0 NATURE AND EXTENT OF CONTAMINATION

6.1 SURFACE SOIL

Eleven surface soil samples were collected during the Phase II RFI (Figure 9). Analytical results for the Phase II RFI are summarized in Table 7 and Figure 9. Chain-of-custody forms and complete analytical results are presented in Appendix G (page G-175) and Appendix H (page H.19-1) of the revised final Phase II RFI Report (SAIC 2000).

VOCs. 2-Butanone was detected in four surface soil locations at concentrations ranging from 0.0049 mg/kg at MW11 to 0.0105 mg/kg at MW7. 4-Methyl-2-pentanone was detected at a concentration of 0.0021 mg/kg at MW4. Acetone was detected in four out of nine surface soil samples at concentrations ranging from 0.0488 mg/kg at MW7 to 0.115 mg/kg at MW10. Carbon disulfide was detected at concentrations of 0.0124 mg/kg at MW3 and 0.0478 mg/kg at MW10. Toluene was detected at a concentration of 0.0218 mg/kg at MW11. 2-Butanone, 4-methyl-2-pentanone, acetone, carbon disulfide, and toluene are considered to be SRCs in surface soil based on the Phase II RFI.

SVOCs. Seventeen SVOCs were detected in surface soil. All of the SVOCs—at their maximum concentrations—were detected at MW10. Four [benzo(*b*)fluoranthene, benzo(*g,h,i*)perylene, benzo(*k*)fluoranthene, and dibenzo(*a,h*)anthracene] of these SVOCs were also detected in surface soil collected from MW11. MW10 and MW11 are a shallow/deep monitoring well pair located adjacent to one another. SVOCs were not detected at any other surface soil location. Acenaphthene (0.0425 mg/kg), anthracene (0.492 mg/kg), benzo(*a*)anthracene (3.94 mg/kg), benzo(*a*)pyrene (2.43 mg/kg), benzo(*b*)fluoranthene (2.88 mg/kg and 0.0345 mg/kg), benzo(*g,h,i*)perylene (0.885 mg/kg and 0.0294 mg/kg), benzo(*k*)fluoranthene (2.1 mg/kg and 0.0203 mg/kg), bis(2-ethylhexyl)phthalate (0.793 mg/kg), butyl benzyl phthalate (0.265 mg/kg), chrysene (3.6 mg/kg), di-*N*-octyl phthalate (0.374 mg/kg), dibenzo(*a,h*)anthracene (0.543 mg/kg and 0.0268 mg/kg), fluoranthene (10.5 mg/kg), fluorene (0.0375 mg/kg), indeno(*1,2,3-cd*)pyrene (0.976 mg/kg), phenanthrene (1.18 mg/kg), and pyrene (8.22 mg/kg) are considered to be SRCs in surface soil based on the Phase II RFI.

RCRA Metals. Arsenic, barium, cadmium, chromium, lead, and selenium were detected in surface soil above reference background criteria. Arsenic was detected at concentrations of 2.6 mg/kg and 4.4 mg/kg at MW6 and MW9, respectively. Barium was detected above the reference background criterion in five of 11 surface soil samples at concentrations ranging from 16.9 mg/kg at MW1 (site background shallow location) to 22.2 mg/kg at MW2 (site background deep location). Cadmium was detected at a concentration of 1.3 mg/kg at MW4. Chromium was detected above the reference background criterion in seven of 11 surface soil samples, including the sample from the site background location, at concentrations ranging from 6.5 mg/kg at MW8 to 19.9 mg/kg at MW9. Lead was detected at concentrations of 10.9 mg/kg at MW4, 11.8 mg/kg at MW6, and 11.5 mg/kg at MW9. Selenium was detected at a concentration of 1.4 mg/kg at MW9. Arsenic, barium, cadmium, chromium, lead, and selenium are considered to be SRCs in surface soil based on the Phase II RFI.

6.2 SUBSURFACE SOIL

A total of 15 subsurface soil samples were collected during the Phase II RFI (see Figure 10). These samples were selected for analysis based on field headspace screening for VOCs. Because MW10 was located in an area of significant contamination, all the subsurface soil intervals to the water table (five) were analyzed for VOCs. Analytical results for the Phase II RFI are summarized in Table 8 and

Figure 10. Chain-of-custody forms and complete analytical results are presented in Appendix G (page G-175) and Appendix H (page H.19-1), respectively, of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000).

VOCs. Six VOCs were detected in the subsurface soil collected at SWMU 27F, northwest of Building 1340. These were 2-butanone, acetone, benzene, carbon disulfide, ethylbenzene, and total xylenes. 2-Butanone was detected at concentrations of 0.0058 mg/kg and 0.0036 mg/kg at MW5 and MW10, respectively. 2-Butanone was also detected at concentrations of 0.0176 mg/kg and 0.005 mg/kg at MW1 and MW2 (the site-specific background locations). Acetone was detected in MW1 (site background location) at a concentration of 0.0847 mg/kg. Benzene was detected at concentrations of 0.0022 mg/kg, 0.0064 mg/kg, and 0.0081 mg/kg at MW7, MW8, and MW9, respectively. Carbon disulfide was detected at concentrations of 0.014 mg/kg at MW1 (site background location) and 0.01 mg/kg at MW6. Ethylbenzene was detected in six of 15 subsurface soil samples at concentrations ranging from 0.0096 mg/kg at MW8 to 1.68 mg/kg at MW10 (6 feet to 8 feet bgs). Total xylenes were detected in six of 15 subsurface soil samples at concentrations ranging from 0.0121 mg/kg at MW8 to 5.04 mg/kg at MW10 (6 feet to 8 feet bgs). Four of the six detections of ethylbenzene and total xylenes were detected in the subsurface soil columns of MW10 and MW11, sample locations that are located adjacent to one another (Figure 10). 2-Butanone, benzene, carbon disulfide, ethylbenzene, and total xylenes are SRCs in subsurface soil based on the Phase II RFI. Acetone is not an SRC in subsurface soil because it was detected at only the site background location.

SVOCs. Twelve SVOCs were detected in subsurface soil during the Phase II RFI. The majority of the detections were at locations MW10 and MW11, which are located adjacent to one another. 2-Methylnaphthalene was detected at concentrations of 18.1 mg/kg, 15.3 mg/kg, and 5.54 mg/kg at MW9, MW10, and MW11, respectively. Benzo(*b*)fluoranthene was detected at a concentration of 0.0302 mg/kg at MW1 (site background location). Benzo(*k*)fluoranthene was detected at a concentration of 0.0541 mg/kg at MW6. Naphthalene was detected at concentrations of 4.49 mg/kg, 3.8 mg/kg, and 1.3 mg/kg at MW9, MW10 (8 feet to 9 feet bgs), and MW11, respectively. Bis(2-ethylhexyl)phthalate was detected at a concentration of 25.6 mg/kg at MW11. Phenanthrene was detected at four out of 11 subsurface soil samples at concentrations ranging from 0.093 mg/kg at MW8 to 5.23 mg/kg at MW9. Pyrene was detected at concentrations of 0.0279 mg/kg, 1.04 mg/kg, and 0.602 mg/kg at MW6, MW10, and MW11, respectively. The remaining SVOCs [acenaphthene (1.12 mg/kg), anthracene (0.393 mg/kg), diphenylamine (2.81 mg/kg), fluoranthene (0.3 mg/kg), and fluorene (2.18 mg/kg)] were detected solely in MW10 (8 feet to 9 feet bgs). 2-Methylnaphthalene, acenaphthene, anthracene, benzo(*k*)fluoranthene, bis(2-ethylhexyl)phthalate, diphenylamine, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene are considered to be SRCs in subsurface soil based on the Phase II RFI. Benzo(*b*)fluoranthene is not an SRC in subsurface soil because it was detected at only the site background location.

RCRA Metals. Barium, chromium, lead, and mercury were detected at concentrations above their respective reference background criteria and are considered to be SRCs in subsurface soil based on the Phase II RFI. Arsenic, cadmium, and selenium were also detected, but at concentrations below the reference background criteria. Barium was detected at a concentration of 28.9 mg/kg at MW9. Chromium was detected above reference background criteria in four of 11 subsurface soil samples at concentrations ranging from 12.7 mg/kg at MW4 to 18.7 mg/kg at MW9. Lead was detected at concentrations of 11.5 mg/kg, 12.8 mg/kg, and 35.6 mg/kg at MW4, MW6, and MW9, respectively. Mercury was detected at a concentration of 0.05 mg/kg at MW9.

6.3 GROUNDWATER

With the use of DPT techniques, groundwater screening samples were collected from 17 locations, which included two vertical profiles. Groundwater screening samples were analyzed for only VOCs. The results of the groundwater screening were used to locate 11 monitoring wells (eight shallow and three deep). The groundwater samples from the monitoring wells were analyzed for VOCs, SVOCs, and RCRA metals. The results of the groundwater analyses are presented in Tables 9 and 10 and in Figure 11. Chain-of-custody forms and complete analytical results are presented in Appendix G (page G-175) and Appendix H (page H.19-1), respectively, of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000).

6.3.1 Shallow Surficial Groundwater (less than 25 feet bgs)

The shallow surficial groundwater (less than 25 feet bgs) was evaluated using the results of the groundwater screening samples (GP5 through GP19), shallow vertical-profile samples [VP1 (10 feet to 14 feet bgs), VP1 (20 feet to 24 feet bgs), VP2 (10 feet to 14 feet bgs), and VP2 (20 feet to 24 feet bgs)], and shallow monitoring wells (MW1, MW3, MW4, MW5, MW6, MW7, MW9, and MW10).

VOCs. Ten VOCs were detected in shallow groundwater screening (including shallow intervals of vertical profiles) and shallow monitoring wells. 1,1,1-Trichloroethane; 1,1-dichloroethane; 2-butanone; 2-hexanone; and 4-methyl-2-pentanone were detected at only sample location GP9 at concentrations of 5.2 µg/L, 4.6 µg/L, 40.2 µg/L, 3.4 µg/L, and 98.4 µg/L, respectively. Benzene was detected in eight of 27 shallow surficial groundwater samples at concentrations ranging from of 3.8 µg/L at GP12 to 141 µg/L at GP9. Six of the eight benzene detections were above the MCL (5 µg/L). Carbon disulfide was detected at concentrations of 9 µg/L at GP6 and 4.7 µg/L at GP7. Ethylbenzene was detected in nine of 27 shallow surficial groundwater samples at concentrations ranging from of 2.3 µg/L at GP10 to 29.6 µg/L at GP6. Toluene was detected at concentrations of 16 µg/L at GP7 and 89 µg/L at GP9. Total xylenes were detected in 11 of 27 shallow surficial groundwater samples at concentrations ranging from 7.1 µg/L at GP11 to 137 µg/L at GP9. Of the 10 VOCs detected, only three (benzene, ethylbenzene, and total xylenes) were detected in shallow surficial groundwater from two of the eight shallow monitoring wells (MW9 and MW10). Benzene was detected at concentrations of 4.6 µg/L and 8.5 µg/L at MW9 and MW10, respectively. Ethylbenzene was detected at a concentration of 4.8 µg/L at MW10. Total xylenes were detected at concentrations of 3 µg/L at MW9 and 19.2 µg/L at MW10. 1,1,1-Trichloroethane; 1,1-dichloroethane; 2-butanone; 2-hexanone; 4-methyl-2-pentanone; benzene; carbon disulfide; ethylbenzene; toluene; and total xylenes are SRCs in shallow surficial groundwater based on the Phase II RFI.

SVOCs. Low concentrations of four SVOCs were detected in groundwater from the monitoring wells, primarily from MW10. 2-Methylnaphthalene was detected at concentrations of 4.1 µg/L at MW3 and 10.8 µg/L at MW10. Bis(2-ethylhexyl)phthalate was detected in four of eight shallow surficial groundwater samples at concentrations ranging from 6.8 µg/L at MW4 to 22.1 µg/L at MW7, all above the MCL (6 µg/L). Naphthalene was detected at concentrations of 4.4 µg/L at MW3 and 6.4 µg/L at MW10. Phenanthrene was detected at a concentration of 2.4 µg/L at MW10. 2-Methylnaphthalene, bis(2-ethylhexyl)phthalate, naphthalene, and phenanthrene are considered to be SRCs in shallow surficial groundwater based on the Phase II RFI.

RCRA Metals. No RCRA metals were detected above reference background criteria in groundwater from the shallow surficial monitoring wells; therefore, there are no RCRA metal SRCs in shallow surficial groundwater based on the Phase II RFI.

6.3.2 Deep Surficial Groundwater (greater than 30 feet bgs)

The deep surficial groundwater (greater than 30 feet bgs) was evaluated using the results of deep vertical-profile samples [VP1 (30 feet to 34 feet bgs) and VP2 (30 feet to 34 feet bgs)] and the deep monitoring wells (MW2, MW8, and MW11).

VOCs. No VOCs were detected in the deep intervals of the vertical profiles or the deep surficial monitoring wells.

SVOCs. No SVOCs were detected in the groundwater from the deep surficial monitoring wells. SVOC analysis was not performed on groundwater from the vertical profiles.

RCRA Metals. Arsenic, chromium, lead, and selenium were detected above reference background criteria in MW2 (background location). Chromium was detected at a concentration of 7 µg/L at MW8. Dissolved metals analysis was also performed on groundwater from MW2 and MW8. All of the filtered metals concentrations at MW2 and MW8 were either nondetect or below reference background criteria (Table 10). Both of these locations had elevated turbidities [291 NTUs and 45.2 NTUs, respectively (see Table 6)] during groundwater sampling, indicating colloids or particulates in the sample. Both of these deep monitoring wells extended into the Hawthorn confining (clay) layer, which is likely to be the source of the colloids/particulates—the probably source of the elevated chromium. Chromium is the only RCRA metal SRC in deep surficial groundwater based on the Phase II RFI.

6.4 SURFACE WATER

No surface water samples were collected at SWMU 27F, northwest of Building 1340 during the Phase II RFI because no surface water pathway exists.

6.5 SEDIMENT

No sediment samples were collected at SWMU 27F, northwest of Building 1340 during the Phase II RFI because no sediment pathway exists.

6.6 CONCLUSIONS AND RECOMMENDATIONS OF THE PHASE II RFI

The Phase II RFI identified benzo(*a*)pyrene as a human health constituent of concern (HHCOC) in surface soil. Benzo(*a*)pyrene was not identified as a CMCOPC, indicating that it is not likely to migrate to groundwater. The extent of benzo(*a*)pyrene in surface soil was confined to a single location near the OWS and the heavily used vehicle maintenance facility. Therefore, the Phase II RFI concluded that the extent of benzo(*a*)pyrene in surface soil was defined and that no additional investigation and/or evaluation was required. Remedial alternatives for benzo(*a*)pyrene in surface soil will be evaluated in the CAP (the subject of this document).

Benzene and bis(2-ethylhexyl)phthalate were identified as HHCOCs in groundwater. The bis(2-ethylhexyl)phthalate concentration was believed to be the result of field or laboratory contamination. Therefore, Fort Stewart recommended in the Phase II RFI that initially three shallow monitoring wells be installed downgradient of the potential source area, followed by potentially three additional shallow wells to further define the extent of potential groundwater contamination.

The installation of the three to six new monitoring wells and the proposed resampling of all the groundwater monitoring wells (new and existing) were recommended to be performed prior to the development of the CAP. No soil samples were to be collected during the installation of the new monitoring wells because the extent of soil contamination was determined by the Phase II RFI. The groundwater samples would be analyzed for VOCs and SVOCs to provide additional site data to fully define the extent of potential groundwater organic contamination. RCRA metals were not identified as either CMCOPCs or HHCOPCs at SWMU 27F, northwest of Building 1340; therefore, RCRA metals did not require further investigation and/or evaluation.

Fort Stewart recommended that a CAP be developed for SWMU 27F, northwest of Building 1340 and submitted to GEPD in accordance with a schedule to be determined by the Director [Condition IV.E.2 of Fort Stewart's Hazardous Waste Facility Permit #HW-045(S&T)]. The purpose of the CAP would be to determine the appropriate corrective action(s) to remediate the identified soil [benzo(*a*)pyrene only] and groundwater contamination to the proposed remedial levels. The potential abandonment or use of the monitoring wells would be evaluated in the CAP.

6.7 SUPPLEMENTAL DATA EVALUATION

Six shallow monitoring wells (MW13 through MW18) were installed in November and December 2000 in accordance with the recommendations of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). All the monitoring wells (existing and new) were sampled in January 2001 to comply with the recommendations of Section 10.9.8.2 of the revised final Phase II RFI Report (SAIC 2000). MW1 and MW2 were specified as the background wells. Boring logs and monitoring well diagrams for the six new wells (MW13 through MW18) are presented in Attachments A and B, respectively. Monitoring well construction details are presented in Table 11. Figure 12 shows the locations of the monitoring wells. The six new monitoring wells were developed until the required amount of water was removed and the turbidity was less than or equal to 10 NTUs. Monitoring well development data are presented in Table 12. Specific conductance, pH, temperature, DO, turbidity, and Redox were measured during well purging for the collection of all groundwater samples. Table 13 summarizes the field data collected from SWMU 27F in January 2001. Water level measurements collected in May 2001 and groundwater elevations are presented in Table 14. The geotechnical data from the January 2001 sampling event can be found in Table 15. The geotechnical report for the soil collected during the installation of the six new monitoring wells is presented in Attachment C. Table 16 presents a summary of groundwater analytical data and includes collection dates, sample identification, and detected results. The complete analytical data and chain-of-custody forms for the groundwater samples are presented in Attachment D.

6.7.1 Groundwater Evaluation

Six shallow monitoring wells (MW13 through MW18) were installed in accordance with the recommendations of the final revised final Phase II RFI Report (SAIC 2000). All of the monitoring wells (new and existing) were low-flow sampled for VOCs and SVOCs only. Conductivity, pH, temperature, DO, Redox, and turbidity were measured in the field during sampling, and the results are presented in Table 16.

In addition, water levels were measured at the monitoring wells, and the results are presented in Table 14. Potentiometric surface maps of the shallow and deep groundwater systems based on the water levels from the resampling are provided in Figures 13 and 14, respectively. The shallow surficial groundwater flow direction across the site is to the southeast. The deep surficial groundwater flow direction is to the south to slight southeast. A slight groundwater high is located at MW17, which may be due to its being located

in a grassy area and closer to a drainage ditch (potential higher percolation). The hydraulic gradients of the shallow and deep surficial groundwater are 0.0009 foot/foot and 0.0014 foot/foot, respectively.

6.7.2 Shallow Groundwater Monitoring Wells

VOCs. Five VOCs (2-butanone, 4-methyl-2-pentanone, benzene, ethylbenzene, and total xylenes) were detected in shallow groundwater at SWMU 27F (see Table 16 and Figure 12). 2-Butanone was detected in one out of 13 shallow groundwater samples at a concentration of 10.6 µg/L in MW7. 4-Methyl-2-pentanone was detected above its background criterion at a concentration of 6.8 µg/L in MW7. Benzene was detected above its background criterion in four out of 13 shallow groundwater samples at concentrations of 2.4 µg/L at MW10, 5.8 µg/L at MW9, 31.4 µg/L at MW7, and 61 µg/L at MW14. Ethylbenzene was detected above its background criterion in two out of 13 shallow groundwater samples at concentrations of 4.3 µg/L and 7 µg/L at MW7 and MW14, respectively. Total xylenes were detected above their background criteria in five out of 13 shallow groundwater samples at concentrations ranging from 3.2 µg/L at MW10 to 38.5 µg/L at MW14. 2-Butanone, 4-methyl-2-pentanone, benzene, ethylbenzene, and total xylenes are considered to be SRCs in shallow groundwater at SWMU 27F. Benzene also exceeded its MCL of 5 µg/L.

SVOCs. Five SVOCs (2-methylnaphthalene, 4-methylphenol, carbazole, fluorene, and naphthalene) were detected in shallow groundwater at SWMU 27F. 2-Methylnaphthalene was detected in four out of 13 shallow groundwater samples at concentrations of 2.3 µg/L, 7.4 µg/L, 15.6 µg/L, and 31.9 µg/L at MW9, MW7, MW4, and MW14, respectively. The following constituents were detected in only one monitoring well: 4-methylphenol (21.3 µg/L in MW7), carbazole (5.7 µg/L in MW14), and fluorene (2.1 µg/L in MW14). Naphthalene was detected above its background criterion at concentrations of 3.6 µg/L, 3.8 µg/L, 11 µg/L, and 37.2 µg/L at MW9, MW18, MW4, and MW14, respectively. 2-Methylnaphthalene, 4-methylphenol, carbazole, fluorene, and naphthalene are considered to be SRCs in groundwater based on the supplemental data collection.

6.7.3 Deep Groundwater Monitoring Wells

VOCs. No VOCs were detected in the deep groundwater at SWMU 27F.

SVOCs. No SVOCs were detected in the deep groundwater at SWMU 27F.

6.8 SITE-RELATED CONTAMINANT SUMMARY

No soil samples (except for investigation-derived waste characterization) were collected during the supplemental data collection; therefore, only soil samples collected during the Phase I and Phase II RFIs were used to determine the SRCs in surface and subsurface soil. SRCs for VOCs and SVOCs in groundwater were determined using only the most current groundwater characterization data (the groundwater resampling from January 2001). Because RCRA metals analyses were not performed during the groundwater sampling of January 2001, metal results from the Phase II RFI were used to determine metal SRCs in groundwater. The results of the shallow and deep surficial groundwater were combined to determine the SRCs. The SRCs by medium and the corresponding maximum concentrations are presented in Table 17.

7.0 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 soil SRCs to the respective generic soil screening levels (GSSLs).

The maximum concentrations of SRCs in surface or subsurface soil did not exceed the respective GSSLs, except for benzo(*a*)anthracene (Table 18); therefore, benzo(*a*)anthracene is the only CMCOPC in soil at SWMU 27F, northwest of Building 1340. Benzo(*a*)anthracene was not detected in groundwater.

8.0 HUMAN HEALTH PRELIMINARY RISK EVALUATION, SWMU 27F, NORTHWEST OF BUILDING 1340

SRCs were identified for 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.

8.1 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. This is a preliminary evaluation that is used to evaluate and select the appropriate screening values used in this HHPRE.

8.1.1 Receptor Assessment

This is an active, secured site within the garrison area. Contamination at the site is limited to surface soil, subsurface soil, and groundwater. An Installation worker and a construction worker are the only probable receptor populations for this site.

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

8.1.2 Migration and Exposure Pathway Analysis

Potential migration pathways for soil include leaching into groundwater and release of volatile compounds into the air. The site is relatively flat, is primarily covered by concrete, and contains man-made structures, although a small area of managed grass does exist between the concrete and the area northwest beyond the fence line. Consequently, soil erosion via fugitive dust or surface water runoff is not a viable migration pathway.

Shallow and deep surficial groundwater at the site may discharge into surface water (in a man-made drainage ditch located approximately 450 feet to the south); therefore, migration via discharge of groundwater is potentially a viable migration pathway.

The on-site resident scenario is not considered to be a viable scenario for this site; however, in accordance with Risk-based Corrective Action (RBCA) guidance, it is used to derive screening values. The exposure pathways associated with this scenario are presented to show what pathways are taken into consideration when deriving the screening values.

8.2 RISK EVALUATION

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

The SRCs for surface soil included five VOCs, 17 SVOCs, and six RCRA metals. None of the maximum concentrations of the VOCs were above their respective screening values. Five of the SVOCs [benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, dibenzo(*a,h*)anthracene, and indeno(*1,2,3-cd*)pyrene] exceeded their respective screening values. The remaining SVOCs were below their respective screening values. Of the six RCRA metals, only arsenic exceeded its screening value (Table 19). Benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, dibenzo(*a,h*)anthracene, indeno(*1,2,3-cd*)pyrene, and arsenic are considered to be HHCOPCs in surface soil.

The maximum concentration of benzo(*a*)pyrene was within two orders of magnitude of its screening value. The maximum concentrations of benzo(*a*)anthracene, benzo(*b*)fluoranthene, and arsenic were an order of magnitude greater than their respective screening values. The maximum concentration of indeno(*1,2,3-cd*)pyrene was within an order of magnitude of its screening value.

The SRCs for subsurface soil included six volatile organics, 11 SVOCs, and four RCRA metals. The concentrations of these contaminants were below their respective screening values (Table 19); therefore, there are no HHCOPCs in subsurface soil.

The SRCs for groundwater consisted of five VOCs, five SVOCs [four polycyclic aromatic hydrocarbons (PAHs) (carbazole, fluorene, 2-methylnaphthalene, and naphthalene) and 4-methylphenol], and chromium. The maximum concentrations of 4-methylphenol, benzene, carbazole, 2-methylnaphthalene, and naphthalene exceeded their respective screening values (Table 19); therefore, they are HHCOPCs in groundwater. The remaining constituents had maximum concentrations that were below their respective screening values.

The maximum values for benzene and naphthalene were more than one order of magnitude above their screening values. 4-Methylphenol, carbazole, and 2-methylnaphthalene had maximum concentrations less than an order of magnitude above their respective screening concentrations.

8.3 UNCERTAINTIES

The human health uncertainties are addressed in Section 7.5 of the HHPRE (Chapter 7.0) of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000).

9.0 ECOLOGICAL PRELIMINARY RISK EVALUATION, SWMU 27F, NORTHWEST OF BUILDING 1340

The EPRE was conducted in accordance with GEPD (1996) guidance [see Chapter 8.0 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000)]. At sites where surface water, sediment, or groundwater was collected, an ecological screening value (ESV) comparison was conducted. If ECOPCs for aquatic biota were identified in 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.

9.1 ECOLOGICAL SCREENING VALUE COMPARISON (STEP i)

There is no surface water or sediment at SWMU 27F, northwest of Building 1340.

Chromium was the only RCRA metal detected in groundwater at a concentration exceeding the respective background criterion. Five VOCs and five SVOCs were detected in groundwater. The results of the ESV comparison for groundwater are presented in Table 20. The ECOPCs identified by the ESV comparison for groundwater are benzene, total xylenes, 2-methylnaphthalene, 4-methylphenol, and carbazole. Benzene and xylenes were detected at concentrations exceeding ESVs. There are no ESVs for 2-methylnaphthalene, 4-methylphenol, and carbazole, so they are ECOPCs by default (GEPD 1997).

SWMU 27F, northwest of Building 1340 is an industrial area with little vegetated or exposed surface soil. Only surface soil samples from vegetated or exposed soil sites (i.e., not under concrete) were evaluated in the EPRE. The surface soil locations potentially impacting ecological receptors included MW4, MW10, and MW11, samples from which were collected during the Phase II RFI (October 1999). The SRCs identified from this set of surface soil samples are presented in Table 21.

Because there are no ESVs for soil, all analytes detected in surface soil from these three sampling locations were evaluated further in EPRE Steps ii through v.

9.2 PRELIMINARY PROBLEM FORMULATION (STEP ii)

The ecological habitat of the site is described in Section 5.5. 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 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000).

9.3 PRELIMINARY EFFECTS (STEP iii)

In the EPRE, toxicity reference values (TRVs) were required for shrews and robins ingesting biota exposed to contaminated soil, raccoons ingesting water, and mink and green herons ingesting aquatic biota if groundwater discharges to downgradient surface water bodies. The derivation of TRVs is discussed in Section 8.3 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). The derivation of no observed adverse effect levels (NOAELs) for test species is shown in Table 22 for

mammals and Table 23 for birds. The derivation of TRVs for surrogate species from the test species NOAELs is shown in Table 24 for shrews, mink, and raccoons and in Table 25 for herons and robins.

For the uncertainty discussion, the derivation of lowest observed adverse effect levels (LOAELs) for test species is shown in Table 26 for mammals and Table 27 for birds. The derivation of TRVs for surrogate species from the test species LOAELs is shown in Table 28 for shrews, raccoons, and mink and in Table 29 for robins and green herons.

9.4 PRELIMINARY EXPOSURE (STEP iv)

Ecological receptors are probably exposed by ingestion of biota exposed to surface soil, of drinking water, and of aquatic biota. The exposure parameters for the surrogate species—shrews, raccoons, mink, herons, and robins—are presented in Table 8-7 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000).

9.5 PRELIMINARY RISK CALCULATION (STEP v)

The preliminary risk calculation (Step v) uses hazard quotients (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 a hazard index (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).

Surface Soil. The preliminary risk calculations for shrews and robins exposed to ECOPCs detected in surface soil are presented in Table 30. This table shows the maximum detected concentrations, average daily doses (ADDs), TRVs, and HQs for the receptors. HQs exceeding one are shown bordered by a double line. The ECOPCs present in surface soil at concentrations resulting in ADDs exceeding the TRVs for the surrogate species are cadmium, chromium, and lead. The cadmium HQs are 3.78 for shrews and 11.9 for robins. The chromium and lead HQs for robins are 1.97 and 4.67, respectively. There are no TRVs for butyl benzyl phthalate and di-*N*-octyl phthalate, so these constituents are evaluated further in the discussion of uncertainties (Section 9.6) using TRVs for surrogate compounds. The HI calculated for VOCs does not exceed one.

Groundwater. The preliminary risk calculations for raccoons, mink, and herons exposed to ECOPCs detected in groundwater at the site are presented in Table 31. 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 TRVs for the surrogate species. The VOC and SVOC HIs calculated for the surrogate species do not exceed one.

9.6 UNCERTAINTIES

The risks to ecological receptors from ECOPCs in surface soil and groundwater at SWMU 27F, northwest of Building 1340 are overestimated by the preliminary risk calculations.

The supplemental risk calculations for shrews and robins exposed to butyl benzyl phthalate, di-*N*-octyl phthalate, cadmium, chromium, and lead in surface soil are presented in Tables 32 and 33. The LOAEL–based TRVs for bis(2-ethylhexyl)phthalate and di-*N*-butyl phthalate are used as surrogates for butyl benzyl phthalate and di-*N*-octyl phthalate because there are no TRVs for these two phthalates. The ADDs calculated using a realistic diet (EPA 1993), the site-specific area use factor (AUF), and mean surface soil concentrations of ECOPCs do not exceed the LOAEL–based TRVs (i.e., the HQs are less than 1); therefore, the ECOPCs in surface soil at SWMU 27F, northwest of Building 1340 do not pose a risk to wildlife receptors.

Fate and transport modeling was performed to estimate the future concentrations of ECOPCs in groundwater (benzene, total xylenes, 2-methylnaphthalene, 4-methylphenol, and carbazole) at the surface water receptor location. The nearest potential surface water receptor is the man-made drainage ditch located approximately 450 feet to the southwest that ultimately feeds into Mill Creek. Using the maximum detected concentrations of benzene, total xylenes, 2-methylnaphthalene, 4-methylphenol, and carbazole in groundwater at SWMU 27F, northwest of Building 1340, the modeled 100-year maximum concentrations estimated at the receptor location (the man-made ditch), are all zero. Therefore, the ECOPCs in groundwater at SWMU 27F, northwest of Building 1340 do not pose a risk to aquatic biota.

10.0 HUMAN HEALTH BASELINE RISK ASSESSMENT, SWMU 27F, NORTHWEST OF BUILDING 1340

The purpose of the HHBRA is to quantify potential risk associated with COPCs identified in the previous screening assessments (i.e., fate and transport analysis and human health preliminary risk assessment). If the estimated risk value for a receptor exceeds the target risk values, constituents of concern (COCs) are selected based on the risk values for the constituents. Remedial levels are derived for each of the COCs identified.

The HHPRE identified HHCOPCs in surface soil and groundwater that may present a potential risk to human health. The fate and transport analysis identified benzo(*a*)anthracene as a CMCOPC in soil; however, subsequent modeling using Seasonal Soil Compartment (SESOIL) modeling (Attachment E) indicated that benzo(*a*)anthracene will completely naturally attenuate before reaching the water table. Therefore, the CMCOPC, benzo(*a*)anthracene was not evaluated further in the HHBRA. According to GEPD (1996) and EPA Region IV (EPA 1995) guidance, an HHBRA is required for those constituents identified as HHCOPCs.

This HHBRA quantifies the potential risk associated with constituents identified in the HHPRE as presenting a potential risk to human health. The potential risk for site-specific human receptor populations is quantified for those potential exposure pathways identified for each receptor population.

The HHBRA consists of five elements: (1) identification of COPCs, (2) exposure assessment, (3) toxicity assessment, (4) risk characterization, and (5) assessment of uncertainty. The discussion in the following sections presents the information required to evaluate the human health risks associated with COPCs at SWMU 27F, northwest of Building 1340. A detailed discussion of each of the five elements, including methodology, selection of exposure parameters, and analysis of inherent uncertainties, is provided in Appendix I of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000).

10.1 IDENTIFICATION OF COPCS

The CMCOPCs and HHCOPCs have been discussed in the sections on contaminant fate and transport (Chapter 7.0) and the HHPRE (Chapter 8.0), respectively. The fate and transport analysis identified benzo(a)anthracene as a CMCOPC in soil; however, subsequent modeling using SESOIL modeling (Attachment E) indicated that benzo(*a*)anthracene will completely naturally attenuate before reaching the water table. Therefore, the CMCOPC, benzo(*a*)anthracene was not evaluated further in the HHBRA.

HHCOPCs were identified in surface soil and groundwater (Section 8.2). The HHCOPCs in surface soil are benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, dibenzo(*a,h*)anthracene, indeno(*1,2,3-cd*)pyrene, and arsenic. The HHCOPCs in groundwater are 2-methylnaphthalene, 4-methylphenol, benzene, carbazole, and naphthalene.

10.2 EXPOSURE ASSESSMENT

The exposure assessment quantifies the amount of a COPC an individual may come in contact with at each site. The exposure assessment considers all pathways of potential human exposure, the magnitude of exposure, and the frequency and duration of exposure. The process for estimating exposure consists of the following elements: (1) characterization of the exposure setting in terms of the physical and demographic characteristics of the site, (2) identification of receptor populations, (3) identification of the exposure pathways by which an individual may come in contact with a COPC, (4) estimation of the exposure point concentration, and (5) quantification of the intake or dose to which an individual may be exposed.

10.2.1 Exposure Setting

The exposure setting describes the physical features at the site that are important when identifying the human populations that may be exposed to COPCs, either currently or in the future.

This OWS is located within a secured area along the northwestern boundary of the motorpool area associated with Building 1340, adjacent to a concrete maintenance pad. The OWS is located in a small, grassy area that extends to the northwestern boundary of the motorpool's fence line, where a fenced storage area is located. The other three sides are comprised of concrete vehicle parking area/road or the maintenance pad.

Groundwater at this site may migrate to a drainage ditch located 450 feet to the south. This drainage ditch feeds into Mill Creek. The results of the groundwater migration modeling indicate that neither the groundwater COPCs in the shallow nor in the deep surficial aquifer will migrate to this drainage ditch (see Section 10.2.3 of this addendum); therefore, migration of COPCs in the surficial aquifer to surface water is not considered to be a viable migration pathway for this site.

10.2.2 Identification of Potential Receptor Populations and Exposure Pathways

A complete exposure pathway consists of four elements: (1) a source of contamination, (2) a transport or retention medium, (3) a point of contact with the chemical, and (4) a route of exposure (ingestion, dermal absorption, or inhalation) at the point of contact through which the chemical may be taken into the body. When all of these elements are present, the pathway is considered to be complete.

A detailed discussion of the potential exposure pathways for the various receptor populations identified for 16 SWMUs is given in Section I.2.2, Appendix I of the revised final Phase II RFI Report for

16 SWMUs (SAIC 2000). The migration and exposure pathways for potential receptors at SWMU 27F, northwest of Building 1340 are presented in Figure 15.

Impacted environmental media at this site include surface soil and groundwater. Groundwater at this site may migrate to a drainage ditch that feeds into Mill Creek.

Current Land-use Populations. Given that the site is secured, the on-site Installation worker is the only receptor that is likely to come in contact with surface soil at the site. The on-site Installation worker is representative of an individual who is employed by Fort Stewart and is present on the site for work purposes. This type of individual would include soldiers, maintenance workers, and game management personnel. The on-site Installation worker may be exposed to COPCs in surface soil via incidental ingestion and dermal contact. The site is currently vegetated; therefore, exposure via inhalation of fugitive dust is not considered to be a viable pathway.

There are no current off-site receptor populations.

Future Land-use Receptor Populations. The potential on-site receptor populations for the future land-use scenario receptor populations include an on-site Installation worker, on-site trespasser, on-site resident, off-site Installation worker, and off-site resident. Although no changes in land use are expected at this site, for the purposes of this risk assessment, it was assumed that the groundwater drinking wells have been placed at the site and the concrete cover has been removed. Therefore, all surface soil SRCs were evaluated under the future land-use scenario.

The on-site Installation worker may be exposed to COPCs in surface soil and groundwater. The potential exposure pathways for surface soil include ingestion, dermal contact, and inhalation of fugitive dust. The exposure pathway for groundwater would be ingestion of drinking water.

The on-site juvenile trespasser may be exposed to COPCs in surface soil. The exposure pathways for surface soil include incidental ingestion, dermal contact, and inhalation of fugitive dust.

The on-site resident is presented for baseline purposes and is not considered to be a viable receptor population. The on-site resident may be exposed to COPCs in surface soil and groundwater. Potential exposure pathways for the on-site resident include incidental ingestion of soil, dermal contact with soil, inhalation of fugitive dust, ingestion of groundwater, inhalation of volatile organics, and dermal contact with groundwater. If the site was developed for residential purposes, it would be landscaped and vegetated; therefore, exposure via inhalation of fugitive dust is not a likely exposure pathway. However, as a conservative assumption, this pathway was evaluated.

Off-site migration includes fugitive dust and the migration of COPCs in groundwater. Future off-site receptor populations include an Installation worker and a resident.

The off-site Installation worker may be exposed to COPCs in surface soil via inhalation of fugitive dust. This receptor may also be exposed to COPCs in groundwater via ingestion.

The off-site resident is likely to be exposed via inhalation of fugitive dust and exposure to COPCs in groundwater. Groundwater exposure pathways include ingestion, dermal contact, and inhalation of VOCs.

10.2.3 Estimation of Exposure Concentrations

The estimation of exposure concentrations for on-site and off-site receptors to COPCs in surface soil and groundwater is discussed in Appendix I, Section I.2.3 of the revised final Phase II RFI Report for

16 SWMUs (SAIC 2000). Exposure concentrations in abiotic media were calculated using either analytical results or environmental fate and transport models. For the purposes of estimating direct exposure of current receptor populations to COPCs in surface soil and groundwater, the analytical results for the respective media were used to estimate exposure concentrations. The exposure point concentrations were equal to 95 percent of the upper confidence limit of the mean, unless this value was greater than the maximum detected concentration. In that case, the exposure concentration defaulted to the maximum concentration. The selected exposure concentrations based on the analytical data or the 95 percent upper confidence limits are given in Table 34.

The majority of SWMU 27F, northwest of Building 1340 is covered by concrete. Current exposure of on-site receptors to COPCs in surface soil would be limited to uncovered soil. The surface soil samples collected from exposed surface soil (at MW4, MW10, and MW11) were used to estimate the exposure concentrations for the current receptors (Table 34). For the purposes of assessing exposure to future receptor populations, it was assumed that all of the concrete had been removed. The exposure concentrations for these receptors were estimated using all of the surface soil samples collected at the site.

Exposure concentrations of fugitive dust in air were calculated using the formulas described in Appendix I, Section I.2.33 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). These values were based on the exposure concentrations for surface soil. For the purposes of estimating exposure of an off-site receptor to fugitive dust, it was assumed that no dilution of the air concentrations occurred and that the exposure concentrations for both on-site and off-site receptors were the same.

Similarly, the estimated concentrations for exposure of off-site receptors to COPCs in groundwater were assumed to be equal to the exposure concentrations for on-site receptors.

Migration of Groundwater to Surface Water. Analysis of the hydrogeologic conditions at this site indicate that groundwater under the SWMU may potentially migrate to a drainage ditch located approximately 450 feet from the OWS. The drainage ditch feeds into Mill Creek. Constituents in groundwater may migrate to the drainage ditch. The concentrations of groundwater HHCOPCs were modeled to estimate potential concentrations of these COPCs in surface water in the tributary to Mill Creek. Groundwater modeling was used to estimate the concentrations of COPCs in groundwater adjacent to the drainage ditch. As a conservative measure, it was assumed that the COPCs in groundwater are not diluted by the surface water present in drainage ditch.

The Analytical Transient 1-, 2-, 3-Dimensional (AT123D) modeling was used to estimate the concentration of HHCOPCs in groundwater adjacent to the tributary (Attachment E). A discussion of the modeling procedures and parameters used for the AT123D modeling is provided in Attachment E of this addendum. The results of the modeling are summarized in Table 35.

The modeling results indicate that none of the COPCs will migrate to the drainage ditch; therefore, the risk associated with these HHCOPCs migrating to surface water will not be addressed further in this HHBRA.

10.2.4 Quantification of Exposure

The equations and exposure factors used to estimate exposures to receptor populations are discussed in Appendix I, Section I.2.4 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). The exposure parameter values used to estimate potential exposures are given in Table 36. Potential noncarcinogenic and carcinogenic intakes were estimated, when appropriate, for each receptor population for all applicable pathways.

A potential intake was estimated for each receptor population for all applicable pathways. The estimated intakes for the current on-site receptor, the Installation worker, are given in Table 37. There are no current off-site receptor populations.

Future on-site receptor populations include an Installation worker, a juvenile trespasser, and a resident. The estimated intakes for the Installation worker and the juvenile trespasser are given in Tables 38 and 39, respectively. The resident population is divided into a resident child and a resident adult because the differences in behavior, exposure duration, and physiology between an adult and a child result in different doses of constituents in various environmental media. The child has a higher incidental soil ingestion rate because of the increased amount of hand-to-mouth behavior in children. This factor, coupled with the child's lower body weight, results in the child's receiving a higher dose of constituents in surface soil relative to the adult. The resident child is more sensitive to noncarcinogens than the resident adult. On the other hand, the increased exposure duration for the adult resident relative to the child resident results in a higher carcinogenic dose to the resident adult relative to the resident child; therefore, the resident adult is more sensitive to carcinogens in groundwater. However, the resident adult is not always more sensitive to exposure to carcinogens because this sensitivity changes with different environmental media. For the purposes of this risk assessment, the systemic and carcinogenic risks were estimated for the resident child, and the resident adult was assessed for only carcinogenic risk. The estimated intakes for the on-site resident child and the on-site resident adult are given in Tables 40 and 41, respectively.

Future off-site receptors include an Installation worker, a resident child, and a resident adult. The estimated intakes for the Installation worker are given in Table 42. The estimated intakes for the off-site resident child and off site resident adult are given in Tables 43 and 44, respectively.

10.3 TOXICITY ASSESSMENT

The purpose of the toxicity assessment is to determine the increased likelihood and magnitude of adverse human health effects based on the extent of exposure to contamination. The toxicity assessment for SWMU 27F, northwest of Building 1340 was carried out as described in Appendix I, Section I.3 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). Toxicity values for the COPCs addressed in this risk assessment are given in Table 45. Toxicity profiles for the COPCs are provided in Attachment F of this addendum.

10.4 RISK CHARACTERIZATION RESULTS

The risk characterization followed the procedures outlined in Appendix I, Section I.4 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000). Quantitative estimates of noncarcinogenic and carcinogenic risks were calculated for the COPCs for each potentially complete exposure pathway.

The total HI and incremental lifetime cancer risk (ILCR) were calculated for each receptor, and these values were compared to a target risk value of 1.0 for the HI and 1×10^{-6} for the ILCR. If the risk values for a receptor exceeded these target risk values, then COCs were identified based on either the HI (HI greater than or equal to 0.1) or ILCR (ILCR greater than or equal to 1.0×10^{-6}).

10.4.1 Current Land-use Scenarios

The current potential receptor is the on-site Installation worker. There is no current use of groundwater at this site; therefore, the current land-use receptors are not at risk from exposure to COPCs in groundwater. The potential risks to this receptor population are discussed below.

On-site Installation Worker. The calculated risk values for the on-site Installation worker are given in Table 46. This receptor may be exposed to PAHs and arsenic in surface soil.

The total HI for this receptor is 1.50×10^{-2}, which is more than an order of magnitude below the target value of 1.0; therefore, adverse systemic health risks are not expected for this receptor population.

The total ILCR for this receptor is 2.74×10^{-5}, which exceeds the target risk value of 1×10^{-6}. Benzo(*a*)pyrene is the primary risk driver, with an ILCR of 1.62×10^{-5}. The other risk drivers include benzo(*a*)anthracene (ILCR = 2.63×10^{-6}), arsenic (ILCR of 2.40×10^{-6}), benzo(*b*)fluoranthene (ILCR = 1.92×10^{-6}), and dibenzo(*a,h*)anthracene (ILCR = 3.62×10^{-6}). The remaining PAH, indeno(*1,2,3-cd*)pyrene, had a carcinogenic risk below 1×10^{-6}.

10.4.2 Future Land-use Scenarios

The future potential on-site receptors are the Installation worker, the juvenile trespasser, and the resident. The future off-site receptors include an Installation worker, a juvenile trespasser, and a resident. The potential risks to each of these receptor populations are discussed below.

On-site Installation Worker. The calculated risk values for the current on-site Installation worker are given in Table 47.

The total HI for this receptor is 8.79×10^{-2}, which is more than an order of magnitude below the target value of 1.0; therefore, adverse systemic health risks are not expected for this receptor population.

The total ILCR for this receptor is 1.55×10^{-5}. This value exceeds the target risk value of 1×10^{-6}. The risk drivers for this site include benzo(*a*)pyrene (ILCR of 6.01×10^{-6}), arsenic (ILCR of 2.41×10^{-6}), and dibenzo(*a,h*)anthracene (ILCR = 1.98×10^{-6}) in surface soil and benzene (ILCR of 2.88×10^{-6}) in groundwater.

On-site Juvenile Trespasser. The calculated risk values for the juvenile trespasser are given in Table 48.

The total HI for this receptor is 2.06×10^{-3}, which is more than two orders of magnitude below the target value of 1.0; therefore, adverse systemic health risks are not expected for this receptor population.

The total ILCR is 9.49×10^{-7}, which is below the target value of 1×10^{-6}; therefore, carcinogenic risks are within an acceptable range for this receptor.

On-site Resident Child. The calculated risk values for the on-site resident child are given in Table 49.

The total HI for this receptor is 6.96×10^{-1}, which is below the target value of 1.0; therefore, adverse systemic health risks are not expected for this receptor population.

The total ILCR for this receptor is 2.75×10^{-5}. This ILCR value is above the target risk value of 1×10^{-6}. Benzo(*a*)pyrene in surface soil is the primary risk driver, with an ILCR of 9.20×10^{-6}. The other risk

drivers include arsenic (ILCR = 6.86×10^{-6}), benzo(*a*)anthracene (ILCR = 1.40×10^{-6}), benzo(*b*)fluoranthene (ILCR = 1.05×10^{-6}), and dibenzo(*a,h*)anthracene (ILCR = 3.03×10^{-6}) in surface soil and benzene (ILCR = 4.75×10^{-6}) in groundwater. The remaining COPC had a carcinogenic risk below 1×10^{-6}.

On-site Resident Adult. The calculated risk values for the on-site resident child are given in Table 50.

The total HI for this receptor is 2.42×10^{-1}, which is below the target value of 1.0; therefore, adverse systemic health risks are not expected for this receptor population.

The total ILCR for this receptor is 3.23×10^{-5}. This ILCR value is above the target risk value of 1×10^{-6}. Benzo(*a*)pyrene in surface soil is the primary risk driver, with an ILCR of 1.01×10^{-5}. The other risk drivers include arsenic (ILCR = 4.04×10^{-6}), benzo(*a*)anthracene (ILCR = 1.55×10^{-6}), benzo(*b*)fluoranthene (ILCR = 1.15×10^{-6}), and dibenzo(*a,h*)anthracene (ILCR = 3.32×10^{-6}) in surface soil and benzene (ILCR = 1.01×10^{-5}) and carbazole (ILCR = 1.47×10^{-6}) in groundwater. The remaining COPC had a carcinogenic risk below 1×10^{-6}.

Off-site Installation Worker. The calculated risk values for the off-site Installation worker are given in Table 51.

The total HI for this receptor is 7.30×10^{-2}, which is more than an order of magnitude less than the target value of 1.0; therefore, adverse systemic health risks are not expected for this receptor population.

The total ILCR for this receptor is 3.24×10^{-6}. This ILCR value is above the target risk value of 1×10^{-6}. Benzene in groundwater is the primary risk driver, with an ILCR of 2.88×10^{-6}. The remaining COPCs had carcinogenic risks below 1×10^{-6}.

Off-site Resident Child. The calculated risk values for the off-site resident child are given in Table 52.

The total HI for this receptor is 5.18×10^{-1}, which is below the target value of 1.0; therefore, adverse systemic health risks are not expected for this receptor population.

The total ILCR for this receptor is 5.48×10^{-6}. This ILCR value is above the target risk value of 1×10^{-6}. Benzene in groundwater is the primary risk driver, with an ILCR of 4.75×10^{-6}. The remaining COPCs had carcinogenic risks below 1×10^{-6}.

Off-site Resident Adult. The calculated risk values for the off-site resident adult are given in Table 53.

The total HI for this receptor is 2.21×10^{-1}, which is below the target value of 1.0; therefore, adverse systemic health risks are not expected for this receptor population.

The total ILCR for this receptor is 1.16×10^{-5}. This ILCR value is above the target risk value of 1×10^{-6}. Benzene and carbazole in groundwater are the risk drivers, with ILCRs of 1.01×10^{-5} and 1.47×10^{-6}, respectively. The remaining COPCs had carcinogenic risks below 1×10^{-6}.

10.5 UNCERTAINTY ASSESSMENT

A discussion of the general uncertainties associated with the analysis of risks at sites within the 16 SWMUs is provided in Appendix I, Section I.5 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000).

It was conservatively assumed that the off-site concentrations of COPCs in various environmental media are equal to the on-site concentrations. However, as COPCs migrate, the concentrations in environmental media generally decrease as a result of dilution, degradation, and other physicochemical processes. Assuming that the concentrations of COPCs remain constant is likely to result in an overestimation of the exposure of off-site receptors.

10.6 RISK SUMMARY

The purpose of the risk summary is to provide an overview of the risk assessment results, including identification of the COPCs assessed, the receptor populations, and the risk characterization results.

This HHBRA addressed the risks associated with exposure to HHCOPCs in surface soil and groundwater. The HHCOPCs in surface soil are benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, dibenzo(*a,h*)anthracene, indeno(*1,2,3-cd*)pyrene, and arsenic. HHCOPCs in groundwater are 2-methylnaphthalene, 4-methylphenol, benzene, carbazole, and naphthalene. The fate and transport analysis identified benzo(a)anthracene as a CMCOPC in soil; however, subsequent modeling using SESOIL modeling (Attachment E) indicated that benzo(*a*)anthracene will completely naturally attenuate before reaching the water table. Therefore, the CMCOPC, benzo(*a*)anthracene was not evaluated further in the HHBRA.

Current on-site receptor populations are limited to the Installation worker. Groundwater is not currently used, so exposure of the on-site receptor is limited to COPCs in surface soil. Given that the site is secured, other receptor populations are not likely to be exposed. There are no current off-site receptors.

Future land-use populations include an Installation worker, a juvenile trespasser, and a resident. These receptor populations represent both on-site and off-site receptors. The residential receptor population was divided into an adult and a child because differences in the behavior and physiology of these two receptors result in differing sensitivities to certain constituents or increased exposure to constituents in different environmental media. The reader is referred to Appendix I, Section I.2.2 (Identification of Potential Receptor Populations and Associated Exposure Pathways) of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000) for a more detailed discussion on the potential exposure pathways and the differences between the exposure of the adult and child resident receptors.

The future off-site receptors may be exposed via off-site migration of fugitive dust and groundwater. COPCs in groundwater are not likely to migrate to surface water, so off-site exposure to groundwater would be limited to receptors who use groundwater as a source of drinking water.

The current on-site Installation worker has a total ILCR of 2.74×10^{-5}, which exceeds the target risk value of 1×10^{-6}. Arsenic and the PAHs benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, and dibenzo(*a,h*)anthracene in surface soil are the risk drivers for this receptor.

With the exception of the on-site juvenile trespasser, all of the future receptor populations have total ILCRs that exceed 1×10^{-6}. These receptors include the following on-site and off-site receptors: Installation worker, resident child, and resident adult.

The risk drivers for the future on-site Installation worker include arsenic (surface soil), benzo(*a*)pyrene (surface soil), dibenzo(*a,h*)anthracene (surface soil), and benzene (groundwater). With the exception of indeno(*1,2,3-cd*)pyrene, all of the HHCOPCs in surface soil are risk drivers for the future on-site resident child and resident adult. These include arsenic, benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, and dibenzo(*a,h*)anthracene. Benzene and carbazole are risk drivers in groundwater.

Surface soil HHCOPCs do not present a significant risk to future off-site receptors. Benzene in groundwater is the single risk driver for all of the future off-site receptors.

The following constituents are considered to be COCs in surface soil: arsenic, benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, and dibenzo(*a,h*)anthracene. Benzene and carbazole are considered to be COCs in groundwater. Remedial levels were derived for these constituents.

10.7 REMEDIAL LEVELS

The first step in determining the remedial levels for a site is to derive remedial levels for each HHCOC based on regulatory and risk-based criteria. These remedial levels are reviewed, and a final remedial level for each COC is recommended. Remedial levels were derived for each HHCOC for all applicable environmental media at SWMU 27F, northwest of Building 1340.

10.7.1 Derivation of Remedial Levels

Remedial levels were derived for the HHCOCs in groundwater (benzene and carbazole) and surface soil [arsenic, benzo(*a*)pyrene, benzo(*a*)anthracene, benzo(*b*)fluoranthene, and dibenzo(*a,h*)anthracene]. The development of remedial levels followed the protocols given in Appendix I, Section I.6 of the revised final Phase II RFI Report for 16 SWMUs (SAIC 2000).

Risk-based remedial values were derived for the most sensitive receptor population. By protecting the most sensitive receptor, other less sensitive receptor populations will also be protected. If the most sensitive receptor population was not well defined, then remedial levels were derived for those populations considered to be representative of the sensitive receptors.

Remedial levels for groundwater took into consideration both regulatory limits and risk-based values. If a constituent had an MCL, that value was used as the remedial value. Given that benzene has an MCL, no risk-based remedial values were calculated (Table 54).

10.7.2 Remedial Level Recommendations

The selection of a remedial level must take into consideration the following factors:

- regulatory standards,
- target risk values for risk-based remedial levels, and
- background concentrations of inorganic COCs.

Regulatory standards that are considered for remedial levels must be derived based on the potential risk to receptors. If regulatory standards were not used as the recommended remedial levels, then risk-based remedial values were recommended based on a target risk value for the receptor population. Finally, the

background concentrations of inorganic COCs had to be taken into consideration because the remedial actions cannot reduce the concentration of a constituent to levels below the background concentrations.

10.7.2.1 Regulatory standards

MCLs were used as the remedial levels for groundwater HHCOCs. The MCL takes into consideration both the potential human health risks associated with exposure to the contaminant in drinking water and the technological limitations in removing that contaminant from water; therefore, these values are appropriate for use as remedial levels, given that if a risk-based concentration (RBC) cannot be obtained as a result of technological limitations, the lowest attainable concentration is used as the remedial level.

10.7.2.2 Target risk values for risk-based remedial levels

The selection of a target risk value for remedial levels must take into account the total risk for that receptor population from all of the potential COCs present at the site. The total potential risks associated with the COCs should not result in a cumulative HI that exceeds 3.0 or an ILCR of greater than 1×10^{-4} (GEPD 1996). The COCs were selected based on their carcinogenic risks because none of the COCs had an HI value that exceeded the respective target value. The risk-based remedial values were derived based on the carcinogenic risk to a resident adult (Table 56).

The on-site resident adult may be exposed to benzene and carbazole in groundwater and to arsenic and PAHs [benzo(*a*)pyrene, benzo(*a*)anthracene, benzo(*b*)fluoranthene, and dibenzo(*a,h*)anthracene] in surface soil. All of these COPCs would contribute to the carcinogenic risk; however, the remedial level for benzene in groundwater was based on regulatory standards (i.e., MCLs). It is recommended that the risk-based remedial values for carcinogens be based upon an ILCR of 1×10^{-5}. The total risk associated with exposure to the remedial levels of the surface soil COCs and carbazole in groundwater would be 6×10^{-5}, which is below the maximum total acceptable ILCR of 1×10^{-4}.

10.7.2.3 Background concentrations of inorganic constituents of concern

The recommended remedial levels for inorganic COCs were compared to the reference surface soil background concentrations. If the remedial level was lower than the reference background concentration, then the remedial level defaulted to background.

10.7.2.4 Recommended remedial levels for the constituents of concern

The selection of the recommended remedial level takes into consideration the MCLs, risk-based remedial levels, and reference background concentrations of inorganics. The recommended remedial level for each COC is discussed in the following paragraphs.

Arsenic. Arsenic was identified as an HHCOC in surface soil. The recommended risk-based remedial value is 10.12 mg/kg, based on an ILCR of 1.0×10^{-5} (Table 55).

Given that the recommended remedial value for arsenic (10.12 mg/kg) is higher than the maximum detected value of 4.4 mg/kg, no further study is required for this constituent.

Benzene. Benzene was identified as an HHCOC for groundwater. The MCL for benzene (5 µg/L) will be used as the remedial level for groundwater (Table 54).

Benzo(*a*)anthracene. Benzo(*a*)anthracene was identified as an HHCOC in surface soil. The recommended risk-based remedial value is 8.93 mg/kg, based on an ILCR of 1.0×10^{-5} (Table 55).

Given that the recommended remedial value for benzo(*a*)anthracene (8.93 mg/kg) is higher than the maximum detected value of 3.94 mg/kg, no further study is required for this constituent.

Benzo(*a*)pyrene. Benzo(*a*)pyrene was identified as an HHCOC in surface soil. The recommended risk-based remedial value is 0.89 mg/kg, based on an ILCR of 1.0×10^{-5} (Table 55).

Benzo(*b*)fluoranthene. Benzo(*b*)fluoranthene was identified as an HHCOC in surface soil. The recommended risk-based remedial value is 8.93 mg/kg, based on an ILCR of 1.0×10^{-5} (Table 55).

Given that the recommended remedial value for benzo(*b*)fluoranthene (8.93 mg/kg) is higher than the maximum detected value of 2.88 mg/kg, no further study is required for this constituent.

Carbazole. Carbazole was identified as an HHCOPC in groundwater. The recommended risk-based remedial value is 34.9 µg/L, based on an ILCR of 1.0×10^{-5} (Table 54).

Given that the recommended remedial value for carbazole (34.9 µg/L) is higher than the maximum detected value of 5.7 µg/L, no further study is required for this constituent.

Dibenzo(*a,h*)anthracene. Dibenzo(*a,h*)anthracene was identified as an HHCOC in surface soil. The recommended risk-based remedial value is 0.89 mg/kg, based on an ILCR of 1.0×10^{-5} (Table 55).

Given that the recommended remedial value for dibenzo(*a,h*)anthracene (0.89 mg/kg) is higher than the maximum detected value of 0.543 mg/kg, no further study is required for this constituent.

10.7.2.5 Summary of recommended remedial levels

The remedial levels for HHCOCs in groundwater and surface soil are given in Tables 54 and 55, respectively. The maximum concentrations of arsenic, benzo(*a*)anthracene, benzo(*b*)fluoranthene, and dibenzo(*a,h*)anthracene in surface soil and carbazole in groundwater were below their recommended remedial levels; therefore, no further investigation is required for these constituents. The following remedial levels are recommended for benzene in groundwater and benzo(*a*)pyrene in surface soil:

- benzene in groundwater: 5 µg/L and
- benzo(*a*)pyrene in surface soil: 0.89 mg/kg.

11.0 CONCLUSIONS AND SITE RECOMMENDATIONS, SWMU 27F, NORTHWEST OF BUILDING 1340

11.1 SUMMARY OF FINDINGS

The Phase II RFI and supplemental data evaluation presented in this addendum was conducted to collect additional analytical data for determining the nature and extent of contamination in environmental media and the potential adverse effects to human health and the environment in the vicinity of SWMU 27F, northwest of Building 1340. The data were derived from a series of screening and primary samples

collected from surface soil, subsurface soil, and groundwater in the study area during the Phase I and Phase II RFIs. The samples collected during the Phase I RFI were analyzed for VOCs, SVOCs, and lead. The samples collected during the Phase II RFI were analyzed for VOCs, SVOCs, and RCRA metals. Groundwater samples collected during supplemental sampling activities (January 2001) were analyzed for only VOCs and SVOCs.

The following section summarizes the significant findings of the Phase I (January 1998), Phase II (October 1999) RFI, and supplemental (January 2001) sampling and analysis activities.

11.1.1 Surface and Subsurface Soil

Low levels of organic and metal constituents were detected in surface and subsurface soil, primarily at MW10 and MW11 sample locations, which are a shallow/deep monitoring well pair located adjacent to one another.

- Five VOCs and 17 SVOCs were identified as SRCs in surface soil. These included the VOCs 2-butanone, 4-methyl-2-pentanone, acetone, carbon disulfide, and toluene and the SVOCs acenaphthene, anthracene, benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, benzo(*g,h,i*)perylene, benzo(*k*)fluoranthene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, chrysene, di-*N*-octyl phthalate, dibenzo(*a,h*)anthracene, fluoranthene, fluorene, indeno(*1,2,3-cd*)pyrene, phenanthrene, and pyrene.

- Arsenic, barium, cadmium, chromium, lead, and selenium were detected above reference background criteria and are SRCs in surface soil.

- Six VOCs and eleven SVOCs were identified as SRCs in subsurface soil. These included the VOCs 2-butanone, acetone, benzene, carbon disulfide, ethylbenzene, and total xylenes and the SVOCs 2-methylnaphthalene, acenaphthene, anthracene, benzo(*k*)fluoranthene, bis(2-ethylhexyl)phthalate, diphenylamine, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene.

- Barium, chromium, lead, and mercury were detected above reference background criteria and are SRCs in subsurface soil.

11.1.2 Groundwater

Groundwater was encountered at approximately 12 feet to 14 feet bgs in the monitoring wells during the Phase II RFI. The shallow and deep surficial groundwater flow direction across the site in November 1999 was to the south. The hydraulic gradients of the shallow and deep surficial groundwater in November 1999 were 0.0008 foot/foot and 0.0009 foot/foot, respectively. The shallow surficial groundwater flow direction in May 2001 across the site was to the southeast. The deep surficial groundwater flow direction in May 2001 was to the south to slight southeast. The hydraulic gradients of the shallow and deep surficial groundwater in May 2001 were 0.0009 foot/foot and 0.0014 foot/foot, respectively. Both the shallow and deep surficial groundwater flow may intercept the man-made drainage ditch located approximately 450 feet to the south.

- 2-Butanone, 4-methyl-2-pentanone, benzene, ethylbenzene, total xylenes, 2-methylnaphthalene, 4-methylphenol, carbazole, fluorene, and naphthalene were detected in shallow surficial groundwater and are considered to be SRCs in shallow surficial groundwater at SWMU 27F.

- No VOCs or SVOCs were detected in the deep surficial groundwater at SWMU 27F.

- Chromium was the only RCRA metal SRC detected above the respective reference background criterion in surficial groundwater.

- No VOCs or SVOCs were identified in the deep surficial groundwater, indicating that the contaminants identified in the shallow surficial groundwater have not migrated vertically to the deeper portion of the surficial groundwater.

11.2 CONCLUSIONS

Several assessments were conducted to determine the significance of the contaminant concentrations found at SWMU 27F, northwest of Building 1340 with respect to their impact on human health and the environment. The assessments included those listed below.

- An analysis of contaminant fate and transport (Chapter 6.0) evaluated the potential for SRCs to migrate from one environmental medium to another (e.g., leaching of constituents from soil into groundwater), resulting in a potential risk to human health and the environment.

- An HHPRE (Chapter 7.0), which used a Step 1 risk screening, identified HHCOPCs.

- An EPRE (Chapter 8.0) was performed for terrestrial and aquatic receptors in the study area.

- An HHBRA (Chapter 9.0) was performed for CMCOPCs identified in the fate and transport analysis and HHCOPCs identified in the HHPRE.

11.2.1 Fate and Transport Analysis

Below is the conclusion regarding contaminant fate and transport.

- Benzo(*a*)anthracene exceeded its GSSL and is considered to be an CMCOPC in surface soil. Benzo(*a*)anthracene was not detected in groundwater.

11.2.2 Human Health Preliminary Risk Evaluation

Based on the results of the screening and the weight-of-evidence analysis, potential HHCOPCs have been identified for surface soil and groundwater. The results of the HHPRE are summarized below.

- Benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, dibenzo(*a,h*)anthracene, indeno(*1,2,3-cd*)pyrene, and arsenic are considered to be HHCOPCs in surface soil.

- There are no HHCOPCs for subsurface soil.

- The maximum groundwater concentrations of 2-methylnaphthalene, 4-methylphenol, benzene, carbazole, and naphthalene exceeded their respective screening values; therefore, they are HHCOPCs in groundwater.

11.2.3 Ecological Preliminary Risk Evaluation

Based on the results of the EPRE screening analysis, ECOPCs were identified in groundwater and surface soil. Those constituents identified as ECOPCs were further evaluated using realistic exposure factors,

mean site concentrations or predicted maximum groundwater discharge concentrations at downgradient surface water bodies. The results of the EPRE are summarized below.

- Benzene and total xylenes in groundwater are ECOPCs for aquatic biota if groundwater discharges to nearby surface water bodies with aquatic habitat because they were detected at concentrations exceeding ESVs. Three SVOCs (2-methylnaphthalene, 4-methylphenol, carbazole) are ECOPCs by default because there are no ESVs. Fate and transport modeling (AT123D Model) was performed to estimate the groundwater concentrations at the nearest surface water body to which groundwater may potentially migrate. The ECOPCs in groundwater are unlikely to pose a hazard to aquatic biota because the predicted maximum discharge concentrations are 0 µg/L for all ECOPCs.

- There are no ECOPCs in groundwater at SWMU 27F, northwest of Building 1340 for terrestrial receptors.

- Cadmium, chromium, and lead in surface soil at SWMU 27F, northwest of Building 1340 are ECOPCs for terrestrial receptors because the preliminary HQs exceed one. There are no TRVs for butyl benzyl phthalate and di-*N*-octyl phthalate, so they are ECOPCs by default. The supplemental risk calculations for these ECOPCs using surrogate toxicity benchmarks for the two SVOCs result in HQs less than one for shrews and robins; therefore, cadmium, chromium, lead, butyl benzyl phthalate and di-*N*-octyl phthalate in surface soil at SWMU 27F, northwest of Building 1340 are unlikely to pose a risk to terrestrial receptors.

11.2.4 Human Health Baseline Risk Assessment

An HHBRA was performed to assess the HHCOPCs identified in surface soil and groundwater by the HHPRE. Benzo(*a*)anthracene, benzo(*a*)pyrene, benzo(*b*)fluoranthene, dibenzo(*a,h*)anthracene, indeno(*1,2,3-cd*)pyrene, and arsenic are considered to be HHCOPCs in surface soil. 4-Methyl-2-pentanone, benzene, toluene, bis(2-ethylhexyl)phthalate, and naphthalene are HHCOPCs in groundwater. The following bullets present the conclusions of the HHBRA.

- Modeling was performed to determine if HHCOPCs [2-methylnaphthalene, 4-methylphenol, benzene, carbazole, and naphthalene] in groundwater would migrate to the nearest surface water, a drainage ditch located approximately 450 feet away from the site that feeds into Mill Creek. Modeling results indicated that these constituents will not migrate to this potential point of discharge (receptor point); therefore, the risk associated with groundwater HHCOPCs migrating to surface water was not addressed.

- HHCOPCs were identified in surface soil and groundwater. The site is predominantly covered by concrete, with limited areas of exposed soil covered with grass. Given that the area is secured, current receptors are limited to an Installation worker exposed to surface soil. For the purposes of estimating exposures, the exposure point concentrations were calculated using the analytical data collected from only the exposed surface soil (i.e., MW4, MW10, and MW11). The future land-use scenario assumed that all of the surface soil was exposed and that groundwater drinking wells had been placed within the shallow aquifer. Future land-use populations include an Installation worker, a juvenile trespasser, and a resident. The Installation worker and the resident represent both on-site and off-site receptors. The juvenile trespasser is an on-site receptor only. The residential population was divided into an adult and a child because the adult receptor is generally at greater risk from exposure to carcinogens, while the child is at greater risk from exposure to noncarcinogens. The ILCR for the current on-site Installation worker exceeded the target risk value of 1×10^{-6}. Benzo(*a*)pyrene, benzo(*a*)anthracene, benzo(*b*)fluoranthene, and dibenzo(*a,h*)anthracene in surface soil had ILCRs

that exceeded the target risk value of 1×10^{-6}. Arsenic, benzo(*a*)pyrene, and dibenzo(*a,h*)anthracene in surface soil and benzene in groundwater were identified as COCs for the future on-site Installation worker. In addition, benzo(*a*)anthracene and benzo(*b*)fluoranthene in surface soil and carbazole in groundwater were identified as COCs based on the residential exposure scenarios.

- The MCL for benzene (5 µg/L) was recommended as the remedial level for groundwater. A risk-based remedial level of 34.9 µg/L was recommended for carbazole in groundwater, based on an ILCR of 1×10^{-5}. The maximum concentration of carbazole in groundwater was below its recommended remedial level; therefore, no further investigation/evaluation is required for carbazole in groundwater.

- The following risk-based remedial levels were derived for surface soil COCs based on an ILCR of 1×10^{-5}: arsenic (10.1 mg/kg), benzo(*a*)pyrene (0.89 mg/kg), benzo(*a*)anthracene (8.93 mg/kg), benzo(*b*)fluoranthene (8.93 mg/kg), and dibenzo(*a,h*)anthracene (0.89 mg/kg). The maximum concentrations of benzo(*a*)anthracene, benzo(*b*)fluoranthene, and dibenzo(*a,h*)anthracene in surface soil were below their recommended remedial levels; therefore, no further investigation is required for these constituents.

11.3 RISK MANAGEMENT AND SITE RECOMMENDATIONS

- The nature and extent of soil contamination at the site was determined during the Phase II RFI activities, and the information gathered is sufficient for development of a CAP. Figure 16 presents the estimated area of soil contamination.

- Benzo(*a*)pyrene was identified as an HHCOC in surface soil. Benzo(*a*)pyrene was detected above its remedial level in only one (MW10) of the eleven surface soil samples collected at the site. It was not detected in the surface soil collected from MW11, the deep well located adjacent to MW10. Benzo(*a*)pyrene was not identified as a CMCOPC, indicating that it is not likely to migrate to groundwater. The extent of benzo(*a*)pyrene in surface soil is confined to a single location near the OWS and the heavily used vehicle maintenance facility. This limited surface soil contamination does not represent widespread contamination and is probably the result of the operations of the maintenance facility rather than a release from the OWS. The OWS is located within a fenced, active maintenance area. The extent of benzo(*a*)pyrene in surface soil has been defined by the Phase II RFI, and no additional investigation and/or evaluation is required. Remedial alternatives for benzo(*a*)pyrene in surface soil will be evaluated in the CAP.

- Fort Stewart recommends that a CAP be developed for SWMU 27F, northwest of Building 1340 and submitted to GEPD in accordance with a schedule to be determined by the Director [Condition IV.E.2 of Fort Stewart's Hazardous Waste Facility Permit #HW-045(S&T)], if this recommendation is approved. The purpose of the CAP would be to determine the appropriate corrective action(s) to remediate the identified soil [benzo(*a*)pyrene only] and groundwater contamination (benzene) to the proposed remedial levels presented in Table 56. If this recommendation is approved by GEPD, Fort Stewart respectfully requests that the Installation's Subpart B permit be amended to reflect the change in investigative status. It is anticipated that the CAP would be submitted to GEPD in the first fiscal quarter (October through December 2001) of 2002. The potential abandonment or use of the monitoring wells would be evaluated in the CAP.

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Table 1. Summary of Phase I RFI Analytes Detected in Subsurface Soil, SWMU 27F, Northwest of Building 1340

Station	Reference Background Criteria	7JGP1	7JGP2	7JGP3	7JGP4
Sample ID		7J1111	7J1211	7J1312	7J1411
Date		01/03/98	02/03/98	05/06/98	02/03/98
Depth (feet)		8 to 10	5 to 6	10 to 12	8 to 10
Sample Type		Grab	Grab	Grab	Grab
Volatile Organic Compounds (mg/kg)					
Acetone	0.00	**0.111**	**0.095**		**0.0382**
Ethylbenzene	0.00			**0.0137**	
Xylenes, total	0.00			**0.0784**	
Metals (mg/kg)					
Lead	11.10	**11.4**	7.7	9.7	4.5

Bold indicates concentrations above reference background criteria.

Table 2. Summary of Phase I RFI Analytes Detected in Groundwater, SWMU 27F, Northwest of Building 1340

Station	Reference Background Criteria	MCL	7JGP1	7JGP2	7JGP3	7JGP4
Sample ID			7J4111	7J4211	7J4311	7J4411
Date			01/18/98	02/03/98	01/17/98	02/03/98
Sample Type			Grab	Grab	Grab	Grab
Volatile Organic Compounds (µg/L)						
1,1,1-Trichloroethane	0.00	200			**3.6**	
1,1,2-Trichloroethane	0.00	5			**2.7**	
1,1-Dichloroethane	0.00				**3**	
Acetone	0.00				**62.6**	
Benzene	0.00	5			***67.2***	**3.6**
Ethylbenzene	0.00	700			**69.5**	**2.4**
Methylene chloride	0.00	5			***42***	
Styrene	0.00	100			**3**	
Toluene	0.00	1,000			**39**	
Xylenes, total	0.00	10,000			**255**	**5.3**
Semivolatile Organic Compounds (µg/L)						
2-Methylnaphthalene	0.00				**1,440**	
Bis(2-ethylhexyl)phthalate	0.00	6	***6.7***			
Naphthalene	0.00				**569**	
Phenanthrene	0.00				**379**	
Metals (µg/L)						
Lead	4.69	15			3.8	

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

Table 3. Monitoring Well Construction Summary, SWMU 27F, Northwest of Building 1340

Well No.	Date Installed	Size/ Type	Coordinates	Total Depth (feet)	Screen Interval (feet bgs)	Top of Filter Pack Elevation (feet bgs)	Top of Casing Elevation (feet)
27F-MW1	10/11/99	2-inch PVC	N 684433.25 E 821537.79	21.0	9.30 to 19.30	9.0	69.16
27F-MW2	10/10/99	2-inch PVC	N 684435.72 E 821540.10	42.0	28.80 to 38.80	23.0	69.27
27F-MW3	10/10/99	2-inch PVC	N 684392.99 E 821630.44	25.0	10.40 to 20.40	10.0	68.45
27F-MW4	10/11/99	2-inch PVC	N 684325.34 E 821527.60	18.0	5.90 to 15.90	5.1	68.02
27F-MW5	10/10/99	2-inch PVC	N 684314.94 E 821614.36	20.0	8.80 to 18.80	8.1	67.99
27F-MW6	10/11/99	2-inch PVC	N 684253.33 E 821526.08	20.0	8.70 to 18.70	7.2	67.88
27F-MW7	10/10/99	2-inch PVC	N 684315.20 E 821556.65	21.0	10.00 to 20.00	8.9	68.14
27F-MW8	10/11/99	2-inch PVC	N 684345.97 E 821585.83	42.0	30.90 to 40.90	29.0	68.34
27F-MW9	10/12/99	2-inch PVC	N 684347.37 E 821587.85	22.0	10.30 to 20.30	8.9	68.46
27F-MW10	10/10/99	2-inch PVC	N 684362.91 E 821540.80	22.0	11.00 to 21.00	10.2	68.70
27F-MW11	10/11/99	2-inch PVC	N 684358.83 E 821536.44	40.0	29.40 to 39.40	27.0	68.66
27F-MW12[a]	10/12/99	2-inch PVC	N 684363.88 E 821543.07	10.0	5.00 to 9.70	4.0	68.74

Note: All elevations are National Geodetic Vertical Datum 1929.
[a]MW12 was installed to recover potential free product identified on a clay lens encountered approximately 8 feet bgs. No soil or groundwater samples were collected at MW12.
PVC = Polyvinyl chloride.

Table 4. Summary of Geotechnical Analyses, SWMU 27F, Northwest of Building 1340

Station	27F-MW1	27F-MW2	27F-MW3	27F-MW4	27F-MW5	27F-MW6	27F-MW7	27F-MW8	27F-MW9	27F-MW10	27F-MW11
Sample ID	**7J1173**	**7J1273**	**7J1373**	**7J1473**	**7J1573**	**7J1673**	**7J1773**	**7J1873**	**7J1973**	**7J1A73**	**7J1B73**
Depth (feet)	**15 to 17**	**37 to 40**	**10.6 to 20.6**	**15 to 16**	**9 to 10**	**16 to 17**	**35 to 45**	**7.7 to 9.0**	**14 to 15**	**11 to 12**	**30 to 40**
Moisture content (%)	20.09	26.18	17.73	30.74	18.83	19.13	35.03	16.7	23.32	23.9	22.92
Liquid limit (%)	NP	NP	18	NP	NP	NP	21.5	35	32.7	NP	NP
Plastic limit (%)	NP	NP	17.7	NP	NP	NP	18.4	25.1	23.8	NP	NP
Plasticity index (%)	NP	NP	0.3	NP	NP	NP	3.1	9.9	8.9	NP	NP
Class	NP	NP	ML	NP	NP	NP	ML	ML	ML	NP	NP
Gravel (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Sand (%)	92.39	88.87	84.4	85.01	90.1	89.66	81.63	67.25	75.24	92.8	94.82
Fines (%)	7.61	11.13	15.6	14.99	9.9	10.34	18.17	32.75	24.76	7.2	5.18
Specific gravity	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.65	NA
Soil porosity	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.45	NA
Bulk density (pcf)	NA	NA	NA	NA	NA	NA	NA	NA	NA	105.91	NA
Permeability (cm/sec)	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.60E-04	NA
Total organic carbon (mg/kg)	6,900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

ML = Soil classification.
NA = Not analyzed.
NP = Non-plastic.

Table 5. Well Development Summary, SWMU 27F, Northwest of Building 1340

Well No.	Date	Total Development Time (hours)	Total Volume Removed (gallons)	Final Turbidity Reading (NTUs)	Total Well Depth (feet)
27F-MW1	10/14/99	6 hours, 25 minutes	128	9.3	19.3
27F-MW2	10/13/99	2 hours, 50 minutes	440	0.8	38.8
27F-MW3	10/13/99	2 hours, 35 minutes	120	9.1	20.3
27F-MW4	10/13/99	2 hours, 5 minutes	220	0.8	15.8
27F-MW5	10/13/99	3 hours	85	2.9	18.75
27F-MW6	10/13/99	1 hour, 40 minutes	110	9.6	18.5
27F-MW7	10/13/99	3 hours, 10 minutes	90	3.6	19.85
27F-MW8	10/14/99	6 hours	421	3	40.78
27F-MW9	10/13/99	3 hours, 30 minutes	105	10	20.2
27F-MW10	10/13/99	1 hour, 5 minutes	110	2.2	20.8
27F-MW11	10/14/99	3 hours	230	9.3	39.35

Table 6. Field Parameter Measurements during Groundwater Sampling, SWMU 27F, Northwest of Building 1340

Well No.	Date	pH (su)	Conductivity (mS/cm)	Temperature (°C)	Turbidity (NTUs)	DO (mg/L)	Redox (mV)
27F-MW1[a]	11/2/99	4.61	27.0	24.28	62.5	0.98	276.7
27F-MW2[a]	11/3/99	6.10	90.0	20.84	291	5.15	82.9
27F-MW3	11/1/99	4.46	21.0	26.84	38.2	1.34	278.4
27F-MW4	11/1/99	5.04	16.0	24.60	4.3	6.72	132.4
27F-MW5	11/1/99	4.79	11.0	26.43	82	2.82	346.5
27F-MW6	11/1/99	4.46	8.0	23.90	9.9	8.92	208.8
27F-MW7	11/1/99	4.65	12.0	25.73	9.5	9.79	194.7
27F-MW8	11/3/99	6.08	61.0	21.25	45.2	7.89	72.3
27F-MW9	11/2/99	4.71	20.0	27.04	7.24	3.02	234.8
27F-MW10	11/1/99	4.72	12.0	25.05	9.7	4.71	176.7
27F-MW11	11/3/99	6.12	19.0	20.75	16.2	7.98	24.7
Average[b]		5.003					

[a]Site-specific background location.
[b]Site-specific background location not included in average.

Table 7. Summary of Phase II RFI Analytes Detected in Surface Soil, SWMU 27F, Northwest of Building 1340

Station	Reference Background Criteria	27F-MW1[a]	27F-MW2[a]	27F-MW3	27F-MW4	27F-MW5	27F-MW6
Sample ID		7J1171	7J1271	7J1371	7J1471	7J1571	7J1671
Date		10/09/99	10/10/99	10/10/99	10/11/99	10/10/99	10/11/99
Depth (feet)		0 to 1	1 to 2	1 to 2	0 to 1	1 to 2	0 to 1
Sample Type		Grab	Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (mg/kg)							
2-Butanone	0.00	R	R	R	**0.0066**	R	R
4-Methyl-2-pentanone	0.00				**0.0021**		
Acetone	0.00				**0.0546**		
Carbon disulfide	0.00			**0.0124**			
Toluene	0.00						
Semivolatile Organic Compounds (mg/kg)							
Acenaphthene	0.00						
Anthracene	0.00						
Benzo(*a*)anthracene	0.00						
Benzo(*a*)pyrene	0.00						
Benzo(*b*)fluoranthene	0.00						
Benzo(*g,h,i*)perylene	0.00						
Benzo(*k*)fluoranthene	0.00						
Bis(2-ethylhexyl)phthalate	0.00						
Butyl benzyl phthalate	0.00						
Chrysene	0.00						
Di-*N*-octyl phthalate	0.00						
Dibenzo(*a,h*)anthracene	0.00						
Fluoranthene	0.00						
Fluorene	0.00						
Indeno(*1,2,3-cd*)pyrene	0.00						
Phenanthrene	0.00						
Pyrene	0.00						
Metals (mg/kg)							
Arsenic	2.1	1.5	1.6	1.2	0.8	2	**2.6**
Barium	14.7	**16.9**	**22.2**	12	9.5	**17.9**	**17.9**
Cadmium	0.175				**1.3**		0.09
Chromium	6.21	**12.2**	**9.5**	5.9	**10.2**	**7.4**	**12.3**
Lead	8.81	8.8	8.6	6.5	**10.9**	7.9	**11.8**
Mercury	0.0342					0.03	
Selenium	0.406						0.35

Note: Footnotes appear on page 40.

Table 7. Summary of Phase II RFI Analytes Detected in Surface Soil, SWMU 27F, Northwest of Building 1340 (continued)

Station	Reference Background Criteria	27F-MW7	27F-MW8	27F-MW9	27F-MW10	27F-MW11
Sample ID		7J1771	7J1871	7J1971	7J1A71	7J1B71
Date		10/10/99	10/09/99	10/12/99	10/10/99	10/10/99
Depth (feet)		0 to 1	0 to 1	0 to 1	0 to 1	0 to 1
Sample Type		Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (mg/kg)						
2-Butanone	0.00	**0.0105**	R	R	**0.0101**	**0.0049**
4-Methyl-2-pentanone	0.00					
Acetone	0.00	**0.0488**			**0.115**	**0.0585**
Carbon disulfide	0.00				**0.0478**	
Toluene	0.00					**0.0218**
Semivolatile Organic Compounds (mg/kg)						
Acenaphthene	0.00				**0.0425**	
Anthracene	0.00				**0.492**	
Benzo(*a*)anthracene	0.00				**3.94**	
Benzo(*a*)pyrene	0.00				**2.43**	
Benzo(*b*)fluoranthene	0.00				**2.88**	**0.0345**
Benzo(*g,h,i*)perylene	0.00				**0.885**	**0.0294**
Benzo(*k*)fluoranthene	0.00				**2.1**	**0.0203**
Bis(2-ethylhexyl)phthalate	0.00				**0.793**	
Butyl benzyl phthalate	0.00				**0.265**	
Chrysene	0.00				**3.6**	
Di-*N*-octyl phthalate	0.00				**0.374**	
Dibenzo(*a,h*)anthracene	0.00				**0.543**	**0.0268**
Fluoranthene	0.00				**10.5**	
Fluorene	0.00				**0.0375**	
Indeno(*1,2,3-cd*)pyrene	0.00				**0.976**	
Phenanthrene	0.00				**1.18**	
Pyrene	0.00				**8.22**	
Metals (mg/kg)						
Arsenic	2.1	0.38	0.95	**4.4**	0.46	0.73
Barium	14.7	6	14.2	**21.5**	12.9	7.8
Cadmium	0.175				0.13	
Chromium	6.21	2	**6.5**	**19.9**	2.7	5.9
Lead	8.81	6.3	6.3	**11.5**	3	4.8
Mercury	0.0342	0.01			0.02	0.03
Selenium	0.406			**1.4**		

[a]Site-specific background location.

R = 2-Butanone values were qualified as nondetected by the laboratory. The nondetect values were rejected during validation due to poor initial or continuing instrument response factors for these compounds during their analyses.

Bold indicates concentrations above reference background criteria.

Table 8. Summary of Phase II RFI Analytes Detected in Subsurface Soil, SWMU 27F, Northwest of Building 1340

Station	Reference Background Criteria	27F-MW1[a]	27F-MW2[a]	27F-MW3	27F-MW4	27F-MW5	27F-MW6	27F-MW7	27F-MW8
Sample ID		7J1172	7J1272	7J1372	7J1472	7J1572	7J1672	7J1772	7J1872
Date		10/09/99	10/10/99	10/10/99	10/11/99	10/10/99	10/11/99	10/10/99	10/09/99
Depth (feet)		3 to 4	3 to 5	8 to 10	5 to 7	2 to 5	8 to 9	3 to 5	9 to 10
Sample Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (mg/kg)									
2-Butanone	0.00	**0.0176**	**0.005**	R	R	**0.0058**	R	R	R
Acetone	0.00	**0.0847**							
Benzene	0.00							**0.0022**	**0.0064**
Carbon disulfide	0.00	**0.014**					**0.01**		
Ethylbenzene	0.00								**0.0096**
Xylenes, total	0.00								**0.0121**
Semivolatile Organic Compounds (mg/kg)									
2-Methylnaphthalene	0.00								
Acenaphthene	0.00								
Anthracene	0.00								
Benzo(*b*)fluoranthene	0.00	**0.0302**							
Benzo(*k*)fluoranthene	0.00						**0.0541**		
Bis(2-ethylhexyl)phthalate	0.00								
Diphenylamine	0.00								
Fluoranthene	0.00								
Fluorene	0.00								
Naphthalene	0.00								
Phenanthrene	0.00								**0.093**
Pyrene	0.00						**0.0279**		
Metals (mg/kg)									
Arsenic	8.04			2.4	0.9	0.54	0.65	1.1	0.46
Barium	17	2.8	2.5	10.5	10.8	5.6	9	9.1	4.7
Cadmium	0.231				0.05		0.11		
Chromium	11.6	2.7	1.6	**13.8**	**12.7**	3.9	**13.5**	10.8	6.8
Lead	11.1	2.2	1.5	11	**11.5**	3.4	**12.8**	6.2	4.6
Mercury	0.048		0.01	0.01	0.03	0.01		0.02	
Selenium	1.12			0.62	0.4				

Note: Footnotes appear on page 42.

Table 8. Summary of Phase II RFI Analytes Detected in Subsurface Soil, SWMU 27F, Northwest of Building 1340 (continued)

Station	Reference Background Criteria	27F-MW9	27F-MW10	27F-MW10	27F-MW10	27F-MW10	27F-MW10	27F-MW11
Sample ID		7J1972	7J1A74	7J1A75	7J1A76	7J1A72	7J1A77	7J1B72
Date		10/12/99	10/10/99	10/10/99	10/10/99	10/10/99	10/10/99	10/10/99
Depth (feet)		8 to 10	2 to 4	4 to 6	6 to 8	8 to 9	9 to 10	8 to 10
Sample Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (mg/kg)								
2-Butanone	0.00	R	R	**0.0036**	R	R	R	R
Acetone	0.00							
Benzene	0.00	**0.0081**						
Carbon disulfide	0.00							
Ethylbenzene	0.00	**0.0202**			**1.68**	**1.51**	**0.267**	**0.672**
Xylenes, total	0.00	**0.0449**			**5.04**	**4.37**	**0.406**	**2.07**
Semivolatile Organic Compounds (mg/kg)								
2-Methylnaphthalene	0.00	**18.1**	NA	NA	NA	**15.3**	NA	**5.54**
Acenaphthene	0.00		NA	NA	NA	**1.12**	NA	
Anthracene	0.00		NA	NA	NA	**0.393**	NA	
Benzo(*b*)fluoranthene	0.00		NA	NA	NA		NA	
Benzo(*k*)fluoranthene	0.00		NA	NA	NA		NA	
Bis(2-ethylhexyl)phthalate	0.00		NA	NA	NA		NA	**25.6**
Diphenylamine	0.00		NA	NA	NA	**2.81**	NA	
Fluoranthene	0.00		NA	NA	NA	**0.3**	NA	
Fluorene	0.00		NA	NA	NA	**2.18**	NA	
Naphthalene	0.00	**4.49**	NA	NA	NA	**3.8**	NA	**1.3**
Phenanthrene	0.00	**5.23**	NA	NA	NA	**4.58**	NA	**2.41**
Pyrene	0.00		NA	NA	NA	**1.04**	NA	**0.602**
Metals (mg/kg)								
Arsenic	8.04	0.87	NA	NA	NA	0.56	NA	1.5
Barium	17	**28.9**	NA	NA	NA	6.5	NA	8.6
Cadmium	0.231	0.09	NA	NA	NA	0.15	NA	
Chromium	11.6	**18.7**	NA	NA	NA	5.1	NA	11.3
Lead	11.1	**35.6**	NA	NA	NA	4	NA	8.4
Mercury	0.048	**0.05**	NA	NA	NA	0.03	NA	0.01
Selenium	1.12		NA	NA	NA		NA	

[a]Site-specific background location.

NA = Not analyzed.

R = 2-Butanone values were qualified as nondetected by the laboratory. The nondetect values were rejected during validation due to poor initial or continuing instrument response factors for these compounds during their analyses.

Bold indicates concentrations above reference background criteria.

Table 9. Summary of Phase II RFI Analytes Detected in Groundwater in Geoprobes/Vertical Profiles, SWMU 27F, Northwest of Building 1340

Station	Reference Background Criteria	Maximum Contaminant Level	27F-GP5	27F-GP6	27F-GP7	27F-GP8	27F-GP9	27F-GP10	27F-GP11
Sample ID			7J4551	7J4651	7J4751	7J4851	7J4B51	7J4C51	7J4D51
Date			09/22/99	09/22/99	09/22/99	09/25/99	09/28/99	09/29/99	09/29/99
Sample Type			Grab	Grab	Grab	Grab	Grab	Grab	Grab
Screened Interval (feet bgs)			0 to 19.8	0 to 15.52	0 to 15.02	0 to 17.9	0 to 15.0	0 to 15.0	0 to 15.0
Volatile Organic Compounds (µg/L)									
1,1,1-Trichloroethane	0.00	200					5.2		
1,1-Dichloroethane	0.00						4.6		
2-Butanone	0.00		R	R	R	R	40.2	R	R
2-Hexanone	0.00						3.4		
4-Methyl-2-pentanone	0.00						98.4		
Benzene	0.00	5		*12.8*	*38.4*		*141*		*9.2*
Carbon disulfide	0.00			9	4.7				
Ethylbenzene	0.00	700		29.6	5.7	2.6	27.5	2.3	
Toluene	0.00	1,000			16		89		
Xylenes, total	0.00	10,000		65.8	13.4	13.8	137	14.7	7.1

Station	Reference Background Criteria	Maximum Contaminant Level	27F-GP12	27F-GP13	27F-GP14	27F-GP15	27F-GP16	27F-GP17	27F-GP18
Sample ID			7J4E51	7J4F51	7J4G51	7J4H51	7J4J51	7J4K51	7J4M51
Date			09/29/99	09/29/99	09/29/99	09/29/99	09/29/99	09/29/99	09/29/99
Sample Type			Grab	Grab	Grab	Grab	Grab	Grab	Grab
Screened Interval (feet bgs)			0 to 16.0	0 to 15.0	0 to 15.0	0 to 15.0	0 to 15.0	0 to 14.0	0 to 15.0
Volatile Organic Compounds (µg/L)									
1,1,1-Trichloroethane	0.00	200							
1,1-Dichloroethane	0.00								
2-Butanone	0.00		R	R	R	R	R	R	R
2-Hexanone	0.00								
4-Methyl-2-pentanone	0.00								
Benzene	0.00	5	3.8			*8.2*			
Carbon disulfide	0.00								
Ethylbenzene	0.00	700	12		4.5	7			
Toluene	0.00	1,000							
Xylenes, total	0.00	10,000	25.6		11.5	16.1			

Note: Footnotes appear on page 44.

Table 9. Summary of Phase II RFI Analytes Detected in Groundwater in Geoprobes/Vertical Profiles, SWMU 27F, Northwest of Building 1340 (continued)

Station	Reference Background Criteria	Maximum Contaminant Level	27F-GP19	27F-VP1	27F-VP1	27F-VP1	27F-VP2	27F-VP2	27F-VP2
Sample ID			**7J4N51**	**7J4951**	**7J4952**	**7J4953**	**7J4A51**	**7J4A52**	**7J4A53**
Date			**09/29/99**	**09/28/99**	**09/28/99**	**09/28/99**	**09/28/99**	**09/28/99**	**09/28/99**
Sample Type			**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Screened Interval (feet bgs)			**0 to 15.0**	**10 to 14**	**20 to 24**	**30 to 34**	**10 to 14**	**20 to 24**	**30 to 34**
Volatile Organic Compounds (µg/L)									
1,1,1-Trichloroethane	0.00	200							
1,1-Dichloroethane	0.00								
2-Butanone	0.00			R	R	R	R	R	R
2-Hexanone	0.00								
4-Methyl-2-pentanone	0.00								
Benzene	0.00	5							
Carbon disulfide	0.00								
Ethylbenzene	0.00	700							
Toluene	0.00	1,000							
Xylenes, total	0.00	10,000							

[a]Site-specific background location.

R = 2-Butanone values were qualified as nondetected by the laboratory. The nondetect values were rejected during validation due to poor initial or continuing instrument response factors for these compounds during their analyses.

Bold indicates concentrations above reference background criteria.

Boxed *italic* indicates concentrations above MCL.

Table 10. Summary of Phase II RFI Analytes Detected in Groundwater in Monitoring Wells, SWMU 27F, Northwest of Building 1340

Station	Reference Background Criteria	MCL	27F-MW1[a]	27F-MW1[a]	27F-MW3	27F-MW3	27F-MW4
Sample ID			7J4171	F7J4171	7J4371	F7J4371	7J4471
Date			11/02/99	11/02/99	11/01/99	11/01/99	11/01/99
Depth (feet bgs)			9.3 to 19.3	9.3 to 19.3	10.4 to 20.4	10.4 to 20.4	5.9 to 15.9
Depth			Shallow	Shallow	Shallow	Shallow	Shallow
Filtered			Total	Dissolved	Total	Dissolved	Total
Sample Type			Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (µg/L)							
Benzene	0.00	5		NA		NA	
Ethylbenzene	0.00	700		NA		NA	
Xylenes, total	0.00	10,000		NA		NA	
Semivolatile Organic Compounds (µg/L)							
2-Methylnaphthalene	0.00			NA	**4.1**	NA	
Bis(2-ethylhexyl)phthalate	0.00	6		NA		NA	***6.8***
Naphthalene	0.00			NA	**4.4**	NA	
Phenanthrene	0.00			NA		NA	
Metals (µg/L)							
Arsenic	3.02	50					
Barium	71.72	2,000	24.3	5.6	16.5	4.7	12.5
Chromium	3.56	1,000	1				
Lead	4.69	15	3.4		1.7		
Selenium	1.90	50					

Note: Footnotes appear on page 47.

Table 10. Summary of Phase II RFI Analytes Detected in Groundwater in Monitoring Wells, SWMU 27F, Northwest of Building 1340 (continued)

Station	Reference Background Criteria	MCL	27F-MW5	27F-MW5	27F-MW6	27F-MW7	27F-MW9	27F-MW10
Sample ID			7J4571	F7J4571	7J4671	7J4771	7J4971	7J4A71
Date			11/02/99	11/02/99	11/01/99	11/01/99	11/02/99	11/01/99
Depth (feet bgs)			8.8 to 18.8	8.8 to 18.8	8.7 to 18.7	10 to 20	10.3 to 20.3	11 to 21
Depth			Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
Filtered			Total	Dissolved	Total	Total	Total	Total
Sample Type			Grab	Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (µg/L)								
Benzene	0.00	5		NA			4.6	*8.5*
Ethylbenzene	0.00	700		NA				4.8
Xylenes, total	0.00	10,000		NA			3	19.2
Semivolatile Organic Compounds (µg/L)								
2-Methylnaphthalene	0.00			NA				10.8
Bis(2-ethylhexyl)phthalate	0.00	6		NA	*18.9*	*22.1*		*18.3*
Naphthalene	0.00			NA				6.4
Phenanthrene	0.00			NA				2.4
Metals (µg/L)								
Arsenic	3.02	50						
Barium	71.72	2,000	20.2	2.3	21.8	33.6	18	37
Chromium	3.56	1,000	2.8		1.4			
Lead	4.69	15	3.1					
Selenium	1.90	50						

Note: Footnotes appear on page 47.

Table 10. Summary of Phase II RFI Analytes Detected in Groundwater in Monitoring Wells, SWMU 27F, Northwest of Building 1340 (continued)

Station	Reference Background Criteria	MCL	27F-MW2[a]	27F-MW2[a]	27F-MW8	27F-MW8	27F-MW11	27F-MW11
Sample ID			7J4271	F7J4271	7J4871	F7J4871	7J4B71	F7J4B71
Date			11/03/99	11/03/99	11/03/99	11/03/99	11/03/99	11/03/99
Depth (feet bgs)			28.8 to 38.8	28.8 to 38.8	30.9 to 40.9	30.9 to 40.9	29.4 to 39.4	29.4 to 39.4
Depth			Deep	Deep	Deep	Deep	Deep	Deep
Filtered			Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample Type			Grab	Grab	Grab	Grab	Grab	Grab
Volatile Organic Compounds (µg/L)								
Benzene	0.00	5		NA		NA		NA
Ethylbenzene	0.00	700		NA		NA		NA
Xylenes, total	0.00	10,000		NA		NA		NA
Semivolatile Organic Compounds (µg/L)								
2-Methylnaphthalene	0.00			NA		NA		NA
Bis(2-ethylhexyl)phthalate	0.00	6		NA		NA		NA
Naphthalene	0.00			NA		NA		NA
Phenanthrene	0.00			NA		NA		NA
Metals (µg/L)								
Arsenic	3.02	50	**4.4**					
Barium	71.72	2,000	50.8	28.3	25.1	18.7	21.7	18.9
Chromium	3.56	1,000	**22.3**		7			
Lead	4.69	15	**7.8**			1.8		
Selenium	1.90	50	**2.2**					

[a]Site-specific background location.
Bold indicates concentrations above reference background criteria.
Boxed *italic* indicates concentrations above MCLs.

Table 11. Monitoring Well Construction Summary (November 2000), SWMU 27F

Well No.	Date Installed	Size/Type	Coordinates	Total Depth (feet)	Screen Interval (feet bgs)	Top of Filter Pack Elevation (feet bgs)	Top of Casing Elevation (feet)
27F-MW13	11/29/00	2-inch PVC	N 684278.17 E 821483.84	15.0	4.10 to 14.10	2.20	67.26
27F-MW14	11/31/00	2-inch PVC	N 684278.63 E 821569.04	15.0	2.90 to 12.90	2.00	67.76
27F-MW15	11/29/00	2-inch PVC	N 684344.10 E 821633.70	15.0	3.80 to 13.80	1.80	68.03
27F-MW16	12/05/00	2-inch PVC	N 684231.17 E 821565.74	15.5	5.0 to 15.0	3.0	67.64
27F-MW17	12/05/00	2-inch PVC	N 684226.55 E 821612.29	15.5	4.90 to 14.90	2.90	69.08
27F-MW18	12/05/00	2-inch PVC	N 684270.23 E 821623.61	15.5	4.90 to 14.90	3.0	67.49

Note: All elevations are National Geodetic Vertical Datum 1929.

Table 12. Well Development Summary (November through December 2000), SWMU 27F

Well No.	Date	Total Development Time (hours)	Total Volume Removed (gallons)	Final Turbidity Reading (NTUs)	Total Well Depth (feet)
27F-MW13	11/30/00	2 hours, 15 minutes	115	2.6	15.23
27F-MW14	12/03/00	2 hours, 22 minutes	42	4.0	15.32
27F-MW15	11/30/00	1 hour, 40 minutes	55	0.8	15.23
27F-MW16	12/06/00	2 hours	27	6.4	20.39
27F-MW17	12/06/00	2 hours, 20 minutes	37	3.1	20.40
27F-MW18	12/06/00	3 hours	31	7.7	20.22

Table 13. Field Parameter Measurements during Groundwater Sampling (January 2001), SWMU 27F

Location	Date	pH (su)	Conductivity (mS/cm)	Temperature (°C)	Turbidity (NTUs)	DO (mg/L)	Redox (mV)
27F-MW1[a]	01/05/01	4.79	33.0	19.20	9.7	0.0	314
27F-MW2[a]	01/06/01	6.26	78.0	18.15	9.2	0.0	41
27F-MW3	01/05/01	5.20	19.0	20.07	9.8	0.0	244
27F-MW4	01/06/01	5.04	34.0	16.88	9.2	1.8	141
27F-MW5	01/05/01	4.76	27.0	20.12	9.1	0.0	305
27F-MW6	01/06/01	4.10	42.3	19.17	6.8	0.51	351
27F-MW7	01/06/01	5.34	64.0	16.58	8.9	0.4	45
27F-MW8	01/08/01	6.18	64.5	21.48	10.0	0.92	-62.0
27F-MW9	01/05/01	4.49	24.0	16.8	15.5	NR	NR
27F-MW10	01/07/01	4.94	45.0	21.52	9.3	0.24	-75.0
27F-MW11	01/08/01	4.91	30.5	20.95	71.0	0.25	38
27F-MW13	01/07/01	4.53	46.0	18.66	9.4	6.72	224
27F-MW14	01/06/01	5.05	33.0	18.37	6.3	0.0	175
27F-MW15	01/06/01	4.47	42.0	20.50	8.6	0.09	174.9
27F-MW16	01/06/01	4.80	75.0	19.68	9.9	1.04	8.0
27F-MW17	01/06/01	4.67	73.0	18.3	7.6	NR	NR
27F-MW18	01/08/01	4.12	44.6	22.43	9.5	0.2	150
Average[b]		4.84					

[a]Site-specific background location.
[b]Site-specific background locations not included in average.
NR = Not recorded.

Table 14. Water Level Data for Monitoring Wells (May 2001), SWMU 27F

Well	Date	Screened Interval (feet bgs)	Depth to Water (feet below MP)	Elevation of Measuring Point (feet amsl)	Elevation of Potentiometric Surface (feet amsl)
27F-MW1	05/04/01	9.30 to 19.30	8.41	69.16	60.75
27F-MW2	05/04/01	28.80 to 38.80	8.61	69.27	60.66
27F-MW3	05/04/01	10.40 to 20.40	7.80	68.45	60.65
27F-MW4	05/04/01	5.90 to 15.90	7.37	68.02	60.65
27F-MW5	05/04/01	8.80 to 18.80	7.34	67.99	60.65
27F-MW6	05/04/01	8.70 to 18.70	7.28	67.88	60.60
27F-MW7	05/04/01	10.00 to 20.00	7.52	68.14	60.62
27F-MW8	05/04/01	30.90 to 40.90	7.82	68.34	60.52
27F-MW9	05/04/01	10.30 to 20.30	7.80	68.46	60.66
27F-MW10	05/04/01	11.00 to 21.00	8.01	68.70	60.69
27F-MW11	05/04/01	29.40 to 39.40	8.06	68.66	60.60
27F-MW12	05/04/01	5.00 to 9.70	7.89	68.74	60.85
27F-MW13	05/04/01	4.10 to 14.10	6.62	67.26	60.64
27F-MW14	05/04/01	2.90 to 12.90	7.15	67.76	60.61
27F-MW15	05/04/01	3.80 to 13.80	7.37	68.03	60.66
27F-MW16	05/04/01	5.0 to 15.0	7.07	67.64	60.57
27F-MW17	05/04/01	4.90 to 14.90	7.46	69.08	61.62
27F-MW18	05/04/01	4.90 to 14.90	6.86	67.49	60.63

amsl = Above mean sea level.
bgs = Below ground surface.
MP = Measuring point (top of casing).
NA = Not available.
NR = Not recorded.

Table 15. Summary of Geotechnical Analyses, SWMU 27F

Station	Sample ID	Depth (feet)	Moisture Content (%)	Atterberg Limits				Grain-size Distribution			Specific Gravity	Soil Porosity	Bulk Density (pcf)	Permeability
				Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Gravel (%)	Sand (%)	Fines (%)				
27F-MW13	7J1D82	8.2 to 10.0	17.0	NP	NP	NP	NP	0.0	84.1	15.9	NA	NA	NA	NA
27F-MW14	7J1E82	8.0 to 10.0	16.0	NP	NP	NP	NP	0.0	86.2	13.8	NA	NA	NA	NA
27F-MW15	7J1F82	8.7 to 11.0	18.0	NP	NP	NP	NP	0.0	86.2	13.8	NA	NA	NA	NA
27F-MW16	7J1G82	10.0 to 12.0	20.0	NP	NP	NP	NP	0.0	88.9	11.1	NA	NA	NA	NA
27F-MW17	7J1H82	8.0 to 15.0	20.0	NP	NP	NP	NP	0.0	85.4	14.6	NA	NA	NA	NA
27F-MW18	7J1J82	7.0 to 15.0	21.0	NP	NP	NP	NP	0.0	84.6	15.4	NA	NA	NA	NA

NA = Not analyzed.
NP = Non-plastic.
pcf = Pounds per cubic foot.

Table 16. Summary of Analytes Detected in Groundwater (January 2001), SWMU 27F

Station	Reference Background Criteria	27F-MW1[a]	27F-MW2[a]	27F-MW3	27F-MW4	27F-MW5	27F-MW6	27F-MW7	27F-MW8	27F-MW9
Sample ID		7J4172	7J4272	7J4372	7J4472	7J4572	7J4672	7J4772	7J4872	7J4972
Date		01/05/01	01/06/01	01/05/01	01/06/01	01/05/01	01/07/01	01/06/01	01/08/01	01/05/01
Filtered		Total	Total	Total	Total	Total	Total	Total	Total	Total
Sample Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Screen Depth (bgs)		9.3 to 19.3	28.8 to 38.8	10.4 to 20.4	5.9 to 15.9	8.8 to 18.8	8.7 to 18.7	10 to 20	30.9 to 40.9	10.3 to 20.3
Volatile Organic Compounds (µg/L)										
2-Butanone	0.00							10.6		
4-Methyl-2-pentanone	0.00							6.8		
Benzene	0.00							31.4		5.8
Ethylbenzene	0.00							4.3		
Xylenes, total	0.00				6.3			20.7		3.6
Semivolatile Organic Compounds (µg/L)										
2-Methylnaphthalene	0.00				15.6			7.4		2.3
4-Methylphenol	0.00							21.3		
Carbazole	0.00									
Fluorene	0.00									
Naphthalene	0.00				11					3.6

Station	Reference Background Criteria	27F-MW10	27F-MW11	27F-MW13	27F-MW14	27F-MW15	27F-MW16	27F-MW17	27F-MW18
Sample ID		7J4A72	7J4B72	7J4D72	7J4E72	7J4F72	7J4G72	7J4H72	7J4J72
Date		01/07/01	01/08/01	01/07/01	01/06/01	01/06/01	01/06/01	01/06/01	01/08/01
Filtered		Total	Total	Total	Total	Total	Total	Total	Total
Sample Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Screen Depth (bgs)		11 to 21	29.4 to 39.4	4.1 to 14.1	2.9 to 12.9	3.8 to 13.8	5 to 15	4.9 to 14.9	4.9 to 14.9
Volatile Organic Compounds (µg/L)									
2-Butanone	0.00								
4-Methyl-2-pentanone	0.00								
Benzene	0.00	2.4			61				
Ethylbenzene	0.00				7				
Xylenes, total	0.00	3.2			38.5				
Semivolatile Organic Compounds (µg/L)									
2-Methylnaphthalene	0.00				31.9				
4-Methylphenol	0.00								
Carbazole	0.00				5.7				
Fluorene	0.00				2.1				
Naphthalene	0.00				37.2				3.8

[a]Site-specific background location.

Table 17. Summary of Site-related Contaminants, SWMU 27F, Northwest of Building 1340

Analyte	Maximum Concentration (mg/kg)			Maximum Concentration (µg/L)	
	Surface Soil	Subsurface Soil	Sediment	Groundwater	Surface Water
Volatile Organic Compounds					
1,1,1-Trichloroethane	ND	ND	NP	ND	NP
1,1-Dichloroethane	ND	ND	NP	ND	NP
2-Butanone	0.0105	0.0058	NP	10.6	NP
2-Hexanone	ND	ND	NP	ND	NP
4-Methyl-2-pentanone	0.0021	ND	NP	6.8	NP
Acetone	0.115	0.111[a]	NP	ND	NP
Benzene	ND	0.0081	NP	61	NP
Carbon disulfide	0.0478	0.01	NP	ND	NP
Ethylbenzene	ND	1.68	NP	7	NP
Toluene	0.0218	ND	NP	ND	NP
Xylenes, total	ND	5.04	NP	38.5	NP
Semivolatile Organic Compounds					
2-Methylnaphthalene	ND	18.1	NP	31.9	NP
4-Methylphenol	ND	ND	ND	21.3	ND
Acenaphthene	0.0425	1.12	NP	ND	NP
Anthracene	0.492	0.393	NP	ND	NP
Benzo(*a*)anthracene	3.94	ND	NP	ND	NP
Benzo(*a*)pyrene	2.43	ND	NP	ND	NP
Benzo(*b*)fluoranthene	2.88	ND	NP	ND	NP
Benzo(*g,h,i*)perylene	0.885	ND	NP	ND	NP
Benzo(*k*)fluoranthene	2.1	0.0541	NP	ND	NP
Bis(2-ethylhexyl)phthalate	0.793	25.6	NP	ND	NP
Butyl benzyl phthalate	0.265	ND	NP	ND	NP
Carbazole	ND	ND	ND	5.7	ND
Chrysene	3.6	ND	NP	ND	NP
Di-*N*-octyl phthalate	0.374	ND	NP	ND	NP
Dibenzo(*a,h*)anthracene	0.543	ND	NP	ND	NP
Diphenylamine	ND	2.81	NP	ND	NP
Fluoranthene	10.5	0.3	NP	ND	NP
Fluorene	0.0375	2.18	NP	2.1	NP
Indeno(*1,2,3-cd*)pyrene	0.976	ND	NP	ND	NP
Naphthalene	ND	4.49	NP	37.2	NP
Phenanthrene	1.18	5.23	NP	ND	NP
Pyrene	8.22	1.04	NP	ND	NP
Metals					
Arsenic	4.4	BRBC	NP	ND	NP
Barium	21.5	28.9	NP	BRBC	NP
Cadmium	1.3	BRBC	NP	ND	NP
Chromium	19.9	18.7	NP	7	NP
Lead	11.8	35.6	NP	BRBC	NP
Mercury	BRBC	0.05	NP	ND	NP
Selenium	1.4	BRBC	NP	ND	NP

[a]Phase I RFI.
BRBC = Below reference background criteria.
NC = Not collected based on field screening results.
ND = Not detected above reference background criteria.
NP = No pathway exists.

Table 18. GSSL Screening of Site-related Contaminants in Soil, SWMU 27F, Northwest of Building 1340

Site-related Contaminant	Maximum Concentration	GSSL[a]	CMCOPC?
Volatile Organic Compounds (mg/kg)			
2-Butanone	0.0105	7.685	No
4-Methyl-2-pentanone	0.0021	NA	No
Acetone	0.115	16	No
Benzene	0.0081	0.03	No
Carbon disulfide	0.0478	32	No
Ethylbenzene	1.68	13	No
Toluene	0.0218	12	No
Xylenes, total	5.04	190	No
Semivolatile Organic Compounds (mg/kg)			
2-Methylnaphthalene[b]	18.1	22.574	No
Acenaphthene	1.12	111	No
Anthracene	0.492	12,000	No
Benzo(*a*)anthracene	3.94	2	Yes
Benzo(*a*)pyrene	2.43	8	No
Benzo(*b*)fluoranthene	2.88	5	No
Benzo(*g,h,i*)perylene[b]	0.885	394	No
Benzo(*k*)fluoranthene	2.1	49	No
Bis(2-ethylhexyl)phthalate	25.6	3,600	No
Butyl benzyl phthalate	0.265	930	No
Chrysene	3.6	160	No
Di-*N*-octyl phthalate	0.374	10,000	No
Dibenzo(*a,h*)anthracene	0.543	2	No
Diphenylamine[c]	2.81	25	No
Fluoranthene	10.5	4,300	No
Fluorene	2.18	560	No
Indeno(*1,2,3-cd*)pyrene	0.976	14	No
Naphthalene	4.49	84	No
Phenanthrene[b,d]	5.23	80.4	No
Pyrene	8.22	4,200	No
Metals (mg/kg)			
Arsenic	4.4	29	No
Barium	28.9	1,600	No
Cadmium	1.3	8	No
Chromium	19.9	38	No
Lead[e]	35.6	400	No
Mercury	0.05	2	No
Selenium	1.4	5	No

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

[b]EPA–suggested GSSL is not available; GSSL is calculated following *Soil Screening Guidance: Technical Background Document* (EPA 1996b). 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 1999).

[c]*Source*: EPA Region III RBC Table (EPA 2000a).

[d]RBC of pyrene was used to develop 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 1994).

Table 19. Human Health Risk Screening for Surface Soil, Subsurface Soil, and Groundwater, SWMU 27F, Northwest of Building 1340

SURFACE SOIL						
Analyte	**Results > Detection Limit**	**Minimum Detect**	**Maximum Detect**	**EPA Region III Residential**	**HHCOPC?**	**Justification**
Volatile Organic Compounds (mg/kg)						
2-Butanone	4/4	0.0049	0.0105	4,693	No	Max Detect < Risk Criteria
4-Methyl-2-pentanone	1/9	0.0021	0.0021	625.7	No	Max Detect < Risk Criteria
Acetone	4/9	0.0488	0.115	782.1	No	Max Detect < Risk Criteria
Carbon disulfide	2/9	0.0124	0.0478	782.1	No	Max Detect < Risk Criteria
Toluene	1/9	0.0218	0.0218	1,564	No	Max Detect < Risk Criteria
Semivolatile Organic Compounds (mg/kg)						
Acenaphthene	1/9	0.0425	0.0425	469.3	No	Max Detect < Risk Criteria
Anthracene	1/9	0.492	0.492	2,346	No	Max Detect < Risk Criteria
Benzo(*a*)anthracene	1/9	3.94	3.94	0.875	Yes	Max Detect > Risk Criteria
Benzo(*a*)pyrene	1/9	2.43	2.43	0.0875	Yes	Max Detect > Risk Criteria
Benzo(*b*)fluoranthene	2/9	0.0345	2.88	0.875	Yes	Max Detect > Risk Criteria
Benzo(*g,h,i*)perylene	2/9	0.0294	0.885	234.6	No	Max Detect < Risk Criteria
Benzo(*k*)fluoranthene	2/9	0.0203	2.1	8.75	No	Max Detect < Risk Criteria
Bis(2-ethylhexyl)phthalate	1/9	0.793	0.793	45.62	No	Max Detect < Risk Criteria
Butyl benzyl phthalate	1/9	0.265	0.265	1,564	No	Max Detect < Risk Criteria
Chrysene	1/9	3.6	3.6	87.5	No	Max Detect < Risk Criteria
Di-*N*-octyl phthalate	1/9	0.374	0.374	156.4	No	Max Detect < Risk Criteria
Dibenzo(*a,h*)anthracene	2/9	0.0268	0.543	0.0875	Yes	Max Detect > Risk Criteria
Fluoranthene	1/9	10.5	10.5	312.9	No	Max Detect < Risk Criteria
Fluorene	1/9	0.0375	0.0375	312.9	No	Max Detect < Risk Criteria
Indeno(*1,2,3-cd*)pyrene	1/9	0.976	0.976	0.875	Yes	Max Detect > Risk Criteria
Phenanthrene	1/9	1.18	1.18	234.6	No	Max Detect < Risk Criteria
Pyrene	1/9	8.22	8.22	234.6	No	Max Detect < Risk Criteria
Metals (mg/kg)						
Arsenic	9/9	0.38	4.4	0.4258	Yes	Max Detect > Risk Criteria
Barium	9/9	6	21.5	547.5	No	Max Detect < Risk Criteria
Cadmium	3/9	0.09	1.3	7.821	No	Max Detect < Risk Criteria
Chromium	9/9	2	19.9	23.46	No	Max Detect < Risk Criteria
Lead	9/9	3	11.8	400	No	Max Detect < Risk Criteria
Selenium	2/9	0.35	1.4	39.11	No	Max Detect < Risk Criteria

Table 19. Human Health Risk Screening for Surface Soil, Subsurface Soil, and Groundwater, SWMU 27F, Northwest of Building 1340 (continued)

SUBSURFACE SOIL						
Analyte	**Results > Detection Limit**	**Minimum Detect**	**Maximum Detect**	**EPA Region III Residential**	**HHCOPC?**	**Justification**
Volatile Organic Compounds (mg/kg)						
2-Butanone	2/3	0.0036	0.0058	4,693	No	Max Detect < Risk Criteria
Acetone	3/16	0.0382	0.111	782.1	No	Max Detect < Risk Criteria
Benzene	3/17	0.0022	0.0081	22.03	No	Max Detect < Risk Criteria
Carbon disulfide	1/17	0.01	0.01	782.1	No	Max Detect < Risk Criteria
Ethylbenzene	7/17	0.0096	1.68	782.1	No	Max Detect < Risk Criteria
Xylenes, total	7/17	0.0121	5.04	15,640	No	Max Detect < Risk Criteria
Semivolatile Organic Compounds (mg/kg)						
2-Methylnaphthalene	3/13	5.54	18.1	156.4	No	Max Detect < Risk Criteria
Acenaphthene	1/13	1.12	1.12	469.3	No	Max Detect < Risk Criteria
Anthracene	1/13	0.393	0.393	2,346	No	Max Detect < Risk Criteria
Benzo(*k*)fluoranthene	1/13	0.0541	0.0541	8.75	No	Max Detect < Risk Criteria
Bis(2-ethylhexyl)phthalate	1/13	25.6	25.6	45.62	No	Max Detect < Risk Criteria
Diphenylamine	1/9	2.81	2.81	195.5	No	Max Detect < Risk Criteria
Fluoranthene	1/13	0.3	0.3	312.9	No	Max Detect < Risk Criteria
Fluorene	1/13	2.18	2.18	312.9	No	Max Detect < Risk Criteria
Naphthalene	3/13	1.3	4.49	156.4	No	Max Detect < Risk Criteria
Phenanthrene	4/13	0.093	5.23	234.6	No	Max Detect < Risk Criteria
Pyrene	3/13	0.0279	1.04	234.6	No	Max Detect < Risk Criteria
Metals (mg/kg)						
Barium	9/9	4.7	28.9	547.5	No	Max Detect < Risk Criteria
Chromium	9/9	3.9	18.7	23.46	No	Max Detect < Risk Criteria
Lead	13/13	3.4	35.6	400	No	Max Detect < Risk Criteria
Mercury	7/9	0.01	0.05	2.346	No	Max Detect < Risk Criteria

Table 19. Human Health Risk Screening for Surface Soil, Subsurface Soil, and Groundwater, SWMU 27F, Northwest of Building 1340 (continued)

GROUNDWATER						
Analyte	**Freq. of Detection**	**Minimum Detect**	**Maximum Detect**	**Human Health Criteria**	**HHCOPC?**	**Justification**
Volatile Organic Compounds (µg/L)						
2-Butanone	1/15	10.6	10.6	190.6	No	Max Detect < Risk Criteria
4-Methyl-2-pentanone	1/15	6.8	6.8	13.9	No	Max Detect < Risk Criteria
Benzene	4/15	2.4	61	0.319	Yes	Max Detect > Risk Criteria
Ethylbenzene	2/15	4.3	7	134	No	Max Detect < Risk Criteria
Xylenes, total	5/15	3.2	38.5	1217	No	Max Detect < Risk Criteria
Semivolatile Organic Compounds (µg/L)						
2-Methylnaphthalene	4/15	2.3	31.9	12.17	Yes	Max Detect > Risk Criteria
4-Methylphenol	1/15	21.3	21.3	18.25	Yes	Max Detect > Risk Criteria
Carbazole	1/15	5.7	5.7	3.349	Yes	Max Detect > Risk Criteria
Fluorene	1/15	2.1	2.1	24.33	No	Max Detect <Risk Criteria
Naphthalene	4/15	3.6	37.2	0.6511	Yes	Max Detect > Risk Criteria
Metals (µg/L)						
Chromium	3/9	1.4	7	10.95	No	Max Detect < Risk Criteria

Table 20. Ecological Screening Value Comparison for Analytes Detected in Groundwater, SWMU 27F, Northwest of Building 1340

Analyte	SWMU 27F, Northwest of Building 1340 Maximum	ESV	ECOPC Aquatic Biota?	Justification
Volatile Organic Compounds (µg/L)				
2-Butanone	10.6	14,000[a]	No	Max Detect < ESV
4-Methyl-2-pentanone	6.8	170[a]	No	Max Detect < ESV
Benzene	61	53	Yes	Max Detect > ESV
Ethylbenzene	7	453	No	Max Detect < ESV
Xylenes, total	38.5	1.8[a]	Yes	Max Detect > ESV
Semivolatile Organic Compounds (µg/L)				
2-Methylnaphthalene	31.9	No ESV	Yes	ECOPC by Default
4-Methylphenol	21.3	No ESV	Yes	ECOPC by Default
Carbazole	5.7	No ESV	Yes	ECOPC by Default
Fluorene	2.1	3.9[a]	No	Max Detect < ESV
Naphthalene	37.2	62	No	Max Detect < ESV
Metals (µg/L)				
Chromium	7	11[b]	No	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.
[b]Assumes Cr(VI).
ESV = EPA Region IV ESVs (EPA 1996a) 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 21. Site-related Contaminants Potentially Impacting Ecological Receptors, SWMU 27F, Northwest of Building 1340

Analyte	Results > Detection Limit[a]	Minimum Detect	Maximum Detect
Volatile Organic Compounds (mg/kg)			
2-Butanone	3/3	0.0049	0.0101
4-Methyl-2-pentanone	1/3	0.0021	0.0021
Acetone	3/3	0.0546	0.115
Carbon disulfide	1/3	0.0478	0.0478
Toluene	1/3	0.0218	0.0218
Semivolatile Organic Compounds (mg/kg)			
Acenaphthene	1/3	0.0425	0.0425
Anthracene	1/3	0.492	0.492
Benzo(*a*)anthracene	1/3	3.94	3.94
Benzo(*a*)pyrene	1/3	2.43	2.43
Benzo(*b*)fluoranthene	2/3	0.0345	2.88
Benzo(*g,h,i*)perylene	2/3	0.0294	0.885
Benzo(*k*)fluoranthene	2/3	0.0203	2.1
Bis(2-ethylhexyl)phthalate	1/3	0.793	0.793
Butyl benzyl phthalate	1/3	0.265	0.265
Chrysene	1/3	3.6	3.6
Di-*N*-octyl phthalate	1/3	0.374	0.374
Dibenzo(*a,h*)anthracene	2/3	0.0268	0.543
Fluoranthene	1/3	10.5	10.5
Fluorene	1/3	0.0375	0.0375
Indeno(*1,2,3-cd*)pyrene	1/3	0.976	0.976
Phenanthrene	1/3	1.18	1.18
Pyrene	1/3	8.22	8.22
Metals (mg/kg)			
Cadmium	2/3	0.13	1.3
Chromium	3/3	2.7	10.2
Lead	3/3	3	10.9

[a]Surface soil SRCs potentially impacting (not under concrete) ecological receptors included surface soil locations MW4, MW10, and MW11 (see Table 7 and Figure 4).

Table 22. Derivation of NOAELs for Mammal Test Species, SWMU 27F, Northwest of Building 1340

ECOPC	Test Species	Test Species Body Weight (kg) BW_t	Benchmark (mg/kg/day)	Test Duration	Endpoint	Effect	Source	Duration Conversion Factor (DCF)	Endpoint Conversion Factor (ECF)	NOAEL (mg/kg/day) Benchmark × DCF × ECF
INORGANICS										
Cadmium	Rat	3.03E-01	1.00E-00	Chronic	NOAEL	Reproduction	Sutou et al. (1980b) in [1]	1.0	1.0	1.00E-00
Chromium	Rat	3.50E-01	2.74E+03	Chronic	NOAEL	Reproduction	Ivankovic and Preussmann (1975) in [1]	1.0	1.0	2.74E+03
Lead[a]	Rat	3.50E-01	8.00E-00	Chronic	NOAEL	Reproduction	Azar et al. (1973) in [1]	1.0	1.0	8.00E-00
ORGANICS										
Volatile Organic Compounds										
Acetone	Rat	3.50E-01	1.00E+02	Subchronic	NOAEL	Reproduction	EPA (1986c) in [1]	0.1	1.0	1.00E+01
Benzene	Mouse	3.00E-02	2.64E+02	Chronic	LOAEL	Reproduction	Nawrot and Staples (1979) in [1]	1.0	0.1	2.64E+01
2-Butanone	Rat	3.50E-01	1.77E+03	Chronic	NOAEL	Reproduction	Cox et al. (1975) in [1]	1.0	1.0	1.77E+03
Carbon disulfide	Rat	3.50E-01	1.10E+01	Chronic	NOAEL	Fetal toxicity	Hardin et al. (1981) in [2]	1.0	1.0	1.10E+01
4-Methyl-2-pentanone	Rat	3.50E-01	2.50E+02	Subchronic	NOAEL	Liver/kidney	Microbiological Associates (1986) in [1]	0.1	1.0	2.50E+01
Toluene	Mouse	3.00E-02	2.60E+02	Chronic	LOAEL	Reproduction	Nawrot and Staples (1979) in [1]	1.0	0.1	2.60E+01
Xylenes, total	Mouse	3.00E-02	2.06E-00	Chronic	NOAEL	Reproduction	Marks et al. (1982) in [1]	1.0	1.0	2.06E-00
Semivolatile Organic Compounds										
Acenaphthene	Mouse	3.00E-02	1.75E+02	Chronic	NOAEL	None	ATSDR (1997) in [3]	1.0	1.0	1.75E+02
Anthracene	Mouse	3.00E-02	1.00E+03	Chronic	LOAEL	None	ATSDR (1997) in [3]	1.0	0.1	1.00E+02
Benzo(*a*)anthracene	Mouse	3.00E-02	1.33E+01	Chronic	NOAEL	None	Neal and Rigdon (1967) in [3]	1.0	1.0	1.33E+01
Benzo(*a*)pyrene	Mouse	3.00E-02	1.00E+01	Chronic	LOAEL	Reproduction	Mackenzie and Angevine (1981) in [1]	1.0	0.1	1.00E-00
Benzo(*b*)fluoranthene	Mouse	3.00E-02	1.33E+01	Chronic	NOAEL	None	Neal and Rigdon (1967) in [3]	1.0	1.0	1.33E+01
Benzo(*g,h,i*)perylene	Mouse	3.00E-02	1.33E+01	Chronic	NOAEL	None	Neal and Rigdon (1967) in [3]	1.0	1.0	1.33E+01
Benzo(*k*)fluoranthene	Mouse	3.00E-02	1.00E+01	Chronic	LOAEL	Reproduction	Opresko (1995) in [3]	1.0	0.1	1.00E-00
Bis(2-ethylhexyl)phthalate	Mouse	3.00E-02	1.83E+01	Chronic	NOAEL	Reproduction	Lamb et al. (1987) in [1]	1.0	1.0	1.83E+01
Butyl benzyl phthalate	None	None	None	None	None	None	None	None	None	No NOAEL
Carbazole	Mouse	3.00E-02	1.50E+05	Chronic	LOAEL	Liver neoplasia	IARC (1983) in [4]	1.0	0.1	1.50E+04
Chrysene	Mouse	3.00E-02	1.33E+01	Chronic	NOAEL	None	Neal and Rigdon (1967) in [3]	1.0	1.0	1.33E+01
Dibenzo(*a,h*)anthracene	Mouse	3.00E-02	1.33E+01	Chronic	NOAEL	None	Neal and Rigdon (1967) in [3]	1.0	1.0	1.33E+01
Di-*N*-octyl phthalate	None	None	None	None	None	None	None	None	None	No NOAEL
Fluoranthene	Mouse	3.00E-02	5.00E+02	Chronic	LOAEL	None	ATSDR (1997) in [3]	1.0	0.1	5.00E+01
Fluorene	Mouse	3.00E-02	1.25E+02	None	None	None	EPA (1989) in [3]	0.1	0.1	1.25E+00
Indeno(*1,2,3-cd*)pyrene	Mouse	3.00E-02	1.33E+01	Chronic	NOAEL	None	Neal and Rigdon (1967) in [3]	1.0	1.0	1.33E+01

Note: Footnotes appear on page 61.

Table 22. Derivation of NOAELs for Mammal Test Species, SWMU 27F, Northwest of Building 1340 (continued)

ECOPC	Test Species	Test Species Body Weight (kg) BW_t	Benchmark (mg/kg/day)	Test Duration	Endpoint	Effect	Source	Duration Conversion Factor (DCF)	Endpoint Conversion Factor (ECF)	NOAEL (mg/kg/day) Benchmark × DCF × ECF
2-Methylnaphthalene	Rat	3.50E-01	5.00E+01	Chronic	LOAEL	None	ATSDR (1997) in [3]	1.0	0.1	5.00E-00
4-Methylphenol	Rat	3.50E-01	2.10E+04	Subchronic	LOAEL	Organ histology	NTIS PB92-174242	0.1	0.1	2.10E+02
Phenanthrene	Mouse	3.00E-02	1.00E+01	Chronic	LOAEL	Reproduction	Opresko (1995) in [3]	1.0	0.1	1.00E-00
Pyrene	Mouse	3.00E-02	1.00E+01	Chronic	LOAEL	Reproduction	Opresko (1995) in [3]	1.0	0.1	1.00E-00

[a] = Lead acetate.
ATSDR = Agency for Toxic Substances and Disease Registry.
DCF = 1 if chronic, 0.1 if subchronic (Sample, Opresko, and Suter 1996).
ECF = 1 if NOAEL, 0.1 if LOAEL (Sample, Opresko, and Suter 1996).
IRIS = Integrated Risk Information System.
[1] = Sample, Opresko, and Suter (1996).
[2] = IRIS (EPA 1997a).
[3] = QST (1997); all values assumed to be chronic.
[4] = National Library of Medicine (2001).

Table 23. Derivation of NOAELs for Bird Test Species, SWMU 27F, Northwest of Building 1340

ECOPC	Test Species	Test Species Body Weight (kg) BW_t	Benchmark (mg/kg/day)	Test Duration	Endpoint	Effect	Source	Duration Conversion Factor (DCF)	Endpoint Conversion Factor (ECF)	NOAEL (mg/kg/day) Benchmark × DCF × ECF
INORGANICS										
Cadmium	Mallard duck	1.15E+00	1.45E+00	Chronic	NOAEL	Reproduction	White and Finley (1978) in [1]	1.0	1.0	1.45E+00
Chromium	Black duck	1.25E+00	1.00E+00	Chronic	NOAEL	Reproduction	Haseltine et al. (unpubl.) in [1]	1.0	1.0	1.00E+00
Lead[a]	Quail	1.50E-01	1.13E+00	Chronic	NOAEL	Reproduction	Edens et al. (1976) in [1]	1.0	1.0	1.13E+00
ORGANICS										
Volatile Organic Compounds										
Acetone	None	None	None	None	None	None	None	None	None	No NOAEL
Benzene	None	None	None	None	None	None	None	None	None	No NOAEL
2-Butanone	None	None	None	None	None	None	None	None	None	No NOAEL
Carbon disulfide	None	None	None	None	None	None	None	None	None	No NOAEL
4-Methyl-2-pentanone	None	None	None	None	None	None	None	None	None	No NOAEL
Toluene	None	None	None	None	None	None	None	None	None	No NOAEL
Xylenes, total	None	None	None	None	None	None	None	None	None	No NOAEL
Semivolatile Organic Compounds										
Acenaphthene	Composite bird	8.50E-01	8.78E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	8.78E+01
Anthracene	Composite bird	8.50E-01	3.30E+02	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	3.30E+02
Benzo(*a*)anthracene	Composite bird	8.50E-01	1.24E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	1.24E+01
Benzo(*a*)pyrene	Composite bird	8.50E-01	9.97E+00	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	9.97E+00
Benzo(*b*)fluoranthene	Composite bird	8.50E-01	1.24E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	1.24E+01
Benzo(*g,h,i*)perylene	Composite bird	8.50E-01	1.24E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	1.24E+01
Benzo(*k*)fluoranthene	Composite bird	8.50E-01	9.97E+00	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	9.97E+00
Bis(2-ethylhexyl)phthalate	Ringed dove	1.55E-01	1.10E+00	Chronic	NOAEL	Reproduction	Peakall (1974) in [1]	1.0	1.0	1.10E+00
Butyl benzyl phthalate	None	None	None	None	None	None	None	None	None	No NOAEL
Carbazole	None	None	None	None	None	None	None	None	None	No NOAEL
Chrysene	Composite bird	8.50E-01	1.24E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	1.24E+01
Dibenzo(*a,h*)anthracene	Composite bird	8.50E-01	1.24E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	1.24E+01
Di-*N*-octyl phthalate	None	None	None	None	None	None	None	None	None	No NOAEL
Fluoranthene	Composite bird	8.50E-01	1.95E+02	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	1.95E+02
Fluorene	Composite bird	8.50E-01	6.80E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	6.80E+01
Indeno(*1,2,3-cd*)pyrene	Composite bird	8.50E-01	1.24E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	1.24E+01

Note: Footnotes appear on page 63.

Table 23. Derivation of NOAELs for Bird Test Species, SWMU 27F, Northwest of Building 1340 (continued)

ECOPC	Test Species	Test Species Body Weight (kg) BW_t	Benchmark (mg/kg/day)	Test Duration	Endpoint	Effect	Source	Duration Conversion Factor (DCF)	Endpoint Conversion Factor (ECF)	NOAEL (mg/kg/day) Benchmark × DCF × ECF
2-Methylnaphthalene	Composite bird	8.50E-01	3.39E+01	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	3.39E+01
4-Methylphenol	None	None	None	None	None	None	None	None	None	No NOAEL
Phenanthrene	Composite bird	8.50E-01	9.97E+00	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	9.97E+00
Pyrene	Composite bird	8.50E-01	9.97E+00	Chronic	NOAEL	None	Shortelle et al. (1997) in [2]	1.0	1.0	9.97E+00

[a] = Lead acetate.
DCF = 1 if chronic, 0.1 if subchronic (Sample, Opresko, and Suter 1996).
ECF = 1 if NOAEL, 0.1 if LOAEL (Sample, Opresko, and Suter 1996).
[1] = Sample, Opresko, and Suter 1996.
[2] = QST (1997).

Table 24. Derivation of NOAELs and Screening Toxicity Reference Values for Mammal Receptors, SWMU 27F, Northwest of Building 1340

Analyte	Test Species	Test Species Body Weight (kg) BW_t	Test Species $NOAEL_t$ (mg/kg/day)	Raccoon		Short-tailed Shrew		Mink	
				Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^{0.25}$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^{0.25}$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^{0.25}$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$
INORGANICS									
Cadmium	Rat	3.03E-01	1.00E+00	4.74E-01	4.74E-01	2.12E+00	2.12E+00	7.42E-01	7.42E-01
Chromium	Rat	3.50E-01	2.74E+03	4.92E-01	1.35E+03	2.20E+00	6.02E+03	7.69E-01	2.11E+03
Lead	Rat	3.50E-01	8.00E+00	4.92E-01	3.93E+00	2.20E+00	1.76E+01	7.69E-01	6.15E+00
ORGANICS									
Volatile Organic Compounds									
Acetone	Rat	3.50E-01	1.00E+01	4.92E-01	4.92E+00	2.20E+00	2.20E+01	7.69E-01	7.69E+00
Benzene	Mouse	3.00E-02	2.64E+01	2.66E-01	7.02E+00	1.19E+00	3.13E+01	4.16E-01	1.10E+01
2-Butanone	Rat	3.50E-01	1.77E+03	4.92E-01	8.71E+02	2.20E+00	3.89E+03	7.69E-01	1.36E+03
Carbon disulfide	Rat	3.50E-01	1.10E+01	4.92E-01	5.41E+00	2.20E+00	2.42E+01	7.69E-01	8.46E+00
4-Methyl-2-pentanone	Rat	3.50E-01	2.50E+01	4.92E-01	1.23E+01	2.20E+00	5.49E+01	7.69E-01	1.92E+01
Toluene	Mouse	3.00E-02	2.60E+01	2.66E-01	6.91E+00	1.19E+00	3.09E+01	4.16E-01	1.08E+01
Xylenes, total	Mouse	3.00E-02	2.06E+00	2.66E-01	5.48E-01	1.19E+00	2.45E+00	4.16E-01	8.57E-01
Semivolatile Organic Compounds									
Acenaphthene	Mouse	3.00E-02	1.75E+02	2.66E-01	4.66E+01	1.19E+00	2.08E+02	4.16E-01	7.28E+01
Anthracene	Mouse	3.00E-02	1.00E+02	2.66E-01	2.66E+01	1.19E+00	1.19E+02	4.16E-01	4.16E+01
Benzo(*a*)anthracene	Mouse	3.00E-02	1.33E+01	2.66E-01	3.54E+00	1.19E+00	1.58E+01	4.16E-01	5.54E+00
Benzo(*a*)pyrene	Mouse	3.00E-02	1.00E+00	2.66E-01	2.66E-01	1.19E+00	1.19E+00	4.16E-01	4.16E-01
Benzo(*b*)fluoranthene	Mouse	3.00E-02	1.33E+01	2.66E-01	3.54E+00	1.19E+00	1.58E+01	4.16E-01	5.54E+00
Benzo(*g,h,i*)perylene	Mouse	3.00E-02	1.33E+01	2.66E-01	3.54E+00	1.19E+00	1.58E+01	4.16E-01	5.54E+00
Benzo(*k*)fluoranthene	Mouse	3.00E-02	1.00E+00	2.66E-01	2.66E-01	1.19E+00	1.19E+00	4.16E-01	4.16E-01
Bis(2-ethylhexyl)phthalate	Mouse	3.00E-02	1.83E+01	2.66E-01	4.87E+00	1.19E+00	2.18E+01	4.16E-01	7.61E+00
Butyl benzyl phthalate	None	None	No NOAEL	None	No NOAEL	None	No NOAEL	None	No NOAEL
Carbazole	Mouse	3.00E-02	1.50E+04	2.66E-01	4.74E+03	1.19E+00	1.79E+04	4.16E-01	6.24E+03
Chrysene	Mouse	3.00E-02	1.33E+01	2.66E-01	3.54E+00	1.19E+00	1.58E+01	4.16E-01	5.54E+00
Dibenzo(*a,h*)anthracene	Mouse	3.00E-02	1.33E+01	2.66E-01	3.54+00	1.19E+00	1.58E+01	4.16E-01	5.54E+00
Di-*N*-octyl phthalate	None	None	No NOAEL	None	No NOAEL	None	No NOAEL	None	No NOAEL
Fluoranthene	Mouse	3.00E-02	5.00E+01	2.66E-01	1.33E+01	1.19E+00	5.95E+01	4.16E-01	2.08E+01
Fluorene	Mouse	3.00E-02	1.25E+00	2.66E-01	3.33E-01	1.19E+00	1.49E+00	4.16E-01	5.20E-01

Note: Footnotes appear on page 65.

Table 24. Derivation of NOAELs and Screening Toxicity Reference Values for Mammal Receptors, SWMU 27F, Northwest of Building 1340 (continued)

Analyte	Test Species	Test Species Body Weight (kg) BW_t	Test Species $NOAEL_t$ (mg/kg/day)	Raccoon		Short-tailed Shrew		Mink	
				Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^{0.25}$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^{0.25}$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^{0.25}$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$
Indeno(*1,2,3-cd*)pyrene	Mouse	3.00E-02	1.33E+01	2.66E-01	3.54E+00	1.19E+00	1.58E+01	4.16E-01	5.54E+00
2-Methylnaphthalene	Rat	3.50E-01	5.00E+00	4.92E-01	2.46E+00	2.20E+00	1.10E+01	7.69E-01	3.85E+00
4-Methylphenol	Rat	3.50E-01	2.10E+02	5.31E-01	1.12E+02	2.20E+00	4.62E+02	7.69E-01	1.62E+02
Phenanthrene	Mouse	3.00E-02	1.00E+00	2.66E-01	2.66E-01	1.19E+00	1.19E+00	4.16E-01	4.16E-01
Pyrene	Mouse	3.00E-02	1.00E+00	2.66E-01	2.66E-01	1.19E+00	1.19E+00	4.16E-01	4.16E-01

BW (kg) Raccoon = 5.98.
BW (kg) Shrew = 0.015.
BW (kg) Mink = 1.0.

Table 25. Derivation of NOAELs and Screening Toxicity Reference Values for Bird Receptors, SWMU 27F, Northwest of Building 1340

Analyte	Test Species	Test Species Body Weight (kg) BW_t	Test Species $NOAEL_t$ (mg/kg/day)	American Robin		Green Heron	
				Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^0$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^0$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$
INORGANICS							
Cadmium	Mallard duck	1.15E+00	1.45E+00	1.00E+00	1.45E+00	1.00E+00	1.45E+00
Chromium	Black duck	1.25E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Lead	Quail	1.50E-01	1.13E+00	1.00E+00	1.13E+00	1.00E+00	1.13E+00
ORGANICS							
Volatile Organic Compounds							
Acetone	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Benzene	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
2-Butanone	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Carbon disulfide	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
4-Methyl-2-pentanone	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Toluene	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Xylenes, total	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Semivolatile Organic Compounds							
Acenaphthene	Composite bird	8.50E-01	8.78E+01	1.00E+00	8.78E+01	1.00E+00	8.78E+01
Anthracene	Composite bird	8.50E-01	3.30E+02	1.00E+00	3.30E+02	1.00E+00	3.30E+02
Benzo(*a*)anthracene	Composite bird	8.50E-01	1.24E+01	1.00E+00	1.24E+01	1.00E+00	1.24E+01
Benzo(*a*)pyrene	Composite bird	8.50E-01	9.97E+00	1.00E+00	9.97E+00	1.00E+00	9.97E+00
Benzo(*b*)fluoranthene	Composite bird	8.50E-01	1.24E+01	1.00E+00	1.24E+01	1.00E+00	1.24E+01
Benzo(*g,h,i*)perylene	Composite bird	8.50E-01	1.24E+01	1.00E+00	1.24E+01	1.00E+00	1.24E+01
Benzo(*k*)fluoranthene	Composite bird	8.50E-01	9.97E+00	1.00E+00	9.97E+00	1.00E+00	9.97E+00
Bis(2-ethylhexyl)phthalate	Ringed dove	1.55E-01	1.10E+00	1.00E+00	1.10E+00	1.00E+00	1.10E+00
Butyl benzyl phthalate	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Carbazole	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Chrysene	Composite bird	8.50E-01	1.24E+01	1.00E+00	1.24E+01	1.00E+00	1.24E+01
Dibenzo(*a,h*)anthracene	Composite bird	8.50E-01	1.24E+01	1.00E+00	1.24E+01	1.00E+00	1.24E+01
Di-*N*-octyl phthalate	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Fluoranthene	Composite bird	8.50E-01	1.95E+02	1.00E+00	1.95E+02	1.00E+00	1.95E+02
Fluorene	Composite bird	8.50E-01	6.80E+01	1.00E+00	6.80E+01	1.00E+00	6.80E+01

Note: Footnotes appear on page 67.

Table 25. Derivation of NOAELs and Screening Toxicity Reference Values for Bird Receptors, SWMU 27F, Northwest of Building 1340 (continued)

Analyte	Test Species	Test Species Body Weight (kg) BW_t	Test Species $NOAEL_t$ (mg/kg/day)	American Robin		Green Heron	
				Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^0$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^0$	NOAEL (mg/kg/day) $NOAEL_t \times BW_{conv}$
Indeno(*1,2,3-cd*)pyrene	Composite bird	8.50E-01	1.24E+01	1.00E+00	1.24E+01	1.00E+00	1.24E+01
2-Methylnaphthalene	Composite bird	8.50E-01	3.39E+01	1.00E+00	3.39E+01	1.00E+00	3.39E+01
4-Methylphenol	None	None	No NOAEL	None	No NOAEL	None	No NOAEL
Phenanthrene	Composite bird	8.50E-01	9.97E+00	1.00E+00	9.97E+00	1.00E+00	9.97E+00
Pyrene	Composite bird	8.50E-01	9.97E+00	1.00E+00	9.97E+00	1.00E+00	9.97E+00

BW (kg) Robin = 0.08.
BW (kg) Green heron = 0.25.

Table 26. Derivation of LOAEL Toxicity Reference Values for Mammal Test Species, SWMU 27F, Northwest of Building 1340

ECOPC	Test Species	Test Species Body Weight (kg) BW_t	Benchmark (mg/kg/day)	Test Duration	Endpoint	Effect	Source	Duration Conversion Factor (DCF)	Endpoint Conversion Factor (ECF)	TRV (mg/kg/day) Benchmark × DCF × ECF
INORGANICS										
Cadmium	Rat	3.03E-01	1.00E+01	Chronic	LOAEL	Reproduction	Sutou et al. (1980b) in [1]	1.0	1.0	1.00E+01
Chromium	Rat	3.50E-01	2.74E+03	Chronic	NOAEL	Reproduction	Ivankovic and Preussmann (1975) in [1]	1.0	10.0	2.74E+04
Lead	Rat	3.50E-01	8.00E+01	Chronic	LOAEL	Reproduction	Azar et al. (1973) in [1]	1.0	1.0	8.00E+01
ORGANICS										
Semivolatile Organic Compounds										
Bis(2-ethylhexyl)phthalate	Mouse	3.00E-02	1.83E+02	Chronic	LOAEL	Reproduction	Lamb et al. (1987) in [1]	1.0	1.0	1.83E+02
Butyl benzyl phthalate	Mouse	3.00E-02	1.83E+02	Chronic	LOAEL	Reproduction	Surrogate from bis(2-ethylhexyl) phthalate	1.0	1.0	1.83E+02
Di-*N*-butyl phthalate	Mouse	3.00E-02	1.83E+03	Chronic	LOAEL	Reproduction	Lamb et al. (1987) in [1]	1.0	1.0	1.83E+03
Di-*N*-octyl phthalate	Mouse	3.00E-02	1.83E+03	Chronic	LOAEL	Reproduction	Surrogate from di-*N*-butyl phthalate	1.0	1.0	1.83E+03

DCF = 1 if chronic, 0.1 if subchronic (Sample, Opresko, and Suter 1996).
ECF = 10 if NOAEL, 1.0 if LOAEL (Sample, Opresko, and Suter 1996).
[1] = Sample, Opresko, and Suter (1996).

Table 27. Derivation of LOAEL Toxicity Reference Values for Bird Test Species, SWMU 27F, Northwest of Building 1340

ECOPC	Test Species	Test Species Body Weight (kg) BW_t	Benchmark (mg/kg/day)	Test Duration	Endpoint	Effect	Source	Duration Conversion Factor (DCF)	Endpoint Conversion Factor (ECF)	TRV (mg/kg/day) Benchmark × DCF × ECF
INORGANICS										
Cadmium	Mallard duck	1.15E-00	2.00E+01	Chronic	LOAEL	Reproduction	White and Finley (1978) in [1]	1.0	1.0	2.00E+01
Chromium	Black duck	1.25E-00	5.00E-00	Chronic	LOAEL	Reproduction	Haseltine et al. (unpubl.) in [1]	1.0	1.0	5.00E-00
Lead	Quail	1.50E-01	1.13E+01	Chronic	LOAEL	Reproduction	Edens et al. (1976) in [1]	1.0	1.0	1.13E+01
ORGANICS										
Semivolatile Organic Compounds										
Bis(2-ethylhexyl)phthalate	Ringed dove	1.55E-01	1.10E+00	Chronic	NOAEL	Reproduction	Peakall (1974) in [1]	1.0	10.0	1.10E+01
Butyl benzyl phthalate	Ringed dove	1.55E-01	1.11E+00	Chronic	LOAEL	Reproduction	Surrogate from di-*N*-butyl phthalate	1.0	1.0	1.11E+00
Di-*N*-butyl phthalate	Ringed dove	1.55E-01	1.11E+00	Chronic	LOAEL	Reproduction	Peakall (1974) in [1]	1.0	1.0	1.11E+00
Di-*N*-octyl phthalate	Ringed dove	1.55E-01	1.11E+00	Chronic	LOAEL	Reproduction	Surrogate from di-*N*-butyl phthalate	1.0	1.0	1.11E+00

DCF = Duration conversion factor; 1 if chronic, 0.1 if subchronic (Sample, Opresko, and Suter 1996).
ECF = Endpoint conversion factor; 10 if NOAEL, 1.0 if LOAEL (Sample, Opresko, and Suter 1996).
[1] = Sample, Opresko, and Suter (1996).

Table 28. Derivation of LOAEL Toxicity Reference Values for Mammal Receptors, SWMU 27F, Northwest of Building 1340

ECOPC	Test Species	Test Species Body Weight BW_t (kg)	TRV_t (mg/kg/day)	Raccoon		Short-tailed Shrew		Mink	
				Body-weight Conversion Factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kg/day) $TRV_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kg/day) $TRV_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kg/day) $TRV_t \times BW_{conv}$
INORGANICS									
Cadmium	Rat	3.03E-01	1.00E+01	5.64E-01	5.64E-00	2.12E-00	2.12E+01	7.42E-01	7.42E-00
Chromium	Rat	3.50E-01	2.74E+04	5.84E-01	1.60E+04	2.20E-00	6.02E+04	7.69E-01	2.11E+04
Lead	Rat	3.50E-01	8.00E+01	5.84E-01	4.68E+01	2.20E-00	1.76E+02	7.69E-01	6.15E+01
ORGANICS									
Semivolatile Organic Compounds									
Bis(2-ethylhexyl)phthalate	Mouse	3.00E-02	1.83E+02	3.16E-01	5.79E+01	1.19E+00	2.18E+02	4.16E-01	7.62+01
Butyl benzyl phthalate	Mouse	3.00E-02	1.83E+02	3.16E-01	5.79E+01	1.19E+00	2.18E+02	4.16E-01	7.62+01
Di-*N*-butyl phthalate	Mouse	3.00E-02	1.83E+03	3.16E-01	5.80E+02	1.19E+00	2.18E+03	4.16E-01	7.63+02
Di-*N*-octyl phthalate	Mouse	3.00E-02	1.83E+03	3.16E-01	5.80E+02	1.19E+00	2.18E+03	4.16E-01	7.63+02

BW(kg) Raccoon = 3 per Rod Stafford (GEPD), September 1999.
BW(kg) Short-tailed shrew = 0.015 (Sample, Opresko, and Suter 1996, Table B.1).
BW(kg) Mink = 1 (Sample, Opresko, and Suter 1996, Table B.1).

Table 29. Derivation of LOAEL Toxicity Reference Values for Bird Receptors, SWMU 27F, Northwest of Building 1340

ECOPC	Test Species	Test Species Body Weight BW_t (kg)	TRV_t (mg/kg/day)	American Robin		Green Heron	
				Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^0$	TRV (mg/kg/day) $TRV_t \times BW_{conv}$	Body-weight Conversion Factor BW_{conv} $(BW_t / BW)^0$	TRV (mg/kg/day) $TRV_t \times BW_{conv}$
INORGANICS							
Cadmium	Mallard duck	1.15E-00	2.00E+01	1.00E-00	2.00E+01	1.00E-00	2.00E+01
Chromium	Black duck	1.25E-00	5.00E-00	1.00E-00	5.00E-00	1.00E-00	5.00E-00
Lead	Quail	1.50E-01	1.13E+01	1.00E-00	1.13E+01	1.00E-00	1.13E+01
ORGANICS							
Semivolatile Organic Compounds							
Bis(2-ethylhexyl)phthalate	Ringed dove	1.55E-01	1.10E+01	1.00E+00	1.10E+01	1.00E+00	1.10E+01
Butyl benzyl phthalate	Ringed dove	1.55E-01	1.11E+00	1.00E+00	1.11E+00	1.00E+00	1.11E+00
Di-*N*-butyl phthalate	Ringed dove	1.55E-01	1.11E+00	1.00E+00	1.11E+00	1.00E+00	1.11E+00
Di-*N*-octyl phthalate	Ringed dove	1.55E-01	1.11E+00	1.00E+00	1.11E+00	1.00E+00	1.11E+00

BW (kg) American robin = 0.077 (Sample, Opresko, and Suter 1996, Table B.1).
BW (kg) Green heron = 0.241 (*Birds of North America*, No. 129, 1994).

Table 30. Preliminary Risk Calculation for ECOPCs in Surface Soil, SWMU 27F, Northwest of Building 1340

ECOPC	C_{Max} (mg/kg)	BAF_i[a]	Short-tailed Shrew			American Robin		
			ADD (mg/kg/day) = $C_{Max} \times BAF_i \times IR_S$	TRV (mg/kg/day)	HQ = ADD/TRV	ADD (mg/kg/day) = $C_{Max} \times BAF_i \times IR_R$	TRV (mg/kg/day)	HQ = ADD/TRV
Volatile Organic Compounds								
2-Butanone	0.0101	5.00E-02	2.83E-04	3.89E+03	7.27E-08	6.11E-04	No TRV	No HQ
4-Methyl-2-pentanone	0.0021	5.00E-02	5.88E-05	5.49E+01	1.07E-06	1.27E-04	No TRV	No HQ
Acetone	0.115	5.00E-02	3.22E-03	2.20E+01	1.47E-04	6.96E-03	No TRV	No HQ
Carbon disulfide	0.0478	1.00E+00[b]	2.68E-02	2.42E+01	1.11E-03	5.78E-02	No TRV	No HQ
Toluene	0.0218	5.00E-02	6.10E-04	3.09E+01	1.98E-05	1.32E-03	No TRV	No HQ
				HI =	**1.27E-03**		**HI =**	**0.00E+00**
Semivolatile Organic Compounds								
Acenaphthene	0.0425	5.00E-02	1.19E-03	2.08E+02	5.72E-06	2.57E-03	8.78E+01	2.93E-05
Anthracene	0.492	5.00E-02	1.38E-02	1.19E+02	1.16E-04	2.98E-02	3.30E+02	9.02E-05
Benzo(*a*)anthracene	3.94	5.00E-02	1.10E-01	1.58E+01	6.98E-03	2.38E-01	1.24E+01	1.92E-02
Benzo(*a*)pyrene	2.43	5.00E-02	6.80E-02	1.19E+00	5.72E-02	1.47E-01	9.97E+00	1.47E-02
Benzo(*b*)fluoranthene	2.88	5.00E-02	8.06E-02	1.58E+01	5.10E-03	1.74E-01	1.24E+01	1.41E-02
Benzo(*g,h,i*)perylene	0.885	5.00E-02	2.48E-02	1.58E+01	1.57E-03	5.35E-02	1.24E+01	4.32E-03
Benzo(*k*)fluoranthene	2.1	5.00E-02	5.88E-02	1.19E+00	4.94E-02	1.27E-01	9.97E+00	1.27E-02
Bis(2-ethylhexyl)phthalate	0.793	5.00E-02	2.22E-02	2.18E+01	1.02E-03	4.80E-02	1.10E+00	4.36E-02
Butyl benzyl phthalate	0.265	5.00E-02	7.42E-03	No TRV	No HQ	1.60E-02	No TRV	No HQ
Chrysene	3.6	5.00E-02	1.01E-01	1.58E+01	6.37E-03	2.18E-01	1.24E+01	1.76E-02
Di-*N*-octyl phthalate	0.374	5.00E-02	1.05E-02	No TRV	No HQ	2.26E-02	No TRV	No HQ
Dibenzo(*a,h*)anthracene	0.543	5.00E-02	1.52E-02	1.58E+01	9.61E-04	3.29E-02	1.24E+01	2.65E-03
Fluoranthene	10.5	5.00E-02	2.94E-01	5.95E+01	4.94E-03	6.35E-01	1.95E+02	3.26E-03
Fluorene	0.0375	5.00E-02	1.05E-03	1.49E+00	7.06E-04	2.27E-03	6.80E+01	3.34E-05
Indeno(*1,2,3-cd*)pyrene	0.976	5.00E-02	2.73E-02	1.58E+01	1.73E-03	5.90E-02	1.24E+01	4.76E-03
Phenanthrene	1.18	5.00E-02	3.30E-02	1.19E+00	2.78E-02	7.14E-02	9.97E+00	7.16E-03
Pyrene	8.22	5.00E-02	2.30E-01	1.19E+00	1.94E-01	4.97E-01	9.97E+00	4.99E-02
				HI =	**3.57E-01**		**HI =**	**1.94E-01**

Note: Footnotes appear on page 73.

Table 30. Preliminary Risk Calculation for ECOPCs in Surface Soil, SWMU 27F, Northwest of Building 1340 (continued)

ECOPC	C_{Max} (mg/kg)	BAF_i[a]	Short-tailed Shrew: ADD (mg/kg/day) = $C_{Max} \times BAF_i \times IR_S$	Short-tailed Shrew: TRV (mg/kg/day)	Short-tailed Shrew: HQ = ADD/TRV	American Robin: ADD (mg/kg/day) = $C_{Max} \times BAF_i \times IR_R$	American Robin: TRV (mg/kg/day)	American Robin: HQ = ADD/TRV
Metals								
Cadmium	1.3	1.10E+01[c]	8.01E+00	2.12E+00	3.78E+00	1.73E+01	1.45E+00	1.19E+01
Chromium	10.2	1.60E-01[c]	9.14E-01	6.02E+03	1.52E-04	1.97E+00	1.00E+00	1.97E+00
Lead	10.9	4.00E-01[d]	2.44E+00	1.76E+01	1.39E-01	5.28E+00	1.13E+00	4.67E+00

[a]Beyer, W.N., 1990, "Evaluating Soil Contamination," *U.S. Fish Wildlife Service Biol. Rep.* **90**(2), unless otherwise noted.
[b]Default value assumed to be 1.
[c]Diercxsens, P., D. deWeck, N. Borsinger, B. Rosset, and J. Tarradellas 1985, "Earthworm Contamination by PCBs and Heavy Metals," *Chemosphere* **14**(5): 511–522.
[d]Corp, N., and A.J. Morgan 1991, "Accumulation of Heavy Metals from Polluted Soils by the Earthworm," *Environ. Pollution* **74**: 39–52.
ADD = Average daily dose (mg/kg/day).
BAF_i = Soil-to-invertebrate bioaccumulation factor (HAZWRAP 1994).
C_{Max} = Maximum detected surface soil concentration (mg/kg)
HQ = Hazard quotient; HI = hazard index = sum of HQs.
IR_R = Robin food ingestion rate (kg/kg/day) = 1.21.
IR_S = Shrew food ingestion rate (kg/kg/day) = 0.56.
TRV = Toxicity reference value = NOAEL (mg/kg/day); see Tables 24 and 25.
Cells with double borders indicate HQ > 1.

Table 31. Preliminary Risk Calculations for ECOPCs in Groundwater, SWMU 27F, Northwest of Building 1340

ECOPC	C_{Max} (µg/L)	BCF	Raccoon: ADD (mg/kg/day) = C_{Max} × 0.001 × IR_w	Raccoon: TRV (mg/kg/day)	Raccoon: HQ = ADD/TRV	Mink: ADD (mg/kg/day) = C_{Max} × 0.001 × BCF × IR_M	Mink: TRV (mg/kg/day)	Mink: HQ = ADD/TRV	Green Heron: ADD (mg/kg/day) = C_{Max} × 0.001 × BCF × IR_H	Green Heron: TRV (mg/kg/day)	Green Heron: HQ = ADD/TRV
Volatile Organic Compounds											
Benzene	61	3.20E+01[a]	4.88E-03	7.02E+00	6.96E-04	2.67E-01	1.10E+01	2.44E-02	3.75E-01	No TRV	No HQ
Xylene, total	38.5	1.70E+01[a]	3.08E-03	5.48E-01	5.62E-03	8.97E-02	8.57E-01	1.05E-01	1.26E-01	No TRV	No HQ
				HI =	**6.31E-03**		**HI =**	**1.29E-01**		**HI =**	**0.00E+00**
Semivolatile Organic Compounds											
2-Methylnaphthalene	31.9	4.30E+02[a,b]	2.55E-03	2.46E+00	1.04E-03	1.88E+00	3.85E+00	4.89E-01	2.63E+00	3.39E+01	7.77E-02
4-Methylphenol	21.3	1.30E+01[c]	1.70E-03	1.12E+02	1.52E-05	3.79E-02	1.62E+02	2.35E-04	5.32E-02	No TRV	No HQ
Carbazole	5.7	3.70E+02[c]	4.56E-04	4.74E+03	9.62E-08	2.89E-01	6.24E+03	4.63E-05	4.05E-01	No TRV	No HQ
				HI =	**1.05E-03**		**HI =**	**4.89E-01**		**HI =**	**7.95E-02**

[a]Barnthouse, L.W., J.E. Breck, T.D. Jones, G.W. Suter, and C. Easterly 1988, *Relative Toxicity Estimates and Bioaccumulation Factors for the Defense Priority Model*, ORNL-6416, Oak Ridge National Laboratory, Environmental Sciences Division, Oak Ridge, Tennessee.

[b]Value for naphthalene used as a surrogate.

[c]Calculated using log BCF = 0.79 × log K_{ow} (-0.40) from Vieth, G.D., D.D. Foe, and M. Knuth, 1985, "Structure-activity relationships for screening organic chemicals for potential ecotoxicity effects," *Drug Metab. Rev.* **15**(7): 1295. Log K_{ow}s are those reported in HAZWRAP 1994.

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

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

BCF = Water-to-fish bioconcentration factor (HAZWRAP 1994).

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

HQ = Hazard quotient.

IR_H = Heron food ingestion rate (kg/kg/day) = 0.192.

IR_M = Mink food ingestion rate (kg/kg/day) = 0.137.

IR_w = Raccoon water ingestion rate (kg/kg/day) = 0.08.

TRV = Toxicity reference value = NOAEL (mg/kg/day); see Tables 24 and 25.

Cells with double borders indicate HQ > 1.

Table 32. Supplemental Risk Calculations for ECOPCs in Surface Soil for Short-tailed Shrew, SWMU 27F, Northwest of Building 1340

ECOPC	Site Concentration Mean (mg/kg)	SP_v	Short-tailed Shrew: ADD_P (mg/kg/day) = Mean × SP_r × I_P × AUF	BAF_i	ADD_A (mg/kg/day) = Mean × BAF_i × I_A × AUF	ADD_S (mg/kg/day) = Mean × I_S × AUF	ADD_{total} (mg/kg/day) = ADD_P + ADD_A + ADD_S	LOAEL TRV (mg/kg/day)	HQ = ADD_{total}/TRV
Semivolatile Organic Compounds									
Butyl benzyl phthalate	2.12E-01	2.00E-02[a]	3.43E-06	5.00E-02[b]	5.74E-05	1.71E-04	2.32E-04	2.18E+02	1.07E-06
Di-*N*-octyl phthalate	2.48E-01	3.70E-05[a]	7.42E-09	5.00E-02[b]	6.71E-05	2.01E-04	2.68E-04	2.18E+03	1.23E-07
Metals									
Cadmium	4.83E-01	1.10E-01[c]	4.30E-05	1.10E+01[d]	2.88E-02	3.91E-04	2.92E-02	2.12E+01	1.38E-03

[a]Travis, C.C., and A.D. Arms 1988, "Bioconcentration of Organics in Beef, Milk, and Vegetation," *Environmental Science Technology* **22**(3): 271–274.
[b]Beyer, W.N., 1990, "Evaluating Soil Contamination," *U.S. Fish Wildlife Service Biol. Rep.* **90**(2).
[c]Soil-to-plant concentration factor (B_r) from Baes et al. (1984) multiplied by 0.2 to represent 80 percent water composition of plants. Baes, C.F., III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor 1984, *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
[d]Diercxsens, P., D. deWeck, N. Borsinger, B. Rosset, and J. Tarradellas 1985, "Earthworm Contamination by PCBs and Heavy Metals," *Chemosphere* **14**(5): 511–522.

ADD_A = Average daily dose; animal.
ADD_P = Average daily dose; plant.
ADD_S = Average daily dose; soil.
ADD_{total} = Average daily dose; total.
AF = Animal fraction.
AUF = 1.04E-02 derived from area (0.004 ha) divided by home range of shrew (0.39 ha).
BAF_i = Soil-to-animal bioaccumulation factor; invertebrates (HAZWRAP 1994).
HQ = Hazard quotient.
I = Average daily dose ingested: S = soil, P = plant, A = animal.
I_A = TUF × IR_f × AF.
I_A (kg/kg/day) = 5.52E-01.
I_P = TUF × IR_f × PF.
I_P (kg/kg/day) = 7.80E-02.
I_S = TUF × IR_f × SF.
I_S (kg/kg/day) = 7.80E-02.
IR_f = Food ingestion rate.
PF = Plant fraction.
SF = Soil fraction.
SP_v = Soil-to-plant bioaccumulation factor; vegetative parts.
TRV = Toxicity reference value = LOAEL (mg/kg/day); see Table 28.
TUF = Temporal use factor = 1.

Table 33. Supplemental Risk Calculations for ECOPCs in Surface Soil for American Robin, SWMU 27F, Northwest of Building 1340

ECOPC	Site Concentration Mean (mg/kg)	SP_r	American Robin						
			ADD_P (mg/kg/day) = Mean × SP_r × I_P × AUF	BAF_i	ADD_A (mg/kg/day) = Mean × BAF_i × I_A × AUF	ADD_S (mg/kg/day) = Mean × I_S × AUF	ADD_{total} (mg/kg/day) = ADD_P + ADD_A + ADD_S	LOAEL TRV (mg/kg/day)	HQ = ADD_{total}/TRV
Semivolatile Organic Compounds									
Butyl benzyl phthalate	2.12E-01	2.00E-02[a]	1.27E-05	5.00E-02[b]	3.18E-05	1.32E-04	1.77E-04	1.11E+00	1.59E-04
Di-*N*-octyl phthalate	2.48E-01	3.70E-05[a]	2.75E-08	5.00E-02[b]	3.72E-05	1.55E-04	1.92E-04	1.11E+00	1.73E-04
Metals									
Cadmium	4.83E-01	3.00E-02[c]	4.34E-05	1.10E+01[d]	1.59E-02	3.01E-04	1.63E-02	2.00E+01	8.14E-04
Chromium	6.27E+00	9.00E-04[c]	1.69E-05	1.60E-01[d]	3.01E-03	3.91E-03	6.93E-03	5.00E+00	1.39E-03
Lead	6.23E+00	1.80E-03[c]	3.36E-05	4.00E-01[e]	7.47E-03	3.88E-03	1.14E-02	1.13E+01	1.01E-03

[a]Travis, C.C., and A.D. Arms 1988, "Bioconcentration of Organics in Beef, Milk, and Vegetation," *Environmental Science Technology* **22**(3): 271–274.

[b]Beyer, W.N., 1990, "Evaluating Soil Contamination," *U.S. Fish Wildlife Service Biol. Rep.* **90**(2).

[c]Soil-to-plant concentration factor (B_r) from Baes et al. (1984) multiplied by 0.2 to represent 80 percent water composition of plants. Baes, C.F., III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor 1984, *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*, ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

[d]Diercxsens, P., D. deWeck, N. Borsinger, B. Rosset, and J. Tarradellas 1985, "Earthworm Contamination by PCBs and Heavy Metals," *Chemosphere* **14**(5): 511–522.

[e]Corp, N., and A.J. Morgan 1991, "Accumulation of heavy metals from polluted soils by the earthworm," *Environ. Pollution* 74:39–52.

ADD_A = Average daily dose; animal.
ADD_P = Average daily dose; plant.
ADD_S = Average daily dose; soil.
ADD_{total} = Average daily dose; total.
AF = Animal fraction.
AUF = 5.00E-03; derived from area of SWMU (0.004 ha) divided by home range of robin (0.81 ha).
BAF_i = Soil-to-animal bioaccumulation factor; invertebrates (HAZWRAP 1994).
HQ = Hazard quotient.
I = Average daily dose ingested: S = soil, P = plant, A = animal.
$I_A = TUF \times IR_f \times AF$.
I_A (kg/kg/day) = 6.00E-01.
$I_P = TUF \times IR_f \times PF$.
I_P (kg/kg/day) = 6.00E-01.
$I_S = TUF \times IR_f \times SF$.
I_S (kg/kg/day) = 1.25E-01.
IR_f = Food ingestion rate.
PF = Plant fraction.
SF = Soil fraction.
SP_r = Soil-to-plant bioaccumulation factor; reproductive parts.
TRV = Toxicity reference value = LOAEL (mg/kg/day); see Table 29.
TUF = Temporal use factor = 1.

Table 34. Selected Exposure Concentrations, SWMU 27F, Northwest of Building 1340

Medium/Units	Land-use Scenario	Analyte	Maximum Detected Concentration	95 Percent Upper Confidence Limit
Surface soil (mg/kg)	Current[a]	Benzo(*a*)anthracene	**3.94**	5.09
Surface soil (mg/kg)	Current[a]	Benzo(*a*)pyrene	**2.43**	3.12
Surface soil (mg/kg)	Current[a]	Benzo(*b*)fluoranthene	**2.88**	3.73
Surface soil (mg/kg)	Current[a]	Benzo(*g,h,i*)perylene	**0.885**	1.13
Surface soil (mg/kg)	Current[a]	Dibenzo(*a,h*)anthracene	**0.543**	0.697
Surface soil (mg/kg)	Current[a]	Indeno(*1,2,3-cd*)pyrene	**0.976**	1.22
Surface soil (mg/kg)	Future[b]	Benzo(*a*)anthracene	3.94	**1.38**
Surface soil (mg/kg)	Future[b]	Benzo(*a*)pyrene	2.43	**0.902**
Surface soil (mg/kg)	Future[b]	Benzo(*b*)fluoranthene	2.88	**1.03**
Surface soil (mg/kg)	Future[b]	Dibenzo(*a,h*)anthracene	0.543	**0.297**
Surface soil (mg/kg)	Future[b]	Indeno(*1,2,3-cd*)pyrene	0.976	**0.44**
Surface soil (mg/kg)	Future[b]	Arsenic	4.4	**4.09**
Groundwater (µg/L)	Current/future	2-Methylnaphthalene	31.9	**8.56**
Groundwater (µg/L)	Current/future	4-Methylphenol	21.3	**7.99**
Groundwater (µg/L)	Current/future	Benzene	61	**15**
Groundwater (µg/L)	Current/future	Carbazole	5.7	**5.12**
Groundwater (µg/L)	Current/future	Naphthalene	37.2	**8.74**

[a]The potential exposure of current receptors to surface soil was determined using soil results from only locations not covered by concrete (i.e., MW4, MW10, and MW11).

[b]The potential exposure of future receptors to surface soil assumed that all concrete had been removed; therefore, all surface soil locations (except background) were included.

Bold indicates exposure concentrations selected.

Table 35. AT123D Modeling Results, SWMU 27F, Northwest of Building 1340

COPC	Source Concentration[a] (mg/L)	Receptor Point Groundwater Concentration (mg/L)
2-Methylnaphthalene	0.0319	0.00E+00
4-Methylphenol	0.0213	0.00E+00
Benzene	0.061	0.00E+00
Carbazole	0.0057	0.00E+00
Naphthalene	0.0372	0.00E+00

[a]Maximum observed groundwater concentrations.

Table 36. Exposure Parameters for Potential Receptor Populations, SWMU 27F, Northwest of Building 1340

Parameter	Units	Current On-site Installation Worker	Future On-site Installation Worker	Future On-site Juvenile Trespasser	Future On-site Resident Adult	Future On-site Resident Child	Future Off-site Installation Worker	Future Off-site Resident Adult	Future Off-site Resident Child
SURFACE SOIL									
Incidental ingestion									
Soil ingestion rate	g/day	0.1	0.1	0.1	0.1	0.2	NA	NA	NA
Fraction ingested from area	unitless	1	1	0.38	1	1	NA	NA	NA
Exposure frequency	days/year	250	250	52	350	350	NA	NA	NA
Exposure duration	years	25	25	10	30	6	NA	NA	NA
Body weight	kg	70	70	45	70	15	NA	NA	NA
Carcinogen averaging time	days	25,550	25,550	25,550	25,550	25,550	NA	NA	NA
Noncarcinogen averaging time	days	9,125	9,125	3,650	10,950	2,190	NA	NA	NA
Dermal Contact									
Skin area	cm^2/event	5,000	5,000	3,700	5,000	4,000	NA	NA	NA
Adherence factor	mg/cm^2	1	1	1	1	1	NA	NA	NA
Exposure frequency	events/year	250	250	52	350	350	NA	NA	NA
Exposure duration	years	25	25	10	30	6	NA	NA	NA
Body weight	kg	70	70	45	70	15	NA	NA	NA
Carcinogen averaging time	days	25,550	25,550	25,550	25,550	25,550	NA	NA	NA
Noncarcinogen averaging time	days	9,125	9,125	3,650	10,950	2,190	NA	NA	NA
Inhalation of Dust									
Inhalation rate	m^3/hour	NA	2.5	1.90	0.80	0.68	2.5	0.80	0.68
Exposure time	hours/day	NA	8	6	18.4	18.4	8	18.4	18.4
Exposure frequency	days/year	NA	250	52	350	350	250	350	350
Exposure duration	years	NA	25	10	30	6	25	30	6
Body weight	kg	NA	70	45	70	15	70	70	15
Carcinogen averaging time	days	NA	25,550	25,550	25,550	25,550	25,550	25,550	25,550
Noncarcinogen averaging time	days	NA	9,125	3,650	10,950	2,190	9,125	10,950	2,190

Note: Footnotes appear on page 79.

Table 36. Exposure Parameters for Potential Receptor Populations, SWMU 27F, Northwest of Building 1340 (continued)

Parameter	Units	Current On-site Installation Worker	Future On-site Installation Worker	Future On-site Juvenile Trespasser	Future On-site Resident Adult	Future On-site Resident Child	Future Off-site Installation Worker	Future Off-site Resident Adult	Future Off-site Resident Child
GROUNDWATER									
Drinking Water Ingestion									
Drinking water ingestion	L/day	NA	1	NA	2	1	1	2	1
Fraction ingested from area	unitless	NA	1	NA	1	1	1	1	1
Exposure frequency	days/year	NA	250	NA	350	350	250	350	350
Exposure duration	years	NA	25	NA	30	6	25	30	6
Body weight	kg	NA	70	NA	70	15	70	70	15
Carcinogen averaging time	days	NA	25,550	NA	25,550	25,550	25,550	25,550	25,550
Noncarcinogen averaging time	days	NA	9,125	NA	10,950	2,190	9,125	10,950	2,190
Inhalation of VOCs									
Inhalation rate	m^3/hour	NA	NA	NA	0.4	NA	NA	0.4	NA
Exposure time	hours/day	NA	NA	NA	0.17	NA	NA	0.17	NA
Exposure frequency	days/year	NA	NA	NA	350	NA	NA	350	NA
Exposure duration	years	NA	NA	NA	30	NA	NA	30	NA
Body weight	kg	NA	NA	NA	70	NA	NA	70	NA
Carcinogen averaging time	days	NA	NA	NA	25,550	NA	NA	25,550	NA
Noncarcinogen averaging time	days	NA	NA	NA	10,950	NA	NA	10,950	NA
Dermal Contact while Bathing									
Skin area	m^2	NA	NA	NA	2	0.700	NA	2	0.700
Exposure time	hours/day	NA	NA	NA	0.17	0.33	NA	0.17	0.33
Exposure frequency	days/year	NA	NA	NA	350	350	NA	350	350
Exposure duration	years	NA	NA	NA	30	6	NA	30	6
Body weight	kg	NA	NA	NA	70	15	NA	70	15
Carcinogen averaging time	days	NA	NA	NA	25,550	25,550	NA	25,550	25,550
Noncarcinogen averaging time	days	NA	NA	NA	10,950	2,190	NA	10,950	2,190

NA = Not applicable.

Table 37. Estimated Intakes for Current On-site Installation Worker, SWMU 27F, Northwest of Building 1340

Environmental Medium	Chemical	Exposure Concentration	Oral Exposure[a]		Dermal Exposure[a]	
			Average Daily Dose for Noncarciuogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
Surface soil	Arsenic	4.09E+00	4.0E-06	1.43E-06	2.0E-07	7.15E-08
Surface soil	Benzo(*a*)anthracene	1.38E+00	ND	4.82E-07	ND	2.41E-07
Surface soil	Benzo(*a*)pyrene	9.02E-01	ND	3.15E-07	ND	1.58E-07
Surface soil	Benzo(*b*)fluoranthene	1.03E+00	ND	3.60E-07	ND	1.80E-07
Surface soil	Dibenzo(*a,h*)anthracene	2.97E-01	ND	1.04E-07	ND	5.19E-08
Surface soil	Indeno(*1,2,3-cd*)pyrene	4.40E-01	ND	1.54E-07	ND	7.69E-08

[a]The equations used to calculate oral and dermal exposures for surface soil are presented in Appendix I, Section I.2.4.2 of the revised final Phase II RFI Report (SAIC 2000).

ND = The toxicity data required to quantify the risk are not available.

Table 38. Estimated Intakes for Future On-site Installation Worker, SWMU 27F, Northwest of Building 1340

Environmental Medium	Chemical	Exposure Concentration	Units	Oral Exposure[a]		Dermal Exposure[a]		Inhalation Exposure[a]	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
Surface soil	Arsenic	4.09E+00	mg/kg	4.0E-06	1.43E-06	2.0E-07	7.15E-08	ND	5.31E-11
Surface soil	Benzo(*a*)anthracene	1.38E+00	mg/kg	ND	4.82E-07	ND	2.41E-07	ND	1.79E-11
Surface soil	Benzo(*a*)pyrene	9.02E-01	mg/kg	ND	3.15E-07	ND	1.58E-07	ND	1.17E-11
Surface soil	Benzo(*b*)fluoranthene	1.03E+00	mg/kg	ND	3.60E-07	ND	1.80E-07	ND	1.34E-11
Surface soil	Dibenzo(*a,h*)anthracene	2.97E-01	mg/kg	ND	1.04E-07	ND	5.19E-08	ND	3.86E-12
Surface soil	Indeno(*1,2,3-cd*)pyrene	4.40E-01	mg/kg	ND	1.54E-07	ND	7.69E-08	ND	5.71E-12
Groundwater	2-Methylnaphthalene	8.56E-03	mg/L	8.38E-05	ND	NA	NA	NA	NA
Groundwater	4-Methylphenol	7.99E-03	mg/L	7.82E-05	ND	NA	NA	NA	NA
Groundwater	Benzene	1.50E-02	mg/L	1.47E-04	5.24E-05	NA	NA	NA	NA
Groundwater	Carbazole	5.12E-03	mg/L	ND	1.79E-05	NA	NA	NA	NA
Groundwater	Naphthalene	8.74E-03	mg/L	8.55E-05	ND	NA	NA	NA	NA

[a]The equations used to calculate oral, dermal, and inhalation exposures for surface soil and groundwater are presented in Appendix I, Sections I.2.4.2 and I.2.4.3, respectively, of the revised final Phase II RFI Report (SAIC 2000).

NA = Not applicable; this pathway was not assessed for this receptor.

ND = The toxicity data required to quantify the risk are not available.

Table 39. Estimated Intakes for Future On-site Juvenile Trespasser, SWMU 27F, Northwest of Building 1340

Environmental Medium	Chemical	Exposure Concentration	Units	Oral Exposure[a]		Dermal Exposure[a]		Inhalation Exposure[a]	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
Surface soil	Arsenic	4.09E+00	mg/kg	4.9E-07	7.03E-08	5.2E-08	7.40E-09	ND	3.92E-12
Surface soil	Benzo(*a*)anthracene	1.38E+00	mg/kg	ND	2.37E-08	ND	2.50E-08	ND	1.32E-12
Surface soil	Benzo(*a*)pyrene	9.02E-01	mg/kg	ND	1.55E-08	ND	1.63E-08	ND	8.64E-13
Surface soil	Benzo(*b*)fluoranthene	1.03E+00	mg/kg	ND	1.77E-08	ND	1.86E-08	ND	9.86E-13
Surface soil	Dibenzo(*a,h*)anthracene	2.97E-01	mg/kg	ND	5.10E-09	ND	5.37E-09	ND	2.84E-13
Surface soil	Indeno(*1,2,3-cd*)pyrene	4.40E-01	mg/kg	ND	7.56E-09	ND	7.96E-09	ND	4.21E-13

[a]The equations used to calculate oral, dermal, and inhalation exposures for surface soil are presented in Appendix I, Section I.2.4.2 of the revised final Phase II RFI Report (SAIC 2000).

ND = The toxicity data required to quantify the risk are not available.

Table 40. Estimated Intakes for Future On-site Resident Child, SWMU 27F, Northwest of Building 1340

Environmental Medium	Chemical	Exposure Concentration	Units	Oral Exposure[a]		Dermal Exposure[a]		Inhalation Exposure[a]	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
Surface soil	Arsenic	4.09E+00	mg/kg	5.2E-05	4.48E-06	4.4E-07	3.81E-08	ND	5.21E-11
Surface soil	Benzo(*a*)anthracene	1.38E+00	mg/kg	ND	1.51E-06	ND	1.29E-07	ND	1.76E-11
Surface soil	Benzo(*a*)pyrene	9.02E-01	mg/kg	ND	9.88E-07	ND	8.40E-08	ND	1.15E-11
Surface soil	Benzo(*b*)fluoranthene	1.03E+00	mg/kg	ND	1.13E-06	ND	9.59E-08	ND	1.31E-11
Surface soil	Dibenzo(*a,h*)anthracene	2.97E-01	mg/kg	ND	3.25E-07	ND	2.77E-08	ND	3.78E-12
Surface soil	Indeno(*1,2,3-cd*)pyrene	4.40E-01	mg/kg	ND	4.82E-07	ND	4.10E-08	ND	5.60E-12
Groundwater	2-Methylnaphthalene	8.56E-03	mg/L	5.47E-04	ND	1.90E-04	ND	NA	NA
Groundwater	4-Methylphenol	7.99E-03	mg/L	5.11E-04	ND	2.12E-05	ND	NA	NA
Groundwater	Benzene	1.50E-02	mg/L	9.59E-04	8.22E-05	4.65E-05	3.99E-06	NA	NA
Groundwater	Carbazole	5.12E-03	mg/L	ND	2.81E-05	ND	5.90E-06	NA	NA
Groundwater	Naphthalene	8.74E-03	mg/L	5.59E-04	ND	8.91E-05	ND	NA	NA

[a]The equations used to calculate oral, dermal, and inhalation exposures for surface soil and groundwater are presented in Appendix I, Sections I.2.4.2 and I.2.4.3, respectively, of the revised final Phase II RFI Report (SAIC 2000).

NA = Not applicable; this pathway was not assessed for this receptor.

ND = The toxicity data required to quantify the risk are not available.

Table 41. Estimated Intakes for Future On-site Resident Adult, SWMU 27F, Northwest of Building 1340

Environmental Medium	Chemical	Exposure Concentration	Units	Oral Exposure[a]		Dermal Exposure[a]		Inhalation Exposure[a]	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
Surface soil	Arsenic	4.09E+00	mg/kg	5.6E-06	2.40E-06	2.8E-07	1.20E-07	ND	6.56E-11
Surface soil	Benzo(*a*)anthracene	1.38E+00	mg/kg	ND	8.10E-07	ND	4.05E-07	ND	2.21E-11
Surface soil	Benzo(*a*)pyrene	9.02E-01	mg/kg	ND	5.30E-07	ND	2.65E-07	ND	1.45E-11
Surface soil	Benzo(*b*)fluoranthene	1.03E+00	mg/kg	ND	6.05E-07	ND	3.02E-07	ND	1.65E-11
Surface soil	Dibenzo(*a,h*)anthracene	2.97E-01	mg/kg	ND	1.74E-07	ND	8.72E-08	ND	4.77E-12
Surface soil	Indeno(*1,2,3-cd*)pyrene	4.40E-01	mg/kg	ND	2.58E-07	ND	1.29E-07	ND	7.06E-12
Groundwater	2-Methylnaphthalene	8.56E-03	mg/L	2.35E-04	ND	5.98E-05	ND	NA	NA
Groundwater	4-Methylphenol	7.99E-03	mg/L	2.19E-04	ND	6.70E-06	ND	NA	NA
Groundwater	Benzene	1.50E-02	mg/L	4.11E-04	1.76E-04	1.47E-05	6.29E-06	6.99E-06	2.99E-06
Groundwater	Carbazole	5.12E-03	mg/L	ND	6.01E-05	ND	9.30E-06	NA	NA
Groundwater	Naphthalene	8.74E-03	mg/L	2.39E-04	ND	2.81E-05	ND	NA	NA

[a]The equations used to calculate oral, dermal, and inhalation exposures for surface soil and groundwater are presented in Appendix I, Sections I.2.4.2 and I.2.4.3, respectively, of the revised final Phase II RFI Report (SAIC 2000).

NA = Not applicable; inhalation exposure is not a viable pathway for this constituent.

ND = The toxicity data required to quantify the risk are not available.

Table 42. Estimated Intakes for Future Off-site Installation Worker, SWMU 27F, Northwest of Building 1340

Euvironmental Medium	Chemical	Exposure Concentration	Units	Oral Exposure[a]		Inhalation Exposure[a]	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
Surface soil	Arsenic	4.09E+00	mg/kg	NA	NA	ND	5.31E-11
Surface soil	Benzo(*a*)anthracene	1.38E+00	mg/kg	NA	NA	ND	1.79E-11
Surface soil	Benzo(*a*)pyrene	9.02E-01	mg/kg	NA	NA	ND	1.17E-11
Surface soil	Benzo(*b*)fluoranthene	1.03E+00	mg/kg	NA	NA	ND	1.34E-11
Surface soil	Dibenzo(*a,h*)anthracene	2.97E-01	mg/kg	NA	NA	ND	3.86E-12
Surface soil	Indeno(*1,2,3-cd*)pyrene	4.40E-01	mg/kg	NA	NA	ND	5.71E-12
Groundwater	2-Methylnaphthalene	8.56E-03	mg/L	8.38E-05	ND	NA	NA
Groundwater	4-Methylphenol	7.99E-03	mg/L	7.82E-05	ND	NA	NA
Groundwater	Benzene	1.50E-02	mg/L	1.47E-04	5.24E-05	NA	NA
Groundwater	Carbazole	5.12E-03	mg/L	ND	1.79E-05	NA	NA
Groundwater	Naphthalene	8.74E-03	mg/L	8.55E-05	ND	NA	NA

[a]The equations used to calculate oral, dermal, and inhalation exposures for surface soil and groundwater are presented in Appendix I, Sections I.2.4.2 and I.2.4.3, respectively, of the revised final Phase II RFI Report (SAIC 2000).

NA = Not applicable; this pathway was not assessed for this receptor.

ND = The toxicity data required to quantify the risk are not available.

Table 43. Estimated Intakes for Future Off-site Resident Child, SWMU 27F, Northwest of Building 1340

Environmental Medium	Chemical	Exposure Concentration	Units	Oral Exposure[a]		Dermal Exposure[a]		Inhalation Exposure[a]	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
Surface soil	Arsenic	4.09E+00	mg/kg	NA	NA	NA	NA	ND	5.21E-11
Surface soil	Benzo(*a*)anthracene	1.38E+00	mg/kg	NA	NA	NA	NA	ND	1.76E-11
Surface soil	Benzo(*a*)pyrene	9.02E-01	mg/kg	NA	NA	NA	NA	ND	1.15E-11
Surface soil	Benzo(*b*)fluoranthene	1.03E+00	mg/kg	NA	NA	NA	NA	ND	1.31E-11
Surface soil	Dibenzo(*a,h*)anthracene	2.97E-01	mg/kg	NA	NA	NA	NA	ND	3.78E-12
Surface soil	Indeno(*1,2,3-cd*)pyrene	4.40E-01	mg/kg	NA	NA	NA	NA	ND	5.60E-12
Groundwater	2-Methylnaphthalene	8.56E-03	mg/L	5.47E-04	ND	1.90E-04	ND	NA	NA
Groundwater	4-Methylphenol	7.99E-03	mg/L	5.11E-04	ND	2.12E-05	ND	NA	NA
Groundwater	Benzene	1.50E-02	mg/L	9.59E-04	8.22E-05	4.65E-05	3.99E-06	NA	NA
Groundwater	Carbazole	5.12E-03	mg/L	ND	2.81E-05	ND	5.90E-06	NA	NA
Groundwater	Naphthalene	8.74E-03	mg/L	5.59E-04	ND	8.91E-05	ND	NA	NA

[a]The equations used to calculate oral, dermal, and inhalation exposures for surface soil and groundwater are presented in Appendix I, Sections I.2.4.2 and I.2.4.3, respectively, of the revised final Phase II RFI Report (SAIC 2000).

NA = Not applicable; this pathway was not assessed for this receptor.

ND = The toxicity data required to quantify the risk are not available.

Table 44. Estimated Intakes for Future Off-site Resident Adult, SWMU 27F, Northwest of Building 1340

Environmental Medium	Chemical	Exposure Concentration	Units	Oral Exposure[a]		Dermal Exposure[a]		Inhalation Exposure[a]	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
Surface soil	Arsenic	4.09E+00	mg/kg	NA[b]	NA[b]	NA[b]	NA[b]	ND	6.56E-11
Surface soil	Benzo(*a*)anthracene	1.38E+00	mg/kg	NA[b]	NA[b]	NA[b]	NA[b]	ND	2.21E-11
Surface soil	Benzo(*a*)pyrene	9.02E-01	mg/kg	NA[b]	NA[b]	NA[b]	NA[b]	ND	1.45E-11
Surface soil	Benzo(*b*)fluoranthene	1.03E+00	mg/kg	NA[b]	NA[b]	NA[b]	NA[b]	ND	1.65E-11
Surface soil	Dibenzo(*a,h*)anthracene	2.97E-01	mg/kg	NA[b]	NA[b]	NA[b]	NA[b]	ND	4.77E-12
Surface soil	Indeno(*1,2,3-cd*)pyrene	4.40E-01	mg/kg	NA[b]	NA[b]	NA[b]	NA[b]	ND	7.06E-12
Groundwater	2-Methylnaphthalene	8.56E-03	mg/L	2.35E-04	ND	5.98E-05	ND	NA[c]	NA[c]
Groundwater	4-Methylphenol	7.99E-03	mg/L	2.19E-04	ND	6.70E-06	ND	NA[c]	NA[c]
Groundwater	Benzene	1.50E-02	mg/L	4.11E-04	1.76E-04	1.47E-05	6.29E-06	6.99E-06	2.99E-06
Groundwater	Carbazole	5.12E-03	mg/L	ND	6.01E-05	ND	9.30E-06	NA[c]	NA[c]
Groundwater	Naphthalene	8.74E-03	mg/L	2.39E-04	ND	2.81E-05	ND	NA[c]	NA[c]

[a]The equations used to calculate oral, dermal, and inhalation exposures for surface soil and groundwater are presented in Appendix I, Sections I.2.4.2 and I.2.4.3, respectively, of the revised final Phase II RFI Report (SAIC 2000).

[b]NA = Not applicable; this pathway was not assessed for this receptor.

[c]NA = Not applicable; inhalation exposure is not a viable pathway for this constituent.

ND = The toxicity data required to quantify the risk are not available.

Table 45. Toxicity Values for Constituents of Concern, SWMU 27F, Northwest of Building 1340

Chemical	Oral Reference Dose (mg/kg/day)	Ref[a]	Oral Cancer Slope Factor $(mg/kg/day)^{-1}$	Ref[a]	Gastrointestinal Absorption Factor[b]	Dermal Reference Dose[c] (mg/kg/day)	Dermal Cancer Slope Factor[d] $(mg/kg/day)^{-1}$	Inhalation Reference Dose (mg/kg/day)	Ref[a]	Inhalation Cancer Slope Factor $(mg/kg/day)^{-1}$	Ref[a]
2-Methylnaphthalene	2.00E-02	E	ND		0.8	1.60E-02	ND	ND		ND	
4-Methylphenol	5.00E-03	H	ND		0.65	3.25E-03	ND	ND		ND	
Arsenic	3.00E-04	I	1.50E+00	I	0.41	1.23E-04	3.66E+00	ND		1.51E+01	I
Benzene	3.00E-03	E	2.90E-02	I	0.97	2.91E-03	2.99E-02	1.70E-03	E	2.90E-02	I
Benzo(*a*)anthracene	ND		7.30E-01	E	0.31	ND	2.35E+00	ND		ND	
Benzo(*a*)pyrene	ND		7.30E+00	E	0.31	ND	2.35E+01	ND		3.10E+00	E
Benzo(*b*)fluoranthene	ND		7.30E-01	I	0.31	ND	2.35E+00	ND		3.10E-01	E
Carbazole	ND		2.00E-02	H	0.7	ND	2.86E-02	ND		ND	
Dibenzo(*a,h*)anthracene	ND		7.30E+00	E	0.31	ND	2.35E+01	ND		3.10E+00	E
Indeno(*1,2,3-cd*)pyrene	ND		7.30E-01	E	0.31	ND	2.35E+00	ND		3.10E-01	E
Naphthalene	2.00E-02	I	ND		0.8	1.60E-02	ND	8.57E-04	I	ND	

[a]References:
A = Health Effects Assessment Summary Tables (HEAST) alternative value (EPA 1997b).
H = HEAST (EPA 1997b).
E = EPA National Center for Environmental Assessment (EPA 2000a).
I = Integrated Risk Information System (EPA 2000b).
[b]ORNL 1999.
[c]Dermal reference dose calculated by multiplying the oral reference dose by the gastrointestinal absorption factor.
[d]Dermal cancer slope factor calculated by dividing the oral cancer slope factor by the gastrointestinal absorption factor.
ND = No data.

Table 46. Hazard Indices and Carcinogenic Risks for Current On-site Installation Worker, SWMU 27F, Northwest of Building 1340

Chemical	Surface Soil[a]			Total Hazard Index[a]
	Ingestion HI	Dermal HI	Total	
Arsenic	1.33E-02	1.63E-03	1.50E-02	1.50E-02
Benzo(*a*)anthracene	ND	ND	—	—
Benzo(*a*)pyrene	ND	ND	—	—
Benzo(*b*)fluoranthene	ND	ND	—	—
Dibenzo(*a,h*)anthracene	ND	ND	—	—
Indeno(*1,2,3-cd*)pyrene	ND	ND	—	—
Pathway Total	**1.33E-02**	**1.63E-03**	**1.50E-02**	**1.50E-02**

Chemical	Surface Soil[b]			Total Cancer Risk[b]
	Ingestion ILCR	Dermal ILCR	Total	
Arsenic	2.14E-06	2.61E-07	2.40E-06	2.40E-06
Benzo(*a*)anthracene	1.01E-06	1.62E-06	2.63E-06	2.63E-06
Benzo(*a*)pyrene	6.20E-06	1.00E-05	1.62E-05	1.62E-05
Benzo(*b*)fluoranthene	7.35E-07	1.18E-06	1.92E-06	1.92E-06
Dibenzo(*a,h*)anthracene	1.39E-06	2.23E-06	3.62E-06	3.62E-06
Indeno(*1,2,3-cd*)pyrene	2.49E-07	4.02E-07	6.51E-07	6.51E-07
Pathway Total	**1.17E-05**	**1.57E-05**	**2.74E-05**	**2.74E-05**

[a]The equations used to calculate noncarcinogenic risk are presented in Appendix I, Section I.4.2 of the revised final Phase II RFI Report (SAIC 2000).

[b]The equations used to calculate carcinogenic risk are presented in Appendix I, Section I.4.1 of the revised final Phase II RFI Report (SAIC 2000).

ND = The toxicity data required to quantify the risk are not available.

— = No sum value could be calculated.

Table 47. Hazard Indices and Carcinogenic Risks for Future On-site Installation Worker, SWMU 27F, Northwest of Building 1340

Chemical	Surface Soil[a]				Groundwater Measured Concentrations[a]		Total Hazard Index[a]
	Ingestion HI	Dermal HI	Inhalation HI	Total	Ingestion HI	Total	
Arsenic	1.33E-02	1.63E-03	ND	1.49E-02	NA	NA	1.49E-02
Benzo(*a*)anthracene	ND	ND	ND	—	NA	NA	—
Benzo(*a*)pyrene	ND	ND	ND	—	NA	NA	—
Benzo(*b*)fluoranthene	ND	ND	ND	—	NA	NA	—
Dibenzo(*a,h*)anthracene	ND	ND	ND	—	NA	NA	—
Indeno(*1,2,3-cd*)pyrene	ND	ND	ND	—	NA	NA	—
2-Methylnaphthalene	NA	NA	NA	NA	4.19E-03	4.19E-03	4.19E-03
4-Methylphenol	NA	NA	NA	NA	1.56E-02	1.56E-02	1.56E-02
Benzene	NA	NA	NA	NA	4.89E-02	4.89E-02	4.89E-02
Carbazole	NA	NA	NA	NA	ND	—	—
Naphthalene	NA	NA	NA	NA	4.28E-03	4.28E-03	4.28E-03
Pathway Total	**1.33E-02**	**1.63E-03**	—	**1.50E-02**	**7.30E-02**	**7.30E-02**	**8.79E-02**

Note: Footnotes appear on page 90.

Table 47. Hazard Indices and Carcinogenic Risks for Future On-site Installation Worker, SWMU 27F, Northwest of Building 1340 (continued)

Chemical	Surface Soil[b]				Groundwater Measured Concentrations[b]		Total Cancer Risk[b]
	Ingestion ILCR	Dermal ILCR	Inhalation ILCR	Total	Ingestion ILCR	Total	
Arsenic	2.14E-06	2.61E-07	7.99E-10	2.40E-06	NA	NA	2.40E-06
Benzo(*a*)anthracene	3.52E-07	5.68E-07	5.55E-12	9.20E-07	NA	NA	9.20E-07
Benzo(*a*)pyrene	2.30E-06	3.71E-06	3.63E-11	6.01E-06	NA	NA	6.01E-06
Benzo(*b*)fluoranthene	2.63E-07	4.24E-07	4.14E-12	6.87E-07	NA	NA	6.87E-07
Dibenzo(*a,h*)anthracene	7.58E-07	1.22E-06	1.20E-11	1.98E-06	NA	NA	1.98E-06
Indeno(*1,2,3-cd*)pyrene	1.12E-07	1.81E-07	1.77E-12	2.93E-07	NA	NA	2.93E-07
2-Methylnaphthalene	NA	NA	NA	NA	ND	—	—
4-Methylphenol	NA	NA	NA	NA	ND	—	—
Benzene	NA	NA	NA	NA	2.88E-06	2.88E-06	2.88E-06
Carbazole	NA	NA	NA	NA	3.58E-07	3.58E-07	3.58E-07
Naphthalene	NA	NA	NA	NA	ND	—	—
Pathway Total	**5.93E-06**	**6.36E-06**	**8.59E-10**	**1.23E-05**	**3.24E-06**	**3.24E-06**	**1.55E-05**

[a]The equations used to calculate noncarcinogenic risk are presented in Appendix I, Section I.4.2 of the revised final Phase II RFI Report (SAIC 2000).

[b]The equations used to calculate carcinogenic risk are presented in Appendix I, Section I.4.1 of the revised final Phase II RFI Report (SAIC 2000).

NA = Not applicable; this constituent is not present in this medium.

ND = The toxicity data required to quantify the risk are not available.

— = No sum value could be calculated.

Table 48. Hazard Indices and Carcinogenic Risks for Future On-site Juvenile Trespasser, SWMU 27F, Northwest of Building 1340

Chemical	Surface Soil[a]			Total Hazard Index[a]
	Ingestion HQ	Dermal HI	Inhalation HI	
Arsenic	1.64E-03	4.21E-04	ND	2.06E-03
Benzo(*a*)anthracene	ND	ND	ND	—
Benzo(*a*)pyrene	ND	ND	ND	—
Benzo(*b*)fluoranthene	ND	ND	ND	—
Dibenzo(*a,h*)anthracene	ND	ND	ND	—
Indeno(*1,2,3-cd*)pyrene	ND	ND	ND	—
Pathway Total	**1.64E-03**	**4.21E-04**	—	**2.06E-03**

Chemical	Surface Soil[b]			Total Cancer Risk[b]
	Ingestion ILCR	Dermal ILCR	Inhalation ILCR	
Arsenic	1.05E-07	2.71E-08	5.89E-11	1.32E-07
Benzo(*a*)anthracene	1.73E-08	5.88E-08	4.10E-13	7.61E-08
Benzo(*a*)pyrene	1.13E-07	3.84E-07	2.68E-12	4.97E-07
Benzo(*b*)fluoranthene	1.29E-08	4.39E-08	3.06E-13	5.68E-08
Dibenzo(*a,h*)anthracene	3.73E-08	1.27E-07	8.82E-13	1.64E-07
Indeno(*1,2,3-cd*)pyrene	5.52E-09	1.87E-08	1.31E-13	2.42E-08
Pathway Total	**2.91E-07**	**6.60E-07**	**6.33E-11**	**9.49E-07**

[a]The equations used to calculate noncarcinogenic risk are presented in Appendix I, Section I.4.2 of the revised final Phase II RFI Report (SAIC 2000).

[b]The equations used to calculate carcinogenic risk are presented in Appendix I, Section I.4.1 of the revised final Phase II RFI Report (SAIC 2000).

ND = The toxicity data required to quantify the risk are not available.

— = No sum value could be calculated.

Table 49. Hazard Indices and Carcinogenic Risks for Future On-site Resident Child, SWMU 27F, Northwest of Building 1340

Chemical	Surface Soil[a]				Groundwater[a]			Total Hazard Index[a]
	Ingestion HI	Dermal HI	Inhalation HI	Total	Ingestion HI	Dermal HI	Total	
Arsenic	1.74E-01	3.61E-03	ND	1.78E-01	NA	NA	NA	1.78E-01
Benzo(*a*)anthracene	ND	ND	ND	—	NA	NA	NA	—
Benzo(*a*)pyrene	ND	ND	ND	—	NA	NA	NA	—
Benzo(*b*)fluoranthene	ND	ND	ND	—	NA	NA	NA	—
Dibenzo(*a,h*)anthracene	ND	ND	ND	—	NA	NA	NA	—
Indeno(*1,2,3-cd*)pyrene	ND	ND	ND	—	NA	NA	NA	—
2-Methylnaphthalene	NA	NA	NA	NA	2.74E-02	1.19E-02	3.93E-02	3.93E-02
4-Methylphenol	NA	NA	NA	NA	1.02E-01	6.53E-03	1.09E-01	1.09E-01
Benzene	NA	NA	NA	NA	3.20E-01	1.60E-02	3.36E-01	3.36E-01
Carbazole	NA	NA	NA	NA	ND	ND	—	—
Naphthalene	NA	NA	NA	NA	2.79E-02	5.57E-03	3.35E-02	3.35E-02
Pathway Total	**1.74E-01**	**3.61E-03**	—	**1.78E-01**	**4.77E-01**	**4.00E-02**	**5.18E-01**	**6.96E-01**

Chemical	Surface Soil[b]				Groundwater[b]			Total Cancer Risk[b]
	Ingestion ILCR	Dermal ILCR	Inhalation ILCR	Total	Ingestion ILCR	Dermal ILCR	Total	
Arsenic	6.72E-06	1.39E-07	7.84E-10	6.86E-06	NA	NA	NA	6.86E-06
Benzo(*a*)anthracene	1.10E-06	3.03E-07	5.45E-12	1.40E-06	NA	NA	NA	1.40E-06
Benzo(*a*)pyrene	7.22E-06	1.98E-06	3.56E-11	9.20E-06	NA	NA	NA	9.20E-06
Benzo(*b*)fluoranthene	8.24E-07	2.26E-07	4.07E-12	1.05E-06	NA	NA	NA	1.05E-06
Dibenzo(*a,h*)anthracene	2.38E-06	6.51E-07	1.17E-11	3.03E-06	NA	NA	NA	3.03E-06
Indeno(*1,2,3-cd*)pyrene	3.52E-07	9.65E-08	1.74E-12	4.49E-07	NA	NA	NA	4.49E-07
2-Methylnaphthalene	NA	NA	NA	NA	ND	ND	—	—
4-Methylphenol	NA	NA	NA	NA	ND	ND	—	—
Benzene	NA	NA	NA	NA	4.52E-06	2.26E-07	4.75E-06	4.75E-06
Carbazole	NA	NA	NA	NA	5.61E-07	1.68E-07	7.29E-07	7.29E-07
Naphthalene	NA	NA	NA	NA	ND	ND	—	—
Pathway Total	**1.86E-05**	**3.40E-06**	**8.41E-10**	**2.20E-05**	**5.08E-06**	**3.95E-07**	**5.48E-06**	**2.75E-05**

[a]The equations used to calculate noncarcinogenic risk are presented in Appendix I, Section I.4.2 of the revised final Phase II RFI Report (SAIC 2000).
[b]The equations used to calculate carcinogenic risk are presented in Appendix I, Section I.4.1 of the revised final Phase II RFI Report (SAIC 2000).
NA = Not applicable; this constituent is not present in this medium.
ND = The toxicity data required to quantify the risk are not available.
— = No sum value could be calculated.

Table 50. Hazard Indices and Carcinogenic Risks for Future On-site Resident Adult, SWMU 27F, Northwest of Building 1340

Chemical	Surface Soil[a]				Groundwater[a]				Total Hazard Index[a]
	Ingestion HI	Dermal HI	Inhalation HI	Total	Ingestion HI	Dermal HI	Inhalation HI	Total	
Arsenic	1.87E-02	2.28E-03	ND	2.10E-02	NA[b]	NA[b]	NA[b]	NA[b]	2.10E-02
Benzo(*a*)anthracene	ND	ND	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Benzo(*a*)pyrene	ND	ND	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Benzo(*b*)fluoranthene	ND	ND	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Dibenzo(*a,h*)anthracene	ND	ND	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Indeno(*1,2,3-cd*)pyrene	ND	ND	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
2-Methylnaphthalene	NA[b]	NA[b]	NA[b]	NA[b]	1.17E-02	3.74E-03	NA[c]	1.54E-02	1.54E-02
4-Methylphenol	NA[b]	NA[b]	NA[b]	NA[b]	4.38E-02	2.06E-03	NA[c]	4.59E-02	4.59E-02
Benzene	NA[b]	NA[b]	NA[b]	NA[b]	1.37E-01	5.04E-03	4.11E-03	1.46E-01	1.46E-01
Carbazole	NA[b]	NA[b]	NA[b]	NA[b]	ND	ND	NA[c]	—	—
Naphthalene	NA[b]	NA[b]	NA[b]	NA[b]	1.20E-02	1.76E-03	NA[c]	1.37E-02	1.37E-02
Pathway Total	**1.87E-02**	**2.28E-03**	—	**2.10E-02**	**2.05E-01**	**1.26E-02**	**4.11E-03**	**2.21E-01**	**2.42E-01**

Chemical	Surface Soil[d]				Groundwater[d]				Total Cancer Risk[d]
	Ingestion ILCR	Dermal ILCR	Inhalation ILCR	Total	Ingestion ILCR	Dermal ILCR	Inhalation ILCR	Total	
Arsenic	3.60E-06	4.39E-07	9.88E-10	4.04E-06	NA[b]	NA[b]	NA[b]	NA[b]	4.04E-06
Benzo(*a*)anthracene	5.91E-07	9.54E-07	6.87E-12	1.55E-06	NA[b]	NA[b]	NA[b]	NA[b]	1.55E-06
Benzo(*a*)pyrene	3.87E-06	6.24E-06	4.49E-11	1.01E-05	NA[b]	NA[b]	NA[b]	NA[b]	1.01E-05
Benzo(*b*)fluoranthene	4.41E-07	7.12E-07	5.12E-12	1.15E-06	NA[b]	NA[b]	NA[b]	NA[b]	1.15E-06
Dibenzo(*a,h*)anthracene	1.27E-06	2.05E-06	1.48E-11	3.32E-06	NA[b]	NA[b]	NA[b]	NA[b]	3.32E-06
Indeno(*1,2,3-cd*)pyrene	1.89E-07	3.04E-07	2.19E-12	4.93E-07	NA[b]	NA[b]	NA[b]	NA[b]	4.93E-07
2-Methylnaphthalene	NA[b]	NA[b]	NA[b]	NA[b]	ND	ND	NA[c]	—	—
4-Methylphenol	NA[b]	NA[b]	NA[b]	NA[b]	ND	ND	NA[c]	—	—
Benzene	NA[b]	NA[b]	NA[b]	NA[b]	9.69E-06	3.57E-07	8.68E-08	1.01E-05	1.01E-05
Carbazole	NA[b]	NA[b]	NA[b]	NA[b]	1.20E-06	2.66E-07	NA[c]	1.47E-06	1.47E-06
Naphthalene	NA[b]	NA[b]	NA[b]	NA[b]	ND	ND	NA[c]	—	—
Pathway Total	**9.96E-06**	**1.07E-05**	**1.06E-09**	**2.07E-05**	**1.09E-05**	**6.22E-07**	**8.68E-08**	**1.16E-05**	**3.23E-05**

[a]The equations used to calculate noncarcinogenic risk are presented in Appendix I, Section I.4.2 of the revised final Phase II RFI Report (SAIC 2000).
[b]NA = Not applicable; this constituent is not present in this medium.
[c]NA = Not applicable; inhalation exposure is not a viable pathway for this constituent.
[d]The equations used to calculate carcinogenic risk are presented in Appendix I, Section I.4.1 of the revised final Phase II RFI Report (SAIC 2000).
ND = The toxicity data required to quantify the risk are not available.
— = No sum value could be calculated.

Table 51. Hazard Indices and Carcinogenic Risks for Future Off-site Installation Worker, SWMU 27F, Northwest of Building 1340

Chemical	Surface Soil[a]		Groundwater[a]		Total Hazard Index[a]
	Inhalation HI	Total	Ingestion HI	Total	
Arsenic	ND	—	NA	NA	—
Benzo(*a*)anthracene	ND	—	NA	NA	—
Benzo(*a*)pyrene	ND	—	NA	NA	—
Benzo(*b*)fluoranthene	ND	—	NA	NA	—
Dibenzo(*a,h*)anthracene	ND	—	NA	NA	—
Indeno(*1,2,3-cd*)pyrene	ND	—	NA	NA	—
2-Methylnaphthalene	NA	NA	4.19E-03	4.19E-03	4.19E-03
4-Methylphenol	NA	NA	1.56E-02	1.56E-02	1.56E-02
Benzene	NA	NA	4.89E-02	4.89E-02	4.89E-02
Carbazole	NA	NA	ND	—	—
Naphthalene	NA	NA	4.28E-03	4.28E-03	4.28E-03
Pathway Total	—	—	**7.30E-02**	**7.30E-02**	**7.30E-02**

Chemical	Surface Soil[b]		Groundwater[b]		Total Cancer Risk[b]
	Inhalation ILCR	Total	Ingestion ILCR	Total	
Arsenic	7.99E-10	7.99E-10	NA	NA	7.99E-10
Benzo(*a*)anthracene	5.55E-12	5.55E-12	NA	NA	5.55E-12
Benzo(*a*)pyrene	3.63E-11	3.63E-11	NA	NA	3.63E-11
Benzo(*b*)fluoranthene	4.14E-12	4.14E-12	NA	NA	4.14E-12
Dibenzo(*a,h*)anthracene	1.20E-11	1.20E-11	NA	NA	1.20E-11
Indeno(*1,2,3-cd*)pyrene	1.77E-12	1.77E-12	NA	NA	1.77E-12
2-Methylnaphthalene	NA	NA	ND	—	—
4-Methylphenol	NA	NA	ND	—	—
Benzene	NA	NA	2.88E-06	2.88E-06	2.88E-06
Carbazole	NA	NA	3.58E-07	3.58E-07	3.58E-07
Naphthalene	NA	NA	ND	—	—
Pathway Total	**8.59E-10**	**8.59E-10**	**3.24E-06**	**3.24E-06**	**3.24E-06**

[a]The equations used to calculate noncarcinogenic risk are presented in Appendix I, Section I.4.2 of the revised final Phase II RFI Report (SAIC 2000).

[b]The equations used to calculate carcinogenic risk are presented in Appendix I, Section I.4.1 of the revised final Phase II RFI Report (SAIC 2000).

NA = Not applicable; this constituent is not present in this medium.

ND = The toxicity data required to quantify the risk are not available.

— = No sum value could be calculated.

Table 52. Hazard Indices and Carcinogenic Risks for Future Off-site Resident Child, SWMU 27F, Northwest of Building 1340

Chemical	Surface Soil[a]		Groundwater[a]			Total Hazard Index[a]
	Inhalation HI	Total	Ingestion HI	Dermal HI	Total	
Arsenic	ND	—	NA	NA	NA	—
Benzo(*a*)anthracene	ND	—	NA	NA	NA	—
Benzo(*a*)pyrene	ND	—	NA	NA	NA	—
Benzo(*b*)fluoranthene	ND	—	NA	NA	NA	—
Dibenzo(*a,h*)anthracene	ND	—	NA	NA	NA	—
Indeno(*1,2,3-cd*)pyrene	ND	—	NA	NA	NA	—
2-Methylnaphthalene	NA	NA	2.74E-02	1.19E-02	3.92E-02	3.92E-02
4-Methylphenol	NA	NA	1.02E-01	6.53E-03	1.09E-01	1.09E-01
Benzene	NA	NA	3.20E-01	1.60E-02	3.36E-01	3.36E-01
Carbazole	NA	NA	ND	ND	—	—
Naphthalene	NA	NA	2.79E-02	5.57E-03	3.35E-02	3.35E-02
Pathway Total	—	—	**4.77E-01**	**4.00E-02**	**5.18E-01**	**5.18E-01**

Chemical	Surface Soil[b]		Groundwater[b]			Total Cancer Risk[b]
	Inhalation ILCR	Total Risk	Ingestion ILCR	Dermal ILCR	Total Risk	
Arsenic	7.84E-10	7.84E-10	NA	NA	NA	7.84E-10
Benzo(*a*)anthracene	5.45E-12	5.45E-12	NA	NA	NA	5.45E-12
Benzo(*a*)pyrene	3.56E-11	3.56E-11	NA	NA	NA	3.56E-11
Benzo(*b*)fluoranthene	4.07E-12	4.07E-12	NA	NA	NA	4.07E-12
Dibenzo(*a,h*)anthracene	1.17E-11	1.17E-11	NA	NA	NA	1.17E-11
Indeno(*1,2,3-cd*)pyrene	1.74E-12	1.74E-12	NA	NA	NA	1.74E-12
2-Methylnaphthalene	NA	NA	ND	ND	—	—
4-Methylphenol	NA	NA	ND	ND	—	—
Benzene	NA	NA	4.52E-06	2.26E-07	4.75E-06	4.75E-06
Carbazole	NA	NA	5.61E-07	1.68E-07	7.30E-07	7.30E-07
Naphthalene	NA	NA	ND	ND	—	—
Pathway Total	**8.41E-10**	**8.41E-10**	**5.08E-06**	**3.95E-07**	**5.48E-06**	**5.48E-06**

[a]The equations used to calculate noncarcinogenic risk are presented in Appendix I, Section I.4.2 of the revised final Phase II RFI Report (SAIC 2000).

[b]The equations used to calculate carcinogenic risk are presented in Appendix I, Section I.4.1 of the revised final Phase II RFI Report (SAIC 2000).

NA = Not applicable; this constituent is not present in this medium.

ND = The toxicity data required to quantify the risk are not available.

— = No sum value could be calculated.

Table 53. Hazard Indices and Carcinogenic Risks for Future Off-site Resident Adult, SWMU 27F, Northwest of Building 1340

Chemical	Surface Soil[a]		Groundwater[a]				Total Hazard Index[a]
	Inhalation HI	Total	Ingestion HI	Dermal HI	Inhalation HI	Total	
Arsenic	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Benzo(*a*)anthracene	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Benzo(*a*)pyrene	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Benzo(*b*)fluoranthene	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Dibenzo(*a,h*)anthracene	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
Indeno(*1,2,3-cd*)pyrene	ND	—	NA[b]	NA[b]	NA[b]	NA[b]	—
2-Methylnaphthalene	NA[b]	NA[b]	1.17E-02	3.74E-03	NA[c]	1.54E-02	1.54E-02
4-Methylphenol	NA[b]	NA[b]	4.38E-02	2.06E-03	NA[c]	4.59E-02	4.59E-02
Benzene	NA[b]	NA[b]	1.37E-01	5.04E-03	4.11E-03	1.46E-01	1.46E-01
Carbazole	NA[b]	NA[b]	ND	ND	NA[c]	—	—
Naphthalene	NA[b]	NA[b]	1.20E-02	1.76E-03	NA[c]	1.37E-02	1.37E-02
Pathway Total	—	—	**2.05E-01**	**1.26E-02**	**4.11E-03**	**2.21E-01**	**2.21E-01**

Chemical	Surface Soil[d]		Groundwater[d]				Total Cancer Risk[d]
	Inhalation ILCR	Total	Ingestion ILCR	Dermal ILCR	Inhalation ILCR	Total	
Arsenic	9.88E-10	9.88E-10	NA[b]	NA[b]	NA[b]	NA[b]	9.88E-10
Benzo(*a*)anthracene	6.87E-12	6.87E-12	NA[b]	NA[b]	NA[b]	NA[b]	6.87E-12
Benzo(*a*)pyrene	4.49E-11	4.49E-11	NA[b]	NA[b]	NA[b]	NA[b]	4.49E-11
Benzo(*b*)fluoranthene	5.12E-12	5.12E-12	NA[b]	NA[b]	NA[b]	NA[b]	5.12E-12
Dibenzo(*a,h*)anthracene	1.48E-11	1.48E-11	NA[b]	NA[b]	NA[b]	NA[b]	1.48E-11
Indeno(*1,2,3-cd*)pyrene	2.19E-12	2.19E-12	NA[b]	NA[b]	NA[b]	NA[b]	2.19E-12
2-Methylnaphthalene	NA[b]	NA[b]	ND	ND	NA[c]	—	—
4-Methylphenol	NA[b]	NA[b]	ND	ND	NA[c]	—	—
Benzene	NA[b]	NA[b]	9.69E-06	3.57E-07	8.68E-08	1.01E-05	1.01E-05
Carbazole	NA[b]	NA[b]	1.20E-06	2.66E-07	NA[c]	1.47E-06	1.47E-06
Naphthalene	NA[b]	NA[b]	ND	ND	NA[c]	—	—
Pathway Total	**1.06E-09**	**1.06E-09**	**1.09E-05**	**6.22E-07**	**8.68E-08**	**1.16E-05**	**1.16E-05**

[a]The equations used to calculate noncarcinogenic risk are presented in Appendix I, Section I.4.2 of the revised final Phase II RFI Report (SAIC 2000).

[b]NA = Not applicable; this constituent is not present in this medium.

[c]NA = Not applicable; inhalation exposure is not a viable pathway for this constituent.

[d]The equations used to calculate carcinogenic risk are presented in Appendix I, Section I.4.1 of the revised final Phase II RFI Report (SAIC 2000).

ND = The toxicity data required to quantify the risk are not available.

— = No sum value could be calculated.

Table 54. Remedial Levels for Groundwater, SWMU 27F, Northwest of Building 1340

COC	Units	Maximum Detected Concentration	Risk-based Remedial Levels ILCR		Maximum Contaminant Level	Quantification Limits
			1×10^{-6}	1×10^{-5}		
Benzene	µg/L	61	NA	NA	**5**	2
Carbazole	µg/L	5.7	3.5	**34.9**	ND	9.6

NA = Not applicable; remedial level for groundwater defaults to the maximum contaminant level.
ND = No data; this constituent does not have a maximum contaminant level.
Bold indicates values are recommended remedial levels.

Table 55. Remedial Levels for Surface Soil, SWMU 27F, Northwest of Building 1340

COC	Units	Maximum Detected Concentration	Risk-based Remedial Levels ILCR		Surface Soil Background Concentration
			1×10^{-6}	1×10^{-5}	
Arsenic	mg/kg	4.40	1.01	**10.12**	2.1
Benzo(*a*)anthracene	mg/kg	3.94	0.89	**8.93**	0
Benzo(*a*)pyrene	mg/kg	2.43	0.09	**0.89**	0
Benzo(*b*)fluoranthene	mg/kg	2.88	0.89	**8.93**	0
Dibenzo(*a,h*)anthracene	mg/kg	0.54	0.09	**0.89**	0

Bold indicates values are recommended remedial levels.

Table 56. Recommended Remedial Levels in Soil and Groundwater, SWMU 27F, Northwest of Building 1340

COC	Medium	Maximum Detected Concentration	Recommended Remedial Level
Benzo(*a*)pyrene	Surface Soil	2.43 mg/kg	0.89 mg/kg
Benzene	Groundwater	61 µg/L	5 µg/L

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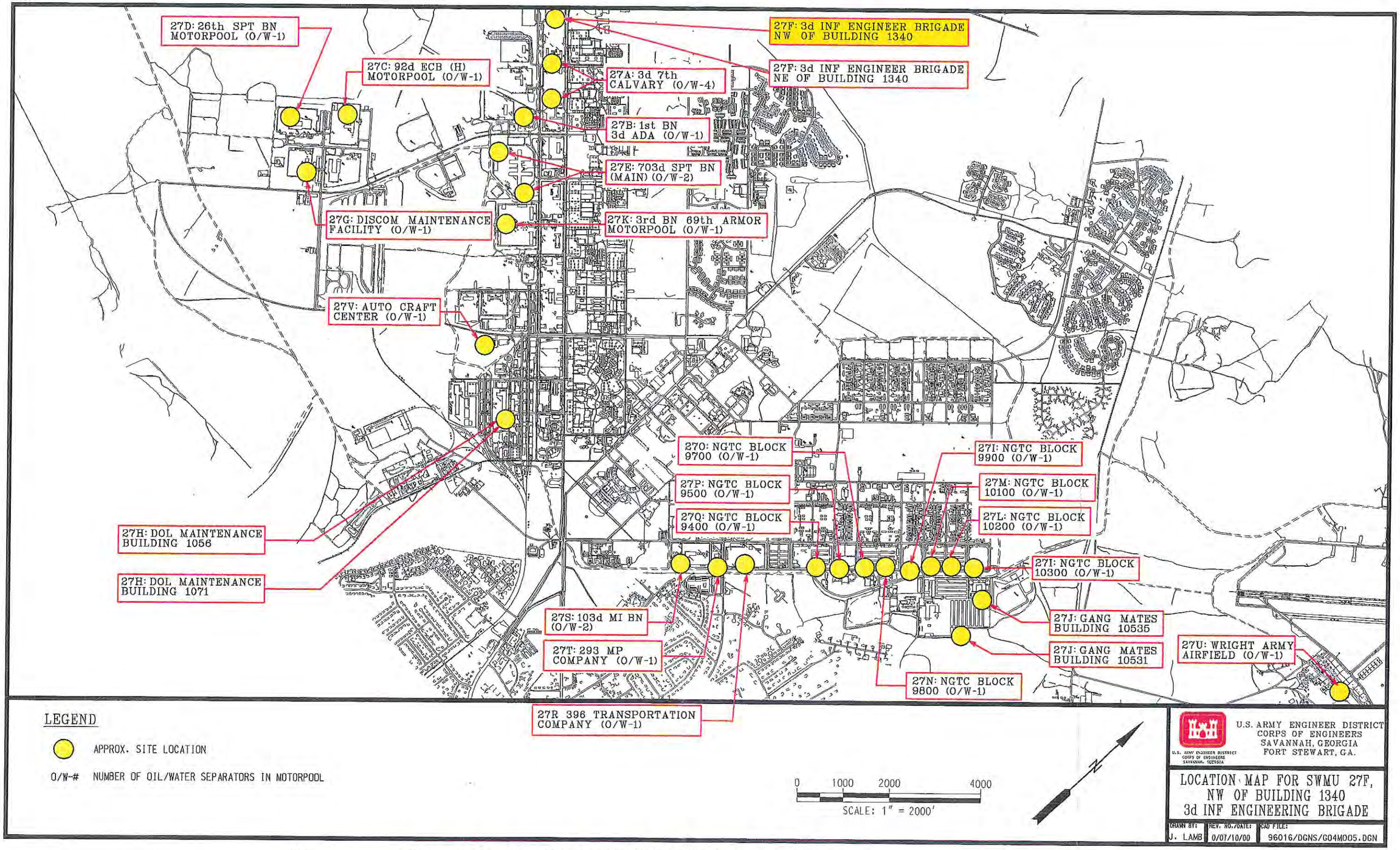


Figure 1. Location Map for SWMU 27F, Northwest of Building 1340

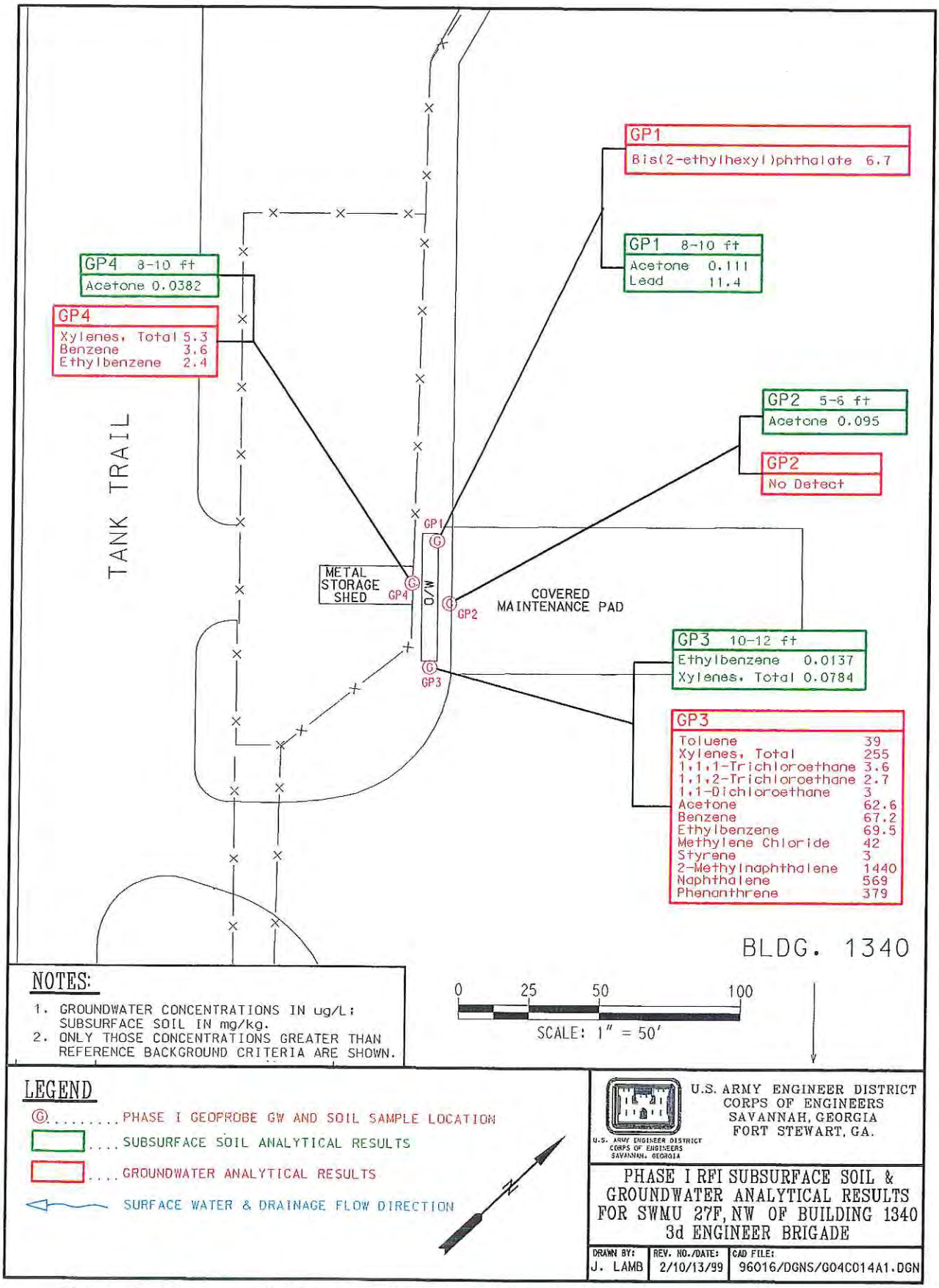


Figure 3. Summary of Phase I RFI Analytical Results in Subsurface Soil and Groundwater, SWMU 27F, Northwest of Building 1340

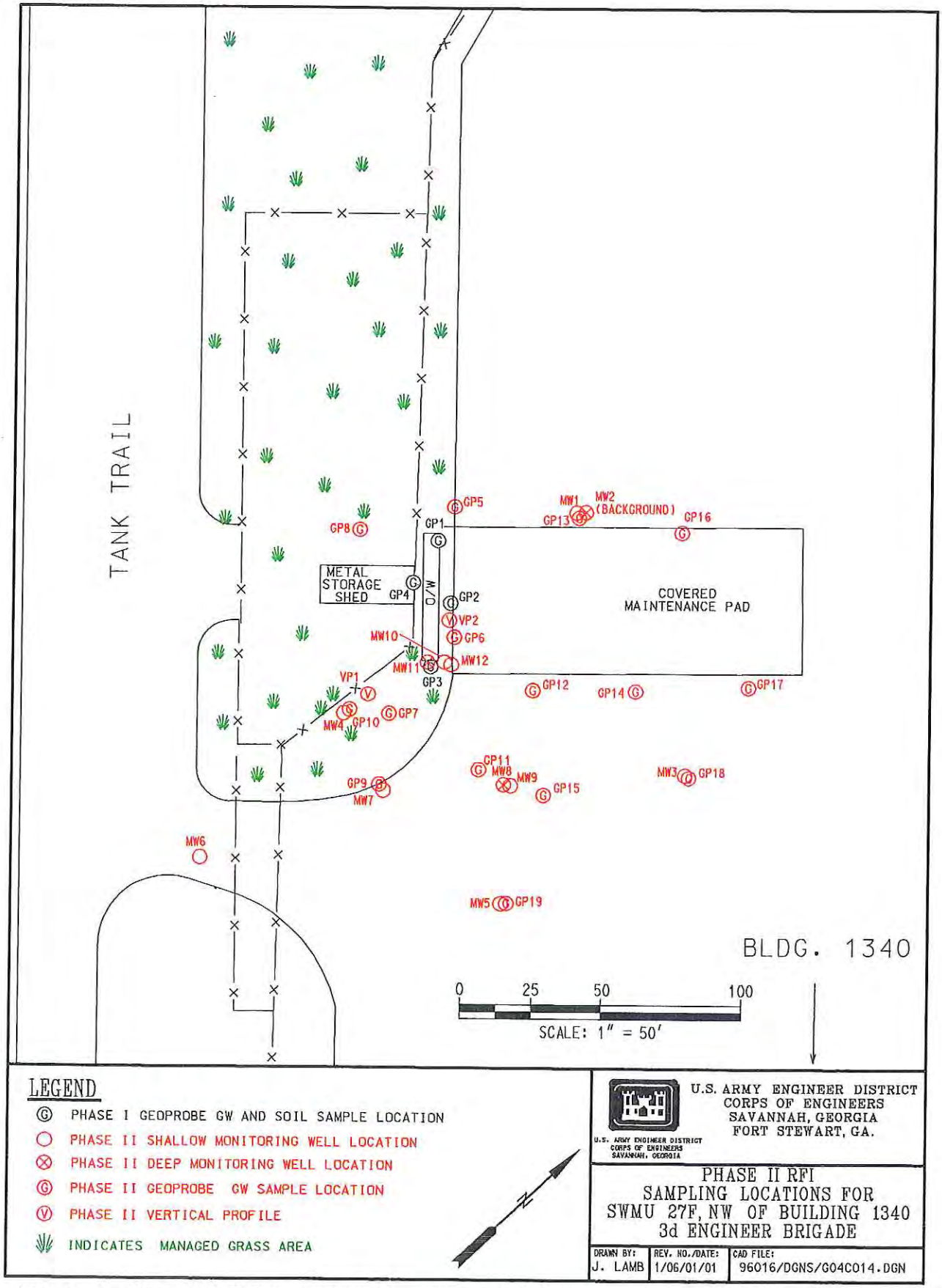
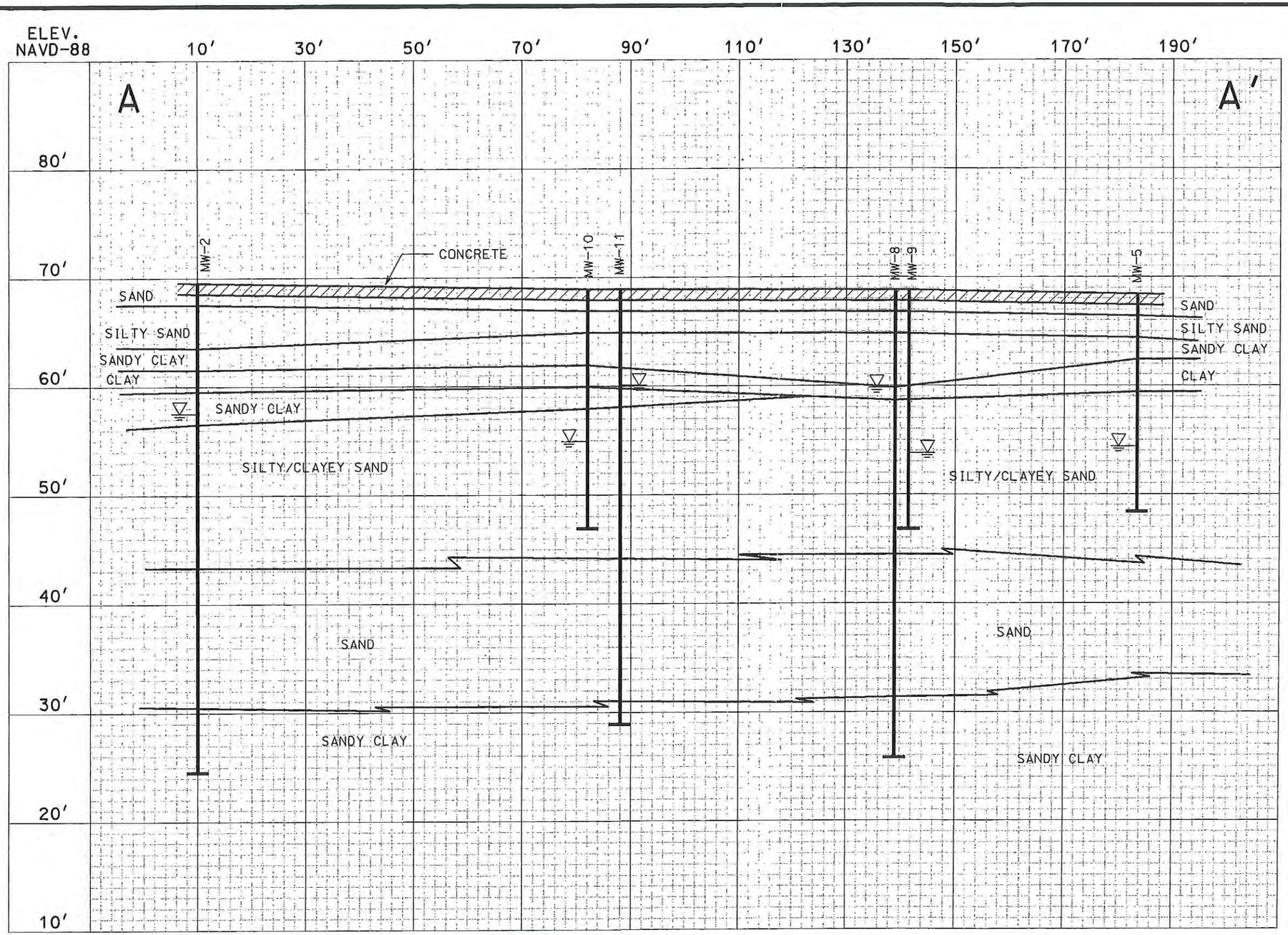
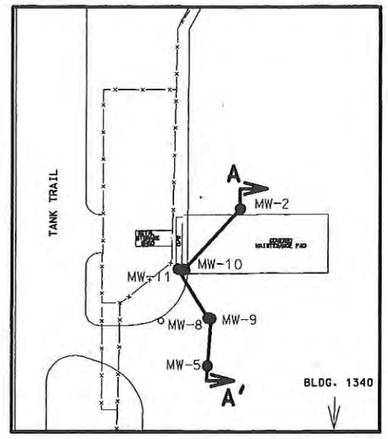


Figure 4. Phase II RFI Sampling Locations, SWMU 27F, Northwest of Building 1340

Figure 2. Phase I RFI Sampling Locations, SWMU 27F, Northwest of Building 1340



LEGEND



KEY PLAN
NTS

0 10 20 40
HORIZONTAL SCALE: 1″ = 20′

0 5 10 20
VERTICAL SCALE: 1″ = 10′

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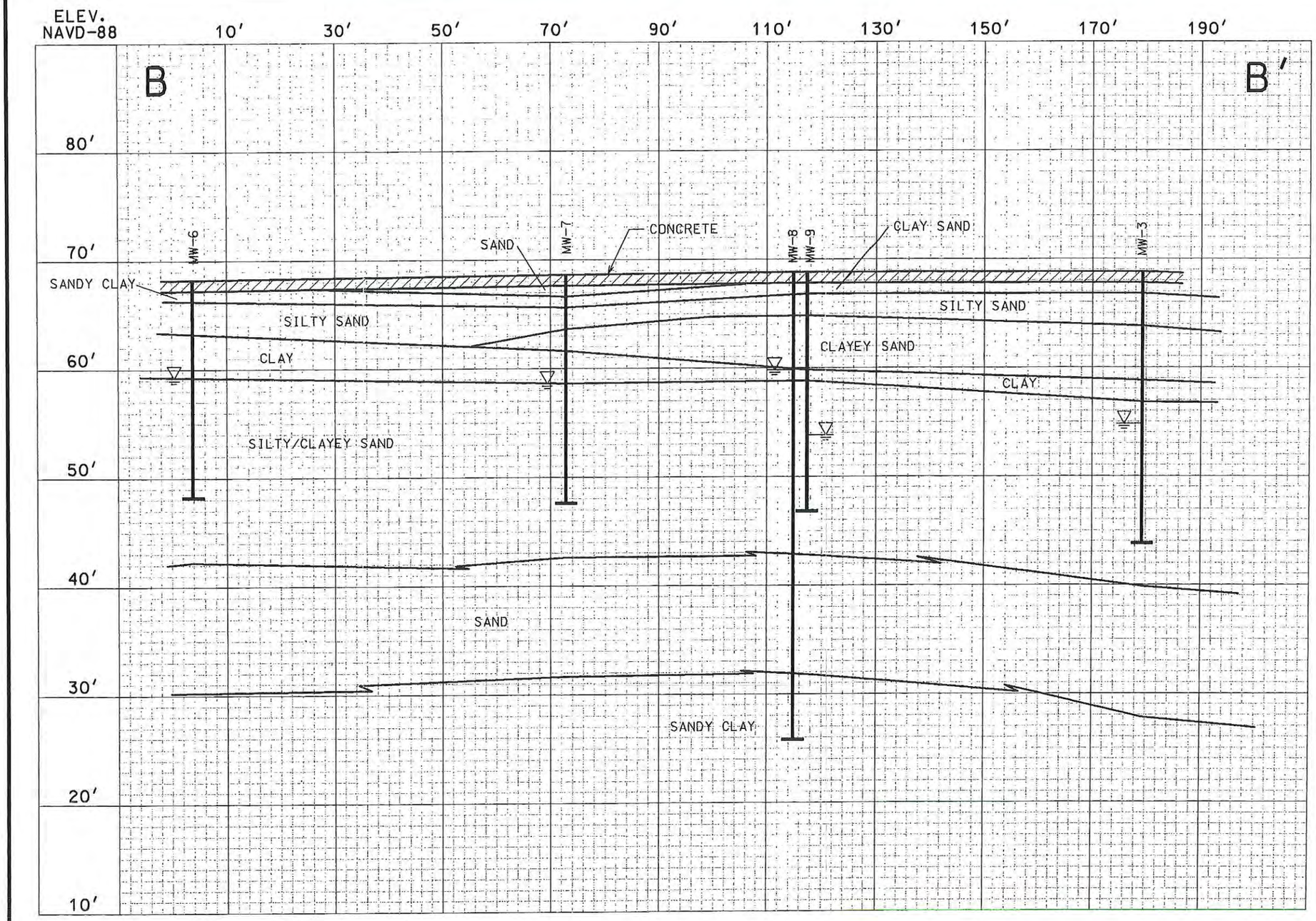
CROSS SECTION A-A′
FOR SWMU 27F, NW OF BUILDING 1340
3d ENGINEER BRIGADE

DRAWN BY:	REV. NO./DATE:	CAD FILE:
J. LAMB	0/03/09/00	96016/DGNS/G04CS014A.DGN

Figure 5. Phase II RFI Cross Section A–A', SWMU 27F, Northwest of Building 1340



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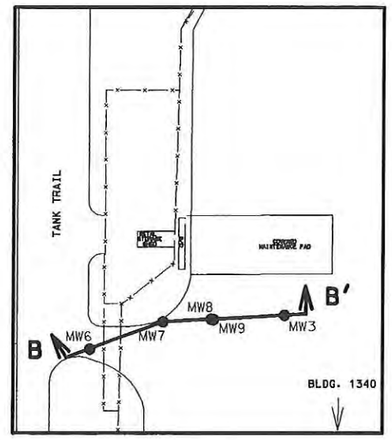

KEY PLAN
NTS

0 10 20 40
HORIZONTAL SCALE: 1″ = 20′

0 5 10 20
VERTICAL SCALE: 1″ = 10′

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**CROSS SECTION B-B′
FOR SWMU 27F NW OF
BUILDING 1340,
3d ENGINEER BRIGADE**

DRAWN BY:	REV. NO./DATE:	CAD FILE:
J. LAMB	0/03/09/00	96016/DGNS/G04CS014B.DGN

Figure 6. Phase II RFI Cross Section B–B', SWMU 27F, Northwest of Building 1340

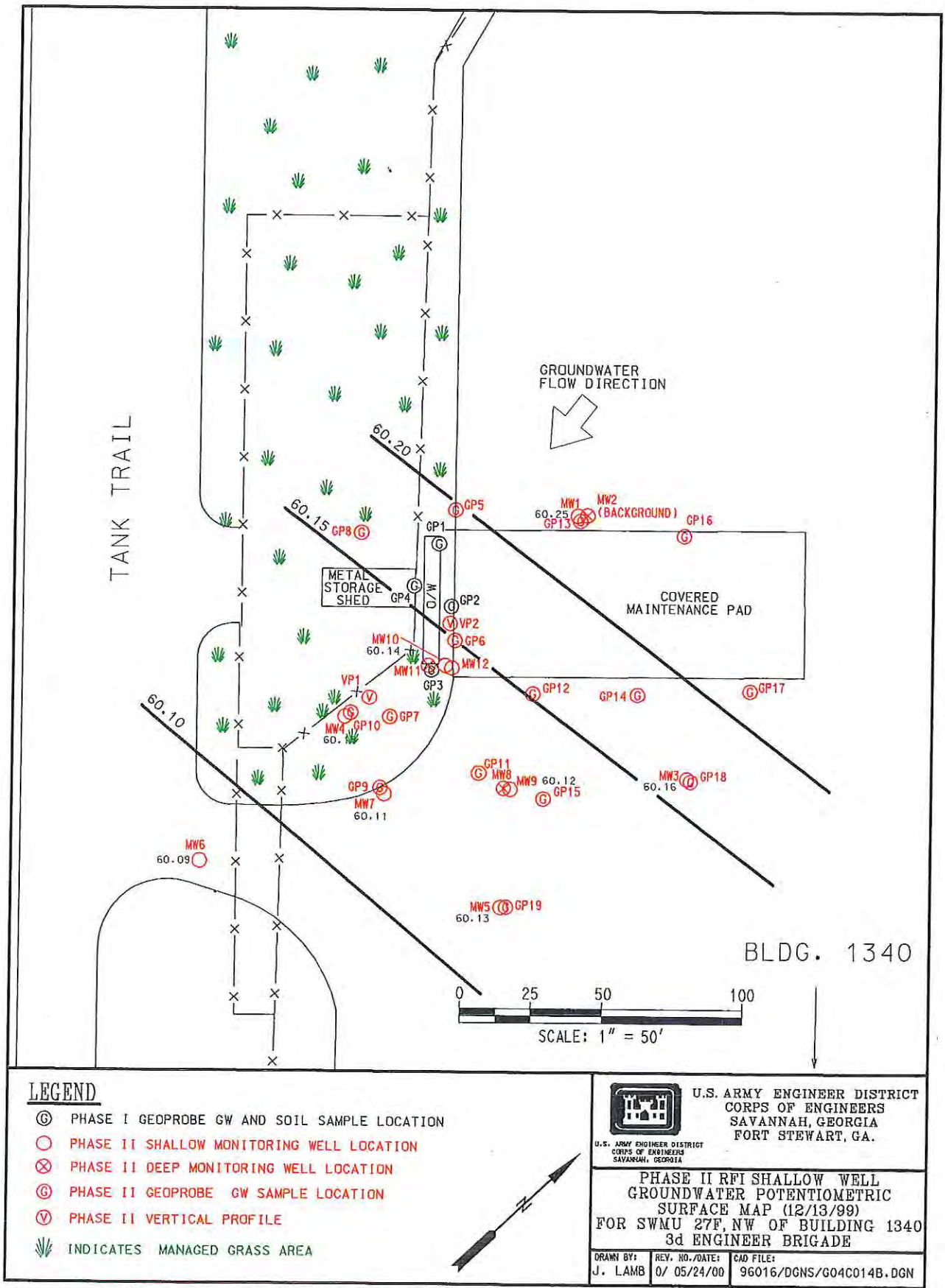

Figure 7. Phase II RFI Groundwater Potentiometric Surface Map for Shallow Wells, SWMU 27F, Northwest of Building 1340

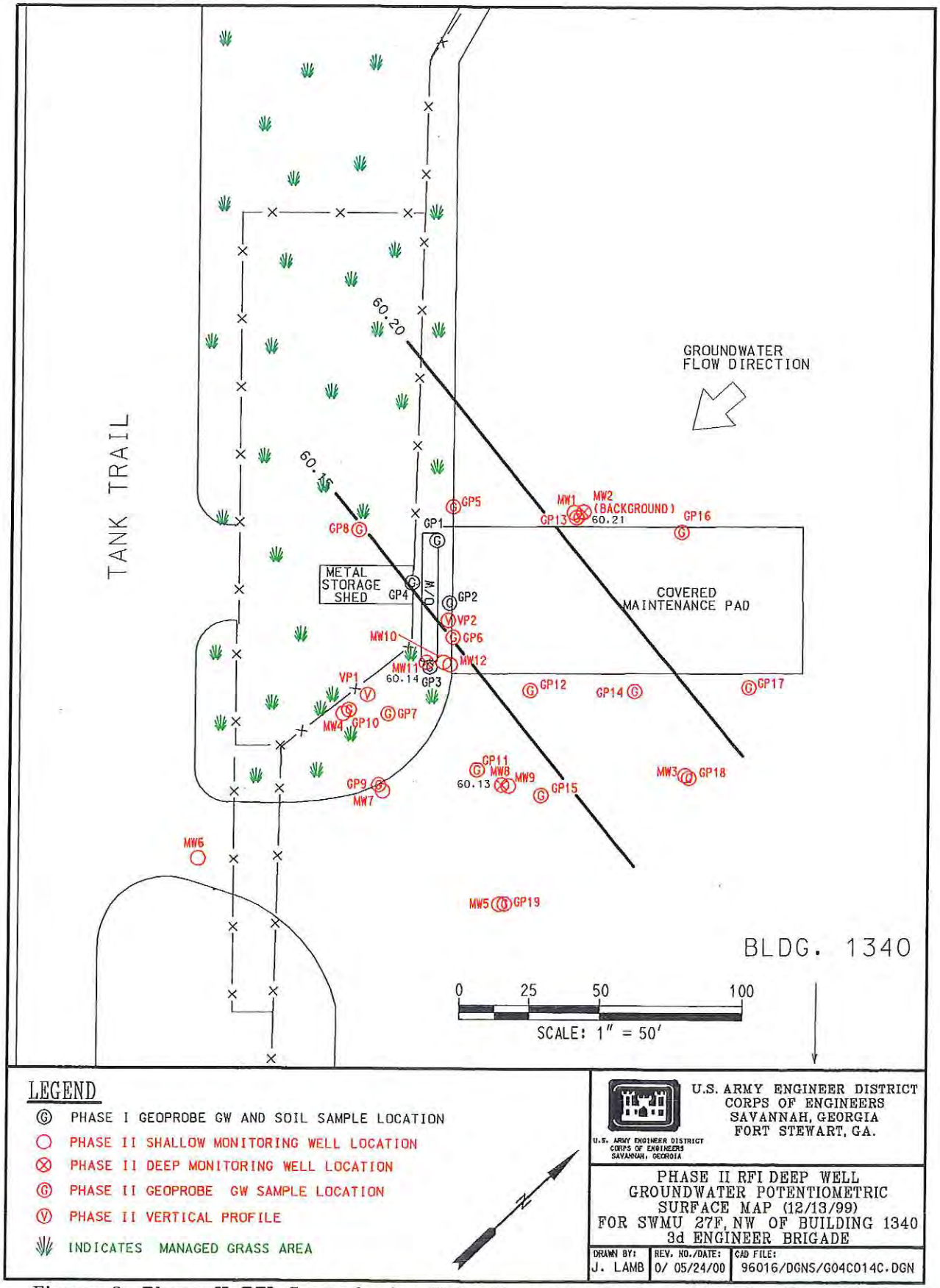

Figure 8. Phase II RFI Groundwater Potentiometric Surface Map for Deep Wells, SWMU 27F, Northwest of Building 1340

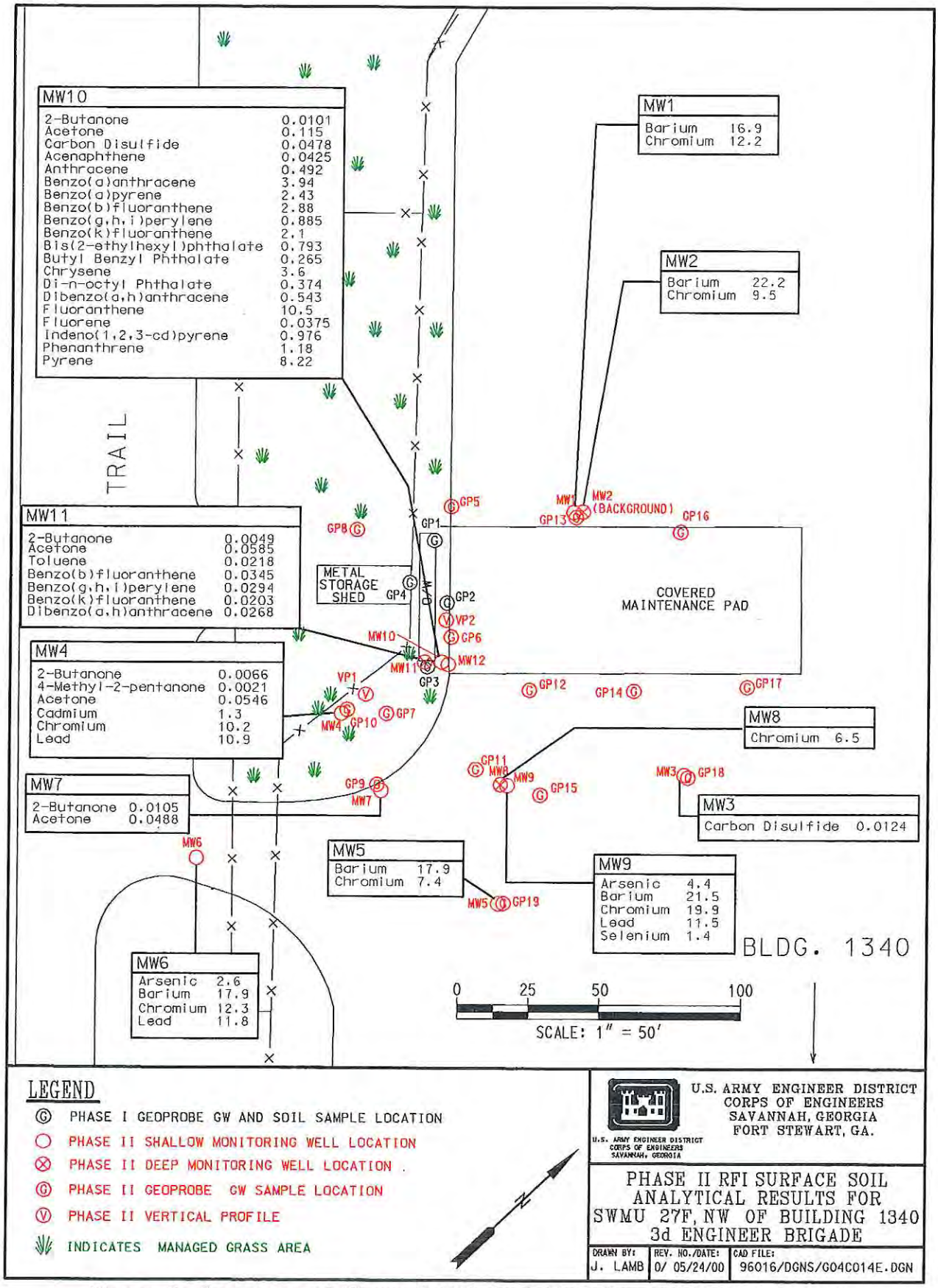

Figure 9. Summary of Phase II RFI Analytical Results in Surface Soil, SWMU 27F, Northwest of Building 1340

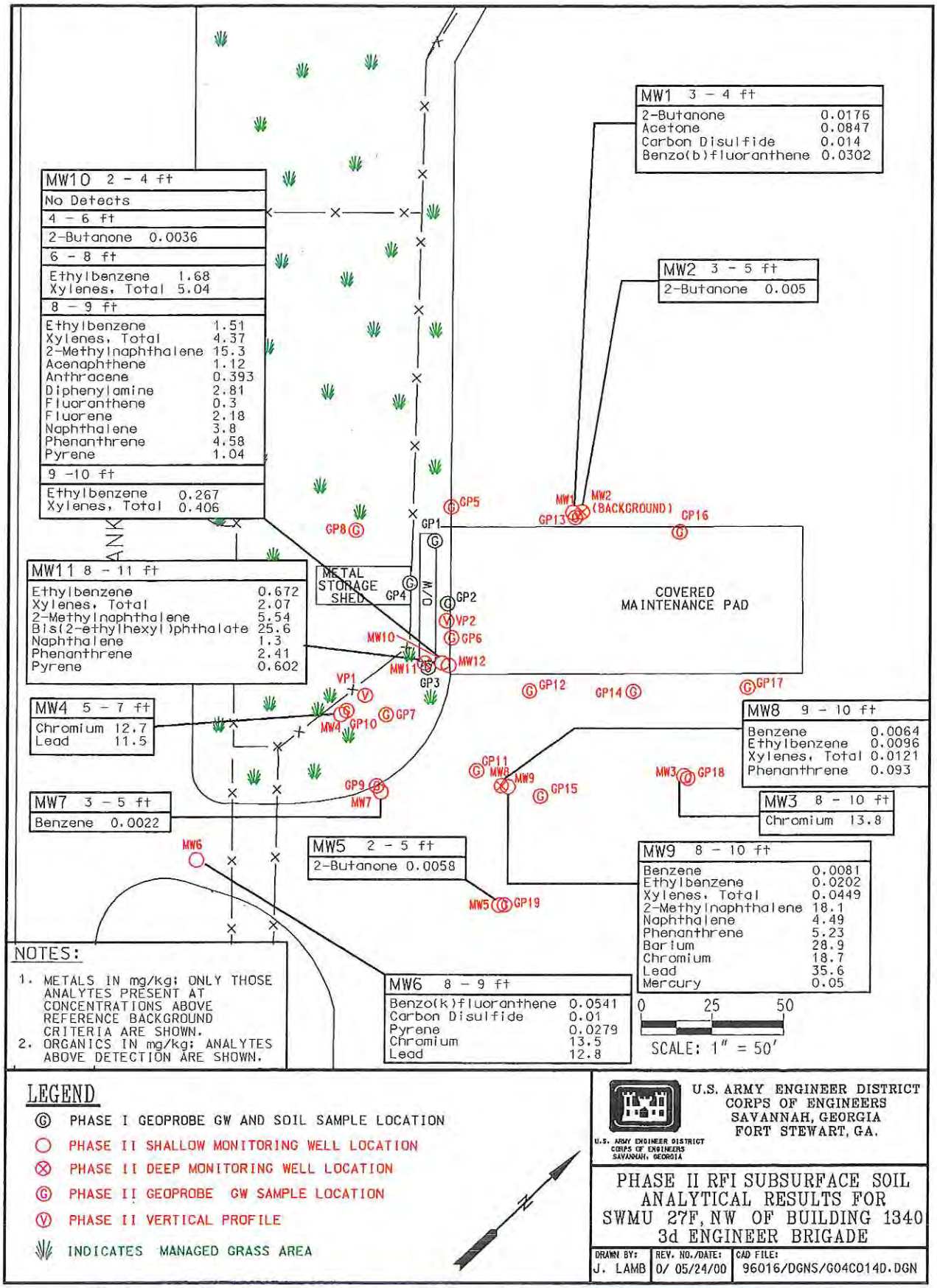

Figure 10. Summary of Phase II RFI Analytical Results in Subsurface Soil, SWMU 27F, Northwest of Building 1340

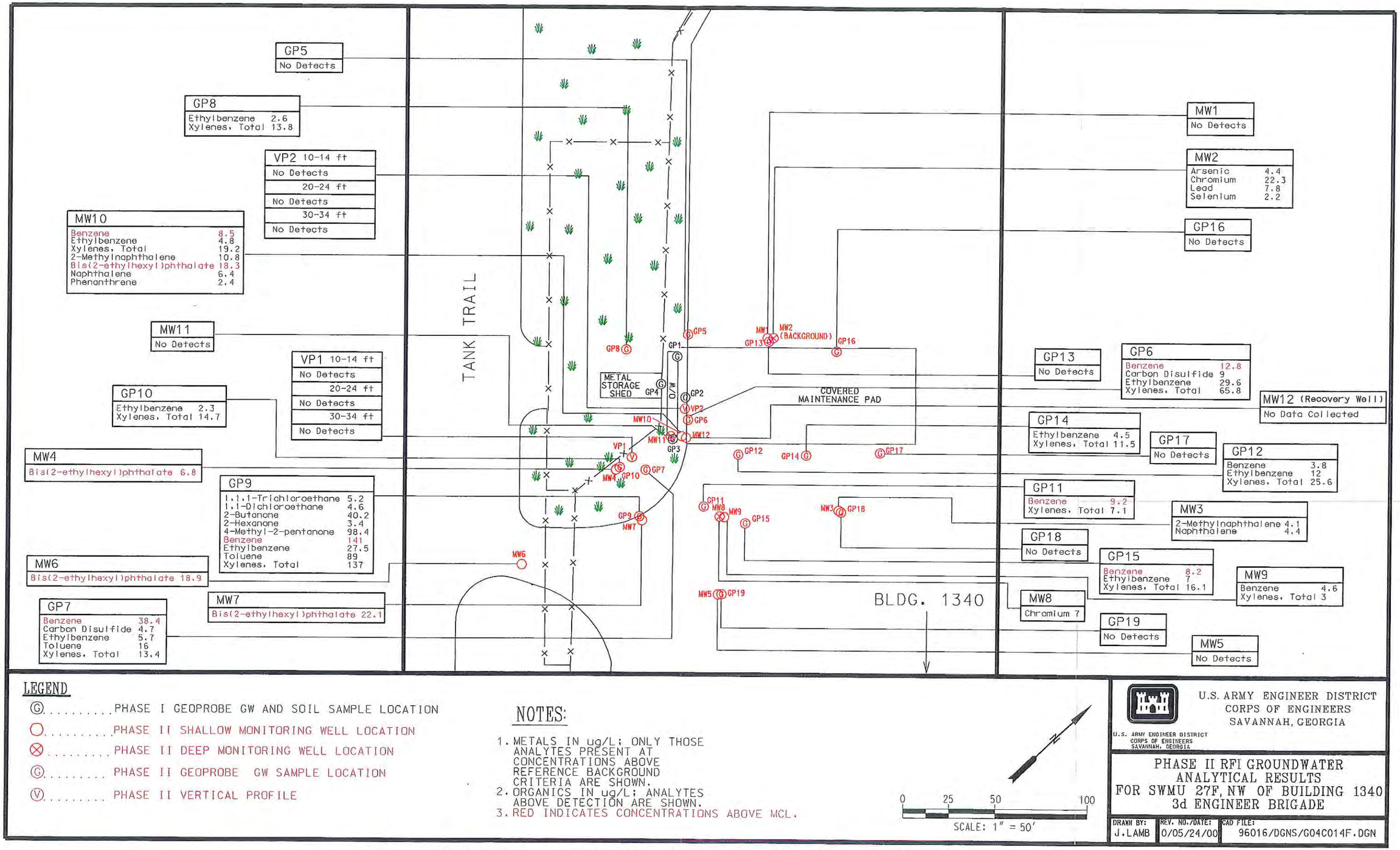

Figure 11. Summary of Phase II RFI Analytical Results in Groundwater, SWMU 27F, Northwest of Building 1340

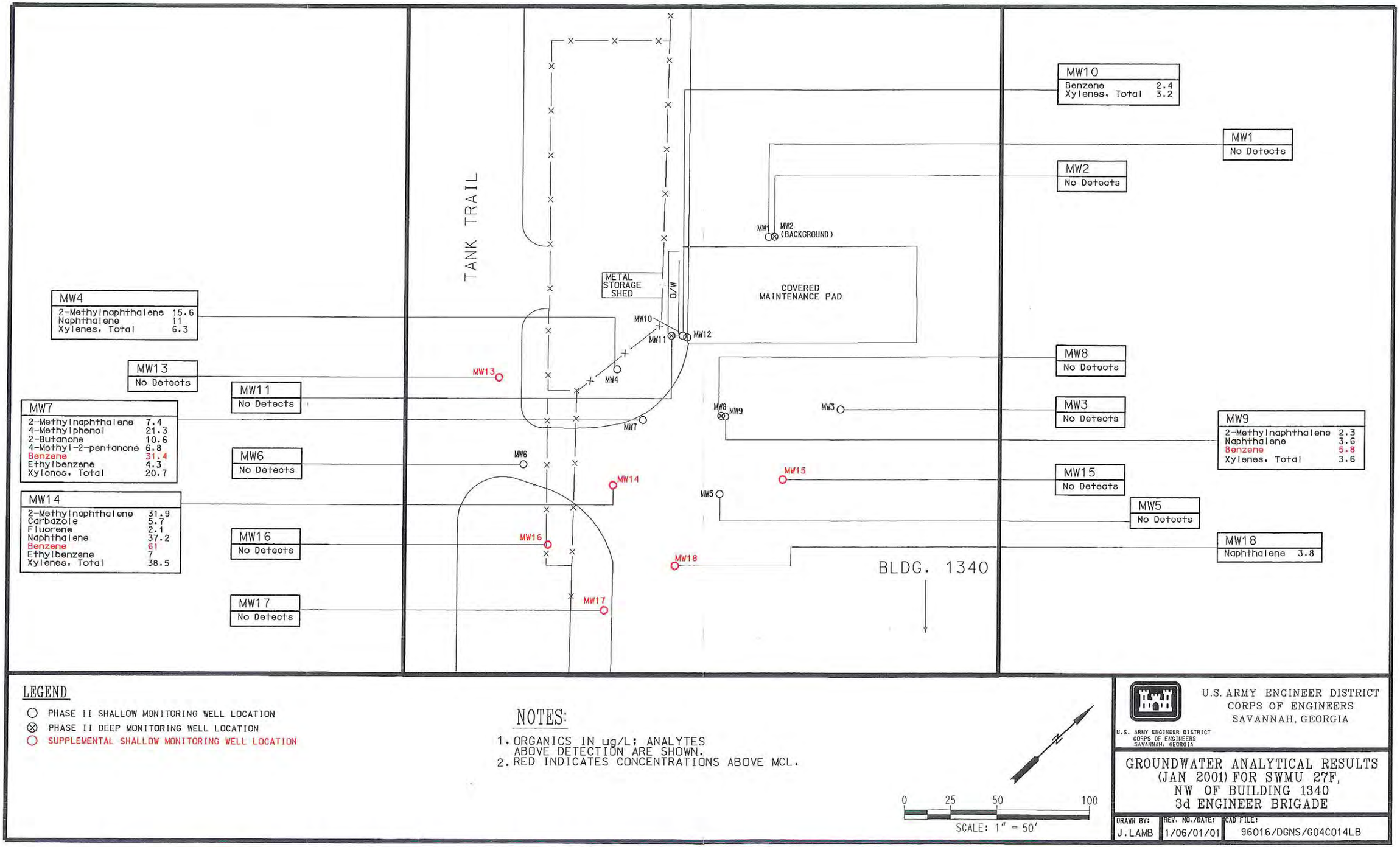

Figure 12. Summary of Supplemental Phase II RFI (January 2001) Analytical Results in Groundwater, SWMU 27F, Northwest of Building 1340

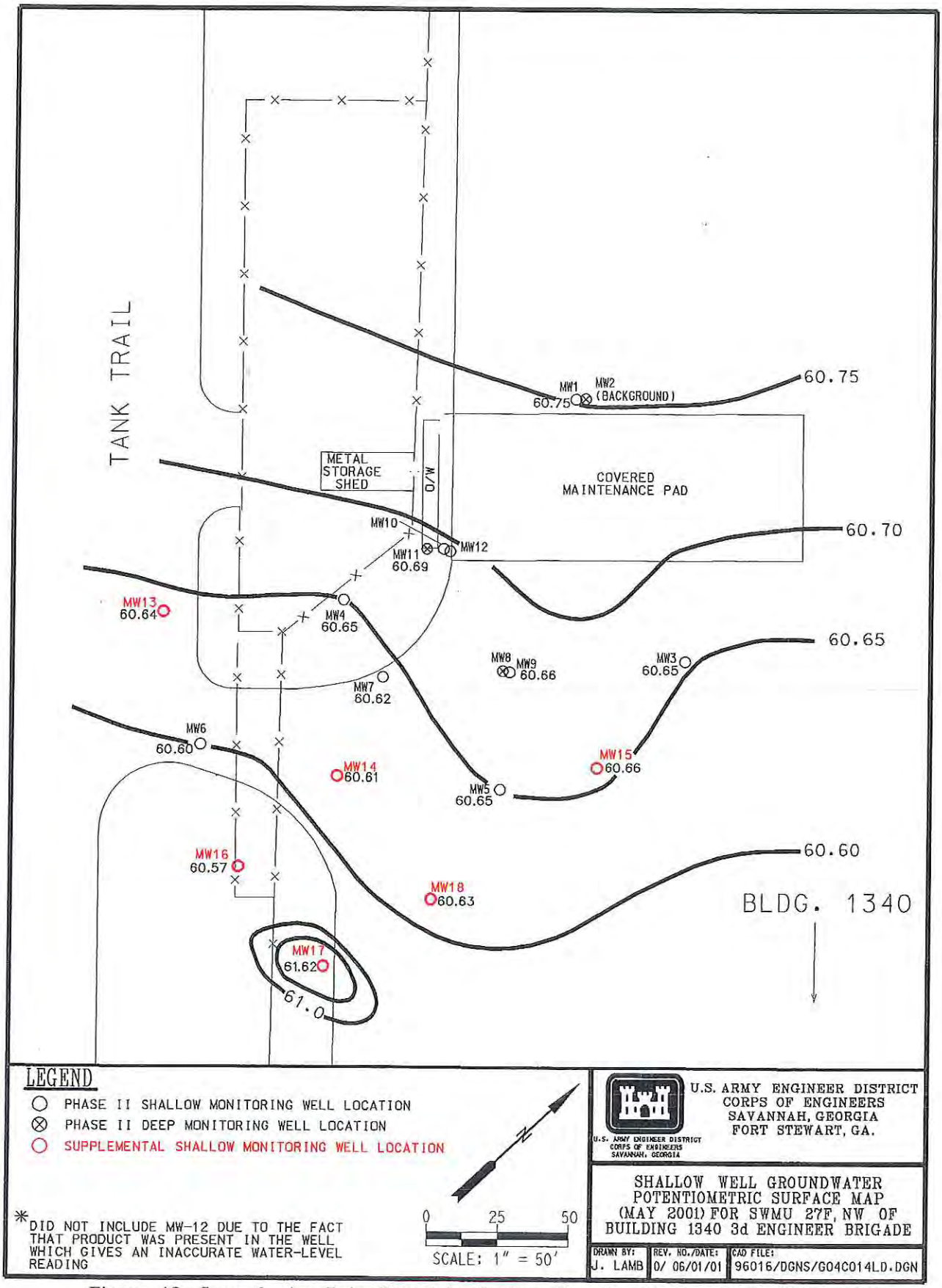

Figure 13. Groundwater Potentiometric Surface Map for Shallow Wells (May 2001), SWMU 27F, Northwest of Building 1340

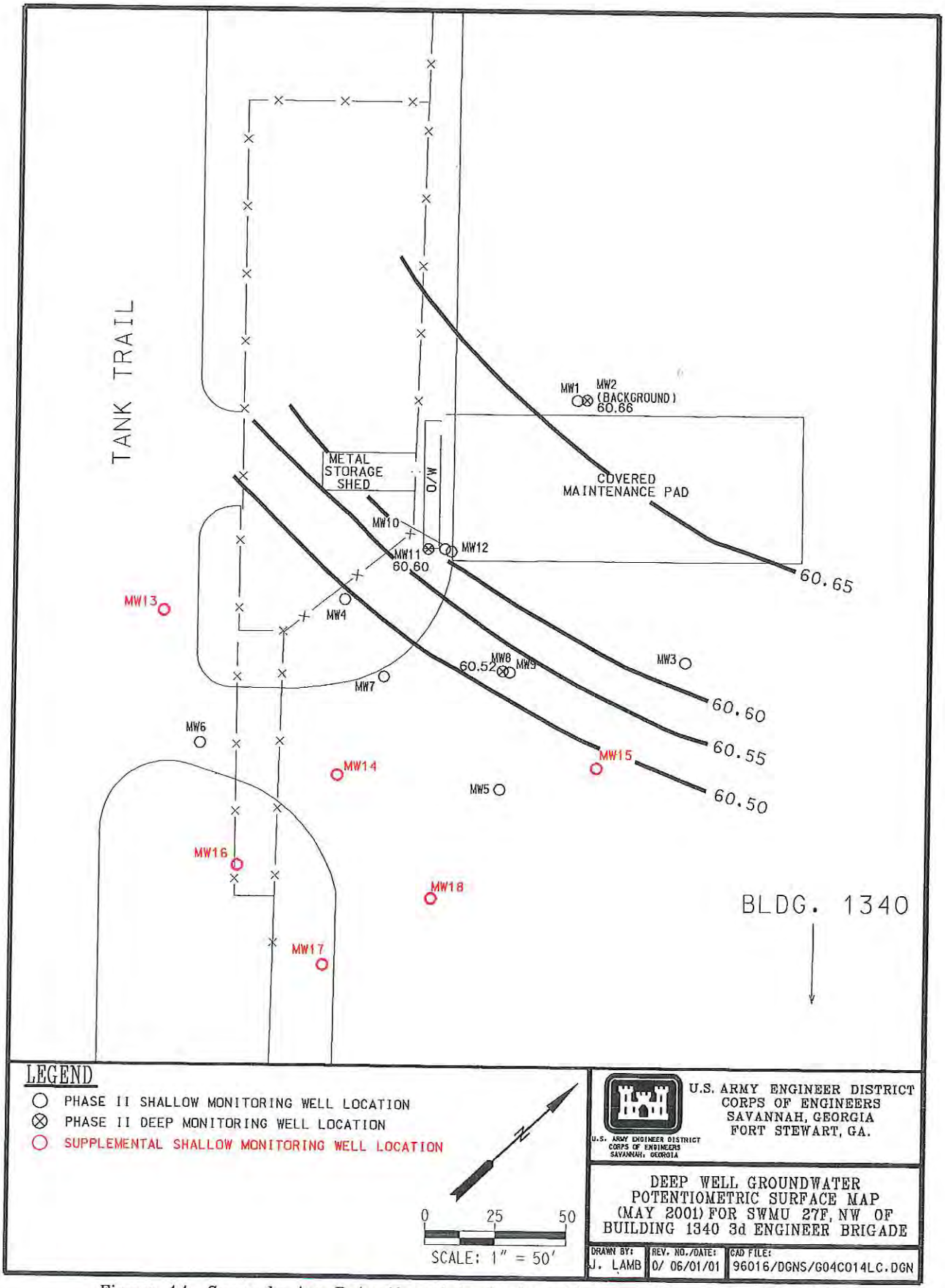

Figure 14. Groundwater Potentiometric Surface Map for Deep Wells (May 2001), SWMU 27F, Northwest of Building 1340