2.0 Study Area Investigation

This chapter summarizes site characterization activities conducted by IT during the SI and RI field activities at Parcel 66(7), including environmental sampling and analysis, groundwater monitoring well installation, and slug testing activities.

2.1 Environmental Sampling

The environmental sampling performed during the SI and RI at Parcel 66(7) included the collection of surface soil samples, subsurface soil samples, and groundwater samples for chemical analysis. The sample locations were determined by observing site physical characteristics during a site walkover and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 2-1. Sampling locations are shown on Figure 2-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 2.3.

2.1.1 Surface Soil Sampling

Three surface soil samples were collected at Parcel 66(7) (as part of the SI at Parcel 75[7]), as shown on Figure 2-1. Soil sampling locations and rationale are presented in Table 2-1. Sample designations and analytical parameters are listed in Table 2-2. Soil sampling locations were determined in the field by the on-site geologist based on sampling rationale, presence of surface structures, and proximity to utilities.

Sample Collection. Surface soil samples were collected from the upper 1 foot of soil using either a direct-push technology (DPT) sampling system or a stainless-steel hand auger following the methodology specified in Section 4.9.1.1 of the SAP (IT, 2000b). Surface soil samples were collected by first removing surface debris (e.g., rocks or vegetation) from the immediate sample area. At some locations, asphalt or concrete pavement was penetrated prior to sample collection. The soil was then collected with the sampling device and screened with a photoionization detector (PID) in accordance with Section 4.7.1.1 of the SAP (IT, 2000b). Samples for volatile organic compound (VOC) analysis were collected directly from the sampler using three En Core® samplers. The remaining portion of the soil was then transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 2-2 using methods outlined in Section 2.3.

Table 2-1

Sampling Locations and Rationale
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sampling Location Rationale
PPMP-75-GP01	Surface soil, subsurface soil, and groundwater	Samples were collected through the asphalt on the west side of Building 335. Visible evidence of staining on asphalt was observed during the IT site visit in June 1998. Sample data were collected to determine if potential site-specific chemicals (PSSC) exists near the building as a result of activities conducted in and around the building.
PPMP-75-GP02	Surface soil, subsurface soil, and groundwater	Sample location is adjacent to the southeastern corner of Building 335 and the southwestern corner of Building 336 (used to store paints). Open paint cans were observed during the IT site visit in June 1998. However, since the IT site visit in June of 1998, the paint cans have been removed. Sample data were collected to indicate if PSSC exists near the building as a result of activities conducted in and around the building.
PPMP-75-GP03	Surface soil, subsurface soil, and groundwater	Sample location is immediately outside of the eastern doors to Building 335. This building was used for small weapons repair in which fluids and oils were used to clean the weapons. Sample data were collected to determine if PSSC exists near the building as a result of activities conducted in and around the building.
PPMP-66-MW01	Groundwater	Residuum groundwater monitoring well PPMP-66-MW01 was installed approximately 100 feet potentially upgradient of temporary monitoring well PPMP-75-GP01 to provide groundwater data and to determine whether the organic compounds detected in temporary monitoring well PPMP-75-GP01 during SI activities are from sources other than the Small Weapons Repair Shop.
PPMP-66-MW02	Groundwater	Residuum groundwater monitoring well PPMP-66-MW02 replaced temporary monitoring well PPMP-75-GP01 located near the southwest corner of the Small Weapons Repair Shop. Groundwater sample was collected from the well to determine the presence or absence of volatile organic compounds.
PPMP-66-MW03	Groundwater	Residuum groundwater monitoring well PPMP-66-MW03 was installed approximately 110 feet south and potentially downgradient of the Small Weapons Repair Shop to provide groundwater data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the lateral extent of groundwater contamination.
PPMP-66-MW04	Groundwater	Residuum groundwater monitoring well PPMP-66-MW04 was installed approximately 180 feet north of the Small Weapons Repair Shop to provide groundwater quality data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the lateral extent of groundwater contamination.
PPMP-66-MW05	Groundwater	Residuum groundwater monitoring well PPMP-66-MW05 was installed approximately 100 feet northeast of temporary monitoring well PPMP-75-GP01 to provide groundwater quality data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the lateral extent of groundwater contamination.
PPMP-66-MW06	Groundwater	Residuum groundwater monitoring well PPMP-66-MW06 was installed approximately 75 feet southeast of temporary monitoring well PPMP-75-GP01 to provide groundwater quality data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the lateral extent of groundwater contamination.
PPMP-66-MW07	Groundwater	Residuum groundwater monitoring well PPMP-66-MW07 was installed approximately 145 feet northeast and potentially downgradient of temporary monitoring well PPMP-75-GP01 to provide groundwater quality data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the lateral extent of groundwater contamination.
PPMP-66-MW08	Groundwater	Bedrock groundwater monitoring well PPMP-66-MW08 was installed adjacent to residuum monitoring well PPMP-66-MW02 to provide groundwater quality data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the vertical extent of groundwater contamination.

Table 2-1

Sampling Locations and Rationale
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sampling Location Rationale
PPMP-66-MW09	Groundwater	Bedrock groundwater monitoring well PPMP-66-MW09 was installed adjacent to residuum monitoring well PPMP-66-MW03 to provide groundwater data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the vertical extent of groundwater contamination.
PPMP-66-MW10	Groundwater	Bedrock groundwater monitoring well PPMP-66-MW10 was installed adjacent to residuum monitoring well PPMP-66-MW04 to provide groundwater data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the vertical extent of groundwater contamination.
PPMP-66-MW11	Groundwater	Bedrock groundwater monitoring well PPMP-66-MW11 was installed adjacent to residuum monitoring well PPMP-66-MW05 to provide groundwater data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the vertical extent of groundwater contamination.
PPMP-66-MW12	Groundwater	Bedrock groundwater monitoring well PPMP-66-MW12 was installed adjacent to residuum monitoring well PPMP-66-MW06 to provide groundwater quality data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the vertical extent of groundwater contamination.
PPMP-66-MW13	Groundwater	Bedrock groundwater monitoring well PPMP-66-MW13 was installed adjacent to residuum monitoring well PPMP-66-MW07 to provide groundwater quality data, groundwater elevations to establish groundwater flow direction, vertical gradient, and to determine the vertical extent of groundwater contamination.
PPMP-66-MW14	Groundwater	Residuum monitoring well PPMP-66-MW14 was installed approximately 65 feet southeast of existing well PPMP-66-MW06 to provide groundwater analytical data to further define the lateral extent of groundwater contamination.
PPMP-66-MW15	Groundwater	Residuum monitoring well PPMP-66-MW15 was installed approximately 35 feet northwest of PPMP-66-MW02 to provide groundwater analytical data to further define the lateral extent of groundwater contamination.
PPMP-66-MW16	Groundwater	Residuum monitoring well PPMP-66-MW16 was installed approximately 60 feet southeast of PPMP-66-MW06 to provide groundwater analytical data to further define the lateral extent of groundwater contamination.

E 671,300

E 671,800

N 1,171,700

N 1,171,500

PPMP-66-MW10

PPMP-66-MW04

PPMP-66-MW11

PPMP-66-MW05

PPMP-66-MW13

PPMP-66-MW15

PPMP-66-MW07

PPMP-66-MW08

PPMP-75-GP03
(SEE NOTE 1)

PPMP-66-MW02

PPMP-75-GP01
(SEE NOTE 1)

PPMP-66-MW01

PPMP-66-MW12

PPMP-66-MW06

PPMP-75-GP02
(SEE NOTE 1)

PPMP-66-MW14

PPMP-66-MW16

PPMP-66-MW03

PPMP-66-MW09

WAVERLY ROAD

FREEMONT ROAD

FLOW

337

335

336

775

780

PAVED
PARKING

PARCEL 66(7)

LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
- TREES / TREELINE
- PARCEL BOUNDARY
- CULVERT WITH HEADWALL
- SURFACE DRAINAGE / CREEK
- MANMADE SURFACE DRAINAGE FEATURE
- FLOW SURFACE WATER FLOW DIRECTION
- FENCE
- UTILITY POLE
- SS SANITARY SEWER LINE
- MANHOLE
- BEDROCK MONITORING WELL AND GROUNDWATER SAMPLE LOCATION
- RESIDUUM MONITORING WELL AND GROUNDWATER SAMPLE LOCATION
- GROUNDWATER, SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION

NOTE:

1. RESIDUUM MONITORING WELL LOCATION.

SCALE
0 60 120 FEET

FIGURE 2-1
SAMPLE LOCATION MAP
SMALL WEAPONS REPAIR SHOP
PARCEL 66(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

IT CORPORATION
A Member of The IT Group

STARTING DATE: 03/26/02	DRAFT. CHCK. BY:	INITIATOR: J. REMO	DWG. NO.: ...\796887es.379
DRAWN BY: D. BOMAR	ENGR. CHCK. BY: S. MORAN	PROJ. MGR.: J. YACOUB	PROJ. NO.: 796887
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Table 2-2

Soil Sample Designations and Analytical Parameters
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft)	QA/QC Samples			Analytical Parameters
			Field Duplicates	Field Splits	MS/MSD	
PPMP-75-GP01	PPMP-75-GP01-SS-KJ0001-REG	0-1	PPMP-75-GP01-SS-KJ0002-FD	PPMP-75-GP01-SS-KJ0003-FS		Metals, VOCs, SVOCs, PCBs, Pesticides, and Herbicides
	PPMP-75-GP01-DS-KJ0004-REG	5-7				
PPMP-75-GP02	PPMP-75-GP02-SS-KJ0005-REG	0-1				Metals, VOCs, SVOCs, PCBs, Pesticides, and Herbicides
	PPMP-75-GP02-DS-KJ0006-REG	3-5				
PPMP-75-GP03	PPMP-75-GP03-SS-KJ0007-REG	0-1				Metals, VOCs, SVOCs, PCBs, Pesticides, and Herbicides
	PPMP-75-GP03-DS-KJ0008-REG	3-5				

FD - Field duplicate.
FS - Field split.
MS/MSD - Matrix spike/matrix spike duplicate.
PCB - Polychlorinated biphenyl.
QA/QC - Quality assurance/quality control.
REG - Regular field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

2.1.2 Subsurface Soil Sampling

Subsurface soil samples were collected from three soil borings at Parcel 66(7) (as part of the SI at Parcel 75[7]), as shown on Figure 2-1. One subsurface soil sample was collected from each soil boring. Subsurface soil sampling locations and rationale are presented in Table 2-1. Subsurface soil sample designations, depths, and analytical parameters are listed in Table 2-2. Soil boring sampling locations were determined in the field by the on-site geologist based on the sampling rationale, presence of surface structures, and proximity to buried or overhead utilities. IT contracted a DPT subcontractor to assist in subsurface soil sample collection.

Sample Collection. Subsurface soil samples were collected from soil borings at depths greater than 1 foot below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and soil samples collected using the DPT sampling procedures specified in Section 4.9.1.1 of the SAP (IT, 2000b). Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 2-2 using methods outlined in Section 2.3.

Subsurface soil samples were collected continuously to 12 feet bgs or until DPT sampler refusal was encountered. Samples were field-screened using a PID in accordance with Section 4.7.1.1 of the SAP (IT, 2000b) to measure for volatile organic vapors. The soil sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were not greater than background, the deepest soil sample interval above the saturated zone was submitted for analysis. Samples for VOC analysis were collected directly from the sampler with three En Core samplers. The remaining portion of the soil was then transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The samples were analyzed for the parameters listed in Table 2-2 using methods outlined in Section 2.3. The on-site geologist constructed a detailed boring log for each soil boring (Appendix B).

At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water following borehole abandonment procedures summarized in Appendix B of the SAP (IT, 2000b).

2.1.3 Monitoring Well Installation

Nineteen monitoring wells, including three temporary wells, ten permanent residuum wells, and six permanent bedrock wells, were installed at Parcel 66(7) to collect groundwater samples for

laboratory analysis. The well locations are shown on Figure 2-1. Table 2-3 summarizes construction details of the monitoring wells installed at the site. The well construction logs are included in Appendix B.

2.1.3.1 Temporary Monitoring Wells

IT contracted Miller Drilling, Inc. to install three temporary wells at Parcel 66(7) (as part of the SI at Parcel 75[7]). The wells were installed with a hollow-stem auger rig at the locations shown on Figure 2-1. The wells were installed following procedures outlined in Section 4.7 and Appendix C of the SAP (IT, 2000b). The boreholes at these locations were advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the saturated zone. The borehole was augered to the depth of DPT refusal, and soil samples were collected from that depth to the bottom of the borehole. A 2-foot-long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect geologic materials for observing and describing lithology. Where spoon refusal was encountered, the auger was advanced until the first water-bearing zone was encountered. The on-site geologist logging the auger boreholes at Parcel 66(7) continued the detailed lithological log for each borehole from the depth of DPT sampler refusal to the bottom of the auger borehole. The boring log for each borehole is included in Appendix B.

Upon reaching the target depth, a 10- or 15-foot length of 2-inch ID, 0.010-inch machine-slotted, Schedule 40 polyvinyl chloride (PVC) screen with a 3-inch PVC end cap was placed through the auger to the bottom of the borehole. The screen and end cap were attached to 2-inch ID, flush-threaded Schedule 40 PVC riser. A filter pack consisting of number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was tremied around the well screen to approximately 2 feet above the top of the well screen as the augers were removed. A bentonite seal, consisting of approximately 2 feet of hydrated bentonite chips, was placed immediately on top of the filter pack. A locking well cap was placed on top of the PVC well casing.

2.1.3.2 Residuum Monitoring Wells

IT contracted Miller Drilling, Inc. to install the residuum monitoring wells using a hollow-stem auger rig. The wells were installed following procedures outlined in Section 4.7 and Appendix C of the SAP (IT, 2000b). The borehole at each well location was advanced with a 4.25-inch ID hollow-stem auger from ground surface to the first water-bearing zone in the residuum. A 2-foot-long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect residuum for observing and describing lithology. Where split-spoon refusal was encountered, the auger was advanced until the first water-bearing zone was encountered. The on-site geologist

Table 2-3

Monitoring Well Construction Summary
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan, Calhoun County, Alabama

Well Location	Well Type	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)	Sump Interval (ft bgs)	Well Material
PPMP-75-GP01	Temporary	1171599.14	671456.86	783.59	782.78	14.0	10	3.25 - 13.25	NA	2" ID Sch. 40 PVC
PPMP-75-GP02	Temporary	1171564.06	671575.57	782.11	781.98	19.5	15	3.25 - 18.25	NA	2" ID Sch. 40 PVC
PPMP-75-GP03	Temporary	1171613.63	671571.30	781.49	781.34	18.0	10	6.75 - 16.75	NA	2" ID Sch. 40 PVC
PPMP-66-MW01	Residuum	1171563.79	671361.97	780.10	782.12	24.0	15	9.0 - 24.0	NA	2" ID Sch. 40 PVC
PPMP-66-MW02	Residuum	1171597.99	671450.77	780.64	780.19	24.0	15	9.0 - 24.0	NA	2" ID Sch. 40 PVC
PPMP-66-MW03	Residuum	1171449.61	671544.07	781.12	780.75	29.0	20	9.0 - 29.0	NA	2" ID Sch. 40 PVC
PPMP-66-MW04	Residuum	1171851.94	671549.23	779.98	781.90	24.0	15	7.0 - 22.0	22.0 - 24.0	2" ID Sch. 40 PVC
PPMP-66-MW05	Residuum	1171664.53	671529.70	780.92	780.37	29.3	20	9.3 - 29.3	NA	2" ID Sch. 40 PVC
PPMP-66-MW06	Residuum	1171555.76	671518.34	780.81	780.56	29.0	20	8.5 - 28.5	NA	2" ID Sch. 40 PVC
PPMP-66-MW07	Residuum	1171622.52	671599.18	782.38	782.13	29.5	20	9.5 - 29.5	NA	2" ID Sch. 40 PVC
PPMP-66-MW08	Bedrock	1171611.84	671449.35	780.88	780.69	74.5	10	61.1 - 71.1	71.1 - 74.5	4" ID Sch. 80 PVC
PPMP-66-MW09	Bedrock	1171438.71	671553.10	781.18	780.89	75.0	20	52.0 - 72.0	72.0 - 75.0	4" ID Sch. 80 PVC
PPMP-66-MW10	Bedrock	1171865.84	671548.39	779.74	781.96	75.0	20	52.0 - 72.0	72.0 - 75.0	4" ID Sch. 80 PVC
PPMP-66-MW11	Bedrock	1171684.94	671550.04	781.15	780.92	85.0	20	63.0 - 83.0	83.0 - 85.0	4" ID Sch. 80 PVC
PPMP-66-MW12	Bedrock	1171556.94	671510.11	780.74	780.46	75.2	10	64.2 - 74.2	74.2 - 75.2	4" ID Sch. 80 PVC
PPMP-66-MW13	Bedrock	1171622.16	671583.36	781.85	781.56	75.0	10	61.6 - 71.6	71.6 - 75.0	4" ID Sch. 80 PVC
PPMP-66-MW14	Residuum	1171522.34	671573.69	781.93	781.74	22.5	15	7.5 - 22.5	NA	2" ID Sch. 40 PVC
PPMP-66-MW15	Residuum	1171623.48	671428.16	780.74	780.58	13.0	10	3.0 - 13.0	NA	2" ID Sch. 40 PVC
PPMP-66-MW16	Residuum	1171515.39	671472.79	780.19	779.89	13.0	10	3.0 - 13.0	NA	2" ID Sch. 40 PVC

Temporary and permanent residuum monitoring wells installed using hollow-stem auger. Bedrock wells installed using both rock coring and air rotary drilling techniques.

Horizontal coordinates referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983 (NAD83).
Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).
2" ID Sch. 40 PVC - 2-inch inside diameter, Schedule 40, polyvinyl chloride.
4" ID Sch. 80 PVC - 4-inch inside diameter, Schedule 80, polyvinyl chloride.

amsl - Above mean sea level.
bgs - Below ground surface.
ft - Feet.
NA - Not applicable.

logging the auger boreholes continued the lithological log for each borehole from the depth of split-spoon sampler refusal to the bottom of the auger borehole by logging the auger drill cuttings. The drill cuttings were logged to determine lithologic changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geologic and hydrogeologic information. The lithological log for each borehole is included in Appendix B.

Upon reaching the target depth in each borehole, a 10- to 20-foot length of 4-inch ID, 0.010-inch continuous slot, Schedule 40 PVC screen with a 3-inch PVC end cap (or 2-foot PVC sump in PPMP-66-MW04) was placed through the auger to the bottom of the borehole. The screen and end cap (or sump) were attached to 2-inch ID, flush-threaded Schedule 40 PVC riser. A filter pack consisting of number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was tremied around the well screen to approximately 5 feet above the top of the well screen as the augers were removed. A bentonite seal, consisting of approximately 5 feet of bentonite pellets, was placed immediately on top of the filter pack and hydrated with potable water. In wells where the bentonite seal was installed below the water table surface, the bentonite pellets were allowed to hydrate in the groundwater. Bentonite seal placement and hydration followed procedures in Appendix C of the SAP (IT, 2000b). Bentonite-cement grout was tremied into the remaining annular space of the well from the top of the bentonite seal to approximately ground surface. After adequate time was allowed for the bentonite-cement grout to set, the PVC well riser was cut off at or near the ground surface and a locking well cap was placed securely on top of the riser. A steel flush-mount, bolt-down, traffic-bearing monitoring well cover was placed over the riser and locking cap and secured in place with a concrete pad.

2.1.3.3 Bedrock Monitoring Wells

Six bedrock monitoring wells were installed at Parcel 66(7) using a combination of rock coring and air-rotary drilling techniques. An air-rotary rig with a 12 1/4-inch rotary bit was used to drill the borehole from land surface to 5 feet into competent bedrock. The borehole diameter was approximately 12 inches to allow installation of a 10-inch ID carbon steel International Pipe Standard outer casing into the borehole from land surface to 5 feet into bedrock. A minimum of 2-inches of annular space was maintained between the outer casing and the borehole wall. The 10-inch outer casing was grouted in place using a tremie pipe suspended in the annulus outside the casing. Bentonite-cement grout was mixed using approximately 6.5 to 7 gallons of water and 5 pounds of bentonite per 94-pound bag of Type I Portland cement. The grout was allowed to

cure for a minimum of 48 hours. A PQ wireline core barrel was used to collect core samples continuously from the bottom of the outer casing to a minimum of 20 feet into bedrock. After completion of core sample collection, a 7 7/8-inch air percussion bit was used to ream the hole a minimum of 15 feet below the bottom of the outer casing and into bedrock.

A 4-inch monitoring well was installed through the outer casing at each borehole location. The well casing consisted of 4-inch ID, threaded, flush-joint, Schedule 80 PVC pipe. A 10- or 20-foot section of threaded, flush joint, 0.010-inch continuous wrap PVC well screen was attached to the bottom of the well casing. A 1 to 4-foot sump was installed at the bottom of each bedrock well. The sump consisted of 4-inch ID, threaded, flush joint Schedule 80 PVC pipe. After the casing and screen material were lowered into the boring, a gravel pack was installed around the well screen. The gravel pack, consisting of number 1 filter sand, was tremied into place from the bottom of the sump to approximately 5 feet above the top of the screen. A bentonite seal, approximately 5 feet thick, was placed above the gravel pack. The remaining annular space was grouted with a bentonite-cement mixture seal to ground surface.

2.1.3.4 Well Development

All the wells were developed by surging and pumping with a submersible pump in accordance with methodology outlined in Section 4.8 and Appendix C of the SAP (IT, 2000b). The submersible pump used for well development was moved in an up-and-down fashion to encourage any residual well installation materials to enter the well. These materials were then pumped out of the well to re-establish the natural hydraulic flow conditions. Development continued until the water turbidity was equal to or less than 20 nephelometric turbidity units (NTU), or for a maximum of 4 hours for the temporary residuum monitoring wells, a maximum of 8 hours for the permanent residuum monitoring wells, or a maximum of 12 hours for the bedrock monitoring wells. The well development logs are included in Appendix C.

2.1.3.5 Temporary Monitoring Well Abandonment

Temporary monitoring wells PPMP-75-GP01, PPMP-75-GP02, and PPMP-75-GP03 were abandoned in November 2000 as outlined in Section 4.7.2 of the SAP (IT, 2000b). Well abandonment forms are included in Appendix D.

2.1.4 Groundwater Sampling

A total of 19 groundwater samples were collected from the temporary, permanent residuum, and permanent bedrock wells installed at Parcel 66(7). The well/groundwater sample locations are

shown on Figure 2-1. The groundwater sampling locations and rationale are listed in Table 2-1. Groundwater sample designations and analytical parameters are listed in Table 2-4.

Sample Collection. Groundwater sampling was performed following procedures outlined in Section 4.9.1.4 of the SAP (IT, 2000b). Groundwater was sampled after purging a minimum of three well volumes and after field parameters (i.e., temperature, pH, dissolved oxygen, specific conductivity, oxidation-reduction potential, and turbidity) stabilized. Purging was performed with either a peristaltic pump, a submersible pump, or a bladder pump, each equipped with Teflon™ tubing. Sampling was performed with either the pump or a Teflon bailer. Field parameters were measured using a calibrated water-quality meter, as summarized in Table 2-5. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 2-4 using methods outlined in Section 2.3.

2.1.5 Hydraulic Characteristics

2.1.5.1 Water Level Measurements

The depth to groundwater was measured in the permanent wells at Parcel 66(7) and in wells at surrounding parcels (Parcels 9[7], 39[7], 43[7], 149[7], 164[7], and 166[7]) on January 7 and 8, 2002, following procedures outlined in Section 4.18 of the SAP (IT, 2000b). Depth to groundwater was measured with an electronic water-level meter. The meter probe and cable were cleaned after use at each well following decontamination methodology presented in Section 4.10 of the SAP (IT, 2000b). Measurements were referenced to the top of the PVC well casing. A summary of groundwater level measurements for Parcel 66(7) and adjacent parcels is presented in Table 2-6.

2.1.5.2 Slug Testing

Slug tests were performed at six wells to determine hydraulic conductivity in the saturated residuum and bedrock at the site. Slug testing locations were chosen based on purge rates recorded during well development activities. The well locations were selected to produce results representing the range of hydraulic conditions at the site. Two slug tests were carried out at each well, a rising head test and a falling head test, unless the static water level was below the top of the screened interval, in which case only a rising head test was carried out. A detailed description of the methods used is presented in Appendix E.

Table 2-4

Groundwater Sample Designations and Analytical Parameters
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	QA/QC Samples			Analytical Parameters
		Field Duplicates	Field Splits	MS/MSD	
PPMP-75-GP01	PPMP-75-GP01-GW-KJ3001-REG				VOCs, SVOCs, Metals, PCBs, Pesticides, and Herbicides
PPMP-75-GP02	PPMP-75-GP02-GW-KJ3002-REG				VOCs, SVOCs, Metals, PCBs, Pesticides, and Herbicides
PPMP-75-GP03	PPMP-75-GP03-GW-KJ3003-REG				VOCs, SVOCs, Metals, PCBs, Pesticides, and Herbicides
PPMP-66-MW01	PPMP-66-MW01-GW-HN3001-REG				VOCs
PPMP-66-MW02	PPMP-66-MW02-GW-HN3002-REG	PPMP-66-MW02-GW-HN3003-FD			VOCs
PPMP-66-MW03	PPMP-66-MW03-GW-HN3005-REG				VOCs
PPMP-66-MW04	PPMP-66-MW04-GW-HN3006-REG			PPMP-66-MW04-GW-HN3006-MS/MSD	VOCs
PPMP-66-MW05	PPMP-66-MW05-GW-HN3007-REG				VOCs
PPMP-66-MW06	PPMP-66-MW06-GW-HN3008-REG				VOCs
PPMP-66-MW07	PPMP-66-MW07-GW-HN3009-REG				VOCs
PPMP-66-MW08	PPMP-66-MW08-GW-HN3010-REG				VOCs
PPMP-66-MW09	PPMP-66-MW09-GW-HN3011-REG				VOCs
PPMP-66-MW10	PPMP-66-MW10-GW-HN3012-REG				VOCs
PPMP-66-MW11	PPMP-66-MW11-GW-HN3013-REG				VOCs
PPMP-66-MW12	PPMP-66-MW12-GW-HN3014-REG				VOCs
PPMP-66-MW13	PPMP-66-MW13-GW-HN3015-REG				VOCs
PPMP-66-MW14	PPMP-66-MW14-GW-HN3016-REG	PPMP-66-MW14-GW-HN3017-FD			VOCs
PPMP-66-MW15	PPMP-66-MW15-GW-HN3018-REG				VOCs
PPMP-66-MW16	PPMP-66-MW16-GW-HN3019-REG			PPMP-66-MW16-GW-HN3019-MS/MSD	VOCs

Groundwater samples were collected from the approximate midpoint of the saturated screened interval of the monitoring well.

FD- Field duplicate.
FS-Field split.
QA/QC - Quality assurance/quality control.
MS/MSD - Matrix spike/matrix spike duplicate.
PCB - Polychlorinated biphenyl.
SVOC - Semivolatile organic compound.
TCL - Target compound list.
VOC - Volatile organic compound.

Table 2-5

Groundwater Field Parameters
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Date	Specific Conductivity (mS/cm)[a]	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTU)	pH (SU)
PPMP-75-GP01	24-Feb-99	1.47 [a]	1.06	63.4	16.9	20.6	6.59
PPMP-75-GP02	24-Feb-99	0.53 [a]	2.99	113	17.8	15.4	7.59
PPMP-75-GP03	24-Feb-99	2.74 [a]	3.46	94.8	17.7	18.6	7.13
PPMP-66-MW01	8-Mar-01	3.00	2.66	-20	16.1	5.0	6.71
PPMP-66-MW02	6-Mar-01	2.13	1.71	50	15.6	2.0	6.37
PPMP-66-MW03	7-Mar-01	2.87	1.98	50	17.0	15.0	6.82
PPMP-66-MW04	5-Mar-01	2.90	0.64	115	14.7	16.0	6.33
PPMP-66-MW05	8-Mar-01	0.77	2.68	-50	15.3	7.0	7.02
PPMP-66-MW06	14-Mar-01	0.89	1.60	-60	19.7	6.0	7.04
PPMP-66-MW07	5-Mar-01	3.52	1.52	100	17.4	15.0	6.22
PPMP-66-MW08	6-Mar-01	2.50	1.73	10	16.8	1.0	6.70
PPMP-66-MW09	7-Mar-01	2.39	8.75	-10	18.0	4.2	6.96
PPMP-66-MW10	6-Mar-01	2.66	10.25 [b]	5	14.7	1.2	6.71
PPMP-66-MW11	16-Mar-01	2.02	7.64	165	13.5	3.4	5.81
PPMP-66-MW12	21-Mar-01	2.38	5.27	155	17.3	19.0	6.39
PPMP-66-MW13	14-Mar-01	2.61	1.08	270	20.6	4.0	6.70
PPMP-66-MW14	18-Oct-01	3.54	4.29	-101	19.6	5.8	7.15
PPMP-66-MW15	18-Oct-01	1.36	13.08 [b]	28	22.0	19.0	7.25
PPMP-66-MW16	18-Oct-01	2.00 [a]	8.05	365	18.6	8.1	6.29

[a] Specific conductivity values standardized to millisiemens per centimeter.

[b] Result artifically elevated due to air in groundwater sampling equipment.

°C - Degrees Celsius
mS/cm - Millisiemens per centimeter.
mg/L - Milligrams per liter.
mV - Millivolts
NTU - Nephelometric turbidity units.
ORP - Oxidation-reduction potential.
SU - Standard units

Table 2-6

Groundwater Elevations
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan, Calhoun County, Alabama

Well Location	Date	Depth to Water (ft BTOC)	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Groundwater Elevation (ft amsl)
PPMP-66-MW01	7-Jan-02	4.27	782.12	780.10	777.85
PPMP-66-MW02	8-Jan-02	3.21	780.19	780.64	776.98
PPMP-66-MW03	8-Jan-02	3.35	780.75	781.12	777.40
PPMP-66-MW04	7-Jan-02	5.28	781.90	779.98	776.62
PPMP-66-MW05	8-Jan-02	3.04	780.37	780.92	777.33
PPMP-66-MW06	8-Jan-02	3.04	780.56	780.81	777.52
PPMP-66-MW07	8-Jan-02	4.82	782.13	782.38	777.31
PPMP-66-MW08	8-Jan-02	3.20	780.69	780.88	777.49
PPMP-66-MW09	8-Jan-02	3.40	780.89	781.18	777.49
PPMP-66-MW10	7-Jan-02	7.19	781.96	779.74	774.77
PPMP-66-MW11	8-Jan-02	3.78	780.92	781.15	777.14
PPMP-66-MW12	8-Jan-02	3.00	780.46	780.74	777.46
PPMP-66-MW13	8-Jan-02	4.53	781.56	781.85	777.03
PPMP-66-MW14	8-Jan-02	4.45	781.74	781.93	777.29
PPMP-66-MW15	8-Jan-02	3.40	780.58	780.74	777.18
PPMP-66-MW16	8-Jan-02	3.05	779.89	780.19	776.84
FTA-149-GP07	9-Jan-02	10.86	784.41	781.95	773.55
FTA-164-GP01	8-Jan-02	5.35	801.38	799.50	796.03
FTA-164-GP02	8-Jan-02	6.31	810.05	807.51	803.74
FTA-164-GP03	8-Jan-02	1.52	807.26	807.16	805.74
FTA-164-GP04	8-Jan-02	4.86	802.10	800.54	797.24
FTA-164-GP05	8-Jan-02	5.80	813.63	812.26	807.83
FTA-164-GP06	8-Jan-02	8.81	819.14	817.22	810.33
FTA-164-GP07	8-Jan-02	5.21	813.57	812.67	808.36
FTA-164-GP10	8-Jan-02	7.96	805.79	803.08	797.83
FTA-164-GP11	8-Jan-02	4.04	801.59	799.96	797.55
FTA-164-MW01	8-Jan-02	5.25	813.54	813.74	808.29
FTA-164-MW02	8-Jan-02	5.68	813.73	814.03	808.05
FTA-164-MW03	8-Jan-02	5.75	814.31	814.62	808.56
FTA-164-MW04	8-Jan-02	4.92	813.39	813.69	808.47
FTA-166-GP01	7-Jan-02	0.00	768.38	767.92	768.38
FTA-166-MW01	7-Jan-02	2.52	767.64	767.98	765.12
FTA-166-MW02	7-Jan-02	4.27	766.89	767.83	762.62
FTA-166-MW03	7-Jan-02	5.30	771.36	772.00	766.06
PPMP-75-GP21	8-Jan-02	3.73	782.20	782.60	778.47
UST-39-MW01	8-Jan-02	11.34	790.52	788.32	779.18
UST-39-MW02	8-Jan-02	14.18	797.18	795.11	783.00
UST-39-MW03	8-Jan-02	11.10	802.46	803.17	791.36
UST-43-MW01	8-Jan-02	11.64	810.29	807.95	798.65
UST-43-MW02	8-Jan-02	11.64	810.24	808.07	798.60
UST-43-MW03	8-Jan-02	10.02	808.31	805.93	798.29
UST-9-MW01	8-Jan-02	2.72	763.44	763.70	760.72

Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).
amsl - Feet above mean sea level.
BTOC - Below top of casing.
ft - Feet.

2.2 Surveying of Sample Locations

Monitoring well and sample locations were surveyed using global positioning system survey techniques described in Section 4.3 of the SAP and conventional civil survey techniques described in Section 4.19 of the SAP (IT, 2000b). Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix F.

2.3 Analytical Program

Samples collected during the field investigations at Parcel 66(7) were analyzed for various chemical parameters based on the potential site-specific chemicals and on EPA, ADEM, FTMC, and USACE requirements. Samples collected during the original SI at Parcel 66(7) (investigated as part of Parcel 75[7]) were analyzed for the following parameters:

- Target compound list (TCL) VOCs – EPA Method 5035/8260B
- TCL semivolatile organic compounds (SVOC) – EPA Method 8270C
- Target analyte list metals – EPA Method 6010B/7000
- Chlorinated pesticides – EPA Method 8081A
- Chlorinated herbicides – EPA Method 8051A
- Organophosphorous pesticides – EPA Method 8141A
- Polychlorinated biphenyls (PCB) – EPA Method 8082.

Groundwater samples collected during the RI at Parcel 66(7) were analyzed for TCL VOCs only using EPA Method 8260B. All samples were analyzed using EPA SW-846 methods, including Update III methods where applicable, as presented in Table 6-1 in Appendix B of the SAP (IT, 2000b).

2.4 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in Section 4.13.2 of the SAP (IT, 2000b). Sample containers, sample volumes, preservatives, and holding times for the analyses required in the SI and RI are listed in Table 5-1 of Appendix B of the SAP (IT, 2000b). Sample documentation and chain-of-custody records were completed as specified in Section 4.13 of the SAP (IT, 2000b).

Completed analysis request and chain-of-custody records (included in Appendix A) were secured and included with each shipment of sample coolers to either Quanterra Environmental Services

in Knoxville, Tennessee, or EMAX Laboratories, Inc. in Torrance, California. Split samples were shipped to the USACE South Atlantic Division Laboratory in Marietta, Georgia.

2.5 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP (IT, 2000b). IDW generated during the field investigations at Parcel 66(7) was segregated as follows:

- Drill cuttings
- Purge water from well development, sampling activities, and decontamination fluids
- Spent well materials and personal protective equipment.

Solid IDW was stored inside the fenced area surrounding Buildings 335 and 336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analysis. Based on the results, drill cuttings, spent well materials, and personal protective equipment generated during the SI and RI were disposed as nonregulated waste at the Industrial Waste Landfill on the Main Post of FTMC.

Liquid IDW was contained in the 20,000-gallon sump associated with the Building T-338 vehicle washrack. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonregulated waste to the FTMC wastewater treatment plant on the Main Post.

2.6 Variances/Nonconformances

One variance to the SFSP was recorded during completion of the RI at Parcel 66(7). This variance did not alter the intent of the investigation or the sampling rationale presented in Table 4-2 of the SFSP addendum (IT, 2000a). The variance is summarized in Table 2-7, and the variance report is included in Appendix G.

No nonconformances were recorded during completion of field activities at Parcel 66(7).

2.7 Data Quality

The field sample analytical data are presented in tabular form in Appendix H. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the

Table 2-7

Variance to the Site-Specific Field Sampling Plan
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan, Calhoun County, Alabama

Variance to the SFSP	Justification for Variance	Impact to Remedial Investigation
Three additional residuum monitoring wells (PPMP-66-MW14, PPMP-66-MW15, and PPMP-66-MW16) were installed and a groundwater sample collected from each well.	The BCT made a decision to install additional wells at Parcel 66(7) to more accurately delineate the extent of the groundwater contaminant plume and provide additional groundwater data for any future remedial action.	The three additional residuum monitoring wells and groundwater samples provided a better horizontal delineation of the contaminant plume at Parcel 66(7).

site-specific work plans; the FTMC SAP and quality assurance plan; and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 1994) and the stipulated requirements for the generation of definitive data (Section 3.1.2 of Appendix B of the SAP [IT, 2000b]). Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms.

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. The results of the data validation are summarized in a quality assurance report, which includes the data validation summary report (Appendix I). Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System™ database for tracking and reporting. The data presented in this report, except where qualified, meet the principle data quality objective for this investigation.