RADFORD ARMY AMMUNITION PLANT, VIRGINIA

Master Work Plan Addendum 19:

SWMU 48
SWMU 49
SWMU 50
SWMU 59
SWMU 41
Area O
FLFA
SWMU 43
Area P

Prepared for:

USACE Baltimore District
10 S. Howard St.
Baltimore, MD 21201

Prepared by:

Shaw Environmental, Inc.
2113 Emmorton Park Rd.
Edgewood, MD 21040

Final Document **July 2007**

received 11-29-07

07-160

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

November 26, 2007

Commander,
Radford Army Ammunition Plant
Attn: SJMRF-OP-EQ (Jim McKenna)
P.O. Box 2
Radford, VA 24141-0099

P.W. Holt
Environmental Manager
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
P.O. Box 1
Radford, VA 24141-0100

Re: Radford Army Ammunition Plant, Va.
Master Work Plan Addendum 019
Review of the Army's RCRA Work Plan Addendum

Dear Mr. McKenna and Ms. Holt:

The U.S. Environmental Protection Agency (EPA) and the Virginia Department of Environmental Quality (VDEQ) have reviewed the U.S. Army's (Army's) September, 2007 submittal of the Final RCRA Master Work Plan Addendum 019 for SWMUs 45, 49, 50, 59, 41, and 43, and Area O, FLFA, and Area P located at the Radford Army Ammunition Plant (RFAAP). Based upon our review, the report is approved, and in accordance with Part II. (E) (5) of RFAAP's Corrective Action Permit, it can now be considered final.

If you have any questions, please call me at 215-814-3413, or Jim Cutler at 804-698-4498. Thanks.

Sincerely,

William Geiger
RCRA Project Manager
General Operations Branch (3WC23)

cc: Jim Cutler, VDEQ
Richard Criqui, VDEQ

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100
USA

September 26, 2007

Mr. William Geiger
RCRA General Operations Branch, Mail Code: 3WC23
Waste and Chemicals Management Division
U. S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject: With Certification, Master Work Plan Addendum 019: SWMU 45, SWMU 49, SWMU 50, SWMU 59, SWMU 41, Area O, FLFA, SWMU 43, Area P, Final Document, July 2007
Radford Army Ammunition Plant Installation Action Plan
EPA ID# VA1 210020730

Dear Mr. Geiger:

Enclosed is the certification for the subject document that was sent to you on September 26, 2007.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

Enclosure

c: Jim Cutler
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
West Central Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

07-815-188
JMcKenna

Rich Mendoza
U.S. Army Environmental Command
1 Rock Island Arsenal
Bldg 90, 3rd Floor, Room 30A
IMAE-CDN
Rock Island, Illinois 61299

Dennis Druck
U.S. Army Center for Health Promotion and Preventive Medicine
5158 Blackhawk Road, Attn: MCHB-TS-REH
Aberdeen Proving Ground, MD 21010-5403

Tom Meyer
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

bc:
Administrative File
J. McKenna, ACO Staff
Rob Davie-ACO Staff
M.A. Miano
P.W. Holt
J. J. Redder
Env. File

Coordination: [signature]
J. McKenna

M. Miano by [signature]
M. A. Miano

07-815-188
JMcKenna

Concerning the following:

Master Work Plan Addendum 019:
SWMU 45, SWMU 49, SWMU 50, SWMU 59, SWMU 41, Area O, FLFA, SWMU 43, Area P,
Final Document,
July 2007
Radford Army Ammunition Plant

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE:
PRINTED NAME: Jon R. Drushal
TITLE: Lieutenant Colonel, US Army
Commanding

SIGNATURE:
PRINTED NAME: Kent Holiday
TITLE: Vice President and General Manager
ATK Energetics Systems Division

07-815-188
JMcKenna

ATK ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100
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September 26, 2007

Mr. William Geiger
RCRA General Operations Branch, Mail Code: 3WC23
Waste and Chemicals Management Division
U. S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject Master Work Plan Addendum 019: SWMU 45, SWMU 49, SWMU 50, SWMU 59, SWMU 41, Area O, FLFA, SWMU 43, Area P, Final Document, July 2007
Radford Army Ammunition Plant Installation Action Plan
EPA ID# VA1 210020730

Dear Mr. Geiger:

Enclosed is one copy of the subject document. It has been revised per your June 20, 2007 email. Also under separate cover, one copy each will be sent to the distribution below.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

Enclosure

c: Jim Cutler
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Durwood Willis
Virginia Department of Environmental Quality
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Richmond, VA 23240-0009

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ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

bc: Administrative File
J. McKenna, ACO Staff
P.W. Holt
J. J. Redder
Env. File

Coordination: J. McKenna

07-815-187
JMcKenna

Leahy, Timothy

From: Geiger.William@epamail.epa.gov
Sent: Wednesday, June 20, 2007 9:13 AM
To: Leahy, Timothy; McKenna, Jim Mr. RFAAP ACO Staff
Subject: Re: Radford Work Plan Addendum 019

Attachments: EAS

Looks good, Tim.

Jim, EPA approves the additional information/updates for Work Plan Addendum 19. Radford can move forward with the field work.

Thanks

William A. Geiger
USEPA Region III
1650 Arch Street
Philadelphia, PA 19103
(215)814-3413

"Leahy, Timothy" <Timothy.Leahy@shawgrp.com>
06/19/2007 05:34 PM

To
William Geiger/R3/USEPA/US@EPA, William Geiger/R3/USEPA/US@EPA

cc

Subject
Radford Work Plan Addendum 019

Will,

Thanks for taking the time to discuss the comments and responses for Work Plan Addendum 019 with me this morning. This email is intended to capture the main points that we discussed and provide additional information/updates to the responses so that we can move forward with the field work.

1) EPA agrees with the RTCs for comments 1-11.
   - Boring Logs (comment #3) will be sent shortly.

2) Comment #12 has been dropped by the EPA.

3) EPA agrees with the RTCs for comments 13-17.
   - Revised Figure 3-2 (comment #14) will be sent shortly. An older figure that shows the location of the requested features is attached.

4) Comment #18 – The Response has been changed. Parsons' sample location map and Parsons' data table with the results is attached. A new table, similar in format to the other tables in the work plan will be included in the RFI report. Sample locations in the vicinity of SWMU 41 will be added to the site figure in the RFI as well.

5) Comment #19 – The Response has been changed. The following information on 2,3,7,8-TCDD TEQ at Area A will be added to the RFI.

"Exceedances of adjusted R-RBCs for organic chemicals at Area A were limited to one "B" sample (41SB2B at 7.5 to 8 ft bgs)) for total 2,3,7,8-TCDD as TEQ. No individual congener exceeded the applicable criteria in the sample. Vertical delineation of this exceedance was provided by the deeper "C" sample at this location (41SB2C at 15 to 16.5 ft bgs), which had a TEQ concentration below the adjusted R-RBC."

6) EPA is OK with the RTCs for comments 20-21.

7) Comment #22 – The Response has been changed. Sediment samples (4) will be collected at the same locations as the surface water samples at SWMU 41. Analyses will be the same as the surface water samples.

8) EPA agrees with the RTCs for comments 23-33.

- (Comment #23) A figure showing the piping from the tanks, if available, will be included in the RFI.
- (Comment #28) The XRF survey area is essentially the same as the area show on the figure as "Former Lead Furnace Area Boundary".

9) Comment #34 – The Response has been changed. The samples from borings 43SB03 and 43SB08, located in the center of each landfill cell, will be analyzed for dioxins/furans in addition to the analytes listed in Table 6-4.

10) EPA agrees with the RTCs for comments 35-40.

- (Comment #37) Figure 7-2 has been revised and is attached.

Let me know if you would like any additional information or clarification.

Thanks,
Tim

Timothy Leahy
Project Manager
Shaw Environmental, Inc
2113 Emmorton Park Road
Edgewood, MD 21040
(410) 612-6357 (direct)
(410) 612-6351 (fax)
www.Shawgrp.com

 (See attached file: RFAAP_006_Fig7-2_Workplan_AreaP_SampleLocations_060107.pdf)(See attached file: parsons tribuary study data.pdf)(See attached file: Parsons New River Study sample location map.pdf)(See attached file: SWMU 41 site layout.pdf)

Attachments:

RFAAP_006_Fig7-2_Workplan_AreaP_SampleLocations_060107.pdf (1405506 Bytes)
parsons tribuary study data.pdf (769794 Bytes)
Parsons New River Study sample location map.pdf (2151958 Bytes)
SWMU 41 site layout.pdf (327460 Bytes)

LEGEND

- Previous Investigation Soil Sample Location
- Proposed Soil Sample Location
- Proposed Geoprobe Groundwater Sample Location
- 10 ft Contour Line
- Area P Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:

0 75 150 300 Feet

U.S. Army Corps of Engineers

Shaw® Shaw Environmental, Inc.

FIGURE 7-2
Area P Sample Locations
Radford Army Ammunition Plant,
Radford, VA

Date: 6/1/07 GIS File: RFAAP_005_Fig7-2_Workplan_SWMU41_SampleLocations.mxd

TABLE 4
POSITIVE RESULTS TABLE OF STROUBLES CREEK - Aqueous Samples
RADFORD ARMY AMMUNITION PLANT

Field Sample Number	SCSW1 1/17/95	SCSW2 1/17/95	SCSW3* 1/17/95
METALS (ug/l)			
Barium	44.7 J4	47.3 J4	48 J4
Beryllium	1.95	2.22	2.23
Chromium		30.9 J4	
EXPLOSIVES (ug/l)			
Cyclotetramethylenetetranitramine (HMX)	5.3 J9	5.3 J9	5.3 J9
OTHER (ug/l)			
*TOTAL HARDNESS	148000	152000	153000
*TOTAL ORGANIC CARBON	2690	2490 J7	2370
*TOTAL ORGANIC HALOGENS	16.9	18 J7	16
CHLORIDE	11000	10000	11000

* SCSW3 is a duplicate sample of SCSW2

J The analyte was analyzed for and was positively identified, but the associated numerical value may be imprecise due to a QC anomaly or due to being between the method detection limit (MDL) and the project reporting limit. The data is considered estimated and usable for many purposes.

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TABLE 4 (Continued)
POSITIVE RESULTS TABLE OF NEW RIVER - Aqueous Samples
RADFORD ARMY AMMUNITION PLANT

Field Sample Number Sample Collection Date	NRSW1 7/21/95	NRSW2 7/21/95	NRSW3 7/21/95	NRSW4 7/28/95	NRSW5 7/18/95	NRSW6 7/28/95	NRSW8* 7/18/95	SPG3SW1 1/13/95
METALS (ug/l)								
Lead				9.80				25.20
Barium	24.90	25.10	24.90	26.30	21.10	24.80	21.10	26.60 J4
Beryllium								1.64
VOLATILES (ug/l)								
Methylene chloride								
OTHER (ug/l)								
Total Hardness	42700.00	42800.00	43200.00	44600.00	47800.00	51300.00	47700.00	
Total Organic Carbon	2180.00	2320.00	2080.00	1960.00	1810.00	2310.00	1870.00 J7	1200.00
Total Organic Halogens				10.00				
Chloride	3890.00	3750.00	3810.00	3950.00	4030.00	4120.00	4000.00	

* NRSW8 is a duplicate sample of NRSW5

J The analyte was analyzed for and was positively identified, but the associated numerical value may be imprecise due to a QC anomaly or due to being between the method detection limit (MDL) and the project reporting limit. The data is considered estimated and usable for many purposes.

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TABLE 4 (Continued)
POSITIVE RESULTS TABLE - Aqueous Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID: / SAMPLING DATE:		NRSW17 11/22/96	NRSW18 11/22/96	NRSW38 11/25/96 DUP/TRIB2	SCSW3(B) 11/20/96	SCSW4 11/21/96	TRIBSW2 11/25/96	TRIBSW4 11/21/96	TRIBSW5 11/20/96
Semivolatile Organic Compounds									
Di-n-butylphthalate	ug/l				74	44 J1		19 J1	17
Butylbenzylphthalate	ug/l				11				
bis(2-Ethylhexyl)phthalate	ug/l				13				
Dissolved Metals									
Barium	ug/l	121	124	132	133		123		170
Calcium	ug/l	8880	9380	49500	56700	58300	47400	36600	72400
Iron	ug/l	165	154						
Magnesium	ug/l	3920	4040	21900	23000	25500	20900	18700	42400
Manganese	ug/l			10.4					12.6
Potassium	ug/l	1880	2470	2320	3300	3210	2470	3880	3120
Sodium	ug/l	5110	5110	17700	13500	13500	17600	11000	7490
Zinc	ug/l	15.6	16.2	11.3			10.5	15.2 J1	
Total Metals									
Aluminum	ug/l	153	168				110	168	
Barium	ug/l	24.8	26	42.5	60.5		49.5		63
Calcium	ug/l	9190	9980	44300	54000	47300	50800	33600	61500
Iron	ug/l	443	436	76.7	51.4	70	125	432	
Magnesium	ug/l	4220	4540	19600	22400	20500	22500	16900	34400
Manganese	ug/l	88.2	83.2	19.6			30.6	146	18.2
Potassium	ug/l	2300	2390	2350	3530	3310	2620	3650	3140
Sodium	ug/l			15800	10300		17700		4880
Wet Chemistry Parameters									
Hardness	ug/l	42900	45600	192000	226000	202000	219000	153000	295000
Total Organic Carbon	ug/l			11000	12000	5000	10000	11000	14000

J1 Analyte detected in the field or laboratory blank associated with this sample. Result should be considered estimated and biased high.

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TABLE 5

POSITIVE RESULTS TABLE OF STROUBLES CREEK - Sediment Samples

RADFORD ARMY AMMUNITION PLANT

Field Sample Number Sample Collection Date	SCSE1 1/17/95	SCSE2 1/17/95	SCSE3 * 1/17/95
METALS (ug/g)			
Arsenic	10.59 J4	9.03 J4	6.70 J4
Lead	13.41 J6	95.87 J6	31.21 J6
Silver	0.03 J4	0.18 J4	0.21 J4
Barium	141.45 J1	240.41 J1	262.41 J1
Beryllium	1.38 J4	1.45 J4	1.39 J4
Chromium	27.80 J6	39.53 J6	36.17 J6
Nickel	32.60 J4	26.99 J4	26.10 J4
SEMIVOLATILES (ug/g)			
Chrysene		0.22	
Di-n-butyl phthalate		7.82 J1	5.53 J1
Fluoranthene		0.27	0.16
Phenanthrene		0.29	0.13
OTHER (ug/g)			
Total Organic Carbon	2841.33	63274.30	43829.80
Extractable Organic Halides (total)	123.00	147.49	141.84

*** SCSE3 is a duplicate sample of SCSE2**

J The analyte was analyzed for and was positively identified, but the associated numerical value may be imprecise due to a QC anomaly or due to being between the method detection limit (MDL) and the project reporting limit. The data is considered estimated and usable for many purposes.

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TABLE 5 (Continued)
POSITIVE RESULTS TABLE OF NEW RIVER - Sediment Samples
RADFORD ARMY AMMUNITION PLANT

Field Sample Number Sample Collection Date	NRSE1 7/21/95	NRSE2 7/21/95	NRSE3 7/21/95	NRSE4 7/28/95	NRSE5 7/18/95	NRSE6 7/28/95	NRSE8* 7/18/95	SPG3SE1 1/13/95
METALS (ug/g)								
Arsenic					6.92		7.83	17.40 J4
Selenium			1.85					
Lead	148.42 J1	136.29 J1	200.00 J1	4415.58	220.08 J1	141.99 J1	245.90 J1	548.59 J6
Silver	0.14	0.09	0.15	0.10	0.10	0.11	0.07	0.22 J4
Barium	226.35 J1	151.82 J1	415.00 J1	97.14	178.82 J1	109.77 J1	187.16 J1	700.63 J1
Beryllium			3.03	0.99	1.31		1.31	4.23 J4
Chromium	46.20 J1	32.01 J1	77.33 J1	37.53	31.50 J1	24.89 J1	33.88 J1	62.70 J6
Nickel	25.05	15.72	41.83	13.25	15.82	12.49	14.89	52.98 J4
Mercury								0.13 J4
SEMIVOLATILES (ug/g)								
Bis (2-ethylhexyl) phthalate				6.62				
Diethyl phthalate				6.23				
Dimethyl phthalate				8.31				
Di-n-butyl phthalate				12.99				
Benzo[a]anthracene	0.58	0.32	0.72			0.40		
Chrysene	1.67	0.35	0.68			0.53		
Fluoranthene		0.30	0.80	0.08		0.50		
Phenanthrene	0.76	0.51	0.82			0.35		
Pyrene	0.80	0.40	1.00			0.76		
N-Nitrosodiphenylamine				2.60				
EXPLOSIVES (ug/g)								
2,4,6-Trinitrotoluene					28.89 J10			
OTHER (ug/g)								
Total Organic Carbon	91651.20	58478.60	36333.30	9831.17	11251.70	22595.40	20218.60	33742.00
Extractable Organic Halides (tot	185.53	158.48	166.67	129.87	82.53	152.67	81.97	244.40

* NRSE8 is a duplicate sample of NRSE5

J The analyte was analyzed for and was positively identified, but the associated numerical value may be imprecise due to a QC anomaly or due to being between the method detection limit (MDL) and the project reporting limit. The data is considered estimated and usable for many purposes.

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TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		NRSE7	NRSE8(b)	NRSE9	NRSE10	NRSE11	NRSE12	NRSE13	NRSE14	NRSE15
SAMPLING DATE:		11/26/96	11/26/96	11/26/96	11/26/96	11/26/96	11/22/96	11/22/96	11/22/96	11/22/96
Volatile Organic Compounds										
Methylene Chloride	µg/g						0.017	0.022		0.014
Acetone	µg/g									
2-Butanone	µg/g									
Semivolatile Organic Compounds										
Diethylphthalate	µg/g									
Fluorene	µg/g									0.76
Phenanthrene	µg/g									4
Anthracene	µg/g									0.86
Carbazole	µg/g									0.49
Fluoranthene	µg/g									2.8
Pyrene	µg/g									3.3
Benzo(a)anthracene	µg/g									2.2
Chrysene	µg/g									1.8
Benzo(b)fluoranthene	µg/g									2.5
Benzo(k)fluoranthene	µg/g									1.1
Benzo(a)pyrene	µg/g									1.6
Indeno(1,2,3-cd)pyrene	µg/g									0.56
Benzo(g,h,i)perylene	µg/g									0.54
Pesticide/PCB Compounds										
Alpha Chlordane	µg/g	0.01								
gamma-Chlordane	µg/g	0.012								
Total Metals										
Aluminum	µg/g	3730 J	12100 J	4290 J	6740 J	8350 J	9070	11200	9910	8680
Arsenic	µg/g	2.5	2.2	1.7	2.8	2.2	4	4.4	3.9	4.6
Barium	µg/g	39.9 J	151 J	60.5 J	105 J	130 J	129	156	110	63.7
Beryllium	µg/g	0.43	0.83	0.46	0.63	0.88	0.78	0.83	0.71	0.48
Cadmium	µg/g					1				2.4
Calcium	µg/g	2810 J	3270 J	1310 J	2830 J	1670 J	4310	5350	2190	11200
Chromium	µg/g	10.9	22.8	13.1	17.8	16.6	18.8	19	21	29.4
Cobalt	µg/g	7.8 J	11.7 J	6.5 J	8.9 J	8.9 J	10	10.2	10	10.9
Copper	µg/g	11.7	21.5	7.5	16.8	13.8	15.9	17.8	13.4	110
Iron	µg/g	17300 J	25000 J	18700 J	21900 J	29200 J	30700	30000	30800	43500
Lead	µg/g	54.1 J	78.1 J	74.7 J	79.4 J	259 J	112	118	104	34.3
Magnesium	µg/g	2610 J	3650 J	1490 J	2410 J	2110 J	3040 J	3790 J	2600 J	7400
Manganese	µg/g	423 J	1570 J	703 J	917 J	909 J	1100 J	1160 J	1210 J	512

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TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		NRSE7	NRSE8(b)	NRSE9	NRSE10	NRSE11	NRSE12	NRSE13	NRSE14	NRSE15
SAMPLING DATE:		11/26/96	11/26/96	11/26/96	11/26/96	11/26/96	11/22/96	11/22/96	11/22/96	11/22/96
Nickel	µg/g	6.9	11.7	7.3	8.9	9.1	12.4	15.1	10.6	44.8
Potassium	µg/g	579 J	1840 J	835 J	1160 J	1160 J	1430	1570	1420	1300
Sodium	µg/g									
Thallium	µg/g				1.7	1.8			1.6	1.6
Vanadium	µg/g	11.3	30.5	13.1	18.9	22.4	22.4	25.8	24.7	33.8
Zinc	µg/g	206 J	250 J	254 J	259 J	797 J	466	479	378	1430
Wet Chemistry Parameters										
Acid Volatile Sulfide	µg/g						4.1			
PH		7.8	7.4	7.4	7.9	7.7	7.3	7.1	6.9	7.6
Total Organic Carbon	µg/g	40	57	60	51	41	51	59	40	71
Total Organic Halogens	µg/g	60.2 J1	137	53.4 J1	65.7 J1	29.7 J1		54.8 J1		

J1 Analyte detected in the field or laboratory blank associated with this sample. Result should be considered estimated and biased high.

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TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID: SAMPLING DATE:		NRSE16 11/22/96	NRSE17 11/22/96	NRSE18 11/22/96	NRSE30 11/22/96 Dup NR15	SCSE3(B) 11/20/96	SCSE4 11/21/96	TRIBSE1 11/25/96	TRIBSE2 11/25/96	TRIBSE3 11/25/96
Volatile Organic Compounds										
Methylene Chloride	µg/g	0.014						0.015		
Acetone	µg/g									
2-Butanone	µg/g									
Semivolatile Organic Compounds										
Diethylphthalate	µg/g								0.82	
Fluorene	µg/g									
Phenanthrene	µg/g				1.7					
Anthracene	µg/g				0.51					
Carbazole	µg/g									
Fluoranthene	µg/g				1.9					
Pyrene	µg/g				1.6					
Benzo(a)anthracene	µg/g				1.1					
Chrysene	µg/g				0.95					
Benzo(b)fluoranthene	µg/g				1.2					
Benzo(k)fluoranthene	µg/g				0.44					
Benzo(a)pyrene	µg/g				0.84					
Indeno(1,2,3-cd)pyrene	µg/g									
Benzo(g,h,i)perylene	µg/g									
Pesticide/PCB Compounds										
Alpha Chlordane	µg/g									0.011
gamma-Chlordane	µg/g									0.01
Total Metals										
Aluminum	µg/g	16000	11800	15800	12100	6010	7270	8770 J	4360 J	2210 J
Arsenic	µg/g	5.1	2.7	3.8	4	6.5	8.7	1.8	1.8	
Barium	µg/g	48.2	134	170	75.2	58.9		55.4 J	48.6 J	25.1 J
Beryllium	µg/g	0.62	0.81	1	0.57	0.48	0.66	0.55	0.41	
Cadmium	µg/g	2.8			1.5					
Calcium	µg/g	900	3600	4190	3260	7740	17200	52500 J	2380 J	5050 J
Chromium	µg/g	29.8	22.2	25.9	30	12.6	16.7	15.9	13.4	6.9
Cobalt	µg/g	10.6	10.2	13.1	10.6	9.1	10.3	5.3 J	6.9 J	2.7 J
Copper	µg/g	13.7	16.7	21.8	27.5	12.7	11.3	10.3	8.1	3.7
Iron	µg/g	22100	27000	33200	27500	20500	34400	14700 J	14900 J	5970 J
Lead	µg/g	14	80.8	87.8	23.5	10.3	12.7	37.8 J	54.9 J	7.4 J
Magnesium	µg/g	9000 J	3780 J	4730 J	3530 J	4400	10200	38900 J	1950 J	1560 J
Manganese	µg/g	512 J	1220 J	1830 J	536 J	260	442	382 J	545 J	135 J

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TABLE 5 (continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID: SAMPLING DATE:		NRSE16 11/22/96	NRSE17 11/22/96	NRSE18 11/22/96	NRSE30 11/22/96 Dup NR15	SCSE3(B) 11/20/96	SCSE4 11/21/96	TRIBSE1 11/25/96	TRIBSE2 11/25/96	TRIBSE3 11/25/96
Nickel	µg/g	19	12.3	16.1	15.9	13.2	17.9	8.6	5.1	
Potassium	µg/g	1670	1800	2210	1600	972	946	3710 J	625 J	454 J
Sodium	µg/g			97.6 J1			89.3 J1			
Thallium	µg/g	1.6		1.9	1.4			1.6		
Vanadium	µg/g	40.9	27.5	35.4	45.8	13.4	20	19.3	13.4	8.1
Zinc	µg/g	33.2	323	358	849	60.4	70.2 J1	122 J	131 J	29.3 J
Wet Chemistry Parameters										
Acid Volatile Sulfide	µg/g					5.5	4.5			
PH		7.2			7.5	7.6	7.4	7.9	8.1	8.2
Total Organic Carbon	µg/g	72			76	45	40	27	36	58
Total Organic Halogens	µg/g	24.3 J1			12.5 J1	76.5		74.4 J1		125 J1

J1 Analyte detected in the field or laboratory blank associated with this sample. Result should be considered estimated and biased high.

TABLE 5 (continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		TRIBSE4	TRIBSE5	TRIBSE6
SAMPLING DATE:		11/21/96	11/20/96	11/21/96
Volatile Organic Compounds				
Methylene Chloride	µg/g			
Acetone	µg/g	0.093		
2-Butanone	µg/g	0.016		
Semivolatile Organic Compounds				
Diethylphthalate	µg/g			
Fluorene	µg/g			
Phenanthrene	µg/g			
Anthracene	µg/g			
Carbazole	µg/g			
Fluoranthene	µg/g			1.1
Pyrene	µg/g			0.69
Benzo(a)anthracene	µg/g			
Chrysene	µg/g			
Benzo(b)fluoranthene	µg/g			
Benzo(k)fluoranthene	µg/g			
Benzo(a)pyrene	µg/g			
Indeno(1,2,3-cd)pyrene	µg/g			
Benzo(g,h,i)perylene	µg/g			
Pesticide/PCB Compounds				
Alpha Chlordane	µg/g			
gamma-Chlordane	µg/g			
Total Metals				
Aluminum	µg/g	11500	13700	10700
Arsenic	µg/g	3.2	13.4	6.9
Barium	µg/g		197	
Beryllium	µg/g	0.6	0.95	0.54
Cadmium	µg/g			
Calcium	µg/g	2660	15600	1230 J1
Chromium	µg/g	19.4	29.6	18.5
Cobalt	µg/g	6	18.5	7.2
Copper	µg/g	12.3	27.6	16.5
Iron	µg/g	15800	36800	20200
Lead	µg/g	19.3	23.7	19.4
Magnesium	µg/g	2870	13300	2450
Manganese	µg/g	423	2430	345

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TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		TRIBSE4	TRIBSE5	TRIBSE6
SAMPLING DATE:		11/21/96	11/20/96	11/21/96
Nickel	µg/g	10.4	20.9	10
Potassium	µg/g	940	1500	1400
Sodium	µg/g			
Thallium	µg/g			
Vanadium	µg/g	25.2	33.2	27.7
Zinc	µg/g	44.8 J1	76.9 J1	75.9 J1
Wet Chemistry Parameters				
Acid Volatile Sulfide	µg/g			
PH		6.7	7.7	6.5
Total Organic Carbon	µg/g	50	36	56
Total Organic Halogens	µg/g	46.7 J1	54 J1	

J1 Analyte detected in the field or laboratory blank associated with this sample. Result should be considered estimated and biased high.

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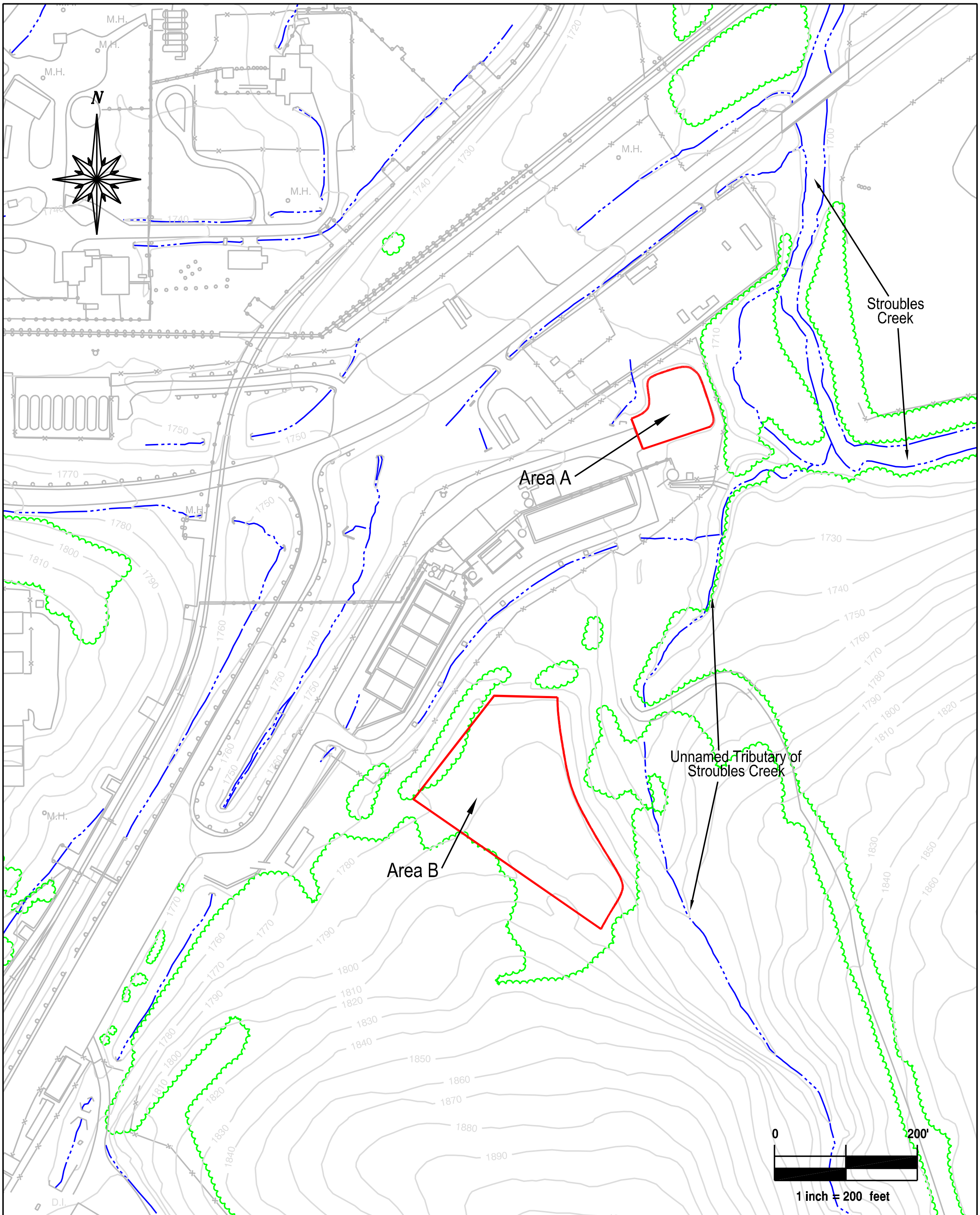
FIGURE 2
NEW RIVER AND TRIBUTARIES
SAMPLE LOCATION MAP

RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA

PARSONS ENGINEERING SCIENCE, INC.



Legend

SWMU Boundary

FIGURE 2-2

Site Layout

Date: August 2005	URS Project #: 21354893
Prepared by: DBC	Approved by: JOS
Scale: 1 inch = 200 feet	File Name: Fig. 2-2

SWMU 41

RCRA Facility Investigation
Radford Army Ammunition Plant
Radford, Virginia

URS Group, Inc.
5540 Falmouth Street
Suite 201
Richmond, Virginia 23230

Leahy, Timothy

From: McKenna, Jim Mr. RFAAP ACO Staff [jim.mckenna@us.army.mil]
Sent: Thursday, June 07, 2007 8:27 AM
To: Leahy, Timothy; Parks, Jeffrey; 'Meyer, Tom NAB02'; Mendoza, Richard R USAEC; 'jim spencer'; 'Tina_Devine@URSCorp.com'; 'Redder, Jerome'; 'Geiger.William@epa.gov'; 'jlcutler@deq.virginia.gov'
Subject: WPA 19 draft responses to comments

Importance: High

Attachments: Draft Final WPA19 USEPA & VDEQ RTCs.doc

Draft Final WPA19 USEPA & VDEQ...

All:

The attached file contains our draft response to comments. If they don't answer the mail then maybe we can schedule a conference call to talk about them. My availability next week is limited and Jerry will be out of pocket at Hawthorne AD. Suggest week of June 18.

Thanks.

Jim
PS URS is welcome to listen in and participate.

Response to USEPA/VDEQ Comments received via email on May 24, 2007

for

Draft Final Work Plan Addendum 019

February 2007

GENERAL COMMENTS

EPA Comment 1

The Work Plan Addendum references the RFAAP Master Work Plan for standard operating procedures (SOPs) that will be used during the proposed investigations. However, in many cases, the SOPs describe several procedures that can be used when sampling environmental media or installing wells or borings. For example, the Master Work Plan indicates that surface water samples can be collected using dip samplers, pond samplers, a peristaltic pump, or other devices. SOP 30.3 (Surface Water Sampling) also states that "the most appropriate method of sample collection and the appropriate depths of sampling (sampling strategies) will be specified in work plan addenda based on site-specific conditions and data quality objectives (DQOs)." The Work Plan Addendum does not describe specific methods for sample collection and boring advancement (with the exception of direct push sampling).

Revise the Work Plan Addendum to describe the specific methods that will be used to collect the surface water, soil, groundwater, and sediment samples proposed in this report. Additionally, revise the Work Plan Addendum to indicate the methods to be used for installing all monitoring wells, and describe the important details of the construction of these wells (i.e. well screen length, filter pack material, well diameter, slot screen size, depth, etc.).

RFAAP Response

Additional information will be added to describe specific sampling methods. Details are provided next to the appropriate specific comments below.

EPA Comment 2

The Work Plan Addendum focuses primarily on the collection of additional chemical data to identify source areas and delineate the extent of contamination. While this is a primary component of the RCRA Facility Investigation (RFI) process, it is also important to characterize the environmental setting of each of the site areas. Of particular concern is that this Work Plan Addendum does not propose to collect data necessary to characterize the underlying aquifer(s). An understanding of hydrogeologic characteristics (hydraulic conductivity, groundwater flow velocities, etc.) is important when evaluating potential contaminant migration and potentially impacted areas. Revise the Work Plan Addendum to propose activities to investigate the environmental setting of each area, including underlying aquifer(s) or provide specific references where this information can be found. Please consider conducting slug tests or other aquifer tests in select monitoring wells to obtain information about the underlying aquifer(s).

RFAAP Response

Hydrogeologic tests were performed during the *Current Conditions Report – Horseshoe Area* (Shaw, August 2005) to gain an understanding of the regional groundwater flow regime at Radford. Additional information may be collected during the CMS phase of the investigations at these sites if groundwater contamination is identified. This information can then be used to design a treatment system (or identify a treatment zone for *in-situ* remedial strategies) for groundwater contamination. At this stage of the investigation, however, the information available in the *Current Conditions Report* is sufficient to characterize the fate and transport of constituents identified in groundwater.

EPA Comment 3

Groundwater sampling of existing wells is proposed for many of the sites. Well construction details for the existing wells have not been provided in this Work Plan Addendum. Knowledge of the well construction (depth, screened interval) is important when evaluating the existing data. Revise the Work Plan Addendum to provide either the well construction logs for existing wells or a summary of well construction details for all of the existing wells that will be sampled as part of this Work Plan Addendum. Alternatively, provide clear references to where the information can be found.

RFAAP Response

Boring logs will be provided for the wells that are proposed to be sampled.

EPA Comment 4

Surface soil sampling for volatile organic compounds (VOCs) is proposed at several of the sites discussed in this Work Plan Addendum. The depth interval for these surface soil samples is identified as 0 to 0.5 feet (ft) below ground surface (bgs). The RFAAP Master Work Plan indicates that surface soil samples for VOCs should be collected within the depth interval of 6 to 12 inches bgs (Section 5.2). Revise the Work Plan Addendum to address this deviation from the Master Work Plan. Alternatively, revise the Work Plan Addendum to propose that surface soil samples collected for VOC analysis be collected from the 6- to 12-inch depth interval.

RFAAP Response

Surface soil samples will be collected from 0-0.5 ft bgs with the exception of the VOC fraction, which will be collected from 0.5-1 ft bgs. Text will be added to the Introduction that explains this discrepancy.

EPA Comment 5

Soil data from only one of the sites (the Former Lead Furnace Area) appears to have been compared to soil screening levels (SSLs) to assess the potential for migration to groundwater. Indicate whether the proposed groundwater sampling at each of the sites considers those contaminants that may have been detected above SSLs in soil, even though the SSLs have not been provided for comparison. Future submittals should include the SSLs on data summary tables for soil.

RFAAP Response

SSLs will be provided with RFI reports. SSLs are intended to screen surface soil data at sites where there is no subsurface soil or groundwater data available. Actual chemical data from subsurface soil samples provides a better indication of the migration potential than a simple comparison to the SSLs.

EPA Comment 6

None of the individual data summary tables include a notes section that defines the meaning of acronyms or highlighted values within the table. A Soil/Sediment Master Table Legend has been provided at the end of Table 2-5d in Section 2, but this table does not address notes that may be associated with surface water or groundwater samples.

Additionally, the Soil/Sediment Master List does not appear to include the meaning of all of the different shading that has been used in the tables. For example, Table 5-1 (Former Lead Furnace Area – VI Detected Soil Results – 1992) includes cells that have been highlighted in gray and outlined in black, and the values inside are shown in white font.

The Soil/Sediment Master Table Legend does not address the use of white font. Revise the Work Plan Addendum so that the meaning of all acronyms and highlighting in all of the tables (including surface water and groundwater tables) is appropriately defined. Consideration should be made to include a notes section on each table for easy reference.

RFAAP Response

Additional legends will be provided for the tables.

EPA Comment 7

Groundwater samples at several sites will be analyzed for metals. Clarify if the samples will be analyzed for total or dissolved metals, or both. If groundwater is analyzed for dissolved metals, indicate whether the samples will be filtered in the field or at the laboratory.

RFAAP Response

Groundwater samples will be collected for total metals for risk assessments. Filtered metals analysis may be performed for samples that have high turbidity after purging. These filtered samples would be used in a qualitative assessment of the metals content of groundwater versus the metals content in suspended sediment.

<u>SPECIFIC COMMENTS</u>

EPA Comment 8

Section 2.1.1, Site Description, Page 2-1. The text states that a 1986 aerial photo is shown on Figure 2-2; however, a note on Figure 2-2 indicates that the source of the figure is a May 25, 2000 aerial photo. Revise the Work Plan Addendum to resolve this discrepancy.

RFAAP Response

The figure is correct. The aerial photo is from 2000. The text will be corrected.

EPA Comment 9

Section 2.5, Data Gap Analysis, Soil, SWMU 49, Page 2-35. Figure 2-2 appears to show that most of the previous sampling at this site is concentrated in the western half of the solid waste management unit (SWMU) (with the exception of one surface soil sample on the southeastern side). Additional information for this sampling approach has not been provided. Revise the Work Plan Addendum to address this apparent data gap. Additional surface and/or subsurface samples may be necessary to characterize the eastern half of SWMU 49.

RFAAP Response

The actual site is a clearing in the woods adjacent to a dirt road that runs south with SWMUs 48 and 50 to the west and SWMUs 49 and 59 to the east. The red site boundary encompasses a greater area than the actual clearing. Disposal practices would have most likely taken place within the clearing and near the road. Previous investigations collected samples from the eastern portion of the site to eliminate this area as a concern.

EPA Comment 10

Section 2.6, Investigation Approach, Groundwater, Page 2-43. Installation of several wells is proposed for the combined site area, but the specific method for installation of the wells has not been provided. Although SOPs 20.1 and 20.11 in the RFAAP Master Work Plan are referenced in this section, these SOPs address several types of drilling methods (hollow stem auger, air rotary, etc.). The specific methods and procedures to be used for installation of the monitoring wells at this site area should be indicated in the Work Plan Addendum.

Additionally, the above mentioned SOPs indicate that the proposed well screen length, screen slot size, filter pack, and method of sampling should be specified in the work plan addenda. However, these details have not been provided. Revise the Work Plan Addendum to address these omissions.

RFAAP Response

Drilling will be performed with Hollow Stem Augers (HSA) to allow split spoon sampling. If water is encountered in the overburden, the well will be installed through the augers. If additional drilling into the bedrock is required, drilling will switch to Air rotary drilling and will continue until water is encountered. Wells will be constructed of two inch Schedule 40 PVC with 0.01 inch slot size screen. Ten feet of screened material will be used unless the rate of water production is low, in which case 15 to 20 feet of screen may be used. Number 1 sand will be used as a filter pack. The wells will be developed using a high capacity submersible pump, and will be periodically surged during development. Water quality parameters will be measured and recorded during development.

Groundwater sampling from the wells will be performed using low-flow sampling techniques and a submersible pump. Water quality parameters will be monitored until stabilized (3 consecutive readings within 10%), the flow cell will be removed, the flow rate will be reduced to 100 ml/min and then sampling will be performed.

EPA Comment 11

Section 2.6, Investigation Approach, Page 2-43. Additional soil sampling is not proposed at SWMU 48, but it is not clear that the extent of explosives contamination has been adequately defined at this SWMU. Concentrations of the dinitrotoluene mix were detected above screening criteria in sample 48SB2 (10-12 ft) (Table 2-2) and sample 48SB6C (1-3 ft) (Table 2-4), both located in the eastern side of SWMU 48 (as shown on Figure 2-2). It is not clear that this contamination has been delineated to the north and east. Furthermore, it is not clear if explosives may be located at shallower depths in sample 48SB2 since it does not appear that any samples were collected between 0 and 10 ft bgs.

Revise the Work Plan Addendum to address the adequacy of the existing samples to define the extent of explosives contamination. Additional soil samples may be necessary to delineate the extent of this contamination.

RFAAP Response

The two former trench areas have subsided relative to the undisturbed land on either side and are visible at the site. Test pits were excavated in 1998 to investigate the former depth of the trenches at the site and collected samples from within (48TP1 & 48TP2) and outside the former trench wall (48TP3 & 48TP4). The elevated levels of explosives (TNT and DNT) were found in samples collected within the pit boundary. Additional samples (48SB08 and 48SB09) collected in 2002 were located outside the trench boundary to the west and south of 48SB07 (highest concentration of TNT). Results from 2002 corroborate the 1998 test pit samples and indicate that the explosives in soil are confined to the trenches.

At this time, it appears that SWMU 48 will have a soil removal action for the trench soil. Prior to implementing the removal action, delineation samples will be collected from the perimeter of the trench to completely define the extent of explosives in soil. After removal of the soil, confirmation samples will be collected from the sidewalls and bottom of the excavation to ensure that explosives-containing soil has been removed. Shaw would prefer to do the final delineation at that time to expedite the action at this site.

EPA Comment 12

Section 2.6, Investigation Approach, Page 2-43. It does not appear that the extent of dioxins in surface soil at SWMU 48 has been adequately characterized. Table 2-1 (Previous Soil Investigations Environmental Samples and Analyses) shows that only three surface soil samples were analyzed for dioxins at this SWMU. Two of the three samples reported tetrachlorodibenzo-p-dioxin (TCDD) TE in excess of the industrial and residential RBCs (as shown on Table 2-5a). The extent of dioxin contamination in surface soil will need to be characterized at SWMU 48. Revise the Work Plan Addendum to propose additional surface soil sampling for dioxins at SWMU 48. Alternatively, provide justification for not characterizing the extent of dioxin contamination.

RFAAP Response

Nine samples from SWMU 48 were collected for dioxins/furans analysis (3 surface soil and 3 subsurface soil). One sample exceeded the residential RBC and one sample exceeded the residential RBC and the SSL. There were no industrial RBC exceedances and no individual congeners exceeded their respective criteria.

EPA Comment 13

Section 3.1.1, Site Description, Page 3-1. The Work Plan Addendum appears to incorrectly reference Figure 3-1 (SWMU 41 and 43 and Areas O and P Site Location Map) in its discussion of the topography of SWMU 41. Topographic contours are actually shown on Figure 3-2 (SWMU 41 Sample Locations). Revise the Work Plan Addendum to correct this reference.

RFAAP Response

The reference will be changed from 3-1 to 3-2.

EPA Comment 14

Section 3.1.1, Site Description, Page 3-1. Important site features at this site include Stroubles Creek, a drainage ditch, and an unnamed tributary of Stroubles Creek. None of these features are labeled on the site figures. Revise the Work Plan Addendum to label Stroubles Creek, the drainage ditch, and the unnamed tributary of Stroubles Creek on a site figure. Additionally, clarify if the drainage ditch is lined or unlined.

RFAAP Response

The figure will be revised to identify these features.

EPA Comment 15

Section 3.2.2, Site Geology, Page 3-3. This section notes that 40 direct push borings were completed at SWMU 41 during the 2005 RFI, but it does not appear that a majority of these boring locations have been shown on a site figure. Figure 3-2 only shows 15 soil sample locations. Revise the Work Plan Addendum to show all of the previous boring locations at SWMU 41.

RFAAP Response

40 direct push were advanced to characterize lithology and overburden thickness. Analytical samples were collected from fifteen of the borings. These borings are shown on Figure 3-2. In the interest of not cluttering the figure, the stratigraphic brings were not presented in the Work Plan. All borings (including the stratigraphic) will be shown in the RFI report.

EPA Comment 16

Section 3.3.2, VI, Dames and Moore, 1992, Groundwater, Page 3-9. This section notes that bis(2-ethylhexyl)phthalate and vanadium were detected above the tapwater risk based concentrations (RBCs). Table 3-1b (1992 VI Detected Analytes for Groundwater at SWMU 41) also notes that antimony was detected in monitoring well 41MW2 above both the federal maximum contaminant level (MCL) and tapwater RBC. Revise Section 3.3.2 to include this notable exceedance in the discussion of groundwater results.

RFAAP Response

Antimony will be added to the text.

EPA Comment 17

Section 3.3.2, VI, Dames and Moore, 1992, Surface Water, Page 3-9. This section indicates that constituents detected in surface water, with the exception of barium, were detected below the tapwater RBCs and the Region 3 Biological Technical Assistance Group (BTAG) freshwater screening values. Table 3-1c (1992 VI Detected Results for Surface Water at SWMU 41) only compares the detected results to MCLs and the tapwater RBCs. Revise Table 3-1c to include the BTAG screening values for easy reference.

RFAAP Response

BTAG screening values will be added to the table and included in the resultant RFI.

EPA Comment 18

Section 3.3.3, New River and Tributaries Study, Parsons, 1997, Page 3-9. A summary of the 1995 and 1996 sampling events is presented, but the sampling locations to which this section refers (i.e., SCSW2) are not shown on a site figure. A summary table of the data has also not been provided. This information will aid in the evaluation of the current understanding of the extent of contamination at and in the vicinity of the site. Revise the Work Plan Addendum to show the 1995 and 1996 surface water and sediment sampling locations. Additionally, include a summary table of the detected concentrations.

RFAAP Response

This information is presented elsewhere. Highlights of the data that are relevant to this work plan are included in the text. The reviewer is referred to the original study for additional details. In order to expedite reviews, a streamlined approach to work plans has been agreed upon between the RFAAP stakeholders.

EPA Comment 19

Section 3.3.5, RFI, URS Corporation, 2005, Nature and Extent Assessment at Area A, Page 3-16. Total 2,3,7,8-TCDD equivalents concentration (TEQ) was identified as a constituent of potential concern (COPC) for Area A, but it is not clear which samples contributed to this constituent's inclusion as a COPC. Table 3-2 (2004 RFI Detected Results for Soil at SWMU 41) has not highlighted any dioxin/furan constituents for exceeding screening criteria. Clarify why total 2,3,7,8-TCDD TEQ was included as a COPC, and indicate which samples contributed to its inclusion as a COPC. This information will be necessary to assess the adequacy of the proposed sampling program in defining the extent of contamination associated with this constituent. Additional soil samples to assess the extent of this contamination may be required.

RFAAP Response

The URS RFI was an internal draft that was never submitted for regulatory review. Information about COPCs will be removed from the text since a reviewed risk assessment has not been completed.

EPA Comment 20

Section 3.3.5, RFI, URS Corporation, 2005, Nature and Extent of Assessment at Area A and Area B, Page 3-16. Table 3-2 indicates that PCB-1254 was detected above the industrial and residential RBCs in surface samples 41SB2A and 41SB10A, but these exceedances are not discussed in Section 3.3.5. Based on the data presented in Table 3-2 and the sampling locations shown on Figure 3-2, it does not appear that the extent of the polychlorinated biphenyl (PCB) contamination has been defined. Most of the samples adjacent to samples 41SB2A and 41SB10A were not analyzed for PCBs or the method reporting limits for those samples that were analyzed exceeded the RBCs. Revise the Work Plan Addendum to propose additional sampling to assess the extent of surface soil PCB contamination in the vicinity of samples 41SB2A and 41SB10A. Alternatively, provide justification for not further characterizing the extent of PCB-1254 contamination.

RFAAP Response

The error is on Table 3-2. The units for the PCBs are shown as mg/kg, and the RBCs are also presented in mg/kg. The actual units for the chemical data are ug/kg. The actual results are below RBCs. Table 3-2 will be revised.

EPA Comment 21

Section 3.6, Investigation Approach, Area A, Page 3-43. It is not clear that the proposed method for collecting groundwater samples (direct push method) is appropriate for this site. Figure 3-3 (SWMU 41 Geological Cross Section) appears to show that the water table is located at or below the top of the bedrock/overburden interface. Direct push sampling is typically used for sampling in the overburden.

Alternative drilling methods may need to be proposed in order to obtain the groundwater samples. Permanent wells should be considered as they will allow for future monitoring and trend analysis, if contaminants of concern are identified. *Realize we discussed at meeting, just putting it out there – Will*

RFAAP Response

It is anticipated that groundwater will be encountered in the overburden, as the site is adjacent to an unnamed tributary to Stroubles Creek. If groundwater is not encountered in the overburden, drilling will be performed with a Hydropunch (similar to a direct push sampler combined with a drill rig).

EPA Comment 22

Section 3.6, Investigation Approach, Area A, Page 3-43. Surface water sampling has been proposed to assess the unnamed tributary to Stroubles Creek, but co-located sediment samples have not been proposed.

Sediment samples collected in 1997 as part of the New River and Tributaries Study identified several metals (arsenic, chromium, lead, nickel, manganese, vanadium, and iron) above applicable screening criteria in samples collected from areas downgradient of the site. To assess whether SWMU 41 may have contributed to this contamination, additional sediment samples should be proposed. Revise the Work Plan Addendum to propose sediment sampling at those locations where surface water sampling has been proposed. Alternatively, provide justification for not characterizing sediment in the vicinity of the site.

RFAAP Response

Seven surface water/sediment pairs were collected during the 2005 URS RFI from Stroubles Creek and the un-named tributary in the vicinity of SWMU 41. Surface water and sediment at the site are considered characterized. Additional surface water samples are proposed for comparison to the proposed groundwater samples.

EPA Comment 23

Section 4.1.2, Site History, Page 4-1. It is proposed that a source of contamination in Area O may have been a leaking discharge line that connected the northeastern-most fuel tank to a pumping station.

The location of this former discharge line is not shown on any figures, so it is not clear if proposed sampling will adequately assess this area. If any additional subsurface structures or pipes are/were located in the vicinity of the Area O tanks, they should also be depicted on a site figure in accordance with Section 2.2.1.1 of EPA's RCRA Facility Investigation (RFI) Guidance (May, 1989). Revise the Work Plan Addendum to include a figure which shows all known past or present product and waste underground tanks or piping. The location of the former leaking discharge line should be specifically identified.

RFAAP Response

The area where the leak occurred is identified on Figure 4-2 and is labeled "oil leak area/proposed soil borings". Additional piping and/or tanks will also be identified on the figure.

EPA Comment 24

Section 4.6, Investigation Approach, Page 4-22. Proposed sample locations are supposed to be shown on Figure 4-2; however, the Figure 4-2 only shows the boundaries of the areas in which the investigations will be conducted. The proposed locations of the soil borings and groundwater samples should be clearly depicted on a site figure that is constructed using a scale that will show sufficient detail of the site area. Revise the Work Plan Addendum to show the specific locations of all of the proposed samples.

RFAAP Response

One of the advantages to direct push sampling is the ability to adjust locations based on conditions encountered in the field. The general areas are shown and the actual locations will be dictated by the results of the borings and field readings (PID, etc.). The EPA/VDEQ are invited to be present during field activities if they would like additional input on locations.

EPA Comment 25

Section 4.6, Investigation Approach, Groundwater, Page 4-22. It is noted that groundwater samples will be analyzed for monitored natural attenuation parameters (MNA), including total organic carbon (TOC), anions, and dissolved gases. The specific anions and dissolved gases have not been identified. Revise the Work Plan Addendum to specify all of the proposed MNA parameters. Additionally, clarify the objective of this sampling.

RFAAP Response

The text has been revised to read:

Groundwater samples will be analyzed for TCL VOCs, SVOCs, PAHs, and monitored natural attenuation (MNA) parameters. The MNA parameters will examine changes in geochemical parameters that directly correlate to the indigenous microbiology. Field parameters (DO, ORP, pH, temperature, and conductivity) will be collected during groundwater sampling as part of the low-flow sampling procedures. Biodegradation parameters (nitrate, sulfate, ferrous iron, chloride, methane, ethene, ethane, alkalinity, TOC, and DHC) will be collected from the monitoring wells to be analyzed.

EPA Comment 26

Section 4.6, Investigation Approach, Groundwater, Page 4-22. The Work Plan Addendum proposes to collect additional groundwater samples using direct push technology. However, based on the anticipated depth to bedrock at this site, it is not clear that this methodology will be appropriate. Figure 4-3 (Cross Section A-A', Area O) appears to show that the water table is located within bedrock at existing monitoring well WC1-2, which is located in the same area for which the direct push sampling is proposed (Figure 4-2). Direct push sampling is typically used for sampling in the overburden, not bedrock. Revise the Work Plan Addendum to address this concern. Alternative drilling methods should be considered in order to obtain the proposed groundwater samples.

RFAAP Response

Groundwater exists in the overburden in paleo-channels ("river jack") incised into the bedrock surface (see Site Hydrogeology, Section 4.2.3). These channels are the likely migration pathway for impacted groundwater at the site. The direct push sampling is intended to define the extent of these deposits and whether they are currently impacted by fuel-constituents. Alternative drilling methods will not be needed since groundwater in the overburden is the goal of the sampling program and there are existing wells to characterize groundwater within the bedrock.

EPA Comment 27

Table 4-1, Detected Results for Soil at Area O, 1994 RFI – Dames and Moore. This table does not include the industrial and residential RBCs for dibenzofuran. RBCs have been established for dibenzofuran, so these values should be included in Table 4-1. Revise Table 4-1 to include the industrial and residential soil RBCs for dibenzofuran.

RFAAP Response

OK.

EPA Comment 28

Section 5.6, Investigation Approach, Soil, Page 5-32. An X-ray fluorescence (XRF) survey is proposed, but the survey area (a 220-ft by 120-ft grid) has not been shown on a site figure. This figure should show the location of the survey area and the initial 12 sampling locations that are described in Section 5.6. Revise the Work Plan Addendum to show the location of the XRF survey grid and the initially proposed sampling locations

RFAAP Response

The survey will start adjacent to the area excavated in 1998 and will step out until concentrations are below the residential screening criteria. The 220 ft by 120 ft area and the 1998 excavation will be added to the figure.

EPA Comment 29

Section 5.6, Investigation Approach, Soil, Page 5-32. It is noted that confirmatory soil samples will be collected around the outer perimeter of the survey area after XRF data have delineated the extent of contamination. The anticipated spacing between confirmatory samples has not been specified. Revise the Work Plan Addendum to specify the spacing between confirmatory soil samples so that a consistent approach is employed in the field.

Additionally, it is noted that these confirmatory samples will be analyzed for lead, PCBs, and dioxins/furans. Table 5-6 (Proposed Sampling and Analysis Plan, Former Lead Furnace Area) notes that these samples will also be analyzed for TAL metals. Confirm that TAL metals will also be analyzed in the perimeter confirmatory soil samples. Metals should be included in the proposed parameter list as there are several inorganic constituents besides lead (copper, iron, zinc, etc.) that exceeded their residential RBC values during the 2002 sampling event (Table 5-3).

RFAAP Response

The text will be revised to shown TAL metals as the analyte instead of lead only. The confirmation sampling will be guided by the overall shape of the area that is delineated. Confirmation samples will be collected in each direction and at inflection points of the boundary. It is anticipated that confirmation sample spacing will be approximately 20 ft apart around the perimeter of the site. Spacing will be greater at the top of the slope that defines the edge of site and at the predefined boundary between the FLFA and SWMU 17A. Sample spacing will be closer (5 ft) along the side boundaries of the area of elevated lead.

EPA Comment 30

Table 5-3, Analytes Detected in Soil – 2002 RFI. Pages 3 and 4 of this table do not include the RBCs, background values, or SSL values. This makes it difficult to assess potential exceedances of the screening criteria. Revise Table 5-3 so that each page of the table includes the applicable screening criteria.

RFAAP Response

The table will be revised to shown the criteria columns at the left on each page, similar to the other multi-page tables included in the work plan.

EPA Comment 31

Section 5.6, Investigation Approach, Groundwater, Page 5-34. One monitoring well is proposed, but the specific method for installation of this well has not been specified. Although SOPs 20.1 and 20.11 in the Master Work Plan are referenced in this section, these SOPs address several types of drilling methods (hollow stem auger, air rotary, etc.). The procedures and methods for installation of the FLFA monitoring well should be indicated in the Work Plan Addendum.

Additionally, the above mentioned SOPs indicate that the proposed well screen length, screen slot size, filter pack, method of sampling, and sampling intervals should be specified in the work plan addenda. However, theses details have not been specified for the FLFA well. Revise the Work Plan Addendum to address these omissions.

RFAAP Response

Drilling will be performed with Hollow Stem Augers (HSA) to allow split spoon sampling. If water is encountered in the overburden, the well will be installed through the augers. If additional drilling into the bedrock is required, drilling will switch to Air Rotary drilling and will continue until water is encountered. Wells will be constructed of two inch Schedule 40 PVC with 0.01 inch slot size screen. Ten feet of screened material will be used unless the rate of water production is low, in which case 15 to 20 feet of screen may be used. Number 1 sand will be used as a filter pack. The well will be developed using a high capacity submersible pump, and will be periodically surged during development. Water quality parameters will be measured and recorded during development.

Groundwater sampling from the well will be performed using low-flow sampling techniques and a submersible pump. Water quality parameters will be monitored until stabilized (3 consecutive readings within 10%), the flow cell will be removed, the flow rate will be reduced to 100 ml/min and then sampling will be performed.

EPA Comment 32

Section 6.1.1, Site Description, Page 6-1. The site description mentions that a pile of soil is located adjacent to the roadway in the western section of SWMU 43. The origin of this soil has not been described, and the proposed investigation does not specifically plan to sample soil from the pile. Revise the Work Plan Addendum to describe the origin of this soil pile, show its location on a site figure, and estimate its volume. If the origin is unknown, it is suggested that it be sampled as part of the SWMU 43 investigation.

RFAAP Response

The site description will be revised. The pile of soil at the western edge of the site is no longer present. The concrete pad and the gravel pad are still present and are currently used to store office and equipment trailers. Soil boring 43SB06 is located adjacent to the pad and will be used to characterize the area where the soil pile was located.

EPA Comment 33

Section 6.6, Investigation Approach, Page 6-16. A geophysical survey is proposed to define the landfill boundaries, but very few specific details of this investigation have been provided. The area proposed for this geophysical survey should be identified on a site figure. Additionally, the grid spacing and anticipated survey depths should be specified. SOP 20.7 (Resistivity and Electromagnetic Induction Surveys) in the Master Work Plan describes two types of EM instruments that could be used for site surveys, but the type of instrument proposed for the SWMU 43 investigation has not been specified. Revise the Work Plan Addendum to provide additional site-specific information for the geophysical survey at SWMU 43.

Geophysical survey already completed - Will

RFAAP Response

The geophysical survey has been completed. The requested information will be included in the resultant RFI report, along with a description of the results of the survey.

EPA Comment 34

Section 6.6, Investigation Approach, Page 6-16. The second paragraph of this section indicates that the chemical parameters needed to fill data gaps include polynuclear aromatic hydrocarbons (PAHs), explosives, TCL pesticides/PCBs, herbicides, dioxins/furans, and perchlorate. However, the proposed analyses for surface water, soil, and groundwater sampling summarized in Table 6-4 (Proposed Sampling and Analysis Plan, SWMU 43) and in the narrative description on Page 6-18 exclude dioxins/furans. Since this is a data gap that needs to be addressed, revise the Work Plan Addendum to include analysis of dioxins/furans for surface water, soil, and groundwater samples. Alternatively, provide justification for not sampling for these chemical parameters.

RFAAP Response

Per previous agreements with the EPA and VDEQ, Radford will sample for dioxins/furans at sites where known or suspected burning took place, or where burning wastes (i.e. ash) were disposed or stored. SWMU 43 does not fit into the category of sites where dioxins/furans are analyzed.

EPA Comment 35

Section 6.6, Investigation Approach, Surface Water Sampling, Page 6-18. Two seep samples are proposed at locations previously sampled. The intent of these samples is to characterize groundwater that is leaving the site and entering the New River. Figure 6-2 (SWMU 43 Sample Locations) appears to show that both of these sample locations are located north of the eastern cell of the landfill. Surface water sampling is apparently not proposed to assess groundwater as it discharges north of the western cell of the landfill. During a previous investigation, monitoring wells 43MW3 and 43MW4, both located downgradient of the western cell, reported concentrations of arsenic, iron, manganese, 1,2-dichloroethane, and/or benzene above screening levels. The potential discharge of these contaminants in groundwater water to surface water needs to be addressed. Revise the Work Plan Addendum to propose additional surface water sampling north of the western cell of the SWMU 43, or provide justification for not addressing this apparent data gap.

RFAAP Response

If seeps are present adjacent to the western cell, then surface water samples will be collected at those locations. The two seeps that are currently proposed to be sampled were identified in a previous investigation. Samplers will walk the bank of the New River to identify additional seeps during the sampling event.

EPA Comment 36

Section 6.6, Investigation Approach, Soil Sampling, Page 6-18. Five soil borings in each landfill cell are proposed at SWMU 43, but the drilling method for these borings has not been specified. Revise the Work Plan Addendum to specify the method for installing the soil borings, and collecting the soil samples. A specific reference to the Master Work Plan and corresponding SOP should be provided.

Additionally, it is noted that samples will be collected at three depths in each boring: 0 to 0.5ft bgs, within the waste, and below the waste (Table 6-4). It is also noted that bedrock in the area was encountered in previous borings at this site. Please clarify the sampling protocol if bedrock prevents sampling below the waste.

RFAAP Response

Soil borings will be completed with a direct push (geoprobe) rig. Samples will be collected continuously with a four ft, 2-in core barrel. If waste is encountered immediately on top of bedrock, the lower sample will be collected from the epikarst zone of weathered bedrock (saprolite). The saprolite is generally fairly clayey and a sample from this zone will provide chemical information used to assess migration of landfill constituents.

EPA Comment 37

Section 7.1.1, Site Description, Page 7-1. The site description identifies features to the north of the site, but it does not describe site features to the south, east, or west. Figure 7-2 appears to show buildings in close proximity to Area P, but the Work Plan Addendum does not describe their current use. A description of the surrounding land use is important as it may help appropriately define all potential receptors. Revise the Work Plan Addendum to describe the area surrounding Area P.

RFAAP Response

After review of the figure, the site outline should be shifted to the west, away from the buildings. The surrounding land is used as a storage yard and a scrap yard. Additional details will be provided, if available.

EPA Comment 38

Section 7.1.2, Site History, Page 7-1. This section does not indicate the time period in which Area P operated as a scrap metal yard. The RFI guidance indicates that the history of the site, including its period of operation, should be included in the RFI Work Plan as background information. Revise the Work Plan Addendum to include the period of operation for Area P.

RFAAP Response

The section contains all available information about the site history. If additional information is discovered during the field investigation, then the Site History section in the RFI Report will be updated to include the new information.

EPA Comment 39

Section 7.3.1, VI, Dames and Moore, 1992, Page 7-3. It is noted that antimony and copper exceeded the residential RBC in site soil, but they are below the RFAAP Facility-Wide Background inorganic screening levels. These conclusions do not appear to be consistent with the data presented in Table 7-1 (1992 VI Detected Results for Soil – Area P).

The table appears to show that copper was detected above both the residential RBC and the background value in sample PSB2. Antimony was detected above the residential RBC in the same sample; however, a background concentration for antimony does not appear to have been established (as noted by the "na" on the table). Revise the Work Plan Addendum to address this discrepancy.

RFAAP Response

The reference to background was for the arsenic, beryllium and cobalt that exceeded criteria when the samples were collected. The section will be revised to read:

"In 1992, soils at Area P were evaluated to determine if they had been impacted from the possible spillage of spent battery acid. At each of five locations, one surface (0-0.5 ft bgs) and one subsurface soil sample (4-5 ft bgs) was collected and analyzed for TAL metals and pH. Arsenic, beryllium, and cobalt were detected at concentrations greater than screening criteria at the time of the investigation. However, a current review of the metals results indicates that these concentrations are below the RFAAP Facility-Wide Background inorganic screening levels (IT, 2002a).

Compared to current RBCs, antimony and copper each exceeded the R-RBC in sample PSB2A (0-0.5 ft bgs). The remaining metals were below screening criteria. Results from the samples are presented in **Table 7-1**. Sample locations are presented on **Figure 7-2**. pH results indicated that soil samples varied from neutral to slightly basic."

EPA Comment 40

Section 7.6, Investigation Approach, Page 7-4. The proposed analyses for the soil investigation do not appear to include metals. Since the site was historically used as a scrap metal yard, it is recommended that soil samples be analyzed for metals. Additionally, concentrations of copper and antimony were detected above the residential RBC and/or background values during a previous investigation. The extent of contamination associated with these exceedances will need to be defined. Revise the Work Plan Addendum to propose metals analysis for soil samples and to define the extent of copper and antimony contamination east of sample PSB2.

RFAAP Response

The approach calls for analyzing samples for analyte groups that were not investigated during the earlier sampling event. Samples were analyzed for metals and pH in 1992. The levels of metals that were identified during that investigation (two residential exceedances out of ten samples) do not seem sufficient to warrant additional sampling.

Leahy, Timothy

From: Geiger.William@epamail.epa.gov
Sent: Thursday, May 24, 2007 3:32 PM
To: Mendoza, Richard R USAEC; Tom.Meyer@nab02.usace.army.mil; jlcutler@deq.virginia.gov; jerome.redder@atk.com; jim.mckenna@us.army.mil; Leahy, Timothy
Cc: Fish.Russell@epamail.epa.gov; Cramer.Mike@epamail.epa.gov
Subject: Draft Comments for Master Work Plan Addendum 19

As stated in my earlier phone conversations with Tim and Jim, EPA would like Shaw to hold off on scheduling the field work portion of Master Work Plan Addendum 19 until several outstanding issues are resolved. I will be out of the office starting tomorrow and will return on June 4. While we are still in the process of reviewing the work plan, I am sending out a draft set of comments that Radford can begin to address, and we can discuss in more detail the week of June 4. Mike Cramer may also be sending some additional hydro comments next week. It should be noted that while this may look like a lot of comments, many of them are minor (3, 6, 8, 13, 14, etc...) and do not necessarily need to be addressed before field work can proceed. Comments dealing with drilling/sampling methods or analyses (1, 4, 7, 10, 31, 36, 40, etc...) will need to be addressed before EPA approves of field work proceeding, and should also be noted for all future submittals. EPA is still in the process of reviewing comments 12, 17, 22, 29, and 34. Certain comments expand on Jim Cutler's comments from the meeting and state the need for further characterization in specified areas. As Jim and I stated at the meeting, these comments do not necessarily need to be addressed before field work can proceed, but we are reserving the right to come back to them if need be.

GENERAL COMMENTS

1. The Work Plan Addendum references the RFAAP Master Work Plan for standard operating procedures (SOPs) that will be used during the proposed investigations. However, in many cases, the SOPs describe several procedures that can be used when sampling environmental media or installing wells or borings. For example, the Master Work Plan indicates that surface water samples can be collected using dip samplers, pond samplers, a peristaltic pump, or other devices. SOP 30.3 (Surface Water Sampling) also states that “the most appropriate method of sample collection and the appropriate depths of sampling (sampling strategies) will be specified in work plan addenda based on site-specific conditions and data quality objectives (DQOs).” The Work Plan Addendum does not describe specific methods for sample collection and boring advancement (with the exception of direct push sampling). Revise the Work Plan Addendum to describe the specific methods that will be used to collect the surface water, soil, groundwater, and sediment samples proposed in this report. Additionally, revise the Work Plan Addendum to indicate the methods to be used for installing all monitoring wells, and describe the important details of the construction of these wells (i.e. well screen length, filter pack material, well diameter, slot screen size, depth, etc.).

2. The Work Plan Addendum focuses primarily on the collection of additional chemical data to identify source areas and delineate the extent of contamination. While this is a primary component of the RCRA Facility Investigation (RFI) process, it is also important to characterize the environmental setting of each of the site areas. Of

particular concern is that this Work Plan Addendum does not propose to collect data necessary to characterize the underlying aquifer(s). An understanding of hydrogeologic characteristics (hydraulic conductivity, groundwater flow velocities, etc.) is important when evaluating potential contaminant migration and potentially impacted areas. Revise the Work Plan Addendum to propose activities to investigate the environmental setting of each area, including underlying aquifer(s) or provide specific references where this information can be found. Please consider conducting slug tests or other aquifer tests in select monitoring wells to obtain information about the underlying aquifer(s).

3. Groundwater sampling of existing wells is proposed for many of the sites. Well construction details for the existing wells have not been provided in this Work Plan Addendum. Knowledge of the well construction (depth, screened interval) is important when evaluating the existing data. Revise the Work Plan Addendum to provide either the well construction logs for existing wells or a summary of well construction details for all of the existing wells that will be sampled as part of this Work Plan Addendum. Alternatively, provide clear references to where the information can be found.

4. Surface soil sampling for volatile organic compounds (VOCs) is proposed at several of the sites discussed in this Work Plan Addendum. The depth interval for these surface soil samples is identified as 0 to 0.5 feet (ft) below ground surface (bgs). The RFAAP Master Work Plan indicates that surface soil samples for VOCs should be collected within the depth interval of 6 to 12 inches bgs (Section 5.2). Revise the Work Plan Addendum to address this deviation from the Master Work Plan. Alternatively, revise the Work Plan Addendum to propose that surface soil samples collected for VOC analysis be collected from the 6- to 12-inch depth interval.

5. Soil data from only one of the sites (the Former Lead Furnace Area) appears to have been compared to soil screening levels (SSLs) to assess the potential for migration to groundwater. Indicate whether the proposed groundwater sampling at each of the sites considers those contaminants that may have been detected above SSLs in soil, even though the SSLs have not been provided for comparison. Future submittals should include the SSLs on data summary tables for soil.

6. None of the individual data summary tables include a notes section that defines the meaning of acronyms or highlighted values within the table. A Soil/Sediment Master Table Legend has been provided at the end of Table 2-5d in Section 2, but this table does not address notes that may be associated with surface water or groundwater samples. Additionally, the Soil/Sediment Master List does not appear to include the meaning of all of the different shading that has been used in the tables. For example, Table 5-1 (Former Lead Furnace Area – VI Detected Soil Results – 1992) includes cells that have been highlighted in gray and outlined in black, and the values inside are shown in white font. The Soil/Sediment Master Table Legend does not address the use of white font. Revise the Work Plan Addendum so that the meaning of all acronyms and highlighting in all of the tables (including surface water and groundwater tables) is appropriately defined. Consideration should be made to include a notes section on each table for easy reference.

7. Groundwater samples at several sites will be analyzed for metals. Clarify if the samples will be analyzed for total or dissolved metals, or both. If groundwater is analyzed for dissolved metals, indicate whether the samples will be filtered in the field or at the laboratory.

SPECIFIC COMMENTS

8. Section 2.1.1, Site Description, Page 2-1. The text states that a 1986 aerial photo is shown on Figure 2-2; however, a note on Figure 2-2 indicates that the source of the figure is a May 25, 2000 aerial photo. Revise the Work Plan Addendum to resolve this discrepancy.

9. Section 2.5, Data Gap Analysis, Soil, SWMU 49, Page 2-35. Figure 2-2 appears to show that most of the previous sampling at this site is concentrated in the western half of the solid waste management unit (SWMU) (with the exception of one surface soil sample on the southeastern side). Additional information for this sampling approach has not been provided. Revise the Work Plan Addendum to address this apparent data gap. Additional surface and/or subsurface samples may be necessary to characterize the eastern half of SWMU 49.

10. Section 2.6, Investigation Approach, Groundwater, Page 2-43. Installation of several wells is proposed for the combined site area, but the specific method for installation of the wells has not been provided. Although SOPs 20.1 and 20.11 in the RFAAP Master Work Plan are referenced in this section, these SOPs address several types of drilling methods (hollow stem auger, air rotary, etc.). The specific methods and procedures to be used for installation of the monitoring wells at this site area should be indicated in the Work Plan Addendum.

Additionally, the above mentioned SOPs indicate that the proposed well screen length, screen slot size, filter pack, and method of sampling should be specified in the work plan addenda. However, these details have not been provided. Revise the Work Plan Addendum to address these omissions.

11. Section 2.6, Investigation Approach, Page 2-43. Additional soil sampling is not proposed at SWMU 48, but it is not clear that the extent of explosives contamination has been adequately defined at this SWMU. Concentrations of the dinitrotoluene mix were detected above screening criteria in sample 48SB2 (10-12 ft) (Table 2-2) and sample 48SB6C (1-3 ft) (Table 2-4), both located in the eastern side of SWMU 48 (as shown on Figure 2-2). It is not clear that this contamination has been delineated to the north and east. Furthermore, it is not clear if explosives may be located at shallower depths in sample 48SB2 since it does not appear that any samples were collected between 0 and 10 ft bgs. Revise the Work Plan Addendum to address the adequacy of the existing samples to define the extent of explosives contamination. Additional soil samples may be necessary to delineate the extent of this contamination.

12. Section 2.6, Investigation Approach, Page 2-43. It does not appear that the extent of dioxins in surface soil at SWMU 48 has been adequately characterized. Table 2-1 (Previous Soil Investigations Environmental Samples and Analyses) shows that only three surface soil samples were analyzed for dioxins at this SWMU. Two of the three samples reported tetrachlorodibenzo-p-dioxin (TCDD) TE in excess of the industrial and residential RBCs (as shown on Table 2-5a). The extent of dioxin contamination in surface soil will need to be characterized at SWMU 48. Revise the Work Plan Addendum to propose additional surface soil sampling for dioxins at SWMU 48. Alternatively, provide justification for not characterizing the extent of dioxin contamination.

13. Section 3.1.1, Site Description, Page 3-1. The Work Plan Addendum appears to incorrectly reference Figure 3-1 (SWMU 41 and 43 and Areas O and P Site Location Map) in its discussion of the topography of SWMU 41. Topographic contours are actually shown on Figure 3-2 (SWMU 41 Sample Locations). Revise the Work Plan Addendum to correct this reference.

14. Section 3.1.1, Site Description, Page 3-1. Important site

features at this site include Stroubles Creek, a drainage ditch, and an unnamed tributary of Stroubles Creek. None of these features are labeled on the site figures. Revise the Work Plan Addendum to label Stroubles Creek, the drainage ditch, and the unnamed tributary of Stroubles Creek on a site figure. Additionally, clarify if the drainage ditch is lined or unlined.

15. Section 3.2.2, Site Geology, Page 3-3. This section notes that 40 direct push borings were completed at SWMU 41 during the 2005 RFI, but it does not appear that a majority of these boring locations have been shown on a site figure. Figure 3-2 only shows 15 soil sample locations. Revise the Work Plan Addendum to show all of the previous boring locations at SWMU 41.

16. Section 3.3.2, VI, Dames and Moore, 1992, Groundwater, Page 3-9. This section notes that bis(2-ethylhexyl)phthalate and vanadium were detected above the tapwater risk based concentrations (RBCs). Table 3-1b (1992 VI Detected Analytes for Groundwater at SWMU 41) also notes that antimony was detected in monitoring well 41MW2 above both the federal maximum contaminant level (MCL) and tapwater RBC. Revise Section 3.3.2 to include this notable exceedance in the discussion of groundwater results.

17. Section 3.3.2, VI, Dames and Moore, 1992, Surface Water, Page 3-9. This section indicates that constituents detected in surface water, with the exception of barium, were detected below the tapwater RBCs and the Region 3 Biological Technical Assistance Group (BTAG) freshwater screening values. Table 3-1c (1992 VI Detected Results for Surface Water at SWMU 41) only compares the detected results to MCLs and the tapwater RBCs. Revise Table 3-1c to include the BTAG screening values for easy reference.

18. Section 3.3.3, New River and Tributaries Study, Parsons, 1997, Page 3-9. A summary of the 1995 and 1996 sampling events is presented, but the sampling locations to which this section refers (i.e., SCSW2) are not shown on a site figure. A summary table of the data has also not been provided. This information will aid in the evaluation of the current understanding of the extent of contamination at and in the vicinity of the site. Revise the Work Plan Addendum to show the 1995 and 1996 surface water and sediment sampling locations. Additionally, include a summary table of the detected concentrations.

19. Section 3.3.5, RFI, URS Corporation, 2005, Nature and Extent Assessment at Area A, Page 3-16. Total 2,3,7,8-TCDD equivalents concentration (TEQ) was identified as a constituent of potential concern (COPC) for Area A, but it is not clear which samples contributed to this constituent's inclusion as a COPC. Table 3-2 (2004 RFI Detected Results for Soil at SWMU 41) has not highlighted any dioxin/furan constituents for exceeding screening criteria. Clarify why total 2,3,7,8-TCDD TEQ was included as a COPC, and indicate which samples contributed to its inclusion as a COPC. This information will be necessary to assess the adequacy of the proposed sampling program in defining the extent of contamination associated with this constituent. Additional soil samples to assess the extent of this contamination may be required.

20. Section 3.3.5, RFI, URS Corporation, 2005, Nature and Extent of Assessment at Area A and Area B, Page 3-16. Table 3-2 indicates that PCB-1254 was detected above the industrial and residential RBCs in surface samples 41SB2A and 41SB10A, but these exceedances are not discussed in Section 3.3.5. Based on the data presented in Table 3-2 and the sampling locations shown on Figure 3-2, it does not appear that the extent of the polychlorinated biphenyl (PCB) contamination has been defined. Most of the samples adjacent to samples 41SB2A and 41SB10A

were not analyzed for PCBs or the method reporting limits for those samples that were analyzed exceeded the RBCs. Revise the Work Plan Addendum to propose additional sampling to assess the extent of surface soil PCB contamination in the vicinity of samples 41SB2A and 41SB10A. Alternatively, provide justification for not further characterizing the extent of PCB-1254 contamination.

21. Section 3.6, Investigation Approach, Area A, Page 3-43. It is not clear that the proposed method for collecting groundwater samples (direct push method) is appropriate for this site. Figure 3-3 (SWMU 41 Geological Cross Section) appears to show that the water table is located at or below the top of the bedrock/overburden interface. Direct push sampling is typically used for sampling in the overburden. Alternative drilling methods may need to be proposed in order to obtain the groundwater samples. Permanent wells should be considered as they will allow for future monitoring and trend analysis, if contaminants of concern are identified. Realize we discussed at meeting, just putting it out there - Will

22. Section 3.6, Investigation Approach, Area A, Page 3-43. Surface water sampling has been proposed to assess the unnamed tributary to Stroubles Creek, but co-located sediment samples have not been proposed. Sediment samples collected in 1997 as part of the New River and Tributaries Study identified several metals (arsenic, chromium, lead, nickel, manganese, vanadium, and iron) above applicable screening criteria in samples collected from areas downgradient of the site. To assess whether SWMU 41 may have contributed to this contamination, additional sediment samples should be proposed. Revise the Work Plan Addendum to propose sediment sampling at those locations where surface water sampling has been proposed. Alternatively, provide justification for not characterizing sediment in the vicinity of the site.

23. Section 4.1.2, Site History, Page 4-1. It is proposed that a source of contamination in Area O may have been a leaking discharge line that connected the northeastern-most fuel tank to a pumping station. The location of this former discharge line is not shown on any figures, so it is not clear if proposed sampling will adequately assess this area. If any additional subsurface structures or pipes are/were located in the vicinity of the Area O tanks, they should also be depicted on a site figure in accordance with Section 2.2.1.1 of EPA's RCRA Facility Investigation (RFI) Guidance (May, 1989). Revise the Work Plan Addendum to include a figure which shows all known past or present product and waste underground tanks or piping. The location of the former leaking discharge line should be specifically identified.

24. Section 4.6, Investigation Approach, Page 4-22. Proposed sample locations are supposed to be shown on Figure 4-2; however, the Figure 4-2 only shows the boundaries of the areas in which the investigations will be conducted. The proposed locations of the soil borings and groundwater samples should be clearly depicted on a site figure that is constructed using a scale that will show sufficient detail of the site area. Revise the Work Plan Addendum to show the specific locations of all of the proposed samples.

25. Section 4.6, Investigation Approach, Groundwater, Page 4-22. It is noted that groundwater samples will be analyzed for monitored natural attenuation parameters (MNA), including total organic carbon (TOC), anions, and dissolved gases. The specific anions and dissolved gases have not been identified. Revise the Work Plan Addendum to specify all of the proposed MNA parameters. Additionally, clarify the objective of this sampling.

26. Section 4.6, Investigation Approach, Groundwater, Page 4-22. The

Work Plan Addendum proposes to collect additional groundwater samples using direct push technology. However, based on the anticipated depth to bedrock at this site, it is not clear that this methodology will be appropriate. Figure 4-3 (Cross Section A-A', Area O) appears to show that the water table is located within bedrock at existing monitoring well WC1-2, which is located in the same area for which the direct push sampling is proposed (Figure 4-2). Direct push sampling is typically used for sampling in the overburden, not bedrock. Revise the Work Plan Addendum to address this concern. Alternative drilling methods should be considered in order to obtain the proposed groundwater samples.

27. Table 4-1, Detected Results for Soil at Area O, 1994 RFI – Dames and Moore. This table does not include the industrial and residential RBCs for dibenzofuran. RBCs have been established for dibenzofuran, so these values should be included in Table 4-1. Revise Table 4-1 to include the industrial and residential soil RBCs for dibenzofuran.

28. Section 5.6, Investigation Approach, Soil, Page 5-32. An X-ray fluorescence (XRF) survey is proposed, but the survey area (a 220-ft by 120-ft grid) has not been shown on a site figure. This figure should show the location of the survey area and the initial 12 sampling locations that are described in Section 5.6. Revise the Work Plan Addendum to show the location of the XRF survey grid and the initially proposed sampling locations.

29. Section 5.6, Investigation Approach, Soil, Page 5-32. It is noted that confirmatory soil samples will be collected around the outer perimeter of the survey area after XRF data have delineated the extent of contamination. The anticipated spacing between confirmatory samples has not been specified. Revise the Work Plan Addendum to specify the spacing between confirmatory soil samples so that a consistent approach is employed in the field.

Additionally, it is noted that these confirmatory samples will be analyzed for lead, PCBs, and dioxins/furans. Table 5-6 (Proposed Sampling and Analysis Plan, Former Lead Furnace Area) notes that these samples will also be analyzed for TAL metals. Confirm that TAL metals will also be analyzed in the perimeter confirmatory soil samples. Metals should be included in the proposed parameter list as there are several inorganic constituents besides lead (copper, iron, zinc, etc.) that exceeded their residential RBC values during the 2002 sampling event (Table 5-3).

30. Table 5-3, Analytes Detected in Soil – 2002 RFI. Pages 3 and 4 of this table do not include the RBCs, background values, or SSL values. This makes it difficult to assess potential exceedances of the screening criteria. Revise Table 5-3 so that each page of the table includes the applicable screening criteria.

31. Section 5.6, Investigation Approach, Groundwater, Page 5-34. One monitoring well is proposed, but the specific method for installation of this well has not been specified. Although SOPs 20.1 and 20.11 in the Master Work Plan are referenced in this section, these SOPs address several types of drilling methods (hollow stem auger, air rotary, etc.). The procedures and methods for installation of the FLFA monitoring well should be indicated in the Work Plan Addendum.

Additionally, the above mentioned SOPs indicate that the proposed well screen length, screen slot size, filter pack, method of sampling, and sampling intervals should be specified in the work plan addenda. However, theses details have not been specified for the FLFA well. Revise the Work Plan Addendum to address these omissions.

32. Section 6.1.1, Site Description, Page 6-1. The site description mentions that a pile of soil is located adjacent to the roadway in the western section of SWMU 43. The origin of this soil has not been described, and the proposed investigation does not specifically plan to sample soil from the pile. Revise the Work Plan Addendum to describe the origin of this soil pile, show its location on a site figure, and estimate its volume. If the origin is unknown, it is suggested that it be sampled as part of the SWMU 43 investigation.

33. Section 6.6, Investigation Approach, Page 6-16. A geophysical survey is proposed to define the landfill boundaries, but very few specific details of this investigation have been provided. The area proposed for this geophysical survey should be identified on a site figure. Additionally, the grid spacing and anticipated survey depths should be specified. SOP 20.7 (Resistivity and Electromagnetic Induction Surveys) in the Master Work Plan describes two types of EM instruments that could be used for site surveys, but the type of instrument proposed for the SWMU 43 investigation has not been specified. Revise the Work Plan Addendum to provide additional site-specific information for the geophysical survey at SWMU 43.
Geophysical survey already completed - Will

34. Section 6.6, Investigation Approach, Page 6-16. The second paragraph of this section indicates that the chemical parameters needed to fill data gaps include polynuclear aromatic hydrocarbons (PAHs), explosives, TCL pesticides/PCBs, herbicides, dioxins/furans, and perchlorate. However, the proposed analyses for surface water, soil, and groundwater sampling summarized in Table 6-4 (Proposed Sampling and Analysis Plan, SWMU 43) and in the narrative description on Page 6-18 exclude dioxins/furans. Since this is a data gap that needs to be addressed, revise the Work Plan Addendum to include analysis of dioxins/furans for surface water, soil, and groundwater samples. Alternatively, provide justification for not sampling for these chemical parameters.

35. Section 6.6, Investigation Approach, Surface Water Sampling, Page 6-18. Two seep samples are proposed at locations previously sampled. The intent of these samples is to characterize groundwater that is leaving the site and entering the New River. Figure 6-2 (SWMU 43 Sample Locations) appears to show that both of these sample locations are located north of the eastern cell of the landfill. Surface water sampling is apparently not proposed to assess groundwater as it discharges north of the western cell of the landfill. During a previous investigation, monitoring wells 43MW3 and 43MW4, both located downgradient of the western cell, reported concentrations of arsenic, iron, manganese, 1,2-dichloroethane, and/or benzene above screening levels. The potential discharge of these contaminants in groundwater water to surface water needs to be addressed. Revise the Work Plan Addendum to propose additional surface water sampling north of the western cell of the SWMU 43, or provide justification for not addressing this apparent data gap.

36. Section 6.6, Investigation Approach, Soil Sampling, Page 6-18. Five soil borings in each landfill cell are proposed at SWMU 43, but the drilling method for these borings has not been specified. Revise the Work Plan Addendum to specify the method for installing the soil borings, and collecting the soil samples. A specific reference to the Master Work Plan and corresponding SOP should be provided.

Additionally, it is noted that samples will be collected at three depths in each boring: 0 to 0.5ft bgs, within the waste, and below the waste (Table 6-4). It is also noted that bedrock in the area was encountered in previous borings at this site. Please clarify the sampling protocol if bedrock prevents sampling below the waste.

37. Section 7.1.1, Site Description, Page 7-1. The site description identifies features to the north of the site, but it does not describe site features to the south, east, or west. Figure 7-2 appears to show buildings in close proximity to Area P, but the Work Plan Addendum does not describe their current use. A description of the surrounding land use is important as it may help appropriately define all potential receptors. Revise the Work Plan Addendum to describe the area surrounding Area P.

38. Section 7.1.2, Site History, Page 7-1. This section does not indicate the time period in which Area P operated as a scrap metal yard. The RFI guidance indicates that the history of the site, including its period of operation, should be included in the RFI Work Plan as background information. Revise the Work Plan Addendum to include the period of operation for Area P.

39. Section 7.3.1, VI, Dames and Moore, 1992, Page 7-3. It is noted that antimony and copper exceeded the residential RBC in site soil, but they are below the RFAAP Facility-Wide Background inorganic screening levels. These conclusions do not appear to be consistent with the data presented in Table 7-1 (1992 VI Detected Results for Soil – Area P). The table appears to show that copper was detected above both the residential RBC and the background value in sample PSB2. Antimony was detected above the residential RBC in the same sample; however, a background concentration for antimony does not appear to have been established (as noted by the "na" on the table). Revise the Work Plan Addendum to address this discrepancy.

40. Section 7.6, Investigation Approach, Page 7-4. The proposed analyses for the soil investigation do not appear to include metals. Since the site was historically used as a scrap metal yard, it is recommended that soil samples be analyzed for metals. Additionally, concentrations of copper and antimony were detected above the residential RBC and/or background values during a previous investigation. The extent of contamination associated with these exceedances will need to be defined. Revise the Work Plan Addendum to propose metals analysis for soil samples and to define the extent of copper and antimony contamination east of sample PSB2.

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February 28, 2007

Mr. William Geiger
RCRA General Operations Branch, Mail Code: 3WC23
Waste and Chemicals Management Division
U. S. Environmental Protection Agency, Region III
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Philadelphia, PA 19103-2029

Subject: Master Work Plan Addendum 19: SWMU 48, SWMU 49, SWMU 50, SWMU 59, SWMU 41, Area O, FLFA, SWMU 43, Area P, Draft Final Document, February 2007
Radford Army Ammunition Plant Installation Action Plan
EPA ID# VA1 210020730

Dear Mr. Geiger:

Enclosed is one copy of the subject document. Your additional four copies will be sent under separate cover . Also under separate cover one copy each will be sent to the distribution below.

This document was discussed at the February 15, 2007 stakeholder meeting in Philadelphia.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

P.W. Holt, Environmental Manager
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c: Russell Fish, P.E., EPA Region III, 3WC23

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07-815-48
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Concerning the following:

Master Work Plan Addendum 19:
SWMU 48, SWMU 49, SWMU 50, SWMU 59, SWMU 41, Area O, FLFA, SWMU 43, Area P,
Draft Final Document, February 2007
Radford Army Ammunition Plant

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

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PRINTED NAME: Ronald F. Fizer
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SIGNATURE: for
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07-815-48
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µg/L ... micrograms per liter
1,1,2,2-TCA ... 1,1,2,2-tetrachloroethane
2,3,7,8-TCDD 2,3,7,8-tetrachlorodibenzo-p-dioxin
ANL ... Argonne National Laboratory
AST ... Aboveground Storage Tank
bgs ... below ground surface
BRA ... Baseline Risk Assessment
BTAG ... Biological Technical Assistance Group
CFR ... Code of Federal Regulations
CMS ... Corrective Measures Study
COPC ... Chemical of Potential Concern
CSM ... Conceptual Site Model
CT ... Carbon Tetrachloride
DHC ... dehalococcoides
DO ... Dissolved Oxygen
DQO ... Data Quality Objective
EM ... Electromagnetic
FLFA ... Former Lead Furnace Area
ft msl ... feet above mean sea level
ft ... feet
ft^3/s ... cubic feet per second
GI ... Gastrointestinal
HHRA ... Human Health Risk Assessment
HI ... Hazard Index
HQ ... Hazard Quotient
HSA ... Horseshoe Area
HWMU ... Hazardous Waste Management Unit
ICF KE ... ICF Kaiser Engineers, Inc.
I-RBC ... Industrial Risk-Based Concentration
MCL ... Maximum Contaminant Level
mg/kg ... milligrams per kilogram
MMA ... Main Manufacturing Area
MNA ... Monitored Natural Attenuation
MWP ... Master Work Plan
ORP ... Oxidation Reduction Potential
PAH ... Polynuclear Aromatic Hydrocarbon
Parsons ... Parsons Engineering Science, Inc.
PCB ... Polychlorinated Biphenyl
PPE ... Personal Protective Equipment and Clothing
QA ... Quality Assurance
QC ... Quality Control
RCRA ... Resource Conservation and Recovery Act
RFA ... RCRA Facility Assessment
RFAAP ... Radford Army Ammunition Plant
RFI ... RCRA Facility Investigation
R-RBC ... Residential Risk-Based Concentration
Shaw ... Shaw Environmental, Inc.
SLERA ... Screening Level Ecological Risk Assessment
SOP ... Standard Operating Procedure
SSL ... Soil Screening Level
SVOC ... Semivolatile Organic Compound
SWMU ... Solid Waste Management Unit
TAL ... Target Analyte List
TCE ... Trichloroethene
TCL ... Target Compound List
TCLP ... Toxicity Characteristic Leachate Procedure
TCLPRL ... Toxicity Characteristic Leachate Procedure Regulatory Limit
TE ... Toxicity Equivalent
TEQ ... Equivalents Concentration
TIC ... Tentatively Identified Compound
TNT ... Trinitrotoluene
TOC ... Total Organic Carbon
TOX ... Total Organic Halides
TPH ... Total Petroleum Hydrocarbons

tw-RBC..........Tap Water Risk-Based Concentration
UCL................Upper Confidence Limit
USACE ..........U.S. Army Corps of Engineers
USAEC ..........U.S. Army Environmental Command
USATHAMA.U.S. Army Toxic and Hazardous Materials Agency
USCS.............Unified Soil Classification System
USEPA...........U.S. Environmental Protection Agency
UST................Underground Storage Tank
UTL................Upper Tolerance Limit
VI ....Verification Investigation
VOC ....Volatile Organic Compound
WPA...............Work Plan Addendum
XRF................X-ray Fluorescence

1.0 INTRODUCTION

Shaw Environmental, Inc. (Shaw) was tasked by the U.S. Army Corps of Engineers (USACE), Baltimore District, to perform characterization and remediation activities at eleven Solid Waste Management Units (SWMUs) and Areas of Concern at Radford Army Ammunition Plant (RFAAP), in accordance with Contract No. W912QR-04-D-0027, Delivery Order DA0101. This document is a Work Plan Addendum (WPA) to RFAAP's Master Work Plan (MWP) (URS, 2003a) and describes additional investigation activities at nine of the eleven sites. The purpose of the investigation is to collect additional data in order to complete Resource Conservation Recovery Act (RCRA) Facility Investigations (RFIs)/Corrective Measures Studies (CMSs) for the nine sites.

RFAAP, the U.S. Environmental Protection Agency (USEPA), and the Virginia Department of Environmental Quality have developed a two-stage approach to facilitate and streamline RCRA site investigations at RFAAP pursuant to the Permit for Corrective Action and Waste Minimization (October 2000). The approach consists of a single facility-wide MWP and multiple site-specific WPAs.

The MWP provides comprehensive discussions of standard procedures, protocol, and methodologies that are to be followed during execution of field investigations at RCRA sites within the RFAAP. The MWP is a generic plan designed to streamline site-specific WPA development, review, and approval. **Table 1-1** lists the appropriate sections of the MWP that are applicable to the current investigation.

Table 1-1
Investigative Activities Discussed in the Master Work Plan

Subject	MWP Section	SOP(s) MWP Appendix A
Installation Description	2.0	NA
Environmental Setting	3.0	NA
Sample Management	5.1	50.1, 50.2, 50.3
Documentation	4.3	10.1, 10.2, 10.3, 10.4
Direct Push Methods	5.2.3.3	20.12
Well Drilling/Installation	5.2	20.1, 20.2, 20.11
Boring Logs/Stratigraphic Characterization	5.2.5	10.3
Geophysical Survey	5.5	20.7, 20.8
Soil Sampling	5.2.8	30.1, 30.7
Sediment Sampling	5.4	30.4
Surface Water Sampling	5.3	30.3
Decontamination Requirements	5.12	80.1
Investigation-Derived Material	5.14	70.1

This WPA describes the site-specific information for nine RCRA sites, providing detailed data on past site operations, potential constituents of concern, sampling strategy, etc. Each addendum, through reference to the MWP, is developed as a concise document, focused on site-specific investigations.

The nine sites covered in this WPA are:

- SWMU 48 – Oily Water Burial Area
- SWMU 49 – Red Water Ash Burial #2
- SWMU 50 – Calcium Sulfate Treatment/Disposal Area
- SWMU 59 – Bottom Ash Pile
- SWMU 41 – Red Water Ash Burial
- Area O – Underground Fuel Oil Spill
- Former Lead Furnace Area (FLFA)
- Area P – Battery Storage Area
- SWMU 43 – Sanitary Landfill No. 2

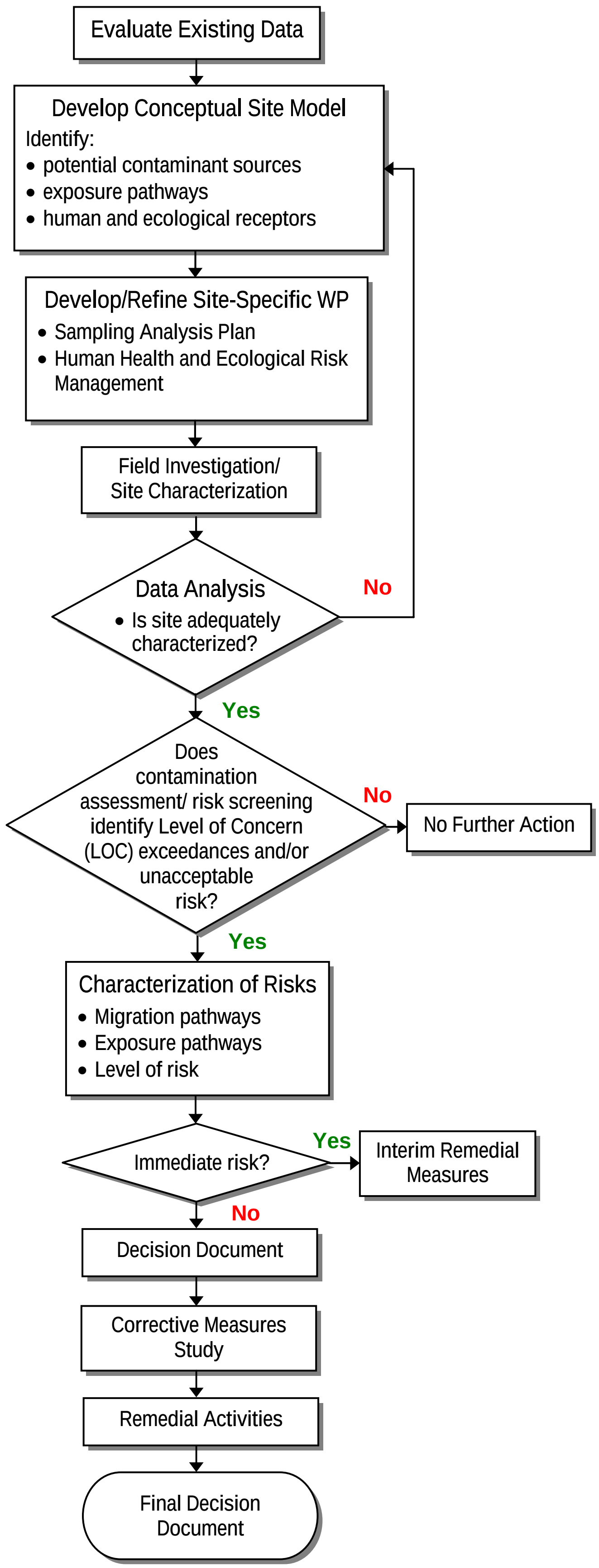
1.1 Investigation Overview

Investigation program activities designed to achieve site-specific data quality objectives (DQOs) are presented in the following sections. Each program systematically establishes the rationale for investigative activities through an assessment of site characteristics and associated project objectives. Supplemental chemical and physical data obtained during the sampling and analysis phase will be used to refine site profiles and enhance the accuracy of risk management decisions. A diagram illustrating the investigation process is presented on **Figure 1-1**.

Investigation programs focus on data gaps and have been designed to provide a comprehensive framework for establishing consistency in the decision-making process. The program clearly articulates project objectives, assumptions, and data use specifications. Program elements include:

- **Site Characteristics:** Brief site descriptions are included in the introductory paragraph for each investigation area to provide an overview of existing site conditions.
- **Preliminary Investigative Results:** Preliminary results will be integrated into conceptual site models (CSMs). Investigative activities have been conducted in each of the study areas. Baseline Human Health and Ecological Risk Assessments have been conducted in applicable study areas.
- **Sampling Program:** Phased, focused investigations will be performed to effectively utilize resources and achieve project DQOs. The sampling design program presented for each area has been structured to meet site-specific DQOs.
- **Quality Assurance/Quality Control (QA/QC):** Independent QC checks are used to demonstrate investigation and laboratory accuracy, precision, and integrity. Section 2.0 of the MWP establishes requirements for documentation, data collection and reporting, management and tracking of electronic and hard copy data, and presentation format. The

Figure 1-1
Investigation Overview



Master Quality Assurance Plan provides assurance that data of known and documented quality is generated to allow the Army to make accurate risk management decisions.

- **Health and Safety:** Site-specific training, personal protective equipment and clothing (PPE), and applicable monitoring requirements are presented in Section 3.0 of the MWP. These procedures were developed to provide the requirements for protection of site personnel including government employees, Shaw, regulators, subcontractors, and visitors, who are expected to be involved with site activities.

1.1.1 Site Characterization Criteria

Shaw was tasked to develop and implement a work plan to complete the characterization of each of the nine sites included in this investigation. Sections 2 through 7 of this report provide site-by-site summaries that include subsections covering the following investigational activities:

1. Review of site conditions and existing data.
2. Completion of a CSM.
3. Proposed sampling plan.

1.1.2 Site Conditions and Previous Investigations

Each site-specific section of this WPA begins with a description of the site and a summary of the current conditions at the site. This section includes physical, natural features that may affect migration pathways as well as structures and former activities that may impact site media.

Following the site description, a summary of previous investigations is provided. These sections primarily focus on sampling activities that have occurred at each site. A re-analysis of existing data, with an emphasis on identifying data gaps, forms the basis for the desktop audit.

1.1.3 Conceptual Site Model

A site-specific CSM has been developed for each site to identify potential contaminant sources, exposure pathways and human and ecological receptors. Each media type (i.e., surface soil, subsurface soil, groundwater, surface water, and sediment) was evaluated to assess whether human (site worker, hypothetical future resident) or biotic (terrestrial, aquatic, and benthic) receptors would be impacted by contamination. For the purposes of this CSM, air is not considered a viable pathway. Should analytical results indicate otherwise, the air pathway will be re-evaluated. Three exposure routes (ingestion, inhalation, and dermal absorption) were evaluated for each media type. Historical site use information was employed to identify types of potential contamination and locations of potentially contaminated areas. Site topography and physical land features, such as creeks, sinkholes, or drainage ditches, were used to approximate contaminant migration pathways. A CSM figure was developed for each site.

1.1.4 Data Gap Analysis

An analysis was performed on each site to assess the current data and identify data gaps that prevent adequate characterization of the sites. Data gaps are identified by media (surface soil, subsurface soil, groundwater, surface water and sediment) and analytical class [volatile organic compounds (VOCs), metals, etc.]. It should be noted that surface soil samples are collected from 0 to 0.5 feet (ft) with the exception of the VOC fraction, which is collected from 0.5 to 1 foot below ground surface. The data gap analysis focuses the sampling strategy so that the data collected is the "right" data required to fill the data gap and further characterize the site.

1.1.5 Planned Field Activities and Technical Approach

Based on the results of previous investigations and the CSM, a site-specific field program has been developed. The sampling and analysis schemes are designed to complete data needs identified during the development of the CSM. Samples collected as part of this investigation can be divided into two groups, based on whether the samples are for 1) site characterization or 2) delineation, as identified in the CSM. Samples will be collected to characterize each site for analyte classes for which site media have not been previously tested. Samples will also be collected to complete the delineation of sites. The purpose of these samples, then, is to refine the characterization of a previously identified constituent. The rationale for the placement of these samples will differ from the first group of samples in that these samples will be placed at specific locations to target specific analytes. A summary table detailing the number of samples to be collected from various media is presented as **Table 1-2**.

1.2 FACILITY-WIDE BACKGROUND STUDY

A Facility-Wide Background Study was conducted at the Main Manufacturing Area (MMA) and New River Unit at RFAAP in 2001 (IT, 2002a). Task objectives were to characterize naturally occurring background soil inorganic concentrations to establish a baseline for inorganic compounds of concern at RFAAP. Data was statistically evaluated across soil types, soil horizons, and study areas to assess the potential for expanding the effective data into one set. Statistical tests demonstrated that the data was statistically similar across soil types and study areas, resulting in one set of background values for both surface and subsurface soil. Facility-wide point estimates for background soil data were calculated as 95% upper tolerance limits (UTLs) and are presented in **Table 1-3**. In general, UTLs were calculated as follows:

$$UTL = \overline{X} + k(a)$$

where:

UTL	=	upper tolerance limit (confidence factor of 0.95 and coverage of 95 percent)
$\overline{x}$	=	arithmetic mean
a	=	standard deviation
k	=	tolerance factor

It should be noted that for seven (aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium) of the constituents, the 95% UTLs are greater than their respective residential screening levels. In addition, the 95% UTLs for arsenic, iron, manganese, and vanadium are greater than their industrial screening levels.

Inorganic constituents detected at concentrations exceeding screening levels are compared to the background concentrations to assess whether these metals are present at concentrations greater than naturally occurring levels. Inorganics detected at concentrations less than background levels are not considered site-related constituents.

Table 1-2
Proposed Sampling and Analysis Plan
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
SWMU 48				
Groundwater	48MW4	84 ft bgs	existing onsite well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	48MW05	screened at first encountered water	proposed downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	48MW06	screened at first encountered water	proposed downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	49MW07	screened at first encountered water	proposed upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
SWMU 49				
Surface Soil	49SS02	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49SS03	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49SS04	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49SS05	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Subsurface Soil	49MW01A	4-6 ft bgs	well boring 49MW01	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49MW01B	10-12 ft bgs	well boring 49MW01	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49MW01C	18-20 ft bgs	well boring 49MW01	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Groundwater	48MW1	125 ft bgs	existing upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	48MW2	123.7 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	48MW3	110 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	49MW01	screened at first encountered water	proposed onsite well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
SWMU 50				
Surface Soil	50SB06A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB07A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB08A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB09A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB10A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans

Table 1-2
Proposed Sampling and Analysis Plan
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
	50SB11A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB12A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB13A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB14A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB15A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Subsurface Soil	50SB06B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB07B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB08B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB09B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB10B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB11B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB12B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB13B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB14B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB15B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Groundwater	50MW01	screened at first encountered water	proposed downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	50MW02	screened at first encountered water	proposed downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
SWMU 59				
Surface Soil	59SS06	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SS07	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SS08	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SS09	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans

Table 1-2
Proposed Sampling and Analysis Plan
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
	59SS10	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB02A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB03A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB04A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB05A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB06A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Subsurface Soil	59SB02B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB02C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB03B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB03C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB04B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB04C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB05B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB05C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB06B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB06C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Groundwater	59MW01	screened at first encountered water	proposed upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
		SWMU 41		
Groundwater	41GW01	at water table	Area A, direct push GW	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41GW02	at water table	Area A, direct push GW	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41GW03	at water table	Area A, direct push GW	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41MW1	70 ft bgs	Area B, existing upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate

Table 1-2
Proposed Sampling and Analysis Plan
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
	41MW2	113 ft bgs	Area B, existing downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41MW3	52.5 ft bgs	Area B, existing downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
SurfaceWater	41SW08	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41SW09	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41SW10	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41SW11	NA	Area B, seep sample	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
Sediment	41SD08	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	41SD09	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	41SD10	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	41SD11	NA	Area B, seep sample	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Area O				
Surface Soil	AOSB01A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB02A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB03A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB04A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB05A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
Subsurface Soil	AOSB01B	4-6 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB01C	8-10 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB02B	4-6 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB02C	8-10 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB03B	4-6 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB03C	8-10 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB04B	4-6 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB04C	8-10 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB05B	4-6 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB05C	8-10 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
Groundwater	AOGW01	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, Monitored Natural Attenuation Parameters (MNA), TOC
	AOGW02	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW03	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW04	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC

Media	Sampling ID	Depth	Location	Analytes
	AOGW05	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW06	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW07	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW08	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW09	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW10	screened at first encountered water	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	S4W-1	10 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	WC1-1	39 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	WC1-2	25 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	8B	25 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	P-1	25 ft bgs	exising upgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	P-2	11 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	P-3	18 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	P-4	23 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	OMW1	31 ft bgs	existing onsite well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	OMW2	31 ft bgs	existing upgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
Surface Water	AOSW01	NA	downgradient drainage ditch	TCL VOCs, SVOCs, PAHs
	AOSW02	NA	downgradient drainage ditch	TCL VOCs, SVOCs, PAHs
Sediment	AOSD01	NA	downgradient drainage ditch	TCL VOCs, SVOCs, PAHs
	AOSD02	NA	downgradient drainage ditch	TCL VOCs, SVOCs, PAHs
Former Lead Furnace Area (FLFA)				
Surface Soil	LFXR01-60	0-0.5 ft bgs	Within defined FLFA Area	XRF Lead. A sufficient number of samples will be collected and screened to define the extent of lead in soil.
	LFSS04-14	0-0.5 ft bgs	At boundiaries of lead containing soil defined by XRF	TAL metals, TCL PCBs, dioxins/furans (assume 10 samples)
	LFSS15-21	0-0.5 ft bgs	Random grid samples within area defined by XRF	TAL metals, TCL PCBs, dioxins/furans (6 samples)
Groundwater	LFMW01	screened at first encountered water	in sinkhole near original furnace location.	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	17PZ01	122.5 ft bgs	exisiting upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	17MW2	mid-point of well screen	exisiting upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	17MW3	mid-point of well screen	existing cross/downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
Surface Water	LFSW01	NA	at spring discharge on New River	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
Sediment	LFSD01	NA	at spring discharge on New River	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
SWMU 43				
Surface Soil	43SB01A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals

Table 1-2
Proposed Sampling and Analysis Plan
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
	43SB02A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB03A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB04A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB05A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB06A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB07A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB08A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxans/furans
	43SB09A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB010A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
Subsurface Soil	43SB01B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB01C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB02B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB02C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB03B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB03C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB04B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB04C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB05B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB05C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB06B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB06C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals

Table 1-2
Proposed Sampling and Analysis Plan
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
	43SB07B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB07C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB08B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB08C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB09B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB09C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB10B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB10C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
Groundwater	43MW1	21 ft bgs	exsiting well - upgradient, east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW2	27 ft bgs	exsiting well - upgradient, west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW3	30 ft bgs	exsiting well - downgradient, west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW4	21 ft bgs	exsiting well - downgradient, west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW5	37 ft bgs	exsiting well - downgradient, east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW6	33 ft bgs	exsiting well - downgradient, east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
Surface Water	43SW01	NA	At seep on New River (collocated with 43SP1)	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43SW02	NA	At seep on New River (collocated with 43SP2)	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
			Area P	
Surface Soil	APSB06A	0-0.5 ft bgs	upgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB07A	0-0.5 ft bgs	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB08A	0-0.5 ft bgs	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB09A	0-0.5 ft bgs	downgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB10A	0-0.5 ft bgs	downgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives

Table 1-2
Proposed Sampling and Analysis Plan
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
Subsurface Soil	APSB06B	4-6 ft bgs	upgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB07B	4-6 ft bgs	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB08B	4-6 ft bgs	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB09B	4-6 ft bgs	downgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB10B	4-6 ft bgs	downgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
Groundwater	APGW01	water table	upgradient of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	APGW02	water table	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	APGW03	water table	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	APGW04	water table	downgradient of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	APGW05	water table	downgradient of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate

Table 1-3
Facility-Wide Point Estimates for Background Soil

Chemical Name	Range of Data (mg/kg)	Background Concentration 95% UTL (mg/kg)
Aluminum	3,620 - 47,900	40,041
Arsenic	1.2 - 35.9	15.8
Barium	23.4 - 174	209
Beryllium	0.61 - 5.4	1.02
Cadmium	0.62 - 2.5	0.69
Chromium	6.3 - 75.8	65.3
Cobalt	5.9 - 130	72.3
Copper	1.6 - 38.7	53.5
Iron	7,250 - 67,700	50,962
Lead	2.1 - 256	26.8
Manganese	16.7 - 2,040	2,543
Mercury	0.038 - 1.2	0.13
Nickel	4.6 - 94.2	62.8
Thallium	1.3 - 5.0	2.11
Vanadium	12.2 - 114	108
Zinc	4.7 - 598	202

1.3 Master Table Legend

Master table legends for the data tables in this work plan are presented on the following pages. The soil and sediment tables are generally similar and use the same comparison criteria. The legend for these tables has been combined. Similarly, groundwater and surface water tables are similar and a single legend identifying the shading, bold font and bold outline is provided. The master legends also include the meanings of abbreviations and laboratory and validation qualifier codes.

Soil/Sediment Master Table Legend

12	J	Shading and black font indicates an industrial RBC exceedance.
12	J	Bold outline indicates a residential RBC exceedance.
<u>12</u>	**<u>J</u>**	Bold, underlined font indicates a background exceedance.
12	*12*	Shading in the MDL/MRL columns indicates the MDL exceeds a criterion.
12	J	Shading and white font indicates a SSL Transfer exceedance.
12	J	Mixed shading indicates a i-RBC and a SSL Transfer exceedance.

The pyrene RBCs and SSL were used for acenaphthylene, benzo(g,h,i)perylene and phenanthrene.
Inorganic results below background UTLs are not indicated as exceedances on the table.
RBC = Risk Based Concentration (October, 2006).
RBC values in table are for the more conservative chromium VI.
Lead screening values from Technical Review Workgroup for Lead: Guidance Document (April, 1999).
mg/kg = milligrams per kilogram (parts per million).
ng/kg = nanograms per kilogram (parts per trillion).
ug/kg = micrograms per kilogram (parts per billion).
NA = not applicable.
NT = analyte not tested.

LQ = Lab Data Qualifiers:
B = (organics) Blank contamination. Value detected in sample and associated blank.
B = (metals) Value <MRL and >MDL and is considered estimated.
E (metals) = Reported value is estimated because of the presence of interferences.
J = (organics) Value <MRL and >MDL and is considered estimated.
U = Analyte not-detected at the method reporting limit.
X = (dioxins) Ion abundance ratio outside acceptable range. Value reported is EMPC.

VQ = Validation Data Qualifiers:
B = blank contamination. Value detected in sample and associated blank.
J = estimated concentration.
K = estimated concentration bias high.
L = estimated concentration bias low.
N = presumptive evidence for tentatively identified compounds using a library search.
U = analyte not detected.
UJ = estimated concentration non-detect.
UL = estimated concentration non-detect bias low.

Groundwater/Surface Water Master Table Legend

12	J	Shading and black font indicates an MCL exceedance.
12	J	Bold outline indicates a tap water RBC exceedance.
12	*12*	Shading in the MDL/MRL columns indicates the MDL exceeds a criterion.

RBCs for non-carcinogenic compounds have been recalculated to an HI of 0.1.
The pyrene RBCs were used for acenaphthylene, benzo(g,h,i)perylene and phenanthrene.
RBC = Risk Based Concentration (October, 2006).
RBC values in table are for the more conservative chromium VI.
mg/L = milligrams per liter (parts per million).
ng/L = nanograms per liter (parts per trillion).
ug/L = micrograms per liter (parts per billion).
NA = not applicable.
NT = analyte not tested.
LQ = Lab Data Qualifiers:
B = (organics) Blank contamination. Value detected in sample and associated blank.
B = (metals) Value <MRL and >MDL and is considered estimated.
E (metals) = Reported value is estimated because of the presence of interferences.
J = (organics) Value <MRL and >MDL and is considered estimated.
U = Analyte not-detected at the method reporting limit.
X = (dioxins) Ion abundance ratio outside acceptable range. Value reported is EMPC.
VQ = Validation Data Qualifiers:
B = blank contamination. Value detected in sample and associated blank.
J = estimated concentration.
K = estimated concentration bias high.
L = estimated concentration bias low.
N = presumptive evidence for tentatively identified compounds using a library search.
U = analyte not detected.
UJ = estimated concentration non-detect.
UL = estimated concentration non-detect bias low.

2.0 SWMU 48 – OILY WATER BURIAL AREA
SWMU 49 – RED WATER ASH BURIAL NO. 2
SWMU 50 – CALCIUM SULFATE DISPOSAL/TREATMENT AREA
SWMU 59 – BOTTOM ASH PILE

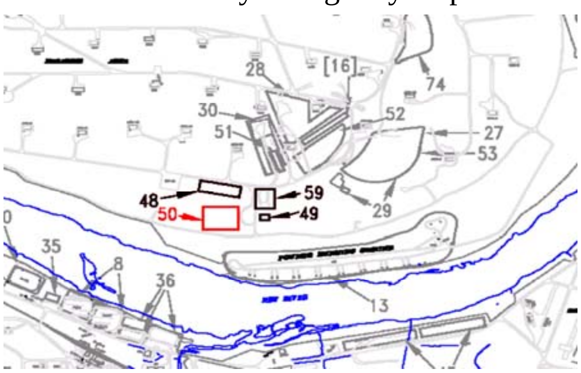
SWMUs 48, 49, 50, and 59 are adjacent sites located in the eastern portion of the Horseshoe Area (HSA). The investigation for these four sites has been combined due to the sites' proximity to each other, similar disposal histories, and similar constituents in groundwater.

2.1 SITE DESCRIPTION AND HISTORY

2.1.1 Site Description

The combined study area (SWMUs 48, 49, 50, and 59) is located in the southeastern portion of the RFAAP HSA, east of the main bridge over the New River. As illustrated on **Figure 2-1**, the four SWMUs are co-located, with SWMU 48 in the northwestern portion of the combined study area. SWMU 48 is located approximately 30 ft north of SWMU 50, 75 ft west of SWMU 59, and 200 ft northwest of SWMU 49.

The combined study area is approximately 460 ft long by 600 ft wide and is situated on a bluff approximately 120 ft above and overlooking SWMU 13 and the New River. The land surface in the combined study area gently slopes from approximately 1,830 feet above mean sea level (ft msl) on the north side of SWMUs 48 and 59, to approximately 1,814 ft msl on the south of SWMU 50. Based on topography, surface water runoff is expected to flow approximately 700 ft southwest to the New River.



The overall study area is grassy with wooded areas to the south, east, and west. The 2000 aerial photo shown on **Figure 2-2** indicates ground scarring and disturbed soil; however, the site has re-vegetated in the years since they were active. A subsided area that coincides with the southern SWMU 48 trench provides evidence of its location.

An east-west asphalt road, located at the northern edge of the study area, parallels SWMU 48 and provides access to the combined study area via a gravel and bottom ash covered dirt road that trends north-south in the middle of the study area. The dirt and gravel road connects to an east-west trending dirt road at the southern end of the area. There are no structures in the combined study area; and, according to RFAAP utility maps, there are no manholes, catch basins, or storm drains located in the immediate vicinity of the area.

2.1.2 Site History

Although the history of the four SWMUs that comprise the combined study area are described separately in this section, and the site figures depict the four SWMUs as separate and distinct areas, it is apparent from analytical testing of soil that the combined study area should be considered as one contiguous area with some degree of cross disposal occurring. This is especially true for SWMUs 48, 49, and 50, at which operations occurred concurrently.

LEGEND

- SWMU 48, 49, 50, and 59 Boundaries
- Other SWMU Boundary
- Installation Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 500 1,000 2,000 Feet

U.S. Army Corps of Engineers

Shaw® Shaw Environmental, Inc.

FIGURE 2-1
SWMU 48, 49, 50 and 59
Site Location Map
Radford Army Ammunition Plant,
Radford, VA

Date: 1/24/07 GIS File: RFAAP_001_Fig2-1_Workplan_48_49_50_59_SiteMap.mxd

Date: 1/24/07 GIS File: RFAAP_001_Fig2-2_Workplan_48_49_50_59_SampleLocations.mxd

LEGEND

- Monitoring Well Location
- Proposed Well Location
- Previous Investigation Soil Sample Location
- Proposed Soil Boring Location
- Proposed Surface Soil Sample Location
- 10 ft Contour Line
- SWMU 48, 49, 50, and 59 Boundaries
- Other SWMU Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

U.S. Army Corps of Engineers

Shaw® Shaw Environmental, Inc.

FIGURE 2-2
SWMU 48, 49, 50, and 59
Sample Locations
Radford Army Ammunition Plant,
Radford, VA

SWMU 48, Oily Water Burial Area. Aerial photographs taken in 1971 and 1986 indicate that SWMU 48 consists of two sets of unlined trenches identified as the northern and southern trenches. Prior to off-post waste oil reclamation, approximately 200,000 gallons of oily wastewater removed from oil/water separators throughout RFAAP was reportedly disposed of in SWMU 48 (Dames and Moore, 1992). However, the results of environmental sampling to date indicate that the oily wastewater was likely disposed in the area associated with SWMU 49. Conversely, sampling indicates that the red water ash associated with SWMU 49 was disposed in the SWMU 48 disposal trenches. Interpretations of aerial photographs indicate that activity first occurred at SWMU 48 in 1970 (USEPA, 1992). The northern trench is visible in the 1971 aerial photograph as light colored east to west trending scars of disturbed soil that parallel the asphalt road. Re-vegetation had occurred by the time of the 1981 aerial photograph. The filled and re-vegetated southern trench is prominent in the 1986 aerial photograph, positioned at a slight angle below the northern trench. This trench is marked by the growth of grass visibly different from the surrounding vegetation (e.g., greener and thicker) and by extensive ground subsidence. Documentation for disposal activities in the southern trench is currently unknown, but observations during soil boring and test pit activities during the 1998 RFI indicate a layer of fine black material occurring at approximately 6-7 ft below ground surface (bgs). Explosives compounds were detected in samples of this material.

SWMU 49, Red Water Ash Burial No. 2. The location of SWMU 49 has been unclear in previous investigations, which essentially considered SWMU 49 to be contiguous or co-located with SWMU 48. In fact, previous sampling of this area was performed as part of SWMU 48 investigations. The location of SWMU 49 is defined in aerial photography by disturbed ground during the time of active disposal in the adjacent SWMUs 48 and 50. No signs of release were noted during the April 1987 visual site inspection performed during the RCRA Facility Assessment (RFA) (USEPA, 1987).

SWMU 49 reportedly received 10 tons of red water ash during its active period (USEPA, 1987). However, the results of environmental sampling to date indicate that the red water ash was likely disposed in the disposal trenches associated with SWMU 48. Conversely, sampling indicates that the oily wastewater associated with SWMU 48 was disposed in the SWMU 49 area. Red water ash is identified as a USEPA hazardous waste (K047) solely for its reactivity [40 Code of Federal Regulations (CFR) 261.32]. During the production and formulation of trinitrotoluene (TNT), an alkaline, red colored aqueous waste is generated (red water). This waste stream is composed of TNT purification filtrate, air pollution control scrubber effluent, washwater from cleaning of equipment and facilities, and washwater from product washdown operations. Red water was concentrated by evaporation and the sludge was burned in rotary kilns located in the TNT manufacturing area (USATHAMA, 1976). The ash from the burned red water sludge is known as red water ash.

SWMU 50, Calcium Sulfate Treatment/Disposal Area. Based on a review of historical aerial photographs (USEPA, 1992) and interviews with plant personnel, SWMU 50 was identified as the major disposal area at RFAAP, until 1982, for sludge removed from the calcium sulfate drying beds (SWMUs 35, 36, 37, 38, and Area Q). Activity at SWMU 50 was first noted in a 1962 aerial photograph as disturbed ground (USEPA, 1992). Re-vegetation of the disturbed ground was noted in 1971; however, renewed activity was identified in a 1981 aerial photograph as a trench, a ground scar, disturbed ground, light-toned material, and mounded material. In

1986, the surface of the excavated features seen in the 1981 photograph appeared to have been filled.

SWMU 59, Bottom Ash Pile. SWMU 59 was used to store bottom ash generated from the coal-fired power plant used to supply steam to the buildings in the HSA. Bottom ash is permitted to be buried in landfills on the Installation (in particular, Former Ash Landfill No. 2). Some bottom ash is apparently stored in piles around RFAAP for use on roadbeds and as landfill cover material (USEPA, 1987). It can be assumed that this pile or similar piles have existed at RFAAP since operation of the coal-fueled power plant began. Activity was first noted at the site in 1986 aerial photography, where a large area of dark-toned material was visible (USEPA, 1992). The storage pile of bottom ash was approximately 100 ft by 50 ft and 20 ft high (USEPA, 1987). The bottom ash pile is no longer visible at the site.

2.2 SITE GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

A comprehensive discussion of the regional physiography, soil, geology, and groundwater at RFAAP is included in the RFAAP MWP (URS, 2003a) and therefore is not discussed in this report.

2.2.1 Site Soil

The soil type in this area is the Braddock Loam, which is described as yellowish-brown grading into yellowish-red and red clay extending to a depth of 60 inches or more. Permeability is moderate; natural fertility is low; organic matter content is moderately low. This soil type is acidic or very strongly acidic (SCS, 1985).

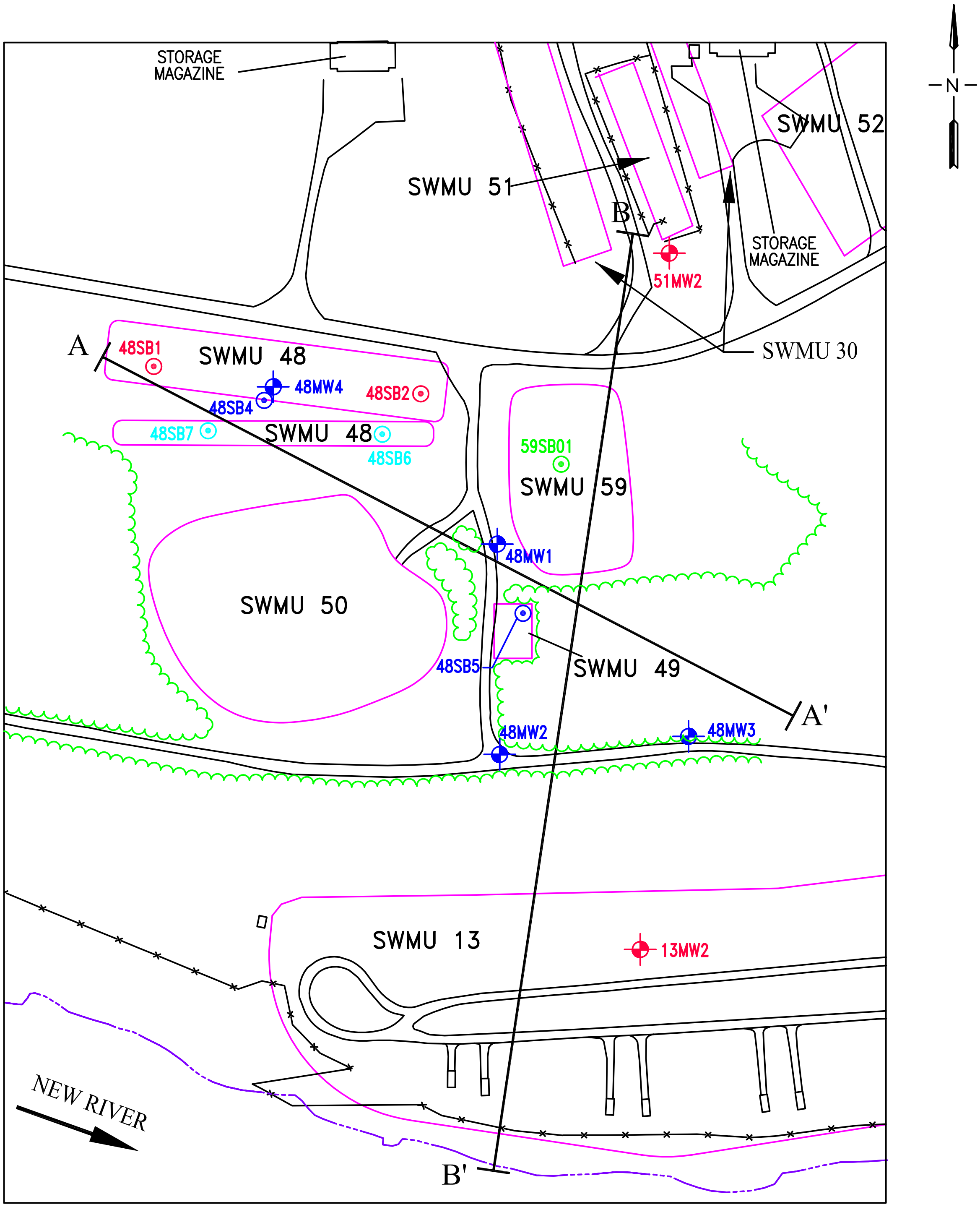
2.2.2 Site Geology

Stratigraphic characterization of the subsurface was performed during the advancement of soil and monitoring well borings at the sites, and geologic cross-sections were developed based on these borings. Boring Logs for the wells are presented in **Appendix B**. Plan view of cross-sectional lines A-A' and B-B' is presented on **Figure 2-3**. As depicted on **Figures 2-4 and 2-5**, the subsurface geology consists of alluvium and residual deposits comprised of clay and silt with some sand and gravel overlying bedrock. Depth to bedrock ranges from approximately 55 to 65 ft bgs.

Bedrock consists of the Cambrian-aged Elbrook Formation - a highly fractured, thickly bedded, blue-gray dolostone interspersed with blue-gray to white limestone and interbedded siltstone. It is locally described in nearby well borings as interbedded green and maroon shale and yellowish-brown dolostone (51MW2 and 16-4) and greenish- to grayish-brown limestone and dolostone (C-1). The Max Meadows Breccia is evident in outcrops along the slope leading to the river. In the outcrop along the slope, the tectonic breccia and the limestone and dolostone are highly weathered with many solution cavities.

A saprolitic layer of yellow to olive clay and silt with interbedded red shale, formed from *in situ* weathering of the carbonate bedrock, immediately overlies the bedrock. The saprolite is up to 25 ft in thickness.

The unconsolidated sediment immediately overlying the saprolite consists of interbedded alluvial deposits. Overbank deposits consisting primarily of silt and clay with varying amounts of fine sand are interbedded with alluvial channel deposits of fine- to coarse-grained, yellowish-brown sand and layers of large cobbles (river jack). These Paleo-channel deposits are incised into the



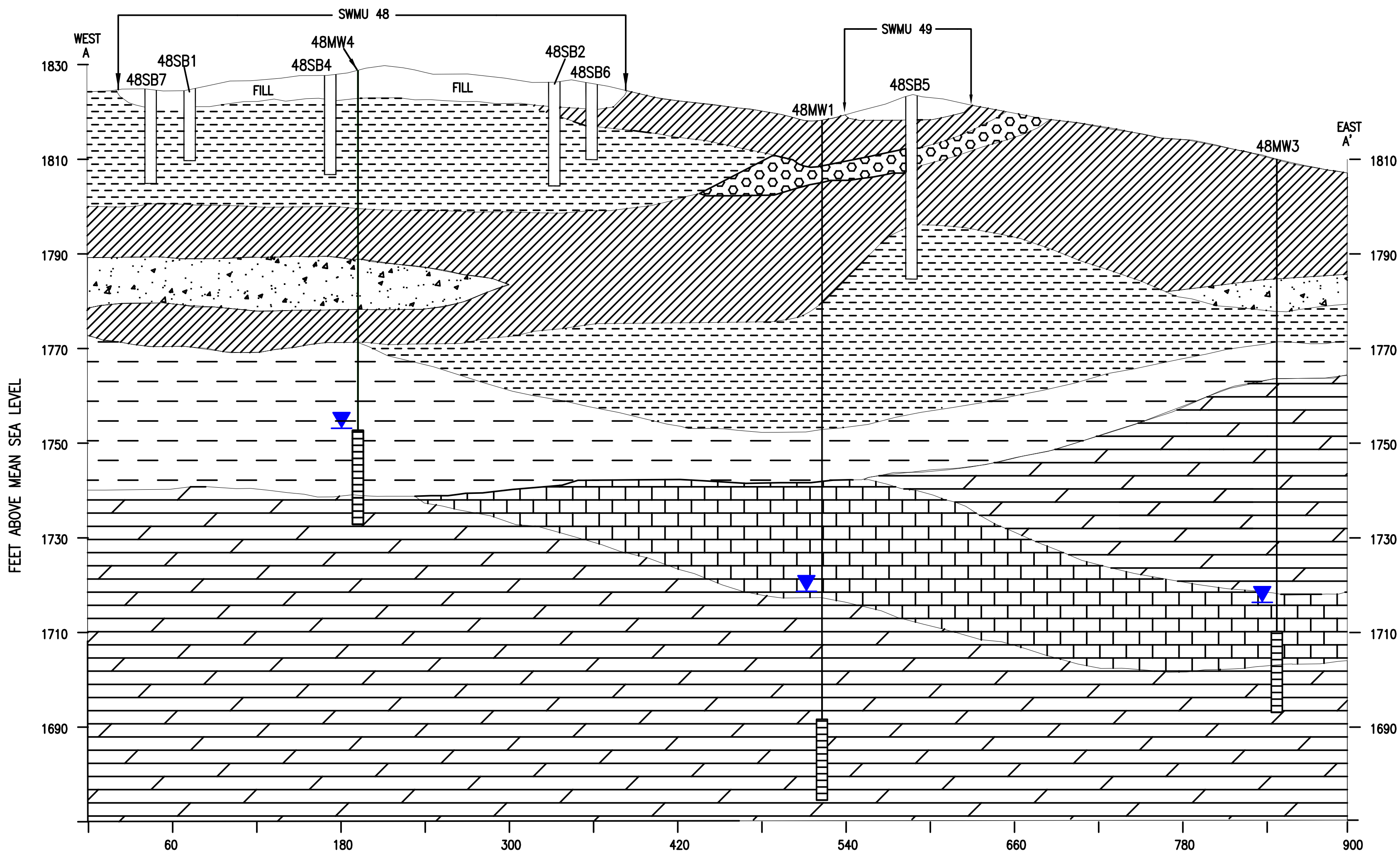
LEGEND

- 1992 VI MONITORING WELL (DAMES & MOORE)
- 1992 VI SOIL BORING (DAMES & MOORE)
- 1996 RFI MONITORING WELL (PARSONS ENGINEERING)
- 1996 RFI SOIL BORING (PARSONS ENGINEERING)
- 1998 RFI SOIL BORING (ICF KAISER)
- 2002 RFI SOIL BORING (SHAW)
- SWMU BOUNDARY
- TREELINE

0 100 200 400

SCALE

RADFORD AAP		FIGURE 2-3
PREPARED BY: SHAW	TASK NO: 12346110000002	PLAN VIEW OF GEOLOGIC CROSS SECTION LINES A-A' AND B-B'
CHECKED BY: MT	SHAW DWG NO: FIG2-3.dwg	
DATE: REVISED MAR. 2004		



HORIZ. SCALE: 0 60 120

VERT. SCALE: 0 20 40

LEGEND

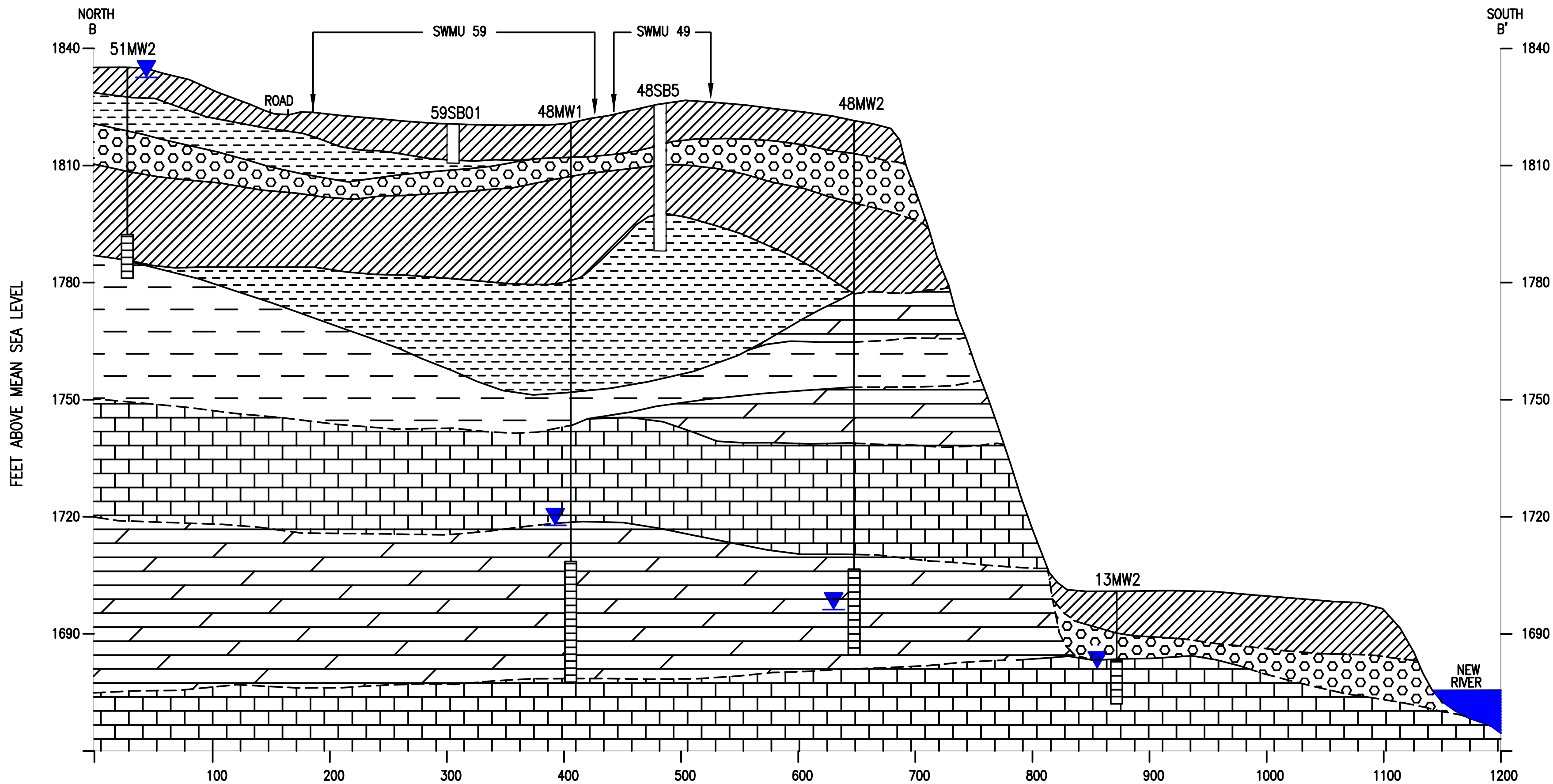
- CLAY AND SILT, LITTLE SAND, RED-BROWN (CL)
- SILT, SOME SAND, SOME CLAY, ORANGE-BROWN (ML)
- SILT AND SAND, GRAVEL ORANGE-BROWN (CM/SM)
- SILT, SAND, AND GRAVEL, ORANGE-BROWN (GM)
- SILTSTONE, WEATHERED RED, GREEN, BROWN, INTERBEDDED DOLOMITE (SLSN)
- DOLOMITE, WEATHERED, GRAY, ARGILLACEOUS (DLMT)
- LIMESTONE, GRAY-BROWN, ARGILLACEOUS (LMSN)
- ▼ STATIC GROUNDWATER LEVEL (MEASURED SEPTEMBER 2003)

NOTES

1) SOME DATA POINTS ARE PROJECTED ONTO PROFILE.
2) 48SB1 AND 48SB2 LITHOLOGY FROM DAMES AND MOORE.
3) LITHOLOGY PATTERNS DO NOT MATCH DRILL LOG PATTERNS BECAUSE OF DIFFERING GRAPHICS SYSTEMS.
4) CONTACT LINES DASHED WHERE INFERRED.
5) LITHOLOGY IS A COMPILATION FROM SWMUs 48 AND 49.

SOURCE: PARSONS ENGINEERING SCIENCE, INC.

RADFORD AAP		FIGURE 2-4
PREPARED BY: SHAW	TASK NO: 12346110000002	GEOLOGIC CROSS-SECTION A-A'
CHECKED BY: MT	SHAW DWG NO: FIG2-4.dwg	
DATE: REVISED MARCH 2004		



HORIZ. SCALE: 0 100 200

VERT. SCALE: 0 30 60

LEGEND

- CLAY AND SILT, LITTLE SAND, RED-BROWN (CL)
- SILT, SOME SAND, SOME CLAY, ORANGE-BROWN (ML)
- SILT AND SAND, GRAVEL ORANGE-BROWN (CM/SM)
- SILT, SAND, AND GRAVEL, ORANGE-BROWN (GM)
- SILTSTONE, WEATHERED RED, GREEN, BROWN, INTERBEDDED DOLOMITE (SLSN)
- DOLOMITE, WEATHERED, GRAY, ARGILLACEOUS (DLMT)
- LIMESTONE, GRAY-BROWN, ARGILLACEOUS (LMSN)
- ▼ STATIC GROUNDWATER LEVEL (MEASURED SEPTEMBER 2003)

NOTES

1) SOME DATA POINTS ARE PROJECTED ONTO PROFILE.
2) 51MW2 AND 13MW2 LITHOLOGY FROM DAMES AND MOORE.
3) LITHOLOGY PATTERNS DO NOT MATCH DRILL LOG PATTERNS BECAUSE OF DIFFERING GRAPHICS SYSTEMS.
4) CONTACT LINES DASHED WHERE INFERRED.

SOURCE: PARSONS ENGINEERING SCIENCE, INC.

RADFORD AAP		FIGURE 2-5
PREPARED BY: SHAW	TASK NO: 12346110000002	GEOLOGIC CROSS-SECTION B-B'
CHECKED BY: MT	SHAW DWG NO: FIG2-5.dwg	
DATE: REVISED MARCH 2004		

silt and clay deposits, and, in some cases, into the saprolite, so that in places the paleo-channel deposits rest directly on bedrock.

A detailed discussion of the geology and soil at RFAAP is presented in Sections 3.4 through 3.7 of the MWP (URS, 2003a) and in the Facility-Wide Background Study (IT, 2002a).

2.2.3 Site Hydrogeology

Within RFAAP, and particularly within the HSA, sinkholes and fractures, which may be associated with sinkhole development, are areas for groundwater recharge. The eastern half of the HSA contains a number of fracture traces and few sinkholes. This eastern area is also the topographically highest point in the HSA. The fracture traces in this area can be zones of high secondary porosity due to fissured and solutionally enhanced carbonate rock, allowing surface water to migrate very quickly into the subsurface.

Figure 2-6 illustrates the groundwater elevation contours in the bedrock aquifer for the eastern end of the HSA and gives an approximation as to where water is entering the HSA and its direction of flow through the study area. Stabilized groundwater depths measured in the four study area monitoring wells during April 2006 ranged from 80 ft bgs (48MW4) to 125 ft bgs (48MW2).

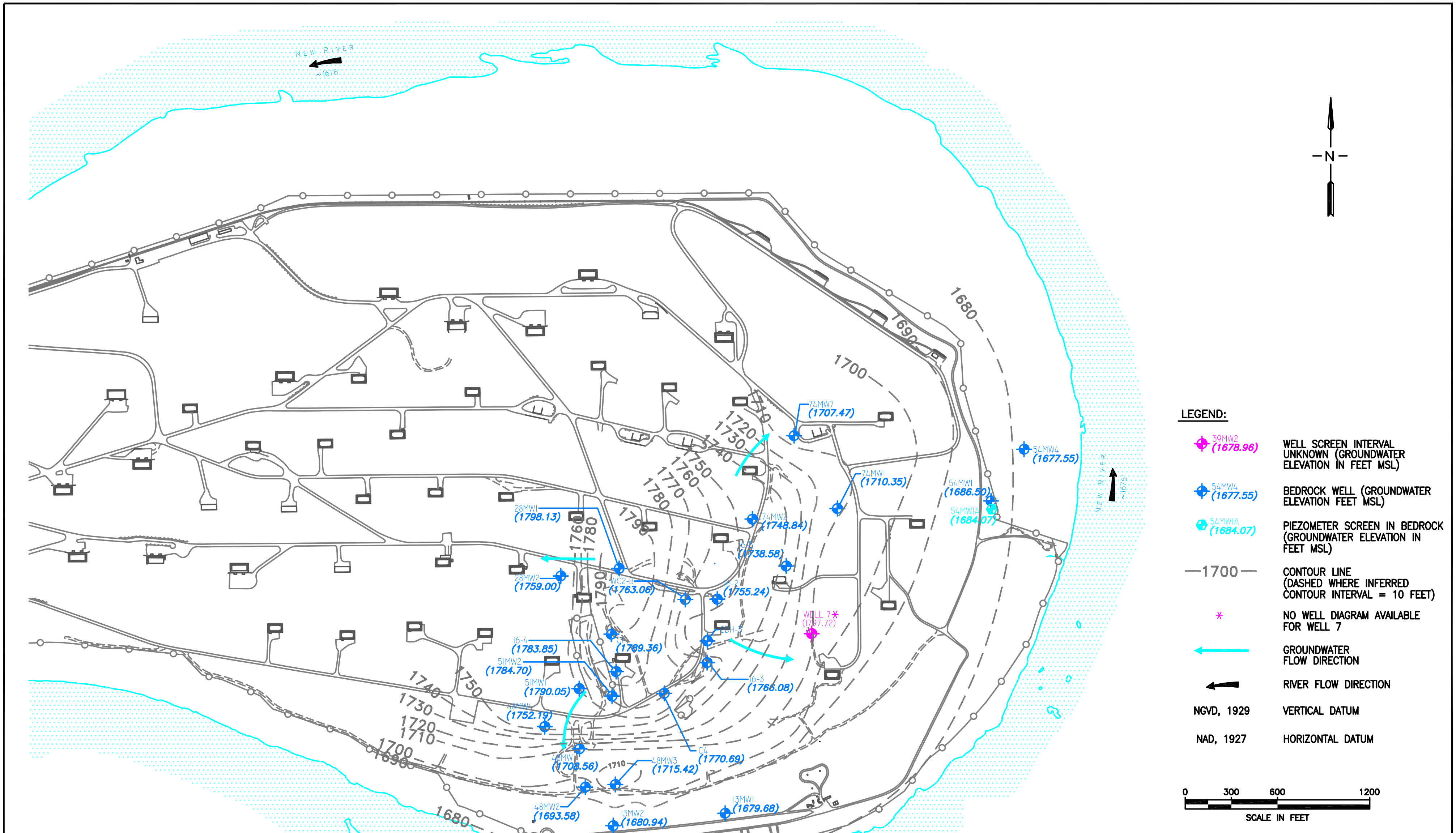
The groundwater elevation contours show a radial pattern with the gradient moving away in every direction from the groundwater high point at well 28MW1 (north of SWMUs 48 and 59) toward the New River. Based on topography, groundwater elevation contours and measured groundwater elevations (April 2006), groundwater flow in the combined study area is to the south towards the New River and roughly follows topography.

2.2.4 Surface Water Hydrology

There area no streams or ponds located within the study area. The four SWMUs are located in the southeastern corner of the HSA, with the New River closest in a southerly direction. Surface water resulting from precipitation on the sites is expected to infiltrate to the unconsolidated sediments underlying the sites, percolate to the bedrock through secondary porosity and eventually discharge to the New River near SWMU 13. During extremely heavy precipitation events, overland flow of surface water would be towards the New River south of the four SWMUs.

2.3 PREVIOUS INVESTIGATIONS

Five previous investigations have been conducted at the combined study area. A summary of samples collected during the previous investigations is presented in **Table 2-1**. In 1987, the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) conducted an RFA to evaluate potential hazardous waste or hazardous constituent releases and implement corrective actions, as necessary. In 1992, Dames and Moore performed a Verification Investigation (VI), which included surface and subsurface soil sampling and a soil gas survey to characterize the nature and extent of contamination. In 1996, Parsons Engineering Science, Inc. (Parsons) conducted an RFI to further delineate the extent of contamination identified during the 1992 VI sampling. ICF Kaiser Engineers, Inc. (ICF KE) also performed an RFI in 1998 to further refine the understanding of the nature and extent of contamination identified during the previous investigations. Additional sampling was conducted by IT Corporation/Shaw in 2002 and 2006 to collect sufficient data to complete human health and ecological risk assessments. These investigations and results of the chemical data are summarized below.



RADFORD AAP		FIGURE 2-6
PREPARED BY: SHAW E&I	TASK NO: 12346110000002	EASTERN HORSESHOE AREA APRIL 2006 GROUNDWATER ELEVATION CONTOUR MAP
CHECKED: EM	SHAW DWG NO: FIG2-6	
DATE: JUNE 2006		

Table 2-1
Previous Soil Investigations Environmental Samples and Analyses at SWMUs 48, 49, 50, and 59

Media	Sample ID	Depth (ft bgs)	Analyses
SWMU 48			
1992 Verification Investigation, Dames and Moore			
Subsurface Soil	48SB1	7.5-9.5	TAL metals, VOCs, SVOCs, TCLP metals
	48SB1	13-15	TAL metals, VOCs, SVOCs, TCLP metals
	48SB2	10-12	TAL metals, VOCs, SVOCs, TCLP metals
	48SB2	20-22	TAL metals, VOCs, SVOCs, TCLP metals
1996 RCRA Facility Investigation, Parsons Engineering Science, Inc.			
Surface Soil	48SS1	0-1	TAL metals, VOCs, SVOCs, explosives, TPH
	48SS2	0-1	TAL metals, VOCs, SVOCs, explosives, TPH
	48SS3	0-1	TAL metals, VOCs, SVOCs, explosives, TPH
Subsurface Soil	48SB4A11	10-11	VOCs, SVOCs, explosives, TPH
	48SB4B21	20-21	VOCs, SVOCs, explosives, TPH, TOC
1998 RCRA Facility Investigation, ICF Kaiser Engineers, Inc.			
Surface Soil	48SB6C	1-3	TAL metals, VOCs, SVOCs, PAHs, explosives
	48SB6C2	1-3	VOCs (methanol preservation)
Subsurface Soil	48SB6A	6-7	TAL metals, VOCs, SVOCs, PAHs, explosives
	48SB6A2	6-7	VOCs (methanol preservation)
	48SB6B	14-16	TAL metals, VOCs, SVOCs, PAHs, explosives
	48SB6B2	14-16	VOCs (methanol preservation)
	48SB7A	8-9	TAL metals, VOCs, SVOCs, PAHs, explosives
	48SB7A2	8-9	VOCs (methanol preservation)
	48SB7B	10-11	TAL metals, VOCs, SVOCs, PAHs, explosives
	48TP1	6-6.5	TAL metals, VOCs, SVOCs, PAHs, explosives
	48TP2	6-6.5	TAL metals, VOCs, SVOCs, PAHs, explosives
	48TP3	6-6.5	TAL metals, VOCs, SVOCs, PAHs, explosives
	48TP4	6-6.5	TAL metals, VOCs, SVOCs, PAHs, explosives

Table 2-1, Continued
Previous Soil Investigations Environmental Samples and Analyses
at SWMUs 48, 49, 50, and 59

Media	Sample ID	Depth (ft bgs)	Analyses
2002 Site Characterization, IT Corporation			
Surface Soil	48SB08A	0-0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	48SB09A	0-0.5	Explosives, dioxins/furans
	48SB10A	0-0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
Subsurface Soil	48SB08B	4–6	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	48SB08C	8–10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	48SB09B	4–6	Explosives, dioxins/furans
	48SB09C	8–10	Explosives, dioxins/furans
	48SB10B	4-6	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	48SB10C	8-10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
2006 Eastern Horseshoe Area GW Sampling, Shaw			
Groundwater	48MW4		TCL VOCs, SVOCs, PAHs, pest/PCBs, explosives, TAL metals
SWMU 49			
1992 Verification Investigation, Dames and Moore			
Subsurface Soil	48SB3	10-12	TAL metals, VOCs, SVOCs, TCLP metals
1996 RCRA Facility Investigation, Parsons Engineering Science, Inc.			
Surface Soil	48SS4	0-1	TAL metals, SVOCs, TPH
	48SS5	0-1	TAL metals, SVOCs, TPH
	48SS6	0-1	TAL metals, SVOCs, TPH
Subsurface Soil	48SB5A19	17-19	SVOCs, TPH
	48SB4B37	35-37	SVOCs, TPH, TOC
	48MW1A22	20-22	SVOCs, TPH
	48MW1B54	52-54	SVOCs, TPH, TOC
	48MW2A42	40-42	SVOCs, TPH
	48MW2B46	44-46	SVOCs, TPH, TOC
	48MW3A22	20-22	SVOCs, TPH
	48MW3B32	30-32	SVOCs, TPH, TOC

Table 2-1, Continued
Previous Soil Investigations Environmental Samples and Analyses
at SWMUs 48, 49, 50, and 59

Media	Sample ID	Depth (ft bgs)	Analyses
1998 RCRA Facility Investigation, ICF Kaiser Engineers, Inc.			
Subsurface Soil	49SB1A	8-10	TAL metals, VOCs, SVOCs, PAHs, explosives
	49SB1B	18-24	TAL metals, VOCs, SVOCs, PAHs, explosives
	49SB1B2	18-24	VOCs (methanol preservation)
	49SB1C	28-32	TAL metals, VOCs, SVOCs, PAHs, explosives
	49SB1C2	28-32	VOCs (methanol preservation)
	49SB1D	38-40	TAL metals, VOCs, SVOCs, PAHs, explosives
	49SB1D2	38-40	VOCs (methanol preservation)
	49SB1E	48-50	TAL metals, VOCs, SVOCs, PAHs, explosives
	49SB1F	58-60	TAL metals, VOCs, SVOCs, PAHs, explosives
2002 Site Characterization, IT Corporation			
Surface Soil	49SS01	0–0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	49SB02A	0–0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
Subsurface Soil	49SB02B	4–6	TCL PCBs, PAHs, TAL metals, dioxins/furans
	49SB02C	8–10	TCL PCBs, PAHs, TAL metals, dioxins/furans
	49SB02D	17-19	TCL PCBs, PAHs, TAL metals, dioxins/furans, TPH, TOC, grain size, pH
2006 Eastern Horseshoe Area GW Sampling, Shaw			
Groundwater	48MW1		TCL VOCs, SVOCs, PAHs, pest/PCBs, explosives, TAL metals
	48MW2		TCL VOCs, SVOCs, PAHs, pest/PCBs, explosives, TAL metals
	48MW3		TCL VOCs, SVOCs, PAHs, pest/PCBs, explosives, TAL metals
SWMU 50			
1992 Verification Investigation, Dames and Moore			
Subsurface Soil	50SL1	0-5	VOCs, SVOCs, TCLP metals
	50SL2	0-5	VOCs, SVOCs, TCLP metals

Table 2-1, Continued
Previous Soil Investigations Environmental Samples and Analyses at SWMUs 48, 49, 50, and 59

Media	Sample ID	Depth (ft bgs)	Analyses
2002 Site Characterization, IT Corporation			
Surface Soil	50SS01	0–0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, TOC, grain size, pH
	50SS02	0–0.5	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SS03	0–0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals
	50SB04A	0–0.5	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB05A	0–0.5	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
Subsurface Soil	50SB04B	4–6	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB04C	8–10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB05B	4–6	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB05C	8–10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB04B	4–6	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB04C	8–10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
SWMU 59			
1992 Verification Investigation, Dames and Moore			
Surface Soil	59SS1	0-1	TAL metals, SVOCs
	59SS2	0-1	TAL metals, SVOCs
2002 Site Characterization, IT Corporation			
Surface Soil	59SS03	0–0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	59SS04	0–0.5	TAL metals
	59SS05	0–0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	59SB01A	0–0.5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
Subsurface Soil	59SB01B	4–6	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	59SB01C	8–10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans

2.3.1 RFA, USATHAMA, 1987

A site-wide assessment was conducted for RFAAP to evaluate potential hazardous waste or hazardous constituent releases and implement corrective actions, as necessary. The assessment consisted of a preliminary review and evaluation of available site information, personnel interviews, and a visual site inspection. Environmental samples were not collected from SWMUs 48, 49, 50, or 59 as part of the inspection.

The assessment indicated that the inactive SWMUs 48, 49, and 50 are contiguous, and no distinction can be made by visual observation. During a site inspection in April 1987, there were no visual signs of release; however, some residue of what appeared to be calcium sulfate was noted. For SWMU 59, the assessment indicated that active storage of bottom ash was occurring.

2.3.2 VI, Dames and Moore, 1992

The VI report was prepared for USATHAMA and covered many RFAAP SWMUs. The objective was to evaluate whether toxic or hazardous contaminants are present and are, or have the potential of, migrating beyond the boundaries of the identified SWMUs. Environmental samples were collected, analyzed for chemical constituents, and evaluated. Recommendations for further study or action (or no further action) were made. Environmental samples collected from the combined study area included:

- Two soil samples from within and two samples below disposed material at SWMU 48, analyzed for target analyte list (TAL) metals, toxicity characteristic leachate procedure (TCLP) metals, VOCs, and semivolatile organic compounds (SVOCs).
- One soil sample from a depth of 20 ft at SWMU 49, analyzed for TAL metals, TCLP metals, VOCs, and SVOCs.
- Two samples of disposed sludge at SWMU 50, analyzed for TCLP metals, VOCs, and SVOCs.
- Two shallow soil samples collected from immediately below bottom ash at SWMU 59, analyzed for TAL metals and SVOCs.

In addition, due to detections of SVOCs in soil and apparent fuel-like odors encountered from 13 to 22 ft in the soil boring from SWMU 49, a subsurface soil gas survey was conducted over a 100 ft x 100 ft area. Eight soil gas samples were collected at 50-foot spacing from a depth of 4 ft bgs and analyzed for pentane/MTBE, benzene, toluene, ethylbenzene, and xylenes. Concentrations were at or below detectable levels.

A summary of VI sampling is included as **Table 2-1**. Positive detections for VI sampling are summarized and screening level exceedances are identified in **Table 2-2**. Soil sampling locations are depicted on **Figure 2-2**. It should be noted that SWMU 49 was not distinguished in the report separately from SWMU 48. The area now considered to be SWMU 49 was sampled and discussed as “the lower disposal area” of SWMU 48. Therefore, samples from SWMU 49 have a “48” prefix.

The VI report concluded that contaminants of concern include:

- Explosive SVOC compounds detected within SWMU 48 that exceed health-based numbers. However, the report also noted that the explosives were not detected in the

Table 2-2
Verification Investigation SWMUs 48, 49, 50, and 59
Detected Soil Results - 1992

SITE ID	Comparison Criteria			48SB1	48SB1	48SB2	48SB2	48SB3	50SL1	50SL2	50SL1	50SL2	59SS1	59SS2
SAMPLING DATE	i-RBC	r-RBC	Facility-Wide	19-AUG-91	19-AUG-91	16-AUG-91	16-AUG-91	19-AUG-91	17-AUG-91	17-AUG-91	25-AUG-91	25-AUG-91	05-MAR-92	05-MAR-92
DEPTH (ft)			Background	7.5-9.5	13-15	10-12	20-22	18-20	0-5	0-5	0-5	0-5	0-1	0-1
Metals (mg/kg)														
Aluminum	na	na	40041	2940	12200	15700	14600	16400	nt	nt	nt	nt	11500	6270
Arsenic	1.9	0.43	15.8	8.19	3.1	4.7	2.75	nd	nt	nt	nt	nt	1.85	**34**
Barium	20000	1600	209	42.5	36.7	52.5	70.8	32.5	nt	nt	nt	nt	190	181
Beryllium	200	16	1.02	0.767	**1.73**	**2.15**	**4.98**	**2.98**	nt	nt	nt	nt	**1.23**	0.736
Calcium	na	na	na	240000	663	9740	198	nd	nt	nt	nt	nt	494	785
Chromium	310	23	65.3	7.78	27.3	29.5	31.9	13.2	nt	nt	nt	nt	22	14.4
Cobalt	na	na	72.3	3.01	6.34	11.3	17.9	25.7	nt	nt	nt	nt	10.1	3.03
Copper	4100	310	53.5	10.8	6.87	**135**	14.6	3	nt	nt	nt	nt	7.08	17
Iron	31000	2300	50962	8550	21200	25800	41600	23700	nt	nt	nt	nt	12700	20600
Lead	800	400	26.8	**36.9**	nd	**154**	nd	nd	nt	nt	nt	nt	15.3	**30.6**
Magnesium	na	na	na	130000	784	3390	763	751	nt	nt	nt	nt	523	528
Manganese	2000	160	2543	222	195	278	547	168	nt	nt	nt	nt	**2560**	38.9
Mercury	31	2.3	0.13	**2.6**	nd	**0.2**	nd	nd	nt	nt	nt	nt	nd	**0.575**
Nickel	2000	160	62.8	4.91	6.57	25.6	24.5	30.8	nt	nt	nt	nt	8.59	6.31
Potassium	na	na	na	327	551	758	934	1890	nt	nt	nt	nt	377	530
Selenium	510	39	na	nd	nd	nd	nd	nd	nt	nt	nt	nt	nd	0.646
Silver	510	39	na	1.03	nd	0.855	nd	nd	nt	nt	nt	nt	nd	0.701
Sodium	na	na	na	551	372	391	2880	315	nt	nt	nt	nt	167	231
Vanadium	102	7.8	108	8.97	30	34.3	32.9	16.8	nt	nt	nt	nt	29.8	25.3
Zinc	31000	2300	202	38.2	23	71.3	29.9	23.9	nt	nt	nt	nt	24.4	41.6
Volatile Organics (µg/kg)														
1,1,1-Trichloroethane	29000000	2200000	na	nd	nd	nd	nd	nd	5150	nd	nt	nt	nt	nt
Chloroform	1000000	78000	na	nd	nd	nd	nd	nd	1720	nd	nt	nt	nt	nt
Ethylbenzene	10000000	780000	na	nd	nd	nd	nd	47	nd	nd	nt	nt	nt	nt
Toluene	8200000	630000	na	nd	nd	1	nd	3	nd	nd	nt	nt	nt	nt
Xylene (total)	20000000	1600000	na	nd	nd	nd	nd	252	nd	nd	nt	nt	nt	nt
Semivolatile Organics (µg/kg)														
2,4-Dinitrotoluene	200000	16000	na	nd	nd	3220	nd	nd	nd	nd	nt	nt	nd	nd
2,6-Dinitrotoluene	100000	7800	na	nd	nd	1220	nd	nd	nd	nd	nt	nt	nd	nd
Dinitrotoluene Mix*	4200	940	na	nd	nd	4440	nd	nd	nd	nd	nt	nt	nd	nd
2-Methylnaphthalene	410000	31000	na	nd	nd	nd	nd	29200	469	nd	nt	nt	nd	nd
Bis(2-Ethylhexyl)phthalate	200000	46000	na	nd	nd	1020	nd	nd	nd	nd	nt	nt	nd	nd
Di-n-butylphthalate	10000000	780000	na	nd	nd	2940	189	nd	nd	nd	nt	nt	nd	nd
Fluorene	4100000	310000	na	nd	nd	nd	nd	8490	nd	nd	nt	nt	nd	nd
Naphthalene	2000000	160000	na	nd	nd	275	nd	5640	432	nd	nt	nt	nd	nd
Phenanthrene	3100000	230000	na	208	nd	127	nd	10000	150	nd	nt	nt	nd	371
Pyrene	3100000	230000	na	318	nd	nd	nd	nd	nd	nd	nt	nt	nd	nd
TCLP Metals (µg/L)	**TCLP Criteria**													
Arsenic	5000			293	264	131	289	nd	nt	nt	3.5	nd	nt	nt
Barium	100000			nd	nd	nd	nd	nd	nt	nt	140	133	nt	nt
Chromium	5000			nd	nd	nd	nd	nd	nt	nt	40.8	22.5	nt	nt
Lead	5000			30.5	nd	149	nd	nd	nt	nt	67	48	nt	nt

* 'Dinitrotoluene mix' RBC values were used for comparison where 2,4- and 2,6-DNT were detected in the same sample

deeper soil sample, indicating that downward migration had not occurred and impact to groundwater was unlikely.

- SVOCs deep in the soil column at SWMU 49 which created the potential for groundwater contamination.
- Metals, specifically arsenic, in coal bottom ash and the underlying soil at SWMU 59.

The report recommended further sampling and/or an RFI to address the source and extent of the contaminants of concern identified.

2.3.3 Draft RFI, Parsons, 1996

The 1996 RFI was performed for the U.S. Army Environmental Command (USAEC) (formerly USATHAMA) to support the Permit for Corrective Action and Incinerator Operation at RFAAP. The RFI was initiated to characterize the nature, extent, and potential migration of releases of hazardous waste or hazardous constituents from SWMUs 17, 31, 48, and 54. However, as with the VI report, sampling and evaluation of SWMU 48 included what is now considered to be SWMU 49. The following investigation activities were performed:

- Collection of six surface soil samples; three from SWMU 48 and three from SWMU 49. Samples were analyzed for metals, SVOCs, and total petroleum hydrocarbons (TPH); SWMU 48 samples were also analyzed for VOCs and explosives.
- Collection of two subsurface soil samples from each of two soil borings (one boring in SWMU 48 and one boring in SWMU 49). Samples were analyzed for SVOCs and TPH; SWMU 48 samples were also analyzed for VOCs and explosives.
- Collection and analysis of two subsurface soil samples from each of three well borings. Samples were analyzed for SVOCs and TPH.
- Collection and analysis of four groundwater samples from new monitoring wells. Samples were analyzed for metals, VOCs, SVOCs, and TPH.

A summary of sampling for the 1996 RFI is included as **Table 2-1**. Positive detections are summarized and screening level exceedances are identified in **Table 2-3**. Soil sampling locations are depicted on **Figure 2-2**. As with the VI sampling, the area now considered to be SWMU 49 was sampled and discussed as “the lower disposal area” of SWMU 48. Therefore, samples from SWMU 49 have a “48” prefix.

The draft RFI report, submitted in January 1996, included a human health risk assessment (HHRA) and identified the following risk drivers:

- Surface Soil – Arsenic and beryllium.
- Subsurface Soil – Not considered in the risk assessment because samples were collected from greater than 10 ft bgs.
- Groundwater – Beryllium and carbon tetrachloride (CT).

The draft RFI report was never finalized. Further RFI characterization of the site continued in 1998 as discussed in the next section.

Table 2-3
SWMUs 48, 49, 50, and 59
1996 RFI Detected Results in Soil
Page 1 of 2

FIELD ID SAMPLING DATE DEPTH (ft)	Comparison Criteria i-RBC	 r-RBC	 Facility-Wide Background	48SS1 16-DEC-94 0-1	48SS2 16-DEC-94 0-1	48SS3 16-DEC-94 0-1	48SS4 16-DEC-94 0-1	48SS5 16-DEC-94 0-1	48SS6 16-DEC-94 0-1	48SB4A11 17-DEC-94 10-11	48SB4B21 17-DEC-94 20-21
Metals (mg/kg)											
Arsenic	1.9	0.43	15.8	4.53	9.78	nd	4.35	nd	4.46	nt	nt
Barium	20000	1600	209	**757.62**	100.98	125.29	135.39	66.63	139.18	nt	nt
Beryllium	200	16	1.02	**2.15**	0.91	1.01	nd	0.77	0.87	nt	nt
Chromium	310	23	65.3	7.07	58.65	28.19	17.10	37.45	18.60	nt	nt
Lead	800	400	26.8	5.83	**196.32**	20.88	25.53	**27.19**	16.49	nt	nt
Mercury	31	2.3	0.13	**1.47**	**0.54**	nd	**0.59**	0.13	nd	nt	nt
Nickel	2000	160	62.8	8.93	25.4	6.13	7.17	12.73	6.75	nt	nt
Selenium	510	39	na	nd	1.07	nd	0.79	nd	nd	nt	nt
Silver	510	39	na	nd	0.0285	0.0245	0.03	nd	0.03	nt	nt
Volatile Organics (µg/kg)											
				nd	nd	nd	nt	nt	nt	nd	nd
Semivolatile Organics (µg/kg)											
bis(2-Ethylhexyl)phthalate	200000	46000	na	1990	1600	nd	nd	nd	1400	3570	4350
Chrysene	390000	87000	na	110	nd	nd	90	nd	80	nd	nd
Di-n-butylphthalate	10000000	780000	na	nd	12270	nd	nd	nd	nd	nd	7260
Naphthalene	2000000	160000	na	nd	nd	nd	nd	nd	nd	nd	nd
N-Nitrosodiphenylamine	580000	130000	na	nd	nd	nd	nd	nd	nd	1790	2060
Phenanthrene	3100000	230000	na	360	nd	nd	370	nd	330	nd	nd
Phenol	31000000	2300000	na	nd	nd	nd	nd	nd	nd	nd	nd
Pyrene	3100000	230000	na	nd	nd	nd	nd	nd	nd	nd	nd
Explosives (mg/kg)											
				nd	nd	nd	nt	nt	nt	nd	nd
TPH (mg/kg)		**TPH Criteria**									
Total petroleum hydrocarbons		100		nd	nd	nd	14	414	nd	nd	nd

Table 2-3
SWMUs 48, 49, 50, and 59
1996 RFI Detected Results in Soil
Page 2 of 2

FIELD ID	Comparison Criteria			48SB5A19	48SB5B37	48MW1A22	48MW1B54	48MW2A42	48MW2B46	48MW3A22	48MW3B32
SAMPLING DATE DEPTH (ft)	i-RBC	r-RBC	Facility-Wide Background	17-DEC-94 17-19	17-DEC-94 35-37	17-DEC-94 20-22	18-DEC-94 52-54	20-DEC-94 40-42	20-DEC-94 44-46	07-JAN-95 20-22	07-JAN-95 30-32
Metals (mg/kg)											
Arsenic	1.9	0.43	15.8	nt	nt	nt	nt	nt	nt	nt	nt
Barium	20000	1600	209	nt	nt	nt	nt	nt	nt	nt	nt
Beryllium	200	16	1.02	nt	nt	nt	nt	nt	nt	nt	nt
Chromium	310	23	65.3	nt	nt	nt	nt	nt	nt	nt	nt
Lead	800	400	26.8	nt	nt	nt	nt	nt	nt	nt	nt
Mercury	31	2.3	0.13	nt	nt	nt	nt	nt	nt	nt	nt
Nickel	2000	160	62.8	nt	nt	nt	nt	nt	nt	nt	nt
Selenium	510	39	na	nt	nt	nt	nt	nt	nt	nt	nt
Silver	510	39	na	nt	nt	nt	nt	nt	nt	nt	nt
Volatile Organics (µg/kg)											
				nt	nt	nt	nt	nt	nt	nt	nt
Semivolatile Organics (µg/kg)											
bis(2-Ethylhexyl)phthalate	200000	46000	na	48600	12330	8140	7170	1960	nd	3770	2490
Chrysene	390000	87000	na	nd	nd	nd	nd	nd	nd	nd	nd
Di-n-butylphthalate	10000000	780000	na	nd	nd	nd	nd	nd	nd	2310	nd
Naphthalene	2000000	160000	na	24300	nd	nd	nd	nd	nd	nd	nd
N-Nitrosodiphenylamine	580000	130000	na	nd	nd	nd	nd	nd	nd	nd	nd
Phenanthrene	3100000	230000	na	12150	nd	nd	nd	nd	nd	nd	nd
Phenol	31000000	2300000	na	nd	nd	nd	nd	140	nd	nd	nd
Pyrene	3100000	230000	na	970	nd	nd	nd	nd	nd	nd	nd
Explosives (mg/kg)											
				nt	nt	nt	nt	nt	nt	nt	nt
TPH (mg/kg)		**TPH Criteria**									
Total petroleum hydrocarbons		100		4337	nd	nd	nd	nd	nd	nd	nd

2.3.4 RFI, ICF KE, 1998

The 1998 RFI was performed for the USAEC and included SWMUs 31, 39, 48, 49, and 58. The objective of the 1998 RFI was to further refine the understanding of the nature and extent of contamination associated with previous disposal and/or burial practices. To meet these objectives, the following field tasks were performed for SWMUs 48 and 49:

- Excavation of a test pit to identify waste disposal boundaries.
- Collection of four subsurface soil samples from the floor of the test pit, analyzed for metals, VOCs, SVOCs, and explosives.
- Collection of eleven subsurface soil samples from three soil borings, analyzed for metals, VOCs, SVOCs, and explosives.
- Collection of groundwater samples from the four monitoring wells installed during the 1996 RFI. Samples were analyzed for metals, VOCs, SVOCs, and explosives.

A summary of sampling for the 1998 RFI is included as **Table 2-1**. Positive detections are summarized and screening level exceedances are identified in **Table 2-4**. Soil sampling locations are depicted on **Figure 2-2**.

The analytical results confirmed the previous finding of explosives compounds in the SWMU 48 disposal trenches and confirmed the VOC contamination in groundwater. The draft RFI report was submitted in January 1999, but was never finalized. It recommended additional sampling to further define the nature and extent of contamination. Additional RFI characterization of the site continued in 2002, as presented below.

2.3.5 RFI, Shaw, 2002

Additional RFI characterization of these sites continued in 2002, with an additional round of sample collection. **Table 2-1** presents the depths and analytes for the 2002 samples. Results from these samples are presented in **Table 2-5**.

The preliminary draft RFI utilized the combined data set for the 1992, 1996, 1998, and 2002 investigations to complete an HHRA and a screening level ecological risk assessment (SLERA) for the combined study area. The preliminary draft RFI report was never submitted or finalized. The following discussion summarizes the results of the HHRA and SLERA.

The receptors and media evaluated in the HHRA included maintenance worker exposure to surface soil as the current scenario, and maintenance worker, excavation worker, adult resident, and child resident exposure to total soil (surface and subsurface combined) as the plausible future scenario. Groundwater exposures were not evaluated in the HHRA.

Upper-bound excess lifetime cancer risks and non-cancer Hazard Indices (HIs) were estimated for each receptor. The upper-bound excess lifetime cancer risks can be compared to USEPA’s target risk range for health protectiveness at Superfund sites of 1×10^{-6} to 1×10^{-4} (USEPA, 2005). Non-cancer HIs that are less than 1 are not likely to be associated with health risks. The USEPA's directive clarifying the role of HHRA in the Superfund process states that, where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 1×10^{-4}, and the noncarcinogenic HI is less than 1, action generally is not warranted unless there could be adverse environmental effects (USEPA, 1991). The HHRA results for each receptor are summarized below.

Analyte			Sample ID	48SB6A					48SB6A2					48SB6B					48SB6B2				
			Sample Date	3/26/98					4/8/98					3/26/98					4/8/98				
			Sample Depth	6-7					6-7					14-16					14-16				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																							
2-Butanone	61000000	4700000	na	NT					990	U	U	990	990	NT					850	U	U	850	850
Acetone	92000000	7000000	na	NT					1300	B	B	5	5	NT					1000	B	B	5	5
Benzene	52000	12000	na	17		J	5	5	990	U	U	990	990	7	U	U	7	7	850	U	U	850	850
Ethylbenzene	10000000	780000	na	8	U	R	8	8	990	U	U	990	990	7	U	U	7	7	850	U	U	850	850
Methylene Chloride	380000	85000	na	49		B	5	5	990	U	U	990	990	2	J	B	5	5	850	U	U	850	850
Toluene	8200000	630000	na	23		J	5	5	990	U	U	990	990	7	U	U	7	7	850	U	U	850	850
Vinyl Chloride	4000	90	na	8	U	R	8	8	990	U	U	990	990	7	U	U	7	7	850	U	U	850	850
o-Xylene	20000000	1600000	na	8	U	R	8	8	640	J	J	5	5	7	U	U	7	7	850	U	U	850	850
PAHs (ug/kg)																							
Anthracene	31000000	2300000	na	2.9	U	UL	2.9	2.9	NT					2	U	UL	2	2	NT				
Benzo(a)anthracene	3900	220	na	2.9	U	UL	2.9	2.9	NT					2	U	UL	2	2	NT				
Benzo(a)pyrene	390	22	na	2.9	U	UL	2.9	2.9	NT					2	U	UL	2	2	NT				
Benzo(k)fluoranthene	39000	2200	na	2.9	U	UL	2.9	2.9	NT					2	U	UL	2	2	NT				
Chrysene	390000	22000	na	2.9	U	UL	2.9	2.9	NT					2	U	UL	2	2	NT				
Fluoranthene	4100000	310000	na	48		L	5.8	5.8	NT					3.9	U	UL	3.9	3.9	NT				
Fluorene	4100000	310000	na	5.8	U	UL	5.8	5.8	NT					3.9	U	UL	3.9	3.9	NT				
Indeno(1,2,3-cd)pyrene	3900	220	na	2.9	U	UL	2.9	2.9	NT					2	U	UL	2	2	NT				
Naphthalene	2000000	160000	na	29	U	UL	29	29	NT					20	U	UL	20	20	NT				
Phenanthrene	3100000	230000	na	2.9	U	UL	2.9	2.9	NT					2	U	UL	2	2	NT				
Pyrene	3100000	230000	na	25		J	2.9	2.9	NT					2	U	UL	2	2	NT				
SVOCs (ug/kg)																							
2-Methylnaphthalene	410000	31000	na	520	U	U	520	520	NT					450	U	U	450	450	NT				
Bis(2-ethylhexyl)phthalate	200000	46000	na	130	J	J	520	520	NT					450	U	U	450	450	NT				
Di-n-butylphthalate	10000000	780000	na	360	J	J	520	520	NT					450	U	U	450	450	NT				
Dibenzofuran	na	na	na	520	U	U	520	520	NT					450	U	U	450	450	NT				
N-nitrosodiphenylamine	580000	130000	na	650			520	520	NT					450	U	U	450	450	NT				
Explosives (mg/kg)																							
1,3,5-Trinitrobenzene	3100	230	na	0.25	U	UL	0.25	0.25	NT					0.24	U	UL	0.24	0.24	NT				
1,3-Dinitrobenzene	10	0.78	na	0.25	U	UL	0.25	0.25	NT					0.24	U	UL	0.24	0.24	NT				
2,4,6-Trinitrotoluene	51	3.9	na	0.25	U	UL	0.25	0.25	NT					0.24	U	UL	0.24	0.24	NT				
2,4-Dinitrotoluene	200	16	na	0.25	U	UL	0.25	0.25	NT					0.24	U	UL	0.24	0.24	NT				
2,6-Dinitrotoluene	100	7.8	na	0.25	U	U	0.25	0.25	NT					0.24	U	U	0.24	0.24	NT				
Dinitrotoluene Mix*	4.2	0.94	na																				
2-Amino-4,6-Dinitrotoluene	200	16	na	0.25	U	U	0.25	0.25	NT					0.24	U	U	0.24	0.24	NT				
4-Amino-2,6-Dinitrotoluene	200	16	na	0.25	U	UL	0.25	0.25	NT					0.24	U	U	0.24	0.24	NT				
HMX	5100	390	na	0.25	U	UL	0.25	0.25	NT					0.24	U	UL	0.24	0.24	NT				
Nitrobenzene	51	3.9	na	0.25	U	UL	0.25	0.25	NT					0.24	U	UL	0.24	0.24	NT				
RDX	26	5.8	na	0.25	U	UL	0.25	0.25	NT					0.24	U	UL	0.24	0.24	NT				
Tetryl	410	31	na	1.3	U	U	1.3	1.3	NT					1.2	U	U	1.2	1.2	NT				
Metals (mg/kg)																							
Aluminum	na	na	40041	15700			0.95	0.95	NT					34200			0.81	0.81	NT				
Antimony	41	3.1	na	1.6	B	J	0.79	0.79	NT					1.1	B	J	0.67	0.67	NT				
Arsenic	1.9	0.43	15.8	2.8			0.95	0.95	NT					5.4			0.81	0.81	NT				
Barium	20000	1600	209	83.4		L	0.16	0.16	NT					72.9		L	0.13	0.13	NT				
Beryllium	200	16	1.02	0.16	U	U	0.16	0.16	NT					0.93		K	0.13	0.13	NT				
Calcium	na	na	na	35800			3.6	3.6	NT					860			3.1	3.1	NT				
Chromium	310	23	65.3	35.5			0.16	0.16	NT					42.2			0.13	0.13	NT				
Cobalt	na	na	72.3	7.6	B	L	0.16	0.16	NT					11.5		L	0.13	0.13	NT				
Copper	4100	310	53.5	33.3		K	0.16	0.16	NT					15.1		K	0.13	0.13	NT				
Iron	31000	2300	50962	18100			2.9	2.9	NT					39700			2.4	2.4	NT				
Lead	800	400	26.8	**59.6**			0.32	0.32	NT					8			0.27	0.27	NT				
Magnesium	na	na	na	4660			4.9	4.9	NT					1440			4.2	4.2	NT				
Manganese	2000	160	2543	148			0.16	0.16	NT					342			0.13	0.13	NT				
Nickel	2000	160	62.8	18.8		K	0.16	0.16	NT					17.6		K	0.13	0.13	NT				
Potassium	na	na	na	2200		K	7	7	NT					1430		K	5.9	5.9	NT				
Silver	510	39	na	0.16	U	U	0.32	0.32	NT					0.13	U	U	0.27	0.27	NT				
Sodium	na	na	na	537	B	K	4.8	4.8	NT					180	B	K	4	4	NT				
Thallium	7.2	0.55	2.11	0.79	U	UL	0.95	0.95	NT					0.67	U	UL	0.81	0.81	NT				
Vanadium	102	7.8	108	33		K	0.16	0.16	NT					41.2		K	0.13	0.13	NT				
Zinc	31000	2300	202	54.5		K	0.32	0.32	NT					46.6		K	0.27	0.27	NT				

Analyte	48SB6C					48SB6C2					48SB7A					48SB7A2				
Sample Date	3/26/98					4/8/98					3/30/98					4/9/98				
Sample Depth	1-3					1-3					8-9					8-9				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																				
2-Butanone	47	U	U	47	47	1200	U	U	1200	1200	8	U	U	8	8	940	U	U	940	940
Acetone	140		B	5	5	1400	B	B	5	5	8		B	5	5	1100	B	B	5	5
Benzene	47	U	U	47	47	1200	U	U	1200	1200	8	U	U	8	8	940	U	U	940	940
Ethylbenzene	490		K	5	5	1200	U	U	1200	1200	8	U	U	8	8	940	U	U	940	940
Methylene Chloride	48		B	5	5	1200	U	U	1200	1200	3	J	B	5	5	940	U	U	940	940
Toluene	47	U	U	47	47	1200	U	U	1200	1200	8	U	U	8	8	940	U	U	940	940
Vinyl Chloride	47	U	U	47	47	1200	U	U	1200	1200	8	U	U	8	8	940	U	U	940	940
o-Xylene	770		K	5	5	1200	U	U	1200	1200	8	U	U	8	8	940	U	U	940	940
PAHs (ug/kg)																				
Anthracene	2	J	J	3.2	3.2	NT					21	U	U	21	21	NT				
Benzo(a)anthracene	5.1			3.2	3.2	NT					21	U	U	21	21	NT				
Benzo(a)pyrene	5.6			3.2	3.2	NT					21	U	U	21	21	NT				
Benzo(k)fluoranthene	5.4			3.2	3.2	NT					21	U	U	21	21	NT				
Chrysene	3.2	U	U	3.2	3.2	NT					21	U	U	21	21	NT				
Fluoranthene	8.2			6.4	6.4	NT					42	U	U	42	42	NT				
Fluorene	6.4	U	U	6.4	6.4	NT					42	U	U	42	42	NT				
Indeno(1,2,3-cd)pyrene	7			3.2	3.2	NT					21	U	U	21	21	NT				
Naphthalene	32	U	UL	32	32	NT					210	U	UL	210	210	NT				
Phenanthrene	8.1			3.2	3.2	NT					21	U	U	21	21	NT				
Pyrene	4.6		J	3.2	3.2	NT					21	U	U	21	21	NT				
SVOCs (ug/kg)																				
2-Methylnaphthalene	620	U	U	620	620	NT					490	U	U	490	490	NT				
Bis(2-ethylhexyl)phthalate	350	J	J	620	620	NT					490	U	U	490	490	NT				
Di-n-butylphthalate	33000			6200	6200	NT					490	U	UJ	490	490	NT				
Dibenzofuran	620	U	U	620	620	NT					490	U	U	490	490	NT				
N-nitrosodiphenylamine	560	J	J	620	620	NT					490	U	UJ	490	490	NT				
Explosives (mg/kg)																				
1,3,5-Trinitrobenzene	0.25	U	UL	0.25	0.25	NT					102		L	25	25	NT				
1,3-Dinitrobenzene	0.25	U	UL	0.25	0.25	NT					3.6		L	0.25	0.25	NT				
2,4,6-Trinitrotoluene	0.25	U	UJ	0.25	0.25	NT					935		L	25	25	NT				
2,4-Dinitrotoluene	3.8		L	0.25	0.25	NT					0.25	U	UL	0.25	0.25	NT				
2,6-Dinitrotoluene	1.1		J	0.25	0.25	NT					0.25	U	UL	0.25	0.25	NT				
Dinitrotoluene Mix*	4.9																			
2-Amino-4,6-Dinitrotoluene	0.25	U	UL	0.25	0.25	NT					0.25	U	UL	0.25	0.25	NT				
4-Amino-2,6-Dinitrotoluene	0.25	U	UL	0.25	0.25	NT					0.25	U	UL	0.25	0.25	NT				
HMX	0.25	U	UL	0.25	0.25	NT					0.25	U	UL	0.25	0.25	NT				
Nitrobenzene	0.25	U	UL	0.25	0.25	NT					0.25	U	UL	0.25	0.25	NT				
RDX	0.25	U	UL	0.25	0.25	NT					0.25	U	UL	0.25	0.25	NT				
Tetryl	1.3	U	UJ	1.3	1.3	NT					0.25	U	UL	0.25	0.25	NT				
Metals (mg/kg)																				
Aluminum	11800			1.1	1.1	NT					24600			0.88	0.88	NT				
Antimony	0.94	U	U	0.94	0.94	NT					0.9	B	J	0.73	0.73	NT				
Arsenic	5			1.1	1.1	NT					8			0.88	0.88	NT				
Barium	47		L	0.19	0.19	NT					111		L	0.15	0.15	NT				
Beryllium	0.56	B	B	0.19	0.19	NT					0.69	B	B	0.15	0.15	NT				
Calcium	1E+05			4.3	4.3	NT					2640			3.4	3.4	NT				
Chromium	65.4			0.19	0.19	NT					33.3			0.15	0.15	NT				
Cobalt	4.2	B	L	0.19	0.19	NT					12.5		L	0.15	0.15	NT				
Copper	**149**		**K**	0.19	0.19	NT					36.9		K	0.15	0.15	NT				
Iron	11700			3.4	3.4	NT					45600			2.6	2.6	NT				
Lead	**286**			0.38	0.38	NT					25.6			0.29	0.29	NT				
Magnesium	4730			5.8	5.8	NT					1810			4.5	4.5	NT				
Manganese	123			0.19	0.19	NT					176			0.15	0.15	NT				
Nickel	39.2		K	0.19	0.19	NT					24.4		K	0.15	0.15	NT				
Potassium	805	B	K	8.3	8.3	NT					2220		K	6.5	6.5	NT				
Silver	0.38	U	U	0.38	0.38	NT					0.39	B	J	0.29	0.29	NT				
Sodium	339	B	K	5.6	5.6	NT					211	B	B	4.4	4.4	NT				
Thallium	1.1	U	U	1.1	1.1	NT					0.88	U	U	0.88	0.88	NT				
Vanadium	16.2		K	0.19	0.19	NT					73.2		K	0.15	0.15	NT				
Zinc	73.6		K	0.38	0.38	NT					67.1		K	0.29	0.29	NT				

* 'Dinitrotoluene mix' RBC values were used for comparison where
2,4- and 2,6-DNT were detected in the same sample.

Table 2-4
SWMUs 48, 49, 50, and 59
1998 RFI Detected Results in Soil

Analyte	i-RBC	r-RBC	Background	48SB7B 3/30/98 10-11 Result	Lab Q	Val Q	MDL	MRL	48TP1 3/24/98 6-6.5 Result	Lab Q	Val Q	MDL	MRL	48TP2 3/24/98 6-6.5 Result	Lab Q	Val Q	MDL	MRL	48TP3 3/24/98 6-6.5 Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																							
2-Butanone	61000000	4700000	na	6	U	U	6	6	NT					NT					NT				
Acetone	92000000	7000000	na	8		B	5	5	NT					NT					NT				
Benzene	52000	12000	na	6	U	U	6	6	11	U	UJ	11	11	6	U	U	6	6	7	U	UJ	7	7
Ethylbenzene	10000000	780000	na	6	U	U	6	6	11	U	UJ	11	11	6	U	U	6	6	7	U	UJ	7	7
Methylene Chloride	380000	85000	na	6		B	5	5	7	JB	B	5	5	2	J	B	5	5	2	J	B	5	5
Toluene	8200000	630000	na	6	U	U	6	6	11	U	UJ	11	11	6	U	U	6	6	7	U	UJ	7	7
Vinyl Chloride	4000	90	na	6	U	U	6	6	11	J	J	11	11	6	U	U	6	6	7	U	UJ	7	7
o-Xylene	20000000	1600000	na	6	U	U	6	6	11	U	UJ	11	11	6	U	U	6	6	7	U	UJ	7	7
PAHs (ug/kg)																							
Anthracene	31000000	2300000	na	1.9	U	U	1.9	1.9	3	U	U	3	3	2.1	U	U	2.1	2.1	2.2	U	U	2.2	2.2
Benzo(a)anthracene	3900	220	na	1.9	U	U	1.9	1.9	3	U	U	3	3	2.1	U	U	2.1	2.1	2.2	U	U	2.2	2.2
Benzo(a)pyrene	390	22	na	1.9	U	U	1.9	1.9	3	U	U	3	3	2.1	U	U	2.1	2.1	2.2	U	U	2.2	2.2
Benzo(k)fluoranthene	39000	2200	na	1.9	U	U	1.9	1.9	3	U	U	3	3	2.1	U	U	2.1	2.1	2.2	U	U	2.2	2.2
Chrysene	390000	22000	na	1.9	U	U	1.9	1.9	17		J	3	3	2.1	U	U	2.1	2.1	2.2	U	U	2.2	2.2
Fluoranthene	4100000	310000	na	3.8	U	U	3.8	3.8	6	U	U	6	6	4.2	U	U	4.2	4.2	4.4	U	U	4.4	4.4
Fluorene	4100000	310000	na	3.8	U	U	3.8	3.8	6	U	U	6	6	4.2	U	U	4.2	4.2	4.4	U	U	4.4	4.4
Indeno(1,2,3-cd)pyrene	3900	220	na	1.9	U	U	1.9	1.9	3	U	U	3	3	2.1	U	U	2.1	2.1	2.2	U	U	2.2	2.2
Naphthalene	2000000	160000	na	19	U	UL	19	19	30	U	U	30	30	21	U	U	21	21	22	U	U	22	22
Phenanthrene	3100000	230000	na	1.9	U	U	1.9	1.9	94		J	3	3	2.1	U	U	2.1	2.1	2.2	U	U	2.2	2.2
Pyrene	3100000	230000	na	1.9	U	U	1.9	1.9	3	U	U	3	3	2.1	U	U	2.1	2.1	2.2	U	U	2.2	2.2
SVOCs (ug/kg)																							
2-Methylnaphthalene	410000	31000	na	380	U	U	380	380	720	U	U	720	720	430	U	U	430	430	440	U	U	440	440
Bis(2-ethylhexyl)phthalate	200000	46000	na	380	U	U	380	380	720	U	U	720	720	430	U	U	430	430	440	U	U	440	440
Di-n-butylphthalate	10000000	780000	na	81	J	J	380	380	720	U	U	720	720	430	U	U	430	430	440	U	U	440	440
Dibenzofuran	na	na	na	380	U	U	380	380	720	U	U	720	720	430	U	U	430	430	440	U	U	440	440
N-nitrosodiphenylamine	580000	130000	na	380	U	U	380	380	720	U	U	720	720	430	U	U	430	430	440	U	U	440	440
Explosives (mg/kg)																							
1,3,5-Trinitrobenzene	3100	230	na	0.53		L	0.25	0.25	1.4		J	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
1,3-Dinitrobenzene	10	0.78	na	0.25	U	UL	0.25	0.25	2.7		J	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
2,4,6-Trinitrotoluene	51	3.9	na	35.68		L	1	1	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
2,4-Dinitrotoluene	200	16	na	0.25	U	UL	0.25	0.25	6.7		J	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
2,6-Dinitrotoluene	100	7.8	na	0.25	U	UL	0.25	0.25	1.3			0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
Dinitrotoluene Mix*	4.2	0.94	na						8.0														
2-Amino-4,6-Dinitrotoluene	200	16	na	0.25	U	UL	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
4-Amino-2,6-Dinitrotoluene	200	16	na	0.25	U	UL	0.25	0.25	5.5		J	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
HMX	5100	390	na	0.25	U	UL	0.25	0.25	5.2		J	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
Nitrobenzene	51	3.9	na	0.25	U	UL	0.25	0.25	1		J	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
RDX	26	5.8	na	0.25	U	UL	0.25	0.25	0.85		J	0.25	0.25	0.25	U	U	0.25	0.25	0.25	U	U	0.25	0.25
Tetryl	410	31	na	0.25	U	UL	0.25	0.25	1.3	U	U	1.3	1.3	1.3	U	U	1.3	1.3	1.3	U	U	1.3	1.3
Metals (mg/kg)																							
Aluminum	na	na	40041	16500			0.69	0.69	9230			1.3	1.3	**47400**			0.75	0.75	**50700**			0.79	0.79
Antimony	41	3.1	na	0.57	U	U	0.57	0.57	0.66	U	U	1.1	1.1	1.3	B	J	0.62	0.62	1.5	B	J	0.66	0.66
Arsenic	1.9	0.43	15.8	3.5			0.69	0.69	8.1			1.3	1.3	4.3			0.75	0.75	4.8			0.79	0.79
Barium	20000	1600	209	49.8		L	0.11	0.11	34.6	B	L	0.22	0.22	71.8		L	0.12	0.12	70.6		L	0.13	0.13
Beryllium	200	16	1.02	0.76		B	0.11	0.11	**1.5**		**K**	0.22	0.22	0.48	B	K	0.12	0.12	0.51	B	K	0.13	0.13
Calcium	na	na	na	984			2.6	2.6	4650			5	5	697			2.9	2.9	266	B	J	3	3
Chromium	310	23	65.3	37.4			0.11	0.11	23.2			0.22	0.22	28.4			0.12	0.12	33			0.13	0.13
Cobalt	na	na	72.3	15		L	0.11	0.11	13.8		L	0.22	0.22	6.7		L	0.12	0.12	7.5		L	0.13	0.13
Copper	4100	310	53.5	9.6		B	0.11	0.11	15.4		K	0.22	0.22	18.6		K	0.12	0.12	19.7		K	0.13	0.13
Iron	31000	2300	50962	25300			2.1	2.1	16700			3.9	3.9	**51100**			2.2	2.2	**55000**			2.4	2.4
Lead	800	400	26.8	9			0.23	0.23	17.8			0.44	0.44	17			0.25	0.25	14.7			0.26	0.26
Magnesium	na	na	na	950			3.6	3.6	442	B	J	6.8	6.8	2310			3.9	3.9	1980			4.1	4.1
Manganese	2000	160	2543	613			0.11	0.11	314			0.22	0.22	188			0.12	0.12	218			0.13	0.13
Nickel	2000	160	62.8	10.6		K	0.11	0.11	8.6	B	K	0.22	0.22	20.9		K	0.12	0.12	21.2		K	0.13	0.13
Potassium	na	na	na	909		K	5.1	5.1	176	B	K	9.6	9.6	2910		K	5.5	5.5	2670		K	5.8	5.8
Silver	510	39	na	0.23	U	U	0.23	0.23	0.22	U	U	0.44	0.44	0.12	U	U	0.25	0.25	0.13	U	U	0.26	0.26
Sodium	na	na	na	100	B	B	3.4	3.4	5740		K	6.6	6.6	323	B	K	3.7	3.7	288	B	K	4	4
Thallium	7.2	0.55	2.11	0.69	U	U	0.69	0.69	1.1	U	UL	1.3	1.3	1.9		L	0.75	0.75	0.66	U	UL	0.79	0.79
Vanadium	102	7.8	108	23.1		K	0.11	0.11	12.1		K	0.22	0.22	94.6		K	0.12	0.12	100		K	0.13	0.13
Zinc	31000	2300	202	29		K	0.23	0.23	58.7		K	0.44	0.44	65.6		K	0.25	0.25	70.2		K	0.26	0.26

Analyte	48TP4 3/24/98 6-6.5 Result	Lab Q	Val Q	MDL	MRL	49SB1A 3/31/98 8-10 Result	Lab Q	Val Q	MDL	MRL	49SB1B 3/31/98 18-24 Result	Lab Q	Val Q	MDL	MRL	49SB1B2 4/9/98 18-24 Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																				
2-Butanone	NT					13		J	5	5	11		J	5	5	780	U	U	780	780
Acetone	NT					97		B	5	5	65		B	5	5	780	U	U	780	780
Benzene	6	U	U	6	6	6	U	UJ	6	6	6	U	U	6	6	780	U	U	780	780
Ethylbenzene	6	U	U	6	6	28		J	5	5	360		L	5	5	1700			5	5
Methylene Chloride	2	J	B	5	5	4	J	B	5	5	9		B	5	5	780	U	U	780	780
Toluene	6	U	U	6	6	6	U	UJ	6	6	6	U	U	6	6	780	U	U	780	780
Vinyl Chloride	6	U	U	6	6	6	U	UJ	6	6	6	U	U	6	6	780	U	U	780	780
o-Xylene	6	U	U	6	6	86		J	5	5	200			5	5	710	J	J	5	5
PAHs (ug/kg)																				
Anthracene	2.1	U	U	2.1	2.1	40	U	U	40	40	42	U	U	42	42	NT				
Benzo(a)anthracene	2.1	U	U	2.1	2.1	40	U	U	40	40	42	U	U	42	42	NT				
Benzo(a)pyrene	2.1	U	U	2.1	2.1	40	U	U	40	40	42	U	U	42	42	NT				
Benzo(k)fluoranthene	2.1	U	U	2.1	2.1	40	U	U	40	40	42	U	U	42	42	NT				
Chrysene	2.1	U	U	2.1	2.1	40	U	U	40	40	42	U	U	42	42	NT				
Fluoranthene	4.2	U	U	4.2	4.2	80	U	U	80	80	83	U	U	83	83	NT				
Fluorene	4.2	U	U	4.2	4.2	1600			80	80	1800			83	83	NT				
Indeno(1,2,3-cd)pyrene	2.1	U	U	2.1	2.1	40	U	U	40	40	42	U	U	42	42	NT				
Naphthalene	21	U	U	21	21	920		L	400	400	2500		L	420	420	NT				
Phenanthrene	2.1	U	U	2.1	2.1	40	U	U	40	40	42	U	U	42	42	NT				
Pyrene	2.1	U	U	2.1	2.1	40	U	U	40	40	42	U	U	42	42	NT				
SVOCs (ug/kg)																				
2-Methylnaphthalene	430	U	U	430	430	16000			2000	2000	15000			2100	2100	NT				
Bis(2-ethylhexyl)phthalate	430	U	U	430	430	2000	U	UJ	2000	2000	410	U	UJ	410	410	NT				
Di-n-butylphthalate	430	U	U	430	430	2000	U	UJ	2000	2000	410	U	UJ	410	410	NT				
Dibenzofuran	430	U	U	430	430	2000	U	U	2000	2000	1800			410	410	NT				
N-nitrosodiphenylamine	430	U	U	430	430	2000	U	UJ	2000	2000	410	U	UJ	410	410	NT				
Explosives (mg/kg)																				
1,3,5-Trinitrobenzene	0.25	U	U	0.25	0.25	0.24	U	UL	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
1,3-Dinitrobenzene	0.25	U	U	0.25	0.25	0.24	U	UL	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
2,4,6-Trinitrotoluene	0.25	U	U	0.25	0.25	0.4		L	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
2,4-Dinitrotoluene	0.25	U	U	0.25	0.25	0.24	U	UL	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
2,6-Dinitrotoluene	0.25	U	U	0.25	0.25	0.24	U	UL	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
Dinitrotoluene Mix*																				
2-Amino-4,6-Dinitrotoluene	0.25	U	U	0.25	0.25	0.6		L	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
4-Amino-2,6-Dinitrotoluene	0.25	U	U	0.25	0.25	0.24	U	UL	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
HMX	0.25	U	U	0.25	0.25	0.24	U	UL	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
Nitrobenzene	0.25	U	U	0.25	0.25	0.24	U	UL	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
RDX	0.25	U	U	0.25	0.25	0.24	U	UL	0.24	0.24	0.25	U	UL	0.25	0.25	NT				
Tetryl	1.3	U	U	1.3	1.3	0.72		L	0.24	0.24	0.6		L	0.25	0.25	NT				
Metals (mg/kg)																				
Aluminum	**47900**			0.78	0.78	27300			0.72	0.72	18300			0.74	0.74	NT				
Antimony	1.5	B	J	0.65	0.65	0.6	U	U	0.6	0.6	0.62	U	U	0.62	0.62	NT				
Arsenic	4.8			0.78	0.78	3.2			0.72	0.72	2.5			0.74	0.74	NT				
Barium	80.4		L	0.13	0.13	56.7		L	0.12	0.12	35		L	0.12	0.12	NT				
Beryllium	0.55	B	K	0.13	0.13	0.6	B	B	0.12	0.12	**1.7**		**J**	0.12	0.12	NT				
Calcium	246	B	J	3	3	714			2.7	2.7	304	B	J	2.8	2.8	NT				
Chromium	31.2			0.13	0.13	29.2			0.12	0.12	22.3			0.12	0.12	NT				
Cobalt	6.2	B	L	0.13	0.13	3.9	B	L	0.12	0.12	28.7		L	0.12	0.12	NT				
Copper	20.1		K	0.13	0.13	24		K	0.12	0.12	5.1		B	0.12	0.12	NT				
Iron	**54800**			2.3	2.3	33600			2.2	2.2	40300			2.2	2.2	NT				
Lead	15.8			0.26	0.26	**55.6**			0.24	0.24	9.6			0.25	0.25	NT				
Magnesium	2160			4	4	1110			3.7	3.7	2270			3.8	3.8	NT				
Manganese	163			0.13	0.13	74.5			0.12	0.12	350			0.12	0.12	NT				
Nickel	22		K	0.13	0.13	11.7		K	0.12	0.12	22.5		K	0.12	0.12	NT				
Potassium	2920		K	5.7	5.7	1280		K	5.3	5.3	1780		K	5.4	5.4	NT				
Silver	0.13	U	U	0.26	0.26	0.24	U	U	0.24	0.24	0.25	U	U	0.25	0.25	NT				
Sodium	224	B	K	3.9	3.9	149	B	B	3.6	3.6	3.7	U	U	3.7	3.7	NT				
Thallium	0.65	U	UL	0.78	0.78	0.78	B	J	0.72	0.72	0.74	U	U	0.74	0.74	NT				
Vanadium	96.4		K	0.13	0.13	63.2		K	0.12	0.12	23.2		K	0.12	0.12	NT				
Zinc	67.8		K	0.26	0.26	48.4		K	0.24	0.24	23.6		K	0.25	0.25	NT				

* 'Dinitrotoluene mix' RBC values were used for comparison where
2,4- and 2,6-DNT were detected in the same sample.

Table 2-4
SWMUs 48, 49, 50, and 59
1998 RFI Detected Results in Soil
Page 3 of 3

Analyte			Sample ID / Sample Date / Sample Depth	49SB1C 3/31/98 28-32					49SB1C2 4/9/98 28-32					49SB1D 3/31/98 38-40					49SB1D2 4/9/98 38-40					49SB1E 3/31/98 48-50					49SB1F 3/31/98 58-60				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																																	
2-Butanone	61000000	4700000	na	6	J	J	*5*	*5*	770	U	U	*770*	*770*	6	U	U	*6*	*6*	740	U	U	*740*	*740*	6	U	U	*6*	*6*	6	U	U	*6*	*6*
Acetone	92000000	7000000	na	58		B	*5*	*5*	830	B	B	*5*	*5*	7		B	*5*	*5*	1100	B	B	*5*	*5*	6		B	*5*	*5*	9		B	*5*	*5*
Benzene	52000	12000	na	6	U	UL	*6*	*6*	770	U	U	*770*	*770*	6	U	U	*6*	*6*	740	U	U	*740*	*740*	6	U	U	*6*	*6*	6	U	U	*6*	*6*
Ethylbenzene	10000000	780000	na	190	E	L	*5*	*5*	1100			*5*	*5*	6	U	U	*6*	*6*	740	U	U	*740*	*740*	6	U	U	*6*	*6*	6	U	U	*6*	*6*
Methylene Chloride	380000	85000	na	3	J	B	*5*	*5*	770	U	U	*770*	*770*	3	J	B	*5*	*5*	740	U	U	*740*	*740*	2	J	B	*5*	*5*	5	J	B	*5*	*5*
Toluene	8200000	630000	na	6	U	UL	*6*	*6*	770	U	U	*770*	*770*	6	U	U	*6*	*6*	740	U	U	*740*	*740*	6	U	U	*6*	*6*	6	U	U	*6*	*6*
Vinyl Chloride	4000	90	na	6	U	UL	*6*	*6*	770	U	U	*770*	*770*	6	U	U	*6*	*6*	740	U	U	*740*	*740*	6	U	U	*6*	*6*	6	U	U	*6*	*6*
o-Xylene	20000000	1600000	na	6	U	UL	*6*	*6*	770	U	U	*770*	*770*	6	U	U	*6*	*6*	740	U	U	*740*	*740*	6	U	U	*6*	*6*	6	U	U	*6*	*6*
PAHs (ug/kg)																																	
Anthracene	31000000	2300000	na	21	U	U	*21*	*21*	NT					2	U	U	*2*	*2*	NT					2	U	U	*2*	*2*	2	U	U	*2*	*2*
Benzo(a)anthracene	3900	220	na	21	U	U	*21*	*21*	NT					2	U	U	*2*	*2*	NT					2	U	U	*2*	*2*	2	U	U	*2*	*2*
Benzo(a)pyrene	390	22	na	21	U	U	*21*	*21*	NT					2	U	U	*2*	*2*	NT					2	U	U	*2*	*2*	0.66	J	J	*2*	*2*
Benzo(k)fluoranthene	39000	2200	na	21	U	U	*21*	*21*	NT					2	U	U	*2*	*2*	NT					2	U	U	*2*	*2*	2	U	U	*2*	*2*
Chrysene	390000	22000	na	21	U	U	*21*	*21*	NT					2	U	U	*2*	*2*	NT					2	U	U	*2*	*2*	2	U	U	*2*	*2*
Fluoranthene	4100000	310000	na	41	U	U	*41*	*41*	NT					3.9	U	U	*3.9*	*3.9*	NT					3.9	U	U	*3.9*	*3.9*	3.9	U	U	*3.9*	*3.9*
Fluorene	4100000	310000	na	680			*41*	*41*	NT					11			*3.9*	*3.9*	NT					3.9	U	U	*3.9*	*3.9*	3.9	U	U	*3.9*	*3.9*
Indeno(1,2,3-cd)pyrene	3900	220	na	21	U	U	*21*	*21*	NT					2	U	U	*2*	*2*	NT					2	U	U	*2*	*2*	2	U	U	*2*	*2*
Naphthalene	2000000	160000	na	1500		L	*210*	*210*	NT					20	U	UL	*20*	*20*	NT					20	U	UL	*20*	*20*	20	U	UL	*20*	*20*
Phenanthrene	3100000	230000	na	21	U	U	*21*	*21*	NT					2	U	U	*2*	*2*	NT					2.9			*2*	*2*	1.8	J	J	*2*	*2*
Pyrene	3100000	230000	na	21	U	U	*21*	*21*	NT					2	U	U	*2*	*2*	NT					2	U	U	*2*	*2*	2	U	U	*2*	*2*
SVOCs (ug/kg)																																	
2-Methylnaphthalene	410000	31000	na	11000			*2000*	*2000*	NT					390	U	U	*390*	*390*	NT					400	U	U	*400*	*400*	400	U	U	*400*	*400*
Bis(2-ethylhexyl)phthalate	200000	46000	na	410	U	U	*410*	*410*	NT					390	U	U	*390*	*390*	NT					64	J	J	*400*	*400*	400	U	U	*400*	*400*
Di-n-butylphthalate	10000000	780000	na	410	U	UJ	*410*	*410*	NT					390	U	U	*390*	*390*	NT					400	U	U	*400*	*400*	400	U	U	*400*	*400*
Dibenzofuran	na	na	na	410	U	U	*410*	*410*	NT					390	U	U	*390*	*390*	NT					400	U	U	*400*	*400*	400	U	U	*400*	*400*
N-nitrosodiphenylamine	580000	130000	na	410	U	UJ	*410*	*410*	NT					390	U	U	*390*	*390*	NT					400	U	U	*400*	*400*	400	U	U	*400*	*400*
Explosives (mg/kg)																																	
1,3,5-Trinitrobenzene	3100	230	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
1,3-Dinitrobenzene	10	0.78	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
2,4,6-Trinitrotoluene	51	3.9	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
2,4-Dinitrotoluene	200	16	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
2,6-Dinitrotoluene	100	7.8	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
Dinitrotoluene Mix*	4.2	0.94	na																														
2-Amino-4,6-Dinitrotoluene	200	16	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
4-Amino-2,6-Dinitrotoluene	200	16	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
HMX	5100	390	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
Nitrobenzene	51	3.9	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
RDX	26	5.8	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
Tetryl	410	31	na	0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	NT					0.24	U	UL	*0.24*	*0.24*	0.25	U	UL	*0.25*	*0.25*
Metals (mg/kg)																																	
Aluminum	na	na	40041	22700			*0.72*	*0.72*	NT					19900			*0.69*	*0.69*	NT					14800			*0.71*	*0.71*	13000			*0.7*	*0.7*
Antimony	41	3.1	na	0.87	B	J	*0.6*	*0.6*	NT					0.75	B	J	*0.58*	*0.58*	NT					0.85	B	J	*0.59*	*0.59*	0.68	B	J	*0.58*	*0.58*
Arsenic	1.9	0.43	15.8	3.8			*0.72*	*0.72*	NT					3.9			*0.69*	*0.69*	NT					4.2			*0.71*	*0.71*	2.8			*0.7*	*0.7*
Barium	20000	1600	209	53.4		L	*0.12*	*0.12*	NT					54.6		L	*0.12*	*0.12*	NT					63.4		L	*0.12*	*0.12*	82		L	*0.12*	*0.12*
Beryllium	200	16	1.02	**3**		**J**	*0.12*	*0.12*	NT					**1.6**		**J**	*0.12*	*0.12*	NT					**1.1**		**J**	*0.12*	*0.12*	0.84		J	*0.12*	*0.12*
Calcium	na	na	na	771			*2.8*	*2.8*	NT					592			*2.7*	*2.7*	NT					1780			*2.7*	*2.7*	1710			*2.7*	*2.7*
Chromium	310	23	65.3	27.5			*0.12*	*0.12*	NT					35.3			*0.12*	*0.12*	NT					27.3			*0.12*	*0.12*	25.4			*0.12*	*0.12*
Cobalt	na	na	72.3	27.1		L	*0.12*	*0.12*	NT					22.3		L	*0.12*	*0.12*	NT					12.3		L	*0.12*	*0.12*	29		L	*0.12*	*0.12*
Copper	4100	310	53.5	7.6		J	*0.12*	*0.12*	NT					14.5		K	*0.12*	*0.12*	NT					12.6		B	*0.12*	*0.12*	37.5		K	*0.12*	*0.12*
Iron	31000	2300	50962	43000			*2.2*	*2.2*	NT					39000			*2.1*	*2.1*	NT					37700			*2.1*	*2.1*	33700			*2.1*	*2.1*
Lead	800	400	26.8	5.5			*0.24*	*0.24*	NT					6.9			*0.23*	*0.23*	NT					3			*0.24*	*0.24*	4.5			*0.23*	*0.23*
Magnesium	na	na	na	9610			*3.7*	*3.7*	NT					8640			*3.6*	*3.6*	NT					10300			*3.7*	*3.7*	9820			*3.6*	*3.6*
Manganese	2000	160	2543	449			*0.12*	*0.12*	NT					271			*0.12*	*0.12*	NT					532			*0.12*	*0.12*	421			*0.12*	*0.12*
Nickel	2000	160	62.8	48.2		K	*0.12*	*0.12*	NT					54.1		K	*0.12*	*0.12*	NT					42.7		K	*0.12*	*0.12*	45.1		K	*0.12*	*0.12*
Potassium	na	na	na	2900		K	*5.3*	*5.3*	NT					1950		K	*5.1*	*5.1*	NT					1000		K	*5.2*	*5.2*	1360		K	*5.1*	*5.1*
Silver	510	39	na	0.24	U	U	*0.24*	*0.24*	NT					0.23	U	U	*0.23*	*0.23*	NT					0.24	U	U	*0.24*	*0.24*	0.23	U	U	*0.23*	*0.23*
Sodium	na	na	na	188	B	B	*3.6*	*3.6*	NT					122	B	B	*3.5*	*3.5*	NT					113	B	B	*3.6*	*3.6*	116	B	B	*3.5*	*3.5*
Thallium	7.2	0.55	2.11	0.72	U	U	*0.72*	*0.72*	NT					0.69	U	U	*0.69*	*0.69*	NT					0.93	B	J	*0.71*	*0.71*	0.7	U	U	*0.7*	*0.7*
Vanadium	102	7.8	108	21		K	*0.12*	*0.12*	NT					18.8		K	*0.12*	*0.12*	NT					22.3		K	*0.12*	*0.12*	14.3		K	*0.12*	*0.12*
Zinc	31000	2300	202	28.7		K	*0.24*	*0.24*	NT					15.8		K	*0.23*	*0.23*	NT					17.2		K	*0.24*	*0.24*	13.3		K	*0.23*	*0.23*

* 'Dinitrotoluene mix' RBC values were used for comparison where 2,4- and 2,6-DNT were detected in the same sample.

Table 2-5a
Analytes Detected in SWMU 48 Soil - 2002 RFI

Analyte	i-RBC	r-RBC	Background	48SB08A 6/24/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	48SB08B 6/24/02 4-6 Result	Lab Q	Val Q	MDL	MRL	48SB08C 6/24/02 8-10 Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																		
Acetone	92000000	7000000	na	26		B	2.2	4.9	5.6	U	UJ	2.5	5.6	5.4	U	UJ	2.4	5.4
Toluene	8200000	630000	na	0.84	J	B	0.32	4.9	5.6	U		0.36	5.6	5.4	U		0.35	5.4
PAHs (ug/kg)																		
2-Methylnaphthalene	410000	31000	na	2.5		B	0.63	1.9	1.2	J	B	0.71	2.1	0.89	J	B	0.69	2.1
Anthracene	31000000	2300000	na	1.9	U		0.2	1.9	2.1	U		0.23	2.1	2.1	U		0.23	2.1
Benzo(a)anthracene	3900	220	na	4.4			0.25	1.9	2.1	U		0.28	2.1	2.1	U		0.27	2.1
Benzo(a)pyrene	390	22	na	3.6			0.21	1.9	2.1	U		0.24	2.1	2.1	U		0.23	2.1
Benzo(b)fluoranthene	3900	220	na	7.9			0.35	1.9	2.1	U		0.4	2.1	2.1	U		0.39	2.1
Benzo(g,h,i)perylene	3100000	230000	na	2.4			0.66	1.9	2.1	U		0.74	2.1	2.1	U		0.72	2.1
Benzo(k)fluoranthene	39000	2200	na	2			0.33	1.9	2.1	U		0.37	2.1	2.1	U		0.36	2.1
Chrysene	390000	22000	na	4.7			0.3	1.9	2.1	U		0.34	2.1	2.1	U		0.33	2.1
Dibenz(a,h)Anthracene	390	22	na	1.9	U		0.64	1.9	2.1	U		0.72	2.1	2.1	U		0.7	2.1
Fluoranthene	4100000	310000	na	9.8			0.32	1.9	2.1	U		0.36	2.1	2.1	U		0.35	2.1
Fluorene	4100000	310000	na	1.9	U		0.5	1.9	2.1	U		0.56	2.1	2.1	U		0.55	2.1
Indeno(1,2,3-cd)pyrene	3900	220	na	2.9			0.6	1.9	2.1	U		0.68	2.1	2.1	U		0.66	2.1
Naphthalene	2000000	160000	na	1.8	JB	B	0.72	1.9	1.5	JB	B	0.82	2.1	1.5	JB	B	0.79	2.1
Phenanthrene	3100000	230000	na	7.6			0.29	1.9	2.1	U		0.32	2.1	2.1	U		0.31	2.1
Pyrene	3100000	230000	na	9.5			0.42	1.9	2.1	U		0.48	2.1	2.1	U		0.46	2.1
SVOCs (ug/kg)																		
Bis(2-ethylhexyl)phthalate	200000	46000	na	190	U		12	190	210	U		14	210	210	U		14	210
Fluoranthene	4100000	310000	na	11	J	J	6.1	190	210	U		6.9	210	210	U		6.7	210
Phenanthrene	3100000	230000	na	10	J	J	5.8	190	210	U		6.5	210	210	U		6.4	210
Pyrene	3100000	230000	na	7.9	J	J	5.7	190	210	U		6.4	210	210	U		6.2	210
Pesticides (ug/kg)																		
4,4'-DDD	12000	2700	na	0.389	J	J	0.155	0.733	NT					NT				
4,4'-DDE	8400	1900	na	0.462	BJ	B	0.154	0.733	NT					NT				
4,4'-DDT	8400	1900	na	0.733	U		0.259	0.733	NT					NT				
Endosulfan II	610000	47000	na	0.733	U		0.262	0.733	NT					NT				
Endrin aldehyde	na	na	na	0.733	U		0.37	0.733	NT					NT				
Methoxychlor	510000	39000	na	0.567	J	J	0.559	0.733	NT					NT				
PCBs (mg/kg)																		
PCB-1254	1.4	0.16	na	0.0366	U	UJ	0.0108	0.0366	0.0415	U	UJ	0.0122	0.0415	0.0403	U	UJ	0.0119	0.0403
Explosives (mg/kg)																		
Nitroglycerine	1700	130	na	0.12	J	J	0.11	0.33	0.374	U		0.124	0.374	0.363	U		0.121	0.363
Herbicides (ug/kg)	**None detected**																	
Metals (mg/kg)																		
Aluminum	na	na	40041	12600			6.1	22	32900			6.9	24.9	22500			6.7	24.2
Antimony	41	3.1	na	0.549	U	UL	0.19	0.549	0.36	B	B	0.21	0.623	0.605	U	UL	0.2	0.605
Arsenic	1.9	0.43	15.8	1.46		L	0.38	0.549	0.6	B	L	0.44	0.623	0.846		L	0.42	0.605
Barium	20000	1600	209	102			0.37	2.2	56.3			0.42	2.49	29.4			0.4	2.42
Beryllium	200	16	1.02	0.73			0.0379	0.549	0.765			0.043	0.623	0.701			0.0418	0.605
Calcium	na	na	na	415		J	3.1	11	141		J	3.5	12.5	81.7		J	3.4	12.1
Chromium	310	23	65.3	27.5			0.41	1.1	36.1			0.47	1.25	27.2			0.45	1.21
Cobalt	na	na	72.3	10.3		J	0.89	5.49	6.1	B	J	1	6.23	4.6	B	J	0.98	6.05
Copper	4100	310	53.5	5.39			0.68	2.2	15.9			0.77	2.49	8.03			0.75	2.42
Iron	31000	2300	50962	15500		J	3.7	5.49	41600		J	4.2	6.23	27500		J	4.1	6.05
Lead	800	400	26.8	18.7			0.033	0.33	13.6			0.038	0.374	4.89			0.037	0.363
Magnesium	na	na	na	587		J	2.6	11	1100		J	2.9	12.5	832		J	2.9	12.1
Manganese	2000	160	2543	998		J	0.061	1.1	129		J	0.07	1.25	122		J	0.068	1.21
Mercury	31	2.3	0.13	0.03	B	J	0.0218	0.0549	0.0674			0.0247	0.0623	0.033	B	J	0.024	0.0605
Nickel	2000	160	62.8	7.16		J	1	4.4	12.3		J	1.1	4.98	7.85		J	1.1	4.84
Potassium	na	na	na	673			37	330	1340			42	374	1490			40	363
Silver	510	39	na	1.1	U		0.54	1.1	0.71	B	B	0.61	1.25	1.21	U		0.6	1.21
Sodium	na	na	na	22.1		B	4.1	22	21	B	B	4.7	24.9	14	B	B	4.5	24.2
Thallium	7.2	0.55	2.11	0.14	B	J	0.033	0.33	0.17	B	J	0.038	0.374	0.097	B	J	0.036	0.363
Vanadium	102	7.8	108	32.6		J	0.64	5.49	73.3		J	0.72	6.23	23.8		J	0.7	6.05
Zinc	31000	2300	202	23.8		J	0.39	2.2	42.9		J	0.45	2.49	29		J	0.43	2.42
Dioxins/Furans (ng/kg)																		
2,3,7,8-TCDF	na	na	na	0.239			0.105	0.19	0.032	U		0.032	0.19	0.036	U		0.036	0.19
2,3,7,8-TCDD	19	4.3	na	0.136	X	J	0.067	0.13	0.047	U		0.047	0.13	0.054	U		0.054	0.13
1,2,3,7,8-PECDD	na	na	na	0.614			0.086	0.19	0.055	U		0.055	0.19	0.064	U		0.064	0.19
1,2,3,4,7,8-HXCDD	na	na	na	2.33			0.095	0.53	0.084	U		0.084	0.53	0.081	U		0.081	0.53
1,2,3,6,7,8-HXCDD	na	na	na	4.764			0.077	0.57	0.068	U		0.068	0.57	0.065	U		0.065	0.57
1,2,3,7,8,9-HXCDD	460	100	na	4.651			0.082	0.68	0.069	U		0.069	0.68	0.067	U		0.067	0.68
1,2,3,4,6,7,8-HPCDD	na	na	na	132			0.173	0.63	2.364			0.073	0.63	1.706			0.098	0.63
OCDD	na	na	na	1527	B		0.091	6.86	286.1	B		0.061	6.86	649.2	B		0.063	6.86
1,2,3,7,8-PECDF	na	na	na	0.248			0.058	0.28	0.04	U		0.04	0.28	0.048	U		0.048	0.28
2,3,4,7,8-PECDF	na	na	na	0.192			0.062	0.56	0.044	U		0.044	0.56	0.053	U		0.053	0.56
1,2,3,4,7,8-HXCDF	na	na	na	0.976			0.058	0.34	0.051	U		0.051	0.34	0.052	U		0.052	0.34
1,2,3,6,7,8-HXCDF	na	na	na	4.151	I	J	0.055	0.49	0.05	U		0.05	0.49	0.051	U		0.051	0.49
2,3,4,6,7,8-HXCDF	na	na	na	0.452			0.07	0.47	0.062	U		0.062	0.47	0.064	U		0.064	0.47
1,2,3,7,8,9-HXCDF	na	na	na	0.078	U		0.078	0.25	0.067	U		0.067	0.25	0.068	U		0.068	0.25
1,2,3,4,6,7,8-HPCDF	na	na	na	21.56			0.098	0.33	0.281			0.031	0.33	0.045	U		0.045	0.33
1,2,3,4,7,8,9-HPCDF	na	na	na	1.254			0.141	0.5	0.042	U		0.042	0.5	0.061	U		0.061	0.5
OCDF	na	na	na	67.39	B		0.078	0.79	0.938	B	B	0.049	0.79	0.333	B	B	0.048	0.79
TOTAL TCDD	na	na	na	0.52			0.067		0.047	U		0.047		0.054	U		0.054	
TOTAL PECDD	na	na	na	0.614			0.086		0.055	U		0.055		0.064	U		0.064	
TOTAL HXCDD	na	na	na	35.61			0.077		0.068	U		0.068		0.065	U		0.065	
TOTAL HPCDD	na	na	na	225.9			0.173		4.582			0.073		3.357			0.098	
TOTAL TCDF	na	na	na	0.664			0.039		0.032	U		0.032		0.036	U		0.036	
TOTAL PECDF	na	na	na	3.237			0.058		0.04	U		0.04		0.048	U		0.048	
TOTAL HXCDF	na	na	na	24.39			0.055		0.05	U		0.05		0.051	U		0.051	
TOTAL HPCDF	na	na	na	62.46			0.098		0.751			0.031		0.045	U		0.045	
TCDD TE	19	4.3	na	4.330					0.2299					0.2784				

Analyte	48SB09A 6/24/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	48SB09B 6/24/02 4-6 Result	Lab Q	Val Q	MDL	MRL	48SB09C 6/24/02 8-10 Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)															
Acetone	NT					NT					NT				
Toluene	NT					NT					NT				
PAHs (ug/kg)															
2-Methylnaphthalene	NT					NT					NT				
Anthracene	NT					NT					NT				
Benzo(a)anthracene	NT					NT					NT				
Benzo(a)pyrene	NT					NT					NT				
Benzo(b)fluoranthene	NT					NT					NT				
Benzo(g,h,i)perylene	NT					NT					NT				
Benzo(k)fluoranthene	NT					NT					NT				
Chrysene	NT					NT					NT				
Dibenz(a,h)Anthracene	NT					NT					NT				
Fluoranthene	NT					NT					NT				
Fluorene	NT					NT					NT				
Indeno(1,2,3-cd)pyrene	NT					NT					NT				
Naphthalene	NT					NT					NT				
Phenanthrene	NT					NT					NT				
Pyrene	NT					NT					NT				
SVOCs (ug/kg)															
Bis(2-ethylhexyl)phthalate	NT					NT					NT				
Fluoranthene	NT					NT					NT				
Phenanthrene	NT					NT					NT				
Pyrene	NT					NT					NT				
Pesticides (ug/kg)															
4,4'-DDD	NT					NT					NT				
4,4'-DDE	NT					NT					NT				
4,4'-DDT	NT					NT					NT				
Endosulfan II	NT					NT					NT				
Endrin aldehyde	NT					NT					NT				
Methoxychlor	NT					NT					NT				
PCBs (mg/kg)															
PCB-1254	NT					NT					NT				
Explosives (mg/kg)															
Nitroglycerine	0.324	U		0.108	0.324	0.382	U		0.127	0.382	0.389	U		0.129	0.389
Herbicides (ug/kg)															
Metals (mg/kg)															
Aluminum	NT					NT					NT				
Antimony	NT					NT					NT				
Arsenic	NT					NT					NT				
Barium	NT					NT					NT				
Beryllium	NT					NT					NT				
Calcium	NT					NT					NT				
Chromium	NT					NT					NT				
Cobalt	NT					NT					NT				
Copper	NT					NT					NT				
Iron	NT					NT					NT				
Lead	NT					NT					NT				
Magnesium	NT					NT					NT				
Manganese	NT					NT					NT				
Mercury	NT					NT					NT				
Nickel	NT					NT					NT				
Potassium	NT					NT					NT				
Silver	NT					NT					NT				
Sodium	NT					NT					NT				
Thallium	NT					NT					NT				
Vanadium	NT					NT					NT				
Zinc	NT					NT					NT				
Dioxins/Furans (ng/kg)															
2,3,7,8-TCDF	0.034	U		0.034	0.19	0.033	U		0.033	0.19	0.028	U		0.028	0.19
2,3,7,8-TCDD	0.036	U		0.036	0.13	0.049	U		0.049	0.13	0.052	U		0.052	0.13
1,2,3,7,8-PECDD	0.096	U		0.096	0.19	0.073	U		0.073	0.19	0.057	U		0.057	0.19
1,2,3,4,7,8-HXCDD	0.36	X	J	0.079	0.53	0.071	U		0.071	0.53	0.061	U		0.061	0.53
1,2,3,6,7,8-HXCDD	0.544			0.063	0.57	0.057	U		0.057	0.57	0.049	U		0.049	0.57
1,2,3,7,8,9-HXCDD	0.701			0.065	0.68	0.284			0.059	0.68	0.051	U		0.051	0.68
1,2,3,4,6,7,8-HPCDD	21.48			0.091	0.63	7.573			0.09	0.63	1.448			0.052	0.63
OCDD	1155	B		0.046	6.86	1944	B		0.039	6.86	302.8	B		0.05	6.86
1,2,3,7,8-PECDF	0.039	U		0.039	0.28	0.047	U		0.047	0.28	0.036	U		0.036	0.28
2,3,4,7,8-PECDF	0.043	U		0.043	0.56	0.051	U		0.051	0.56	0.039	U		0.039	0.56
1,2,3,4,7,8-HXCDF	0.211			0.049	0.34	0.045	U		0.045	0.34	0.035	U		0.035	0.34
1,2,3,6,7,8-HXCDF	0.428	I	J	0.048	0.49	0.044	U		0.044	0.49	0.034	U		0.034	0.49
2,3,4,6,7,8-HXCDF	0.06	U		0.06	0.47	0.055	U		0.055	0.47	0.043	U		0.043	0.47
1,2,3,7,8,9-HXCDF	0.065	U		0.065	0.25	0.059	U		0.059	0.25	0.046	U		0.046	0.25
1,2,3,4,6,7,8-HPCDF	2.581			0.04	0.33	0.38			0.035	0.33	0.083	X	J	0.031	0.33
1,2,3,4,7,8,9-HPCDF	0.054	U		0.054	0.5	0.048	U		0.048	0.5	0.042	U		0.042	0.5
OCDF	6.751	B		0.064	0.79	0.915	B	B	0.036	0.79	0.279	B	B	0.038	0.79
TOTAL TCDD	0.036	U		0.036		0.049	U		0.049		0.052	U		0.052	
TOTAL PECDD	0.096	U		0.096		0.073	U		0.073		0.057	U		0.057	
TOTAL HXCDD	1.244			0.063		1.346			0.057		0.049	U		0.049	
TOTAL HPCDD	43.53			0.091		15.46			0.09		3.203			0.052	
TOTAL TCDF	0.034	U		0.034		0.033	U		0.033		0.028	U		0.028	
TOTAL PECDF	0.172			0.039		0.047	U		0.047		0.036	U		0.036	
TOTAL HXCDF	2.199			0.048		0.044	U		0.044		0.034	U		0.034	
TOTAL HPCDF	6.227			0.04		0.843			0.035		0.031	U		0.031	
TCDD TE	0.7531					0.4892					0.2110				

Analyte	48SB10A 6/24/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	48SB10B 6/24/02 4-6 Result	Lab Q	Val Q	MDL	MRL	48SB10C 6/24/02 8-10 Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)															
Acetone	4.8	U	UJ	2.1	4.8	5.4	U	UJ	2.4	5.4	5.6	U	UJ	2.5	5.6
Toluene	4.8	U		0.31	4.8	5.4	U		0.35	5.4	5.6	U		0.36	5.6
PAHs (ug/kg)															
2-Methylnaphthalene	9.6			0.61	1.8	2	U		0.69	2	0.95	J	B	0.71	2.1
Anthracene	0.71	J	J	0.2	1.8	2	U		0.22	2	2.1	U		0.23	2.1
Benzo(a)anthracene	2.9			0.24	1.8	2	U		0.27	2	2.1	U		0.28	2.1
Benzo(a)pyrene	2.4			0.2	1.8	2	U		0.23	2	2.1	U		0.24	2.1
Benzo(b)fluoranthene	4.7			0.34	1.8	2	U		0.39	2	2.1	U		0.4	2.1
Benzo(g,h,i)perylene	1.4	J	J	0.63	1.8	2	U		0.72	2	2.1	U		0.74	2.1
Benzo(k)fluoranthene	1.5	J	J	0.31	1.8	2	U		0.36	2	2.1	U		0.37	2.1
Chrysene	4.6			0.29	1.8	2	U		0.33	2	2.1	U		0.34	2.1
Dibenz(a,h)Anthracene	0.74	J	J	0.61	1.8	2	U		0.69	2	2.1	U		0.72	2.1
Fluoranthene	6.3			0.31	1.8	2	U		0.35	2	2.1	U		0.36	2.1
Fluorene	1.1	J	J	0.48	1.8	2	U		0.54	2	2.1	U		0.56	2.1
Indeno(1,2,3-cd)pyrene	1.6	J	J	0.58	1.8	2	U		0.65	2	2.1	U		0.68	2.1
Naphthalene	6.7	B		0.7	1.8	1.2	JB	B	0.79	2	1.6	JB	B	0.82	2.1
Phenanthrene	18			0.28	1.8	2	U		0.31	2	2.1	U		0.32	2.1
Pyrene	8.2			0.41	1.8	2	U		0.46	2	2.1	U		0.48	2.1
SVOCs (ug/kg)															
Bis(2-ethylhexyl)phthalate	130	J	B	12	180	200	U		14	200	210	U		14	210
Fluoranthene	7.9	J	J	5.9	180	200	U		6.6	200	210	U		6.9	210
Phenanthrene	13	J	J	5.6	180	200	U		6.3	200	210	U		6.5	210
Pyrene	8.1	J	J	5.5	180	200	U		6.2	200	210	U		6.4	210
Pesticides (ug/kg)															
4,4'-DDD	0.347	J	J	0.15	0.708	NT					NT				
4,4'-DDE	0.525	BJ	B	0.149	0.708	NT					NT				
4,4'-DDT	2.31			0.251	0.708	NT					NT				
Endosulfan II	0.418	J	J	0.253	0.708	NT					NT				
Endrin aldehyde	0.55	J	J	0.358	0.708	NT					NT				
Methoxychlor	0.708	U		0.54	0.708	NT					NT				
PCBs (mg/kg)															
PCB-1254	0.0769		J	0.0104	0.0354	0.04	U	UJ	0.0118	0.04	0.0415	U	UJ	0.0122	0.0415
Explosives (mg/kg)															
Nitroglycerine	0.15	J	J	0.106	0.318	0.36	U		0.12	0.36	0.374	U		0.124	0.374
Herbicides (ug/kg)															
Metals (mg/kg)															
Aluminum	10900			5.9	21.2	24200			6.6	24	24100			6.9	24.9
Antimony	0.531	U	UL	0.18	0.531	0.6	U	UL	0.2	0.6	0.623	U	UL	0.21	0.623
Arsenic	2.62		L	0.37	0.531	0.6	U	UL	0.42	0.6	0.623	U	UL	0.44	0.623
Barium	73.3			0.36	2.12	164			0.4	2.4	63.4			0.42	2.49
Beryllium	0.44	B	J	0.0366	0.531	0.745			0.0414	0.6	1			0.043	0.623
Calcium	15900		J	3	10.6	26.8		B	3.4	12	16.8		B	3.5	12.5
Chromium	30.7			0.4	1.06	17.6			0.45	1.2	27.6			0.47	1.25
Cobalt	5.98		J	0.86	5.31	58.2		J	0.97	6	18.6		J	1	6.23
Copper	6.59			0.66	2.12	13.7			0.74	2.4	15.7			0.77	2.49
Iron	12100		J	3.6	5.31	**81800**		**J**	4	6	**61400**		**J**	4.2	6.23
Lead	17			0.032	0.318	19.9			0.036	0.36	10.5			0.038	0.374
Magnesium	1640		J	2.5	10.6	1040		J	2.8	12	1480		J	2.9	12.5
Manganese	248		J	0.059	1.06	2070		J	0.067	1.2	508		J	0.07	1.25
Mercury	0.037	B	J	0.021	0.0531	0.047	B	J	0.0238	0.06	0.0623	U		0.0247	0.0623
Nickel	5.54		J	0.97	4.25	11.3		J	1.1	4.8	13		J	1.1	4.98
Potassium	642			36	318	1280			40	360	1720			42	374
Silver	1.06	U		0.52	1.06	1.2	B	B	0.59	1.2	0.87	B	B	0.61	1.25
Sodium	19	B	B	4	21.2	19	B	B	4.5	24	16	B	B	4.7	24.9
Thallium	0.14	B	J	0.032	0.318	0.27	B	J	0.036	0.36	0.21	B	J	0.038	0.374
Vanadium	30.8		J	0.61	5.31	55.9		J	0.69	6	63.7		J	0.72	6.23
Zinc	24.4		J	0.38	2.12	42.2		J	0.43	2.4	53.9		J	0.45	2.49
Dioxins/Furans (ng/kg)															
2,3,7,8-TCDF	70	U				0.04	U		0.04	0.19	0.028	U		0.028	0.19
2,3,7,8-TCDD	0.366	X	J	0.043	0.13	0.078	U		0.078	0.13	0.05	U		0.05	0.13
1,2,3,7,8-PECDD	0.869			0.081	0.19	0.103	U		0.103	0.19	0.057	U		0.057	0.19
1,2,3,4,7,8-HXCDD	2.622			0.09	0.53	0.11	U		0.11	0.53	0.067	U		0.067	0.53
1,2,3,6,7,8-HXCDD	6.14			0.073	0.57	0.089	U		0.089	0.57	0.054	U		0.054	0.57
1,2,3,7,8,9-HXCDD	5.901			0.076	0.68	0.091	U		0.091	0.68	0.055	U		0.055	0.68
1,2,3,4,6,7,8-HPCDD	159			0.111	0.63	2.766			0.115	0.63	7.592			0.08	0.63
OCDD	3244	B		0.057	6.86	422.5	B		0.098	6.86	1408	B		0.039	6.86
1,2,3,7,8-PECDF	0.045	U		0.045	0.28	0.06	U		0.06	0.28	0.038	U		0.038	0.28
2,3,4,7,8-PECDF	0.102			0.049	0.56	0.066	U		0.066	0.56	0.042	U		0.042	0.56
1,2,3,4,7,8-HXCDF	1.088			0.06	0.34	0.058	U		0.058	0.34	0.04	U		0.04	0.34
1,2,3,6,7,8-HXCDF	3.495	I	J	0.058	0.49	0.057	U		0.057	0.49	0.038	U		0.038	0.49
2,3,4,6,7,8-HXCDF	0.394	X	J	0.073	0.47	0.071	U		0.071	0.47	0.048	U		0.048	0.47
1,2,3,7,8,9-HXCDF	0.078	U		0.078	0.25	0.076	U		0.076	0.25	0.052	U		0.052	0.25
1,2,3,4,6,7,8-HPCDF	27.16			0.089	0.33	0.066	U		0.066	0.33	0.125	X	J	0.029	0.33
1,2,3,4,7,8,9-HPCDF	1.09			0.121	0.5	0.09	U		0.09	0.5	0.04	U		0.04	0.5
OCDF	86.22	B		0.052	0.79	0.252	B	B	0.074	0.79	0.238	B	B	0.029	0.79
TOTAL TCDD	0.648			0.043		0.078	U		0.078		0.05	U		0.05	
TOTAL PECDD	0.869			0.081		0.103	U		0.103		0.057	U		0.057	
TOTAL HXCDD	38.29			0.073		0.089	U		0.089		0.054	U		0.054	
TOTAL HPCDD	269.4			0.111		6.227			0.115		14.09			0.08	
TOTAL TCDF	0.674			0.038		0.04	U		0.04		0.028	U		0.028	
TOTAL PECDF	5.03			0.045		0.06	U		0.06		0.038	U		0.038	
TOTAL HXCDF	22.85			0.058		0.057	U		0.057		0.038	U		0.038	
TOTAL HPCDF	79.41			0.089		0.066	U		0.066		0.029	U		0.029	
TCDD TE	12.47					0.3477					0.3865				

Table 2-5b
Analytes Detected in SWMU 49 Soil - 2002 RFI

Analyte			Sample ID	49SS01					49SB02A					49SB02B					49SB02C					49SB02D				
			Sample Date	6/24/02					6/24/02					6/24/02					6/24/02					6/24/02				
			Sample Depth	0-0.5					0-0.5					4-6					8-10					17-19				
	i-RBC	**r-RBC**	**Background**	**Result**	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																												
Acetone	92000000	7000000	na	100		B	*2.5*	*5.5*	5.2	U	UJ	*2.3*	*5.2*	NT					NT					NT				
PAHs (ug/kg)																												
2-Methylnaphthalene	410000	31000	na	5.1		B	*0.63*	*1.9*	3		B	*0.67*	*2*	2	U		*0.68*	*2*	12000			*0.73*	*2.2*	11000			*0.69*	*2*
Acenaphthene	6100000	470000	na	1.9	U		*1*	*1.9*	2	U		*1.1*	*2*	15		B	*1.1*	*2*	1100			*1.2*	*2.2*	720			*1.1*	*2*
Acenaphthylene	3100000	230000	na	1.9	U		*0.25*	*1.9*	2	U		*0.26*	*2*	7.1			*0.27*	*2*	290			*0.29*	*2.2*	210			*0.27*	*2*
Anthracene	31000000	2300000	na	1	J	J	*0.21*	*1.9*	2	U		*0.22*	*2*	3.4			*0.22*	*2*	480			*0.24*	*2.2*	130			*0.22*	*2*
Benzo(a)anthracene	3900	220	na	6.1			*0.25*	*1.9*	2	U		*0.26*	*2*	1.5	J	J	*0.27*	*2*	34			*0.29*	*2.2*	2	U		*0.27*	*2*
Benzo(a)pyrene	390	22	na	4.9			*0.21*	*1.9*	2	U		*0.22*	*2*	1.3	J	J	*0.23*	*2*	2.2	U		*0.24*	*2.2*	2	U		*0.23*	*2*
Benzo(b)fluoranthene	3900	220	na	9.9			*0.36*	*1.9*	2	U		*0.38*	*2*	1.8	J	J	*0.39*	*2*	21			*0.41*	*2.2*	2	U		*0.39*	*2*
Benzo(g,h,i)perylene	3100000	230000	na	2.9			*0.66*	*1.9*	2	U		*0.7*	*2*	1.3	J	J	*0.71*	*2*	2.2	U		*0.76*	*2.2*	2	U		*0.72*	*2*
Benzo(k)fluoranthene	39000	2200	na	4.2			*0.33*	*1.9*	2	U		*0.34*	*2*	0.96	J	J	*0.35*	*2*	2.2	U		*0.38*	*2.2*	2	U		*0.35*	*2*
Chrysene	390000	22000	na	6.6			*0.3*	*1.9*	1.1	J	J	*0.32*	*2*	6.6			*0.32*	*2*	68			*0.35*	*2.2*	2	U		*0.32*	*2*
Dibenz(a,h)Anthracene	390	22	na	2.3			*0.64*	*1.9*	2	U		*0.67*	*2*	2	U		*0.69*	*2*	2.2	U		*0.74*	*2.2*	2	U		*0.69*	*2*
Fluoranthene	4100000	310000	na	14			*0.32*	*1.9*	1.3	J	J	*0.34*	*2*	16			*0.35*	*2*	120			*0.37*	*2.2*	35			*0.35*	*2*
Fluorene	4100000	310000	na	1.5	J	J	*0.5*	*1.9*	2	U		*0.53*	*2*	2	U		*0.54*	*2*	1400		J	*0.57*	*2.2*	1200			*0.54*	*2*
Indeno(1,2,3-cd)pyrene	3900	220	na	3.4			*0.6*	*1.9*	2	U		*0.63*	*2*	2	U		*0.65*	*2*	2.2	U		*0.69*	*2.2*	2	U		*0.65*	*2*
Naphthalene	2000000	160000	na	3.8	B	B	*0.73*	*1.9*	2.6	B	B	*0.76*	*2*	1.7	JB	B	*0.78*	*2*	2100	B		*0.84*	*2.2*	1800	B		*0.79*	*2*
Phenanthrene	3100000	230000	na	14			*0.29*	*1.9*	2.6			*0.3*	*2*	14			*0.31*	*2*	4900			*0.33*	*2.2*	2400			*0.31*	*2*
Pyrene	3100000	230000	na	1.9	U		*0.42*	*1.9*	1.1	J	J	*0.45*	*2*	32			*0.46*	*2*	360			*0.49*	*2.2*	150			*0.46*	*2*
SVOCs (ug/kg)																												
Benzoic acid	410000000	31000000	na	210	J	B	*130*	*920*	970	U		*130*	*970*	NT					NT					NT				
Fluoranthene	4100000	310000	na	13	J	J	*6.1*	*190*	200	U		*6.4*	*200*	NT					NT					NT				
Phenanthrene	3100000	230000	na	13	J	J	*5.8*	*190*	200	U		*6.1*	*200*	NT					NT					NT				
Pyrene	3100000	230000	na	10	J	J	*5.7*	*190*	200	U		*6*	*200*	NT					NT					NT				
Pesticides (ug/kg)																												
4,4'-DDD	12000	2700	na	1.01			*0.156*	*0.738*	0.776	U		*0.164*	*0.776*	NT					NT					NT				
4,4'-DDE	8400	1900	na	0.344	BJ	B	*0.155*	*0.738*	0.776	U		*0.163*	*0.776*	NT					NT					NT				
delta-BHC	na	na	na	0.738	U		*0.128*	*0.738*	0.687	BJ	B	*0.135*	*0.776*	NT					NT					NT				
Dieldrin	180	40	na	0.738	U		*0.454*	*0.738*	9.45		K	*0.477*	*0.776*	NT					NT					NT				
Endosulfan II	610000	47000	na	0.738	U		*0.263*	*0.738*	7.22			*0.277*	*0.776*	NT					NT					NT				
Endosulfan sulfate	na	na	na	0.738	U		*0.232*	*0.738*	6.64			*0.244*	*0.776*	NT					NT					NT				
Endrin aldehyde	na	na	na	0.723	J	J	*0.373*	*0.738*	0.776	U		*0.392*	*0.776*	NT					NT					NT				
Endrin	31000	2300	na	0.757			*0.177*	*0.738*	0.776	U		*0.186*	*0.776*	NT					NT					NT				
PCBs (mg/kg)																												
PCB-1232	1.4	0.32	na	0.0368	U	UJ	*0.0205*	*0.0368*	0.0388	U	UJ	*0.0215*	*0.0388*	9.23		J	*0.221*	*0.398*	0.708		J	*0.0236*	*0.0424*	0.0399	U	UJ	*0.0222*	*0.0399*
Explosives (mg/kg)	**None detected**																											
Herbicides (ug/kg)	**None detected**																											
Metals (mg/kg)																												
Aluminum	na	na	40041	10200			*6.1*	*22.1*	28900			*6.4*	*23.3*	28200			*6.6*	*23.9*	33700			*7*	*25.5*	22100			*6.6*	*24*
Arsenic	1.9	0.43	15.8	0.52	B	L	*0.39*	*0.553*	0.771		L	*0.41*	*0.582*	0.597	U	UL	*0.42*	*0.597*	0.51	B	L	*0.45*	*0.637*	0.599	U	UL	*0.42*	*0.599*
Barium	20000	1600	209	92.1			*0.37*	*2.21*	53			*0.39*	*2.33*	54.5			*0.4*	*2.39*	56.8			*0.43*	*2.55*	33.2			*0.4*	*2.4*
Beryllium	200	16	1.02	0.54	B	J	*0.0382*	*0.553*	0.663			*0.0402*	*0.582*	0.679			*0.0412*	*0.597*	0.697			*0.0439*	*0.637*	**1.28**			*0.0413*	*0.599*
Calcium	na	na	na	321		J	*3.1*	*11.1*	474		J	*3.3*	*11.6*	133		J	*3.3*	*11.9*	258		J	*3.6*	*12.7*	223		J	*3.3*	*12*
Chromium	310	23	65.3	13.6			*0.41*	*1.11*	24.9			*0.44*	*1.16*	25.8			*0.45*	*1.19*	23.1			*0.48*	*1.27*	16.7			*0.45*	*1.2*
Cobalt	na	na	72.3	5.75		J	*0.9*	*5.53*	5.6	B	J	*0.94*	*5.82*	5.3	B	J	*0.97*	*5.97*	6.3	B	J	*1*	*6.37*	19.1		J	*0.97*	*5.99*
Copper	4100	310	53.5	5.49			*0.68*	*2.21*	13.9			*0.72*	*2.33*	13.7			*0.74*	*2.39*	15.3			*0.79*	*2.55*	3.85			*0.74*	*2.4*
Iron	31000	2300	50962	9060		J	*3.7*	*5.53*	32600		J	*3.9*	*5.82*	31300		J	*4*	*5.97*	34500		J	*4.3*	*6.37*	23200		J	*4*	*5.99*
Lead	800	400	26.8	18.4			*0.033*	*0.332*	15.4			*0.035*	*0.349*	14.8			*0.036*	*0.358*	**34.1**			*0.039*	*0.382*	4.8			*0.036*	*0.359*
Magnesium	na	na	na	512		J	*2.6*	*11.1*	1080		J	*2.8*	*11.6*	962		J	*2.8*	*11.9*	1120		J	*3*	*12.7*	1430		J	*2.8*	*12*
Manganese	2000	160	2543	570		J	*0.062*	*1.11*	130		J	*0.065*	*1.16*	131		J	*0.067*	*1.19*	107		J	*0.071*	*1.27*	286		J	*0.067*	*1.2*
Mercury	31	2.3	0.13	0.048	B	J	*0.0219*	*0.0553*	0.0665			*0.0231*	*0.0582*	0.053	B	J	*0.0237*	*0.0597*	0.071			*0.0252*	*0.0637*	0.0599	U		*0.0237*	*0.0599*
Nickel	2000	160	62.8	5.33		J	*1*	*4.42*	10.7		J	*1.1*	*4.66*	9.9		J	*1.1*	*4.78*	12		J	*1.2*	*5.1*	14.9		J	*1.1*	*4.79*
Potassium	na	na	na	508			*37*	*332*	1120			*39*	*349*	1040			*40*	*358*	1420			*43*	*382*	3850			*40*	*359*
Silver	510	39	na	1.11	U		*0.54*	*1.11*	0.59	B	B	*0.57*	*1.16*	1.19	U		*0.59*	*1.19*	1.27	U		*0.63*	*1.27*	1.2	U		*0.59*	*1.2*
Sodium	na	na	na	17	B	B	*4.1*	*22.1*	18	B	B	*4.3*	*23.3*	16	B	B	*4.5*	*23.9*	42.1		J	*4.8*	*25.5*	20	B	B	*4.5*	*24*
Thallium	7.2	0.55	2.11	0.1	B	J	*0.033*	*0.332*	0.13	B	J	*0.035*	*0.349*	0.092	B	J	*0.036*	*0.358*	0.14	B	J	*0.038*	*0.382*	0.067	B	J	*0.036*	*0.359*
Vanadium	102	7.8	108	20.3		J	*0.64*	*5.53*	63.9		J	*0.67*	*5.82*	60.3		J	*0.69*	*5.97*	69.8		J	*0.74*	*6.37*	13.9		J	*0.69*	*5.99*
Zinc	31000	2300	202	23.3		J	*0.4*	*2.21*	39.7		J	*0.42*	*2.33*	37.2		J	*0.43*	*2.39*	50.1		J	*0.46*	*2.55*	25		J	*0.43*	*2.4*
Dioxins/Furans (ng/kg)																												
1,2,3,4,7,8-HXCDD	na	na	na	0.717		J	*0.135*	*0.53*	0.299		J	*0.047*	*0.53*	0.099	U	UJ	*0.099*	*0.53*	3.593	U		*3.593*	*0.53*	2.538	U		*2.538*	*0.53*
1,2,3,6,7,8-HXCDD	na	na	na	1.222			*0.109*	*0.57*	0.727			*0.038*	*0.57*	0.08	U		*0.08*	*0.57*	2.814	U		*2.814*	*0.57*	1.988	U		*1.988*	*0.57*
1,2,3,7,8,9-HXCDD	460	100	na	1.408			*0.112*	*0.68*	0.776			*0.039*	*0.68*	0.082	U		*0.082*	*0.68*	2.726	U		*2.726*	*0.68*	1.926	U		*1.926*	*0.68*
1,2,3,4,6,7,8-HPCDD	na	na	na	28.16			*0.143*	*0.63*	30.02			*0.065*	*0.63*	6.561			*0.159*	*0.63*	69.66		J	*6.279*	*0.63*	12.37			*2.363*	*0.63*
OCDD	na	na	na	1027	B		*0.109*	*6.86*	4030	B		*0.086*	*6.86*	1630	B		*0.287*	*6.86*	14930		J	*7.206*	*6.86*	188.3	B		*3.747*	*6.86*
1,2,3,7,8-PECDF	na	na	na	0.085	U		*0.085*	*0.28*	0.029	U		*0.029*	*0.28*	0.06	U		*0.06*	*0.28*	1.982	U		*1.982*	*0.28*	0.559	U		*0.559*	*0.28*
2,3,4,7,8-PECDF	na	na	na	0.249			*0.093*	*0.56*	0.032	U		*0.032*	*0.56*	0.065	U		*0.065*	*0.56*	2.074	U		*2.074*	*0.56*	0.585	U		*0.585*	*0.56*
1,2,3,4,7,8-HXCDF	na	na	na	0.56			*0.098*	*0.34*	0.217			*0.032*	*0.34*	0.078	U		*0.078*	*0.34*	7.7	U		*7.7*	*0.34*	2.248	U		*2.248*	*0.34*
1,2,3,6,7,8-HXCDF	na	na	na	0.938	I	J	*0.096*	*0.49*	0.768	I	J	*0.032*	*0.49*	0.076	U		*0.076*	*0.49*	7.493	U		*7.493*	*0.49*	2.188	U		*2.188*	*0.49*
2,3,4,6,7,8-HXCDF	na	na	na	0.255	X	J	*0.12*	*0.47*	0.11	X	J	*0.04*	*0.47*	0.095	U		*0.095*	*0.47*	8.766	U		*8.766*	*0.47*	2.559	U		*2.559*	*0.47*
1,2,3,7,8,9-HXCDF	na	na	na	0.128	U		*0.128*	*0.25*	0.042	U		*0.042*	*0.25*	0.102	U		*0.102*	*0.25*	8.829	U		*8.829*	*0.25*	2.578	U		*2.578*	*0.25*
1,2,3,4,6,7,8-HPCDF	na	na	na	3.974			*0.101*	*0.33*	3.188			*0.029*	*0.33*	0.291			*0.077*	*0.33*	3.341	U		*3.341*	*0.33*	1.12	U		*1.12*	*0.33*
1,2,3,4,7,8,9-HPCDF	na	na	na	0.138	U		*0.138*	*0.5*	0.273			*0.04*	*0.5*	0.104	U		*0.104*	*0.5*	4.318	U		*4.318*	*0.5*	1.447	U		*1.447*	*0.5*
OCDF	na	na	na	10.16	B		*0.083*	*0.79*	10.1	B		*0.093*	*0.79*	1.423	B	B	*0.457*	*0.79*	12.02	U		*12.02*	*0.79*	5.075	U		*5.075*	*0.79*
TOTAL TCDD	na	na	na	0.081	U		*0.081*		0.028	U		*0.028*		0.051	U		*0.051*		1.135	U		*1.135*		5.603			*0.44*	
TOTAL PECDD	na	na	na	0.168	U		*0.168*		0.043	U		*0.043*		0.073	U		*0.073*		2.066	U		*2.066*		1.032	U		*1.032*	
TOTAL HXCDD	na	na	na	13			*0.109*		4.008			*0.038*		0.08	U		*0.08*		2.726	U		*2.726*		1.926	U		*1.926*	
TOTAL HPCDD	na	na	na	59.79			*0.143*		55.94			*0.065*		12.88			*0.159*		121.3		J	*6.279*		22.13			*2.363*	
TOTAL TCDF	na	na	na	1.905			*0.062*		0.07			*0.023*		0.031	U		*0.031*		1.223	U		*1.223*		0.428	U		*0.428*	
TOTAL PECDF	na	na	na	1.221			*0.085*		0.343			*0.029*		0.06	U		*0.06*		1.982	U		*1.982*		0.559	U		*0.559*	
TOTAL HXCDF	na	na	na	3.66			*0.096*		3.62			*0.032*		0.076	U		*0.076*		7.493	U		*7.493*		2.188	U		*2.188*	
TOTAL HPCDF	na	na	na	8.766			*0.101*		9.681			*0.029*		1.124			*0.077*		3.341	U		*3.341*		1.12	U		*1.12*	
TCDD TE	19	4.3	na	1.369					1.129					0.4565					10.92					3.606				

Table 2-5c
Analytes Detected in SWMU 50 Soil - 2002 RFI

Analyte			Sample ID	50SS01					50SS02					50SS03				
			Sample Date	6/25/02					6/25/02					6/25/02				
			Sample Depth	0-0.5					0-0.5					0-0.5				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																		
Acetone	92000000	7000000	na	41		B	2.5	5.6	5.7	U	UJ	2.6	5.7	5.7	U	UJ	2.6	5.7
Carbon Disulfide	10000000	780000	na	5.6	U		0.38	5.6	5.7	U		0.39	5.7	5.7	U		0.39	5.7
PAHs (ug/kg)																		
2-Methylnaphthalene	410000	31000	na	9.1			0.71	2.1	48			0.74	2.2	45			0.74	2.2
Acenaphthene	6100000	470000	na	2	J	B	1.1	2.1	2.4		B	1.2	2.2	1.9	J	B	1.3	2.2
Acenaphthylene	3100000	230000	na	2.2			0.28	2.1	10			0.3	2.2	3.1			0.3	2.2
Anthracene	31000000	2300000	na	2.1	U		0.23	2.1	6.2			0.24	2.2	3			0.24	2.2
Benzo(a)anthracene	3900	220	na	3.6			0.28	2.1	42			0.3	2.2	14			0.3	2.2
Benzo(a)pyrene	390	22	na	3.3			0.23	2.1	54			0.25	2.2	12			0.25	2.2
Benzo(b)fluoranthene	3900	220	na	6.5			0.4	2.1	81			0.42	2.2	21			0.42	2.2
Benzo(g,h,i)perylene	3100000	230000	na	3.4		J	0.75	2.1	59			0.77	2.2	15			0.77	2.2
Benzo(k)fluoranthene	39000	2200	na	2	J	J	0.37	2.1	29			0.39	2.2	6.7			0.39	2.2
Chrysene	390000	22000	na	6.1			0.33	2.1	61			0.35	2.2	19			0.35	2.2
Dibenz(a,h)Anthracene	390	22	na	1.6	J	J	0.71	2.1	14			0.75	2.2	3.5			0.75	2.2
Fluoranthene	4100000	310000	na	9			0.37	2.1	73			0.37	2.2	26			0.38	2.2
Fluorene	4100000	310000	na	1.1	J	J	0.56	2.1	5.4		J	0.58	2.2	3		J	0.58	2.2
Indeno(1,2,3-cd)pyrene	3900	220	na	2.3			0.68	2.1	40			0.7	2.2	9.7			0.71	2.2
Naphthalene	2000000	160000	na	4.2		B	0.81	2.1	27			0.84	2.2	27			0.85	2.2
Phenanthrene	3100000	230000	na	11			0.32	2.1	65			0.34	2.2	38			0.34	2.2
Pyrene	3100000	230000	na	7.5			0.48	2.1	85			0.49	2.2	27			0.5	2.2
SVOCs (ug/kg)																		
1,2-Dichlorobenzene	9200000	700000	na	190	U		5.3	190	11	J	J	5.4	190	190	U		5.4	190
1,3-Dichlorobenzene	310000	23000	na	190	U		5.8	190	8.6	J	J	5.9	190	190	U		5.9	190
1,4-Dichlorobenzene	120000	27000	na	190	U		6.4	190	11	J	J	6.5	190	190	U		6.5	190
2,4-Dinitrotoluene	200000	16000	na	190	U		6.3	190	43	J	J	6.5	190	190	J	J	6.5	190
2,6-Dinitrotoluene	100000	7800	na	190	U		4.7	190	190	U		4.8	190	190	U		4.8	190
2-Methylnaphthalene	410000	31000	na	8.4	J	J	7.2	190	86	J	J	7.3	190	84	J	J	7.3	190
2-Methylphenol	5100000	390000	na	190	U	UL	7.6	190	190	U	UL	7.7	190	190	U	UL	7.7	190
4-Methylphenol	510000	39000	na	190	U	UL	6.6	190	190	U	UL	6.7	190	190	U	UL	6.8	190
Acenaphthene	6100000	470000	na	190	U		5.2	190	12	J	J	5.3	190	190	U		5.3	190
Acenaphthylene	3100000	230000	na	190	U		5	190	9.7	J	J	5.1	190	190	U		5.2	190
Anthracene	31000000	2300000	na	190	U		5.5	190	15	J	J	5.6	190	190	U		5.6	190
Benzo(a)anthracene	3900	220	na	190	U		5.4	190	52	J	J	5.5	190	27	J	J	5.5	190
Benzo(a)pyrene	390	22	na	190	U		4.6	190	53	J	J	4.7	190	23	J	J	4.7	190
Benzo(b)fluoranthene	3900	220	na	190	U		4	190	70	J	J	4.1	190	39	J	J	4.1	190
Benzo(g,h,i)perylene	3100000	230000	na	190	U		5.3	190	43	J	J	5.4	190	190	U		5.4	190
Benzo(k)fluoranthene	39000	2200	na	190	U		5.3	190	29	J	J	5.4	190	11	J	J	5.4	190
Bis(2-ethylhexyl)phthalate	200000	46000	na	190	U		13	190	91	J	B	13	190	65	J	B	13	190
Butylbenzylphthalate	20000000	1600000	na	190	U		7.3	190	190	U		7.5	190	39	J	B	7.5	190
Carbazole	140000	32000	na	190	U	UJ	8.2	190	17	J	J	8.3	190	11	J	J	8.3	190
Chrysene	390000	87000	na	190	U		4.3	190	83	J	J	4.4	190	37	J	J	4.4	190
Di-n-butylphthalate	10000000	780000	na	190	U		54	190	63	J	B	55	190	420		B	55	190
Di-n-octylphthalate	na	na	na	190	U		8.4	190	190	U		8.5	190	190	U		8.6	190
Dibenzofuran	na	na	na	190	U		5.4	190	30	J	J	5.5	190	20	J	J	5.5	190
Diethylphthalate	82000000	6300000	na	190	U		5.4	190	12	J	B	5.5	190	8	J	B	5.6	190
Dimethylphthalate	na	na	na	190	U		4.9	190	190	U		5	190	190	U		5	190
Fluoranthene	4100000	310000	na	11	J	J	6.1	190	83	J	J	6.3	190	48	J	J	6.3	190
Fluorene	4100000	310000	na	190	U		6.1	190	14	J	J	6.2	190	190	U		6.3	190
Indeno(1,2,3-cd)pyrene	3900	220	na	190	U		7.2	190	37	J	J	7.4	190	190	U		7.4	190
N-nitrosodiphenylamine	580000	130000	na	190	U		8.9	190	21	J	J	9.1	190	170	J	J	9.1	190
Naphthalene	2000000	160000	na	7.2	J	J	6.9	190	57	J	J	7	190	44	J	J	7	190
Phenanthrene	3100000	230000	na	14	J	J	5.8	190	100	J	J	6	190	73	J	J	6	190
Pyrene	3100000	230000	na	8.9	J	J	5.7	190	100	J	J	5.8	190	50	J	J	5.9	190
Pesticides (ug/kg)																		
4,4'-DDD	12000	2700	na	0.41	J	J	0.157	0.743	NT					0.447	J	J	0.16	0.759
4,4'-DDE	8400	1900	na	0.657	J	B	0.156	0.743	NT					3.37			0.159	0.759
4,4'-DDT	8400	1900	na	0.743	U		0.263	0.743	NT					12.9			0.268	0.759
Endosulfan II	610000	47000	na	0.636	J	J	0.265	0.743	NT					2.24			0.271	0.759
Endrin	31000	2300	na	0.288	J	J	0.178	0.743	NT					0.759	U		0.182	0.759
Methoxychlor	510000	39000	na	0.743	U		0.567	0.743	NT					1.29			0.579	0.759
PCBs (mg/kg)																		
PCB-1254	1.4	0.16	na	0.0254	J	J	0.0109	0.0371	0.467			0.0112	0.0378	0.0387			0.0112	0.0379
Explosives (mg/kg)																		
2,4,6-Trinitrotoluene	51	3.9	na	0.2	U		0.0187	0.2	0.4	U		0.0374	0.4	0.2	U		0.0187	0.2
2,4-Dinitrotoluene	200	16	na	0.2	U		0.0163	0.2	0.4	U		0.0326	0.4	0.443			0.0163	0.2
2,6-Dinitrotoluene	100	7.8	na	0.2	U		0.0246	0.2	0.4	U		0.0492	0.4	0.2	U		0.0246	0.2
Dinitrotoluene Mix*	4.2	0.94	na															

Analyte	50SB04A					50SB04B					50SB04C				
	6/25/02					6/25/02					6/25/02				
	0-0.5					4-6					8-10				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)															
Acetone	17		B	2.5	5.5	9.1	U	UJ	4.1	9.1	12	U	UJ	5.4	12
Carbon Disulfide	5.5	U		0.38	5.5	1.1	J	B	0.63	9.1	12	U		0.81	12
PAHs (ug/kg)															
2-Methylnaphthalene	16			0.69	2.1	4.6	U		1.6	4.6	190			2.2	6.7
Acenaphthene	3.8		B	1.1	2.1	7		B	2.6	4.6	6.2	J	B	3.8	6.7
Acenaphthylene	4.4			0.28	2.1	2.8	J	J	0.61	4.6	3.6	J	J	0.89	6.7
Anthracene	9.5			0.22	2.1	2	J	J	0.51	4.6	6.3	J	J	0.73	6.7
Benzo(a)anthracene	15			0.28	2.1	8.2			0.61	4.6	23			0.89	6.7
Benzo(a)pyrene	12			0.23	2.1	5.7			0.51	4.6	17			0.75	6.7
Benzo(b)fluoranthene	32			0.4	2.1	9.4			0.88	4.6	27			1.3	6.7
Benzo(g,h,i)perylene	21			0.73	2.1	4.1	J	J	1.6	4.6	16			2.4	6.7
Benzo(k)fluoranthene	7.7			0.36	2.1	3.6	J	J	0.81	4.6	7.5			1.2	6.7
Chrysene	21			0.33	2.1	8.5			0.74	4.6	29			1.1	6.7
Dibenz(a,h)Anthracene	2.3			0.7	2.1	4.6	U		1.6	4.6	3.4	J	J	2.2	6.7
Fluoranthene	110			0.35	2.1	18			0.79	4.6	36			1.2	6.7
Fluorene	8.4		J	0.55	2.1	1.3	J	J	1.2	4.6	10		J	1.8	6.7
Indeno(1,2,3-cd)pyrene	15			0.66	2.1	3.5	J	J	1.5	4.6	11			2.2	6.7
Naphthalene	8.4			0.79	2.1	3.5	J	B	1.8	4.6	120			2.6	6.7
Phenanthrene	70			0.32	2.1	11			0.71	4.6	120			1	6.7
Pyrene	240			0.46	2.1	14			1	4.6	41			1.5	6.7
SVOCs (ug/kg)															
1,2-Dichlorobenzene	190	U		5.3	190	280	U		7.9	280	16	J	J	9.5	340
1,3-Dichlorobenzene	190	U		5.8	190	280	U		8.6	280	16	J	J	10	340
1,4-Dichlorobenzene	190	U		6.3	190	280	U		9.5	280	16	J	J	11	340
2,4-Dinitrotoluene	2500			6.3	190	280	U		9.4	280	140	J	J	11	340
2,6-Dinitrotoluene	410			4.6	190	280	U		6.9	280	30	J	J	8.3	340
2-Methylnaphthalene	26	J	J	7.1	190	17	J	J	11	280	460			13	340
2-Methylphenol	190	U	UL	7.5	190	280	U	UL	11	280	21	J	B	14	340
4-Methylphenol	190	U	UL	6.5	190	280	U	UL	9.8	280	29	J	B	12	340
Acenaphthene	8.5	J	J	5.1	190	280	U		7.7	280	28	J	J	9.3	340
Acenaphthylene	7.3	J	J	5	190	280	U		7.5	280	340	U		9	340
Anthracene	12	J	J	5.4	190	280	U		8.1	280	23	J	J	9.8	340
Benzo(a)anthracene	24	J	J	5.3	190	280	U		8	280	41	J	J	9.6	340
Benzo(a)pyrene	15	J	J	4.6	190	280	U		6.9	280	340	U		8.3	340
Benzo(b)fluoranthene	38	J	J	3.9	190	280	U		5.9	280	340	U		7.1	340
Benzo(g,h,i)perylene	190	U		5.2	190	280	U		7.8	280	340	U		9.4	340
Benzo(k)fluoranthene	8.8	J	J	5.3	190	280	U		7.9	280	340	U		9.5	340
Bis(2-ethylhexyl)phthalate	2500			12	190	280	U		19	280	200	J	B	22	340
Butylbenzylphthalate	190	U		7.2	190	280	U		11	280	340	U		13	340
Carbazole	30	J	J	8.1	190	280	U	UJ	12	280	23	J	J	15	340
Chrysene	31	J	J	4.3	190	280	U		6.4	280	32	J	J	7.7	340
Di-n-butylphthalate	61000		B	1100	3700	280	U		80	280	2200		B	97	340
Di-n-octylphthalate	64	J	J	8.3	190	280	U		12	280	340	U		15	340
Dibenzofuran	14	J	J	5.3	190	280	U		8	280	92	J	J	9.5	340
Diethylphthalate	7.7	J	B	5.4	190	280	U		8.1	280	340	U		9.7	340
Dimethylphthalate	1500			4.9	190	280	U		7.3	280	340	U		8.8	340
Fluoranthene	120	J	J	6.1	190	18	J	J	9.1	280	45	J	J	11	340
Fluorene	16	J	J	6.1	190	280	U		9.1	280	43	J	J	11	340
Indeno(1,2,3-cd)pyrene	190	U		7.1	190	280	U		11	280	340	U		13	340
N-nitrosodiphenylamine	1100			8.8	190	280	U		13	280	150	J	J	16	340
Naphthalene	18	J	J	6.8	190	11	J	J	10	280	340			12	340
Phenanthrene	81	J	J	5.8	190	14	J	J	8.7	280	190	J	J	10	340
Pyrene	250			5.7	190	14	J	J	8.5	280	56	J	J	10	340
Pesticides (ug/kg)															
4,4'-DDD	NT					NT					NT				
4,4'-DDE	NT					NT					NT				
4,4'-DDT	NT					NT					NT				
Endosulfan II	NT					NT					NT				
Endrin	NT					NT					NT				
Methoxychlor	NT					NT					NT				
PCBs (mg/kg)															
PCB-1254	0.963			0.0108	0.0366	1.27			0.0162	0.055	0.75			0.0195	0.0661
Explosives (mg/kg)															
2,4,6-Trinitrotoluene	0.075	J	J	0.0187	0.2	0.2	U		0.0187	0.2	0.2	U		0.0187	0.2
2,4-Dinitrotoluene	1.96			0.0163	0.2	0.2	U		0.0163	0.2	0.094	J	J	0.0163	0.2
2,6-Dinitrotoluene	0.375			0.0246	0.2	0.2	U		0.0246	0.2	0.2	U		0.0246	0.2
Dinitrotoluene Mix*	2.335														

Analyte	50SB05A					50SB05B					50SB05C				
	6/25/02					6/25/02					6/25/02				
	0-0.5					4-6					8-10				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)															
Acetone	6	U	UJ	2.7	6	5.7	U	UJ	2.5	5.7	6.4	U	UJ	2.9	6.4
Carbon Disulfide	0.64	J	B	0.42	6	5.7	U		0.39	5.7	0.48	J	B	0.44	6.4
PAHs (ug/kg)															
2-Methylnaphthalene	400			0.69	2.1	2.8	U		0.93	2.8	29			0.93	2.8
Acenaphthene	16			1.1	2.1	2.8	U		1.5	2.8	2.8	U		1.5	2.8
Acenaphthylene	20			0.27	2.1	5.1			0.37	2.8	2.8	U		0.37	2.8
Anthracene	11			0.22	2.1	2.8	U		0.31	2.8	2.8	U		0.31	2.8
Benzo(a)anthracene	36			0.27	2.1	2.8	U		0.37	2.8	1.6	J	J	0.37	2.8
Benzo(a)pyrene	19			0.23	2.1	2.8	U		0.31	2.8	2.8	U		0.31	2.8
Benzo(b)fluoranthene	34			0.38	2.1	2.8	U		0.52	2.8	1.8	J	J	0.52	2.8
Benzo(g,h,i)perylene	17			0.71	2.1	2.8	U		0.97	2.8	1.1	J	J	0.97	2.8
Benzo(k)fluoranthene	7.1			0.35	2.1	2.8	U		0.48	2.8	0.55	J	J	0.48	2.8
Chrysene	49			0.33	2.1	2.8	U		0.43	2.8	2.6	J	J	0.45	2.8
Dibenz(a,h)Anthracene	3.3			0.69	2.1	2.8	U		0.94	2.8	2.8	U		0.94	2.8
Fluoranthene	41			0.35	2.1	2.8	U		0.47	2.8	1.6	J	J	0.47	2.8
Fluorene	18		J	0.54	2.1	2.8	U		0.73	2.8	1	J	J	0.74	2.8
Indeno(1,2,3-cd)pyrene	6.9			0.66	2.1	2.8	U		0.88	2.8	2.8	U		0.88	2.8
Naphthalene	270			0.79	2.1	2.8	U		1.1	2.8	16			1.1	2.8
Phenanthrene	260			0.31	2.1	2.8	U		0.42	2.8	13			0.42	2.8
Pyrene	47			0.46	2.1	2.8	U		0.62	2.8	2.3	J	J	0.63	2.8
SVOCs (ug/kg)															
1,2-Dichlorobenzene	370	U		10	370	220	U		6.1	220	220	U		6.1	220
1,3-Dichlorobenzene	370	U		11	370	220	U		6.7	220	220	U		6.7	220
1,4-Dichlorobenzene	370	U		13	370	220	U		7.3	220	220	U		7.3	220
2,4-Dinitrotoluene	510			12	370	220	U		7.2	220	220	U		7.3	220
2,6-Dinitrotoluene	46	J	J	9.2	370	220	U		5.3	220	220	U		5.3	220
2-Methylnaphthalene	870			14	370	220	U		8.2	220	55	J	J	8.2	220
2-Methylphenol	370	U	UL	15	370	220	U	UL	8.7	220	220	U	UL	8.7	220
4-Methylphenol	370	U	UL	13	370	220	U	UL	7.6	220	220	U	UL	7.6	220
Acenaphthene	370	U		10	370	220	U		5.9	220	220	U		6	220
Acenaphthylene	370	U		9.9	370	220	U		5.8	220	220	U		5.8	220
Anthracene	24	J	J	11	370	220	U		6.3	220	220	U		6.3	220
Benzo(a)anthracene	54	J	J	11	370	220	U		6.2	220	220	U		6.2	220
Benzo(a)pyrene	32	J	J	9.1	370	220	U		5.3	220	220	U		5.3	220
Benzo(b)fluoranthene	53	J	J	7.8	370	220	U		4.6	220	220	U		4.6	220
Benzo(g,h,i)perylene	370	U		10	370	220	U		6	220	220	U		6	220
Benzo(k)fluoranthene	370	U		10	370	220	U		6.1	220	220	U		6.1	220
Bis(2-ethylhexyl)phthalate	120	J	B	25	370	220	U		14	220	220	U		14	220
Butylbenzylphthalate	370	U		14	370	220	U		8.4	220	220	U		8.4	220
Carbazole	28	J	J	16	370	220	U	UJ	9.3	220	220	U	UJ	9.3	220
Chrysene	100	J	J	8.5	370	220	U		4.9	220	220	U		5	220
Di-n-butylphthalate	5000		B	110	370	220	U		62	220	220	U		62	220
Di-n-octylphthalate	370	U		16	370	220	U		9.6	220	220	U		9.6	220
Dibenzofuran	200	J	J	11	370	220	U		6.1	220	12	J	J	6.1	220
Diethylphthalate	88	J	B	11	370	220	U		6.2	220	220	U		6.2	220
Dimethylphthalate	370	U		9.7	370	220	U		5.6	220	220	U		5.7	220
Fluoranthene	64	J	J	12	370	220	U		7	220	220	U		7	220
Fluorene	35	J	J	12	370	220	U		7	220	220	U		7	220
Indeno(1,2,3-cd)pyrene	370	U		14	370	220	U		8.2	220	220	U		8.3	220
N-nitrosodiphenylamine	190	J	J	17	370	220	U		10	220	220	U		10	220
Naphthalene	490			13	370	220	U		7.8	220	30	J	J	7.9	220
Phenanthrene	470			11	370	220	U		6.7	220	27	J	J	6.7	220
Pyrene	78	J	J	11	370	220	U		6.6	220	220	U		6.6	220
Pesticides (ug/kg)															
4,4'-DDD	NT					NT					NT				
4,4'-DDE	NT					NT					NT				
4,4'-DDT	NT					NT					NT				
Endosulfan II	NT					NT					NT				
Endrin	NT					NT					NT				
Methoxychlor	NT					NT					NT				
PCBs (mg/kg)															
PCB-1254	0.376			0.0108	0.0364	0.0424	U		0.0125	0.0424	0.0425	U		0.0125	0.0425
Explosives (mg/kg)															
2,4,6-Trinitrotoluene	0.2	U		0.0187	0.2	0.2	U		0.0187	0.2	0.2	U		0.0187	0.2
2,4-Dinitrotoluene	0.4			0.0163	0.2	0.2	U		0.0163	0.2	0.2	U		0.0163	0.2
2,6-Dinitrotoluene	0.2	U		0.0246	0.2	0.2	U		0.0246	0.2	0.2	U		0.0246	0.2
Dinitrotoluene Mix*															

Table 2-5c
Analytes Detected in SWMU 50 Soil - 2002 RFI
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Analyte			Sample ID	50SS01					50SS02					50SS03				
			Sample Date	6/25/02					6/25/02					6/25/02				
			Sample Depth	0-0.5					0-0.5					0-0.5				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Herbicides (ug/kg)																		
2,4,5-T	1000000	78000	na	8.18	J	J	*3.1*	*11.1*	NT					114	U		*31.6*	*114*
2,4-D	1000000	78000	na	22.3	U		*9.99*	*22.3*	NT					142	J	J	*102*	*228*
Dicamba	3100000	230000	na	6.29	J	B	*2.33*	*22.3*	NT					228	U		*23.8*	*228*
Metals (mg/kg)																		
Aluminum	na	na	40041	11400			*6.2*	*22.3*	20100			*6.3*	*22.7*	24300			*6.3*	*22.8*
Antimony	41	3.1	na	0.19	B	B	*0.19*	*0.557*	0.691		L	*0.19*	*0.568*	0.25	B	B	*0.19*	*0.569*
Arsenic	1.9	0.43	15.8	1.03		J	*0.39*	*0.557*	3.24		J	*0.4*	*0.568*	4.33		J	*0.4*	*0.569*
Barium	20000	1600	209	141			*0.37*	*2.23*	70.9			*0.38*	*2.27*	97.4			*0.38*	*2.28*
Beryllium	200	16	1.02	0.756		B	*0.0384*	*0.557*	0.885		B	*0.0392*	*0.568*	0.85		B	*0.0392*	*0.569*
Cadmium	51	3.9	0.69	0.058	B	B	*0.053*	*0.111*	0.143			*0.054*	*0.114*	0.074	B	B	*0.054*	*0.114*
Calcium	na	na	na	484		J	*3.1*	*11.1*	28600		J	*3.2*	*11.4*	13700		J	*3.2*	*11.4*
Chromium	310	23	65.3	18.6		J	*0.42*	*1.11*	28.5		J	*0.43*	*1.14*	43.7		J	*0.43*	*1.14*
Cobalt	na	na	72.3	6.4			*0.9*	*5.57*	9.73			*0.92*	*5.68*	11			*0.92*	*5.69*
Copper	4100	310	53.5	7.95			*0.69*	*2.23*	31.5			*0.7*	*2.27*	22.7			*0.7*	*2.28*
Iron	31000	2300	50962	9580			*3.7*	*5.57*	20600			*3.8*	*5.68*	28300			*3.8*	*5.69*
Lead	800	400	26.8	21.7			*0.034*	*0.334*	**148**			*0.034*	*0.341*	**98.1**			*0.034*	*0.341*
Magnesium	na	na	na	525			*2.6*	*11.1*	20200			*2.7*	*11.4*	9430			*2.7*	*11.4*
Manganese	2000	160	2543	1320			*0.062*	*1.11*	372			*0.064*	*1.14*	558			*0.064*	*1.14*
Mercury	31	2.3	0.13	0.041	B	J	*0.022*	*0.0557*	0.0837			*0.0225*	*0.0568*	0.0984			*0.0225*	*0.0569*
Nickel	2000	160	62.8	7.09			*1*	*4.45*	16.3			*1*	*4.54*	14.9			*1*	*4.55*
Potassium	na	na	na	465			*37*	*334*	2050			*38*	*341*	1550			*38*	*341*
Selenium	510	39	na	1.11	U	UL	*0.36*	*1.11*	1.14	U	UL	*0.37*	*1.14*	1.14	U	UL	*0.37*	*1.14*
Silver	510	39	na	1.11	U		*0.55*	*1.11*	0.61	B	J	*0.56*	*1.14*	0.58	B	J	*0.56*	*1.14*
Sodium	na	na	na	13	B	B	*4.2*	*22.3*	61.7		J	*4.2*	*22.7*	72.5		J	*4.2*	*22.8*
Thallium	7.2	0.55	2.11	0.24	B	B	*0.034*	*0.334*	0.18	B	B	*0.034*	*0.341*	0.15	B	B	*0.034*	*0.341*
Vanadium	102	7.8	108	24			*0.64*	*5.57*	41.2			*0.66*	*5.68*	47			*0.66*	*5.69*
Zinc	31000	2300	202	23.9		J	*0.4*	*2.23*	93.3		J	*0.41*	*2.27*	54.8		J	*0.41*	*2.28*

Analyte	50SB04A					50SB04B					50SB04C				
	6/25/02					6/25/02					6/25/02				
	0-0.5					4-6					8-10				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Herbicides (ug/kg)															
2,4,5-T	NT					NT					NT				
2,4-D	NT					NT					NT				
Dicamba	NT					NT					NT				
Metals (mg/kg)															
Aluminum	20900			*6.1*	*22*	16700			*9.1*	*33.1*	17500			*11*	*39.7*
Antimony	0.55	U	UL	*0.19*	*0.55*	0.56	B	B	*0.28*	*0.826*	1.46		L	*0.33*	*0.992*
Arsenic	2.33		J	*0.38*	*0.55*	13.7		J	*0.58*	*0.826*	5.02		J	*0.69*	*0.992*
Barium	111			*0.37*	*2.2*	68			*0.55*	*3.31*	60.4			*0.66*	*3.97*
Beryllium	0.74		B	*0.038*	*0.55*	0.77	B	B	*0.057*	*0.827*	0.97	B	B	*0.0685*	*0.992*
Cadmium	0.062	B	B	*0.052*	*0.11*	0.12	B	J	*0.079*	*0.165*	0.15	B	J	*0.094*	*0.198*
Calcium	1280		J	*3.1*	*11*	163000		J	*4.6*	*16.5*	136000		J	*5.5*	*19.8*
Chromium	43.5		J	*0.41*	*1.1*	50.8		J	*0.62*	*1.65*	**255**		J	*0.74*	*1.98*
Cobalt	16.7			*0.89*	*5.5*	7.7	B	J	*1.3*	*8.26*	13.7			*1.6*	*9.92*
Copper	9.96			*0.68*	*2.2*	**120**			*1*	*3.31*	**163**			*1.2*	*3.97*
Iron	22200			*3.7*	*5.5*	13600			*5.6*	*8.26*	23800			*6.7*	*9.92*
Lead	19.8			*0.033*	*0.33*	**138**			*6.1*	*16.5*	**585**			*7.3*	*19.8*
Magnesium	1080			*2.6*	*11*	3100			*3.9*	*16.5*	4110			*4.7*	*19.8*
Manganese	1580			*0.062*	*1.1*	199			*0.092*	*1.65*	223			*0.11*	*1.98*
Mercury	0.0987			*0.0218*	*0.055*	**0.16**			*0.0327*	*0.0826*	**0.524**			*0.0393*	*0.0992*
Nickel	9.89			*1*	*4.4*	24.7			*1.5*	*6.61*	**181**			*1.8*	*7.94*
Potassium	966			*37*	*330*	631			*55*	*496*	1070			*66*	*595*
Selenium	1.1	U	UL	*0.36*	*1.1*	0.57	B	L	*0.54*	*1.65*	1.98	U	UL	*0.65*	*1.98*
Silver	1.1	U		*0.54*	*1.1*	1.65	U		*0.81*	*1.65*	1.1	B	J	*0.98*	*1.98*
Sodium	28.8		B	*4.1*	*22*	75.8		J	*6.2*	*33.1*	78.7		J	*7.4*	*39.7*
Thallium	0.15	B	B	*0.033*	*0.33*	0.25	B	B	*0.05*	*0.496*	0.595	U		*0.06*	*0.595*
Vanadium	46.7			*0.64*	*5.5*	21.5			*0.96*	*8.26*	24.5			*1.2*	*9.92*
Zinc	88.1		J	*0.39*	*2.2*	50.9		J	*0.59*	*3.31*	79.2		J	*0.71*	*3.97*

Analyte	50SB05A					50SB05B					50SB05C				
	6/25/02					6/25/02					6/25/02				
	0-0.5					4-6					8-10				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Herbicides (ug/kg)															
2,4,5-T	NT					NT					NT				
2,4-D	NT					NT					NT				
Dicamba	NT					NT					NT				
Metals (mg/kg)															
Aluminum	13300			*6*	*21.9*	37900			*7*	*25.4*	38400			*7*	*25.5*
Antimony	0.547	U	UL	*0.18*	*0.547*	0.636	U	UL	*0.21*	*0.636*	0.22	B	B	*0.21*	*0.638*
Arsenic	4.5		J	*0.38*	*0.547*	2.78		J	*0.44*	*0.636*	1.67		J	*0.45*	*0.638*
Barium	92.5			*0.37*	*2.19*	66.8			*0.43*	*2.54*	60.6			*0.43*	*2.55*
Beryllium	0.841		B	*0.0377*	*0.547*	0.877		B	*0.0439*	*0.636*	0.816		B	*0.0439*	*0.638*
Cadmium	0.127			*0.052*	*0.109*	0.127	U		*0.06*	*0.127*	0.128	U		*0.061*	*0.128*
Calcium	1720		J	*3.1*	*10.9*	27.3		B	*3.6*	*12.7*	59.5		J	*3.6*	*12.8*
Chromium	22.5		J	*0.41*	*1.09*	29.4		J	*0.48*	*1.27*	33.1		J	*0.48*	*1.28*
Cobalt	10.5			*0.89*	*5.47*	13.6			*1*	*6.36*	6.1	B	J	*1*	*6.38*
Copper	22.6			*0.68*	*2.19*	14.5			*0.79*	*2.54*	18.6			*0.79*	*2.55*
Iron	17800			*3.7*	*5.47*	32800			*4.3*	*6.36*	40900			*4.3*	*6.38*
Lead	**31.9**			*0.033*	*0.328*	14.2			*0.038*	*0.382*	15.8			*0.039*	*0.383*
Magnesium	1630			*2.6*	*10.9*	967			*3*	*12.7*	1150			*3*	*12.8*
Manganese	553			*0.061*	*1.09*	375			*0.071*	*1.27*	104			*0.071*	*1.28*
Mercury	**0.816**			*0.0217*	*0.0547*	0.061	B	J	*0.0252*	*0.0636*	**0.205**			*0.0253*	*0.0638*
Nickel	13			*1*	*4.38*	12.2			*1.2*	*5.09*	12.6			*1.2*	*5.1*
Potassium	923			*37*	*328*	1380			*43*	*382*	1450			*43*	*383*
Selenium	1.09	U	UL	*0.36*	*1.09*	1.27	U	UL	*0.42*	*1.27*	1.28	U	UL	*0.42*	*1.28*
Silver	0.89	B	J	*0.54*	*1.09*	1.27	U		*0.63*	*1.27*	0.74	B	J	*0.63*	*1.28*
Sodium	64.9		J	*4.1*	*21.9*	35.2		J	*4.8*	*25.4*	29.2		B	*4.8*	*25.5*
Thallium	0.13	B	B	*0.033*	*0.328*	0.18	B	B	*0.038*	*0.382*	0.16	B	B	*0.038*	*0.383*
Vanadium	33.9			*0.63*	*5.47*	56.7			*0.74*	*6.36*	77			*0.74*	*6.38*
Zinc	42.8		J	*0.39*	*2.19*	47.1		J	*0.46*	*2.54*	47.7		J	*0.46*	*2.55*

* "Dinitrotoluene mix" screening levels used for comparison where 2,4- and 2,6-dinitrotoluene were detected in the same sample

Table 2-5d
Analytes Detected in SWMU 59 Soil - 2002 RFI

Analyte			Sample ID	59SS03					59SS04					59SS05					59SB01A					59SB01B					59SB01C				
			Sample Date	6/27/02					6/27/02					6/27/02					6/27/02					6/27/02					6/27/02				
			Sample Depth	0-0.5					0-0.5					0-0.5					0-0.5					4-6					8-10				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																																	
Acetone	92000000	7000000	na	5.4	U		*2.4*	*5.4*	NT					17		B	*3.1*	*7*	8.5	U	UJ	*3.9*	*8.5*	6	U		*2.7*	*6*	6.1	U		*2.8*	*6.1*
Carbon Disulfide	10000000	780000	na	5.4	U		*0.37*	*5.4*	NT					7	U		*0.48*	*7*	2.2	J	B	*0.58*	*8.5*	6	U		*0.42*	*6*	6.1	U		*0.42*	*6.1*
Toluene	8200000	630000	na	5.4	U		*0.35*	*5.4*	NT					7	U		*0.45*	*7*	15		J	*0.56*	*8.5*	6	U		*0.39*	*6*	6.1	U		*0.4*	*6.1*
o-Xylene	20000000	1600000	na	5.4	U		*1.1*	*5.4*	NT					7	U		*1.4*	*7*	2.5	J	J	*1.8*	*8.5*	6	U		*1.3*	*6*	6.1	U		*1.3*	*6.1*
PAHs (ug/kg)																																	
2-Methylnaphthalene	410000	31000	na	3.7		B	*0.69*	*2*	NT					110			*0.67*	*2*	210			*0.65*	*1.9*	6			*0.77*	*2.3*	2.1	U		*0.7*	*2.1*
Acenaphthene	6100000	470000	na	6.5		B	*1.1*	*2*	NT					3.1		B	*1.1*	*2*	4		B	*1.1*	*1.9*	2.3	U		*1.3*	*2.3*	2.1	U		*1.1*	*2.1*
Acenaphthylene	3100000	230000	na	2	U		*0.27*	*2*	NT					2			*0.26*	*2*	2.9			*0.26*	*1.9*	2.3	U		*0.3*	*2.3*	2.1	U		*0.27*	*2.1*
Anthracene	31000000	2300000	na	20			*0.22*	*2*	NT					3.5			*0.22*	*2*	4.4			*0.21*	*1.9*	2.3	U		*0.25*	*2.3*	2.1	U		*0.23*	*2.1*
Benzo(a)anthracene	3900	220	na	60			*0.27*	*2*	NT					12			*0.26*	*2*	13			*0.26*	*1.9*	2.3	U		*0.3*	*2.3*	2.1	U		*0.27*	*2.1*
Benzo(a)pyrene	390	22	na	46			*0.23*	*2*	NT					7.3			*0.22*	*2*	6.6			*0.22*	*1.9*	2.3	U		*0.26*	*2.3*	2.1	U		*0.23*	*2.1*
Benzo(b)fluoranthene	3900	220	na	63			*0.39*	*2*	NT					12			*0.38*	*2*	13			*0.37*	*1.9*	2.3	U		*0.43*	*2.3*	2.1	U		*0.39*	*2.1*
Benzo(g,h,i)perylene	3100000	230000	na	25		J	*0.72*	*2*	NT					8.2		J	*0.7*	*2*	15		J	*0.68*	*1.9*	2.3	U		*0.8*	*2.3*	2.1	U		*0.73*	*2.1*
Benzo(k)fluoranthene	39000	2200	na	33			*0.35*	*2*	NT					2.3			*0.34*	*2*	3			*0.34*	*1.9*	2.3	U		*0.4*	*2.3*	2.1	U		*0.36*	*2.1*
Chrysene	390000	22000	na	57			*0.32*	*2*	NT					16			*0.32*	*2*	18			*0.31*	*1.9*	2.3	U		*0.36*	*2.3*	2.1	U		*0.33*	*2.1*
Dibenz(a,h)Anthracene	390	22	na	6.4			*0.69*	*2*	NT					1.8	J	J	*0.67*	*2*	1.9			*0.66*	*1.9*	2.3	U		*0.78*	*2.3*	2.1	U		*0.71*	*2.1*
Fluoranthene	4100000	310000	na	110			*0.35*	*2*	NT					13			*0.34*	*2*	15			*0.33*	*1.9*	2.3	U		*0.39*	*2.3*	2.1	U		*0.36*	*2.1*
Fluorene	4100000	310000	na	9.1		J	*0.54*	*2*	NT					4.3		J	*0.53*	*2*	5.8		J	*0.51*	*1.9*	2.3	U		*0.61*	*2.3*	2.1	U		*0.55*	*2.1*
Indeno(1,2,3-cd)pyrene	3900	220	na	23			*0.65*	*2*	NT					3.7			*0.63*	*2*	3.6			*0.62*	*1.9*	2.3	U		*0.73*	*2.3*	2.1	U		*0.66*	*2.1*
Naphthalene	2000000	160000	na	4.5		B	*0.78*	*2*	NT					60			*0.76*	*2*	130			*0.75*	*1.9*	4.7		B	*0.88*	*2.3*	2.1	U		*0.8*	*2.1*
Phenanthrene	3100000	230000	na	83			*0.31*	*2*	NT					71			*0.3*	*2*	97			*0.3*	*1.9*	2.4			*0.35*	*2.3*	2.1	U		*0.32*	*2.1*
Pyrene	3100000	230000	na	92			*0.46*	*2*	NT					16			*0.45*	*2*	20			*0.44*	*1.9*	2.3	U		*0.51*	*2.3*	2.1	U		*0.47*	*2.1*
SVOCs (ug/kg)																																	
2-Methylnaphthalene	410000	31000	na	200	U		*7.7*	*200*	NT					120	J	J	*7.5*	*200*	95	J	J	*7.3*	*190*	230	U		*8.7*	*230*	210	U		*7.9*	*210*
Acenaphthene	6100000	470000	na	24	J	J	*5.6*	*200*	NT					200	U		*5.4*	*200*	190	U		*5.3*	*190*	230	U		*6.3*	*230*	210	U		*5.7*	*210*
Anthracene	31000000	2300000	na	61	J	J	*5.9*	*200*	NT					200	U		*5.7*	*200*	190	U		*5.6*	*190*	230	U		*6.6*	*230*	210	U		*6*	*210*
Benzo(a)anthracene	3900	220	na	180	J	J	*5.8*	*200*	NT					19	J	J	*5.6*	*200*	190	U		*5.5*	*190*	230	U		*6.5*	*230*	210	U		*5.9*	*210*
Benzo(a)pyrene	390	22	na	140	J	J	*5*	*200*	NT					200	U		*4.8*	*200*	190	U		*4.7*	*190*	230	U		*5.6*	*230*	210	U		*5.1*	*210*
Benzo(b)fluoranthene	3900	220	na	210			*4.3*	*200*	NT					200	U		*4.2*	*200*	190	U		*4.1*	*190*	230	U		*4.8*	*230*	210	U		*4.4*	*210*
Benzo(g,h,i)perylene	3100000	230000	na	91	J	J	*5.7*	*200*	NT					200	U		*5.5*	*200*	190	U		*5.4*	*190*	230	U		*6.4*	*230*	210	U		*5.8*	*210*
Benzo(k)fluoranthene	39000	2200	na	60	J	J	*5.7*	*200*	NT					200	U		*5.6*	*200*	190	U		*5.4*	*190*	230	U		*6.4*	*230*	210	U		*5.8*	*210*
Carbazole	140000	32000	na	73	J	J	*8.8*	*200*	NT					200	U	UJ	*8.5*	*200*	190	U	UJ	*8.3*	*190*	230	U	UJ	*9.8*	*230*	210	U	UJ	*8.9*	*210*
Chrysene	390000	22000	na	150	J	J	*4.7*	*200*	NT					21	J	J	*4.5*	*200*	190	U		*4.4*	*190*	230	U		*5.2*	*230*	210	U		*4.7*	*210*
Dibenzofuran	na	na	na	16	J	J	*5.8*	*200*	NT					32	J	J	*5.6*	*200*	23	J	J	*5.5*	*190*	230	U		*6.5*	*230*	210	U		*5.9*	*210*
Fluoranthene	4100000	310000	na	320			*6.6*	*200*	NT					18	J	J	*6.4*	*200*	9.3	J	J	*6.3*	*190*	230	U		*7.4*	*230*	210	U		*6.7*	*210*
Fluorene	4100000	310000	na	37	J	J	*6.6*	*200*	NT					200	U		*6.4*	*200*	190	U		*6.3*	*190*	230	U		*7.4*	*230*	210	U		*6.7*	*210*
Indeno(1,2,3-cd)pyrene	3900	220	na	96	J	J	*7.8*	*200*	NT					200	U		*7.6*	*200*	190	U		*7.4*	*190*	230	U		*8.7*	*230*	210	U		*7.9*	*210*
Naphthalene	2000000	160000	na	9.6	J	J	*7.4*	*200*	NT					75	J	J	*7.2*	*200*	69	J	J	*7*	*190*	230	U		*8.3*	*230*	210	U		*7.5*	*210*
Phenanthrene	3100000	230000	na	290			*6.3*	*200*	NT					86	J	J	*6.1*	*200*	52	J	J	*6*	*190*	230	U		*7.1*	*230*	210	U		*6.4*	*210*
Pyrene	3100000	230000	na	240			*6.2*	*200*	NT					18	J	J	*6*	*200*	8.2	J	J	*5.9*	*190*	230	U		*6.9*	*230*	210	U		*6.3*	*210*
Pesticides (ug/kg)																																	
4,4'-DDD	12000	2700	na	0.676	J	J	*0.169*	*0.798*	NT					0.777	U		*0.164*	*0.777*	0.76	U		*0.161*	*0.76*	NT					NT				
4,4'-DDE	8400	1900	na	0.768	J	B	*0.167*	*0.798*	NT					0.777	U		*0.163*	*0.777*	0.76	U		*0.159*	*0.76*	NT					NT				
4,4'-DDT	8400	1900	na	4.41			*0.282*	*0.798*	NT					1.97			*0.275*	*0.777*	1.12		B	*0.269*	*0.76*	NT					NT				
Dieldrin	180	40	na	0.798	U		*0.49*	*0.798*	NT					4.52			*0.478*	*0.777*	0.76	U		*0.467*	*0.76*	NT					NT				
Endosulfan II	610000	47000	na	0.798	U		*0.285*	*0.798*	NT					3.33			*0.277*	*0.777*	3.94			*0.271*	*0.76*	NT					NT				
Endosulfan I	610000	47000	na	0.798	U		*0.124*	*0.798*	NT					0.777	U		*0.121*	*0.777*	0.961			*0.118*	*0.76*	NT					NT				
Endrin aldehyde	na	na	na	0.428	J	J	*0.403*	*0.798*	NT					0.777	U		*0.393*	*0.777*	0.76	U		*0.384*	*0.76*	NT					NT				
Endrin Ketone	na	na	na	1.66			*0.644*	*0.798*	NT					2.9			*0.627*	*0.777*	2.43			*0.613*	*0.76*	NT					NT				
gamma-Chlordane	8200	1800	na	1.1			*0.185*	*0.798*	NT					0.777	U		*0.181*	*0.777*	0.76	U		*0.177*	*0.76*	NT					NT				
Heptachlor Epoxide	310	70	na	0.798	U		*0.483*	*0.798*	NT					0.777	U		*0.471*	*0.777*	1.06			*0.46*	*0.76*	NT					NT				
Methoxychlor	510000	39000	na	2.82			*0.609*	*0.798*	NT					10.2			*0.593*	*0.777*	9.99			*0.58*	*0.76*	NT					NT				
PCBs (mg/kg)																																	
PCB-1254	1.4	0.16	na	0.061			*0.0118*	*0.0398*	NT					0.0388	U		*0.0115*	*0.0388*	0.0379	U		*0.0112*	*0.0379*	0.0448	U		*0.0132*	*0.0448*	0.0407	U		*0.012*	*0.0407*
Explosives (mg/kg)																																	
1,3,5-Trinitrobenzene	3100	230	na	0.1	U		*0.0246*	*0.1*	NT					0.138			*0.0246*	*0.1*	0.134			*0.0246*	*0.1*	0.1	U		*0.0246*	*0.1*	0.1	U		*0.0246*	*0.1*
Herbicides (ug/kg)																																	
2,4,5-T	1000000	78000	na	120	U		*33.3*	*120*	NT					36.6		J	*3.24*	*11.7*	114	U		*31.7*	*114*	NT					NT				
Metals (mg/kg)																																	
Aluminum	na	na	40041	14700		J	*6.6*	*23.9*	12200		J	*6.6*	*23.9*	3180		J	*6.4*	*23.3*	3120		J	*6.3*	*22.8*	38100		J	*7.4*	*26.9*	18800		J	*6.7*	*24.4*
Antimony	41	3.1	na	0.598	U	UL	*0.2*	*0.598*	0.21	B	B	*0.2*	*0.598*	0.583	U	UL	*0.2*	*0.583*	0.569	U	UL	*0.19*	*0.569*	0.672	U	UL	*0.23*	*0.672*	0.611	U	UL	*0.21*	*0.611*
Arsenic	1.9	0.43	15.8	2.58		J	*0.42*	*0.598*	4.52		J	*0.42*	*0.598*	5.51		J	*0.41*	*0.583*	3.04		J	*0.4*	*0.569*	2.94		J	*0.47*	*0.672*	1.81		J	*0.43*	*0.611*
Barium	20000	1600	209	88			*0.4*	*2.39*	71.1			*0.4*	*2.39*	57.1			*0.39*	*2.33*	133			*0.38*	*2.28*	68.4			*0.45*	*2.69*	35.7			*0.41*	*2.44*
Beryllium	200	16	1.02	0.748			*0.0413*	*0.598*	0.51	B	J	*0.0413*	*0.598*	0.54	B	J	*0.0402*	*0.583*	0.589			*0.0393*	*0.569*	0.673			*0.0464*	*0.0672*	0.43	B	J	*0.0421*	*0.611*

Analyte	i-RBC	r-RBC	Background	59SS03 6/27/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	59SS04 6/27/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	59SS05 6/27/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL
Cadmium	51	3.9	0.69	0.11	B	J	*0.057*	*0.12*	0.11	B	J	*0.057*	*0.12*	0.117	U		*0.055*	*0.117*
Calcium	na	na	na	2680			*3.3*	*12*	1660			*3.3*	*12*	437			*3.3*	*11.7*
Chromium	310	23	65.3	23.2			*0.45*	*1.2*	21.1			*0.45*	*1.2*	8.89			*0.44*	*1.17*
Cobalt	na	na	72.3	9.18			*0.97*	*5.98*	6.36			*0.97*	*5.98*	6.22			*0.94*	*5.83*
Copper	4100	310	53.5	11		J	*0.74*	*2.39*	9.07		J	*0.74*	*2.39*	11.7		J	*0.72*	*2.33*
Iron	31000	2300	50962	19300			*4*	*5.98*	18700			*4*	*5.98*	4200			*3.9*	*5.83*
Lead	800	400	26.8	**30.9**			*0.036*	*0.359*	22.6			*0.036*	*0.359*	5.37			*0.035*	*0.35*
Magnesium	na	na	na	2270			*2.8*	*12*	1320			*2.8*	*12*	272			*2.8*	*11.7*
Manganese	2000	160	2543	289			*0.067*	*1.2*	213			*0.067*	*1.2*	140			*0.065*	*1.17*
Mercury	31	2.3	0.13	**0.45**	**B**	**J**	*0.0237*	*0.0598*	**0.153**			*0.0237*	*0.0598*	0.109			*0.0231*	*0.0583*
Nickel	2000	160	62.8	12.8			*1.1*	*4.78*	5.74			*1.1*	*4.78*	8.65			*1.1*	*4.66*
Potassium	na	na	na	945			*40*	*359*	684			*40*	*359*	330	B	J	*39*	*350*
Selenium	510	39	na	1.2	U	UL	*0.39*	*1.2*	0.39	B	J	*0.39*	*1.2*	0.72	B	J	*0.38*	*1.17*
Sodium	na	na	na	30		B	*4.5*	*23.9*	35.4			*4.5*	*23.9*	60.6			*4.4*	*23.3*
Thallium	7.2	0.55	2.11	0.16	B	J	*0.036*	*0.359*	0.21	B	J	*0.036*	*0.359*	0.092	B	J	*0.035*	*0.35*
Vanadium	102	7.8	108	36.1			*0.69*	*5.98*	34.4			*0.69*	*5.98*	12.1			*0.67*	*5.83*
Zinc	31000	2300	202	76.3		J	*0.43*	*2.39*	38.3		J	*0.43*	*2.39*	7.74		J	*0.42*	*2.33*
Dioxins/Furans (ng/kg)																		
1,2,3,7,8-PECDD	na	na	na	1.158	X	J	*0.19*	*0.283*	NT					0.358	U		*0.19*	*0.358*
1,2,3,4,7,8-HXCDD	na	na	na	2.868			*0.53*	*0.275*	NT					0.252	U		*0.53*	*0.252*
1,2,3,6,7,8-HXCDD	na	na	na	6.39			*0.57*	*0.215*	NT					0.198	U		*0.57*	*0.198*
1,2,3,7,8,9-HXCDD	460	100	na	7.918			*0.68*	*0.209*	NT					0.191	U		*0.68*	*0.191*
1,2,3,4,6,7,8-HPCDD	na	na	na	213.5			*0.63*	*0.495*	NT					13.77		J	*0.63*	*0.248*
OCDD	na	na	na	2768	B		*6.86*	*0.288*	NT					260.2	B	J	*6.86*	*0.355*
1,2,3,7,8-PECDF	na	na	na	0.221	U		*0.28*	*0.221*	NT					0.161	U		*0.28*	*0.161*
2,3,4,7,8-PECDF	na	na	na	0.231	U		*0.56*	*0.231*	NT					0.168	U		*0.56*	*0.168*
1,2,3,4,7,8-HXCDF	na	na	na	0.21	U		*0.34*	*0.21*	NT					0.168	U		*0.34*	*0.168*
1,2,3,6,7,8-HXCDF	na	na	na	0.205	U		*0.49*	*0.205*	NT					0.164	U		*0.49*	*0.164*
2,3,4,6,7,8-HXCDF	na	na	na	0.24	U		*0.47*	*0.24*	NT					0.192	U		*0.47*	*0.192*
1,2,3,7,8,9-HXCDF	na	na	na	0.241	U		*0.25*	*0.241*	NT					0.193	U		*0.25*	*0.193*
1,2,3,4,6,7,8-HPCDF	na	na	na	29.22			*0.33*	*0.139*	NT					1.896		J	*0.33*	*0.167*
1,2,3,4,7,8,9-HPCDF	na	na	na	1.229			*0.5*	*0.179*	NT					0.216	U		*0.5*	*0.216*
OCDF	na	na	na	71.1			*0.79*	*0.296*	NT					8.541		J	*0.79*	*0.347*
TOTAL TCDD	na	na	na	0.18	U			*0.18*	NT					0.066	U			*0.066*
TOTAL PECDD	na	na	na	0.283	U			*0.283*	NT					0.358	U			*0.358*
TOTAL HXCDD	na	na	na	35.79				*0.209*	NT					1.478		J		*0.191*
TOTAL HPCDD	na	na	na	400				*0.495*	NT					24.69		J		*0.248*
TOTAL TCDF	na	na	na	0.235	U			*0.235*	NT					0.257	U			*0.257*
TOTAL PECDF	na	na	na	2.207				*0.221*	NT					0.161	U			*0.161*
TOTAL HXCDF	na	na	na	27.5				*0.205*	NT					0.164	U			*0.164*
TOTAL HPCDF	na	na	na	86.5				*0.139*	NT					7.273		J		*0.167*
TCDD TE	19	4.3	na	6.019					NT					0.8632				

Analyte	i-RBC	r-RBC	Background	59SB01A 6/27/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	59SB01B 6/27/02 4-6 Result	Lab Q	Val Q	MDL	MRL	59SB01C 6/27/02 8-10 Result	Lab Q	Val Q	MDL	MRL
Cadmium	51	3.9	0.69	0.114	U		*0.054*	*0.114*	0.134	U		*0.064*	*0.134*	0.122	U		*0.058*	*0.122*
Calcium	na	na	na	432			*3.2*	*11.4*	781			*3.8*	*13.4*	162			*3.4*	*12.2*
Chromium	310	23	65.3	8.82			*0.43*	*1.14*	30.9			*0.5*	*1.34*	33.6			*0.46*	*1.22*
Cobalt	na	na	72.3	7.22			*0.92*	*5.69*	4.3	B	J	*1.1*	*6.72*	5.9	B	J	*0.99*	*6.11*
Copper	4100	310	53.5	15.3		J	*0.7*	*2.28*	16.2		J	*0.83*	*2.69*	7.48		J	*0.75*	*2.44*
Iron	31000	2300	50962	5790			*3.8*	*5.69*	38600			*4.5*	*6.72*	21900			*4.1*	*6.11*
Lead	800	400	26.8	6.84			*0.034*	*0.342*	14.2			*0.041*	*0.403*	8.52			*0.037*	*0.366*
Magnesium	na	na	na	227			*2.7*	*11.4*	1080			*3.2*	*13.4*	1020			*2.9*	*12.2*
Manganese	2000	160	2543	128			*0.064*	*1.14*	132			*0.075*	*1.34*	360			*0.068*	*1.22*
Mercury	31	2.3	0.13	**0.282**			*0.0226*	*0.0569*	0.0902			*0.0266*	*0.0672*	0.0611	U		*0.0242*	*0.0611*
Nickel	2000	160	62.8	10.3			*1*	*4.56*	12.9			*1.2*	*5.38*	7.11			*1.1*	*4.88*
Potassium	na	na	na	300	B	J	*38*	*342*	1230			*45*	*403*	773			*41*	*366*
Selenium	510	39	na	1.14	U	UL	*0.37*	*1.14*	1.34	U	UL	*0.44*	*1.34*	1.22	U	UL	*0.4*	*1.22*
Sodium	na	na	na	72.8			*4.3*	*22.8*	40.5			*5*	*26.9*	17	B	B	*4.6*	*24.4*
Thallium	7.2	0.55	2.11	0.073	B	J	*0.034*	*0.342*	0.13	B	J	*0.041*	*0.403*	0.11	B	J	*0.037*	*0.366*
Vanadium	102	7.8	108	14.4			*0.66*	*5.69*	68.1			*0.78*	*6.72*	25.2			*0.71*	*6.11*
Zinc	31000	2300	202	7.23		J	*0.41*	*2.28*	56.2		J	*0.48*	*2.69*	23.2		J	*0.44*	*2.44*
Dioxins/Furans (ng/kg)																		
1,2,3,7,8-PECDD	na	na	na	0.156	U		*0.19*	*0.156*	0.148	U		*0.19*	*0.148*	0.169	U		*0.19*	*0.169*
1,2,3,4,7,8-HXCDD	na	na	na	0.158	U		*0.53*	*0.158*	0.343	U		*0.53*	*0.343*	0.158	U		*0.53*	*0.158*
1,2,3,6,7,8-HXCDD	na	na	na	0.124	U		*0.57*	*0.124*	0.269	U		*0.57*	*0.269*	0.124	U		*0.57*	*0.124*
1,2,3,7,8,9-HXCDD	460	100	na	0.12	U		*0.68*	*0.12*	0.26	U		*0.68*	*0.26*	0.12	U		*0.68*	*0.12*
1,2,3,4,6,7,8-HPCDD	na	na	na	11.63			*0.63*	*0.254*	1.436			*0.63*	*0.146*	0.82			*0.63*	*0.174*
OCDD	na	na	na	111	B		*6.86*	*0.201*	254.7	B		*6.86*	*0.246*	116.3	B		*6.86*	*0.262*
1,2,3,7,8-PECDF	na	na	na	0.107	U		*0.28*	*0.107*	0.117	U		*0.28*	*0.117*	0.113	U		*0.28*	*0.113*
2,3,4,7,8-PECDF	na	na	na	0.112	U		*0.56*	*0.112*	0.122	U		*0.56*	*0.122*	0.119	U		*0.56*	*0.119*
1,2,3,4,7,8-HXCDF	na	na	na	0.13	U		*0.34*	*0.13*	0.119	U		*0.34*	*0.119*	0.11	U		*0.34*	*0.11*
1,2,3,6,7,8-HXCDF	na	na	na	0.497	X	J	*0.49*	*0.127*	0.116	U		*0.49*	*0.116*	0.108	U		*0.49*	*0.108*
2,3,4,6,7,8-HXCDF	na	na	na	0.148	U		*0.47*	*0.148*	0.135	U		*0.47*	*0.135*	0.126	U		*0.47*	*0.126*
1,2,3,7,8,9-HXCDF	na	na	na	0.149	U		*0.25*	*0.149*	0.136	U		*0.25*	*0.136*	0.127	U		*0.25*	*0.127*
1,2,3,4,6,7,8-HPCDF	na	na	na	1.952			*0.33*	*0.093*	0.096	U		*0.33*	*0.096*	0.112	U		*0.33*	*0.112*
1,2,3,4,7,8,9-HPCDF	na	na	na	0.121	U		*0.5*	*0.121*	0.124	U		*0.5*	*0.124*	0.144	U		*0.5*	*0.144*
OCDF	na	na	na	6.303			*0.79*	*0.245*	0.317	U		*0.79*	*0.317*	0.301	U		*0.79*	*0.301*
TOTAL TCDD	na	na	na	0.124	U			*0.124*	0.181	U			*0.181*	0.187	U			*0.187*
TOTAL PECDD	na	na	na	0.156	U			*0.156*	0.148	U			*0.148*	0.169	U			*0.169*
TOTAL HXCDD	na	na	na	0.12	U			*0.12*	0.26	U			*0.26*	0.12	U			*0.12*
TOTAL HPCDD	na	na	na	19.15				*0.254*	3.33				*0.146*	1.867				*0.174*
TOTAL TCDF	na	na	na	0.139	U			*0.139*	0.148	U			*0.148*	0.183	U			*0.183*
TOTAL PECDF	na	na	na	0.107	U			*0.107*	0.117	U			*0.117*	0.113	U			*0.113*
TOTAL HXCDF	na	na	na	1.468				*0.127*	0.116	U			*0.116*	0.108	U			*0.108*
TOTAL HPCDF	na	na	na	6.149				*0.093*	0.295				*0.096*	0.112	U			*0.112*
TCDD TE	19	4.3	na	0.6366					0.5905					0.5492				

Note: Refer to the Master Table Legend following this table for a list of definitions and table notes.

Receptor	Media	Carcinogenic Risk	Non-Carcinogenic Hazard
Current Timeframe			
Maintenance Worker	Surface Soil	1.2×10^{-6} (Within target risk range)	Total HI <1
Future Timeframe			
Maintenance Worker	Total Soil	1.6×10^{-6} (Within target risk range)	Total HI <1
Excavation Worker	Total Soil	$<1.0\times10^{-6}$ (Below target risk range)	Total HI = 1.5. No individual chemical HI was equal to or exceeded 1 and no sum of chemicals grouped by target organ equaled or exceeded 1.
Adult Resident	Total Soil	1.1×10^{-5} (Within target risk range)	Total HI <1
Child Resident	Total Soil	2.0×10^{-5} (Within target risk range)	Total HI = 3.3, primarily due to 2,4,6-TNT and iron. The margin-of-exposure evaluation indicated that the intake of iron was within the allowable range.

The SLERA was performed to provide an estimate of current and future ecological risk associated with potential hazardous substance releases at the combined study area. Conclusions were based on assessment results for food chain exposure and direct contact results for terrestrial invertebrates, which may serve as a food source for wildlife. The food chain assessment suggests potential adverse impacts to terrestrial wildlife, especially shrews, robins, and voles for modeled contact with the hazard drivers (primarily chromium, barium, Aroclor-1254) in surface soil. The direct contact assessment suggests a potential reduction in wildlife food supply due to mercury in surface soil.

The conclusions of this RFI, based on review of site data, the HHRA, and the SLERA, were as follows:

- VOCs, SVOCs, pesticides, herbicides, and dioxins/furans were sporadically detected in soil samples; however, none of these compounds were identified by the HHRA or SLERA as posing a significant risk to human health or the environment. Based on an evaluation of the extent of contamination and comparison to soil screening levels, no VOCs, SVOCs, pesticides, herbicides, or dioxins/furans were identified as posing a migration concern.
- VOCs were detected in site groundwater wells at concentrations in excess of maximum contaminant levels (MCLs). Specifically, CT and trichloroethene (TCE) were detected at concentrations of up to 180 micrograms per liter (µg/L) and 37 µg/L, respectively. The MCL for both these compounds is 5 µg/L.
- The HHRA identified potential risk from exposure to 2,4,6-TNT in total soil by hypothetical future child residents, with an estimated hazard quotient (HQ) of 1.7.

Review of site data reveals that 2,4,6-TNT is not widely distributed in the combined study area, with 4 detections in 45 samples. The two highest concentrations [935 and 35.7 milligrams per kilogram (mg/kg)] were found in two samples collected from a single soil boring at depths of 8-9 and 10-11 ft bgs. The two other detections were below 0.5 mg/kg. The HHRA conservatively estimated that a receptor would be exposed to an average 2,4,6-TNT concentration of 52.1 mg/kg based on the 95% upper confidence limit (UCL). However, it is believed that this exposure point concentration overestimates the risk for the entire site because the contaminant is limited to a much smaller area.

- The HHRA identified potential risk from exposure to iron in total soil by hypothetical future child residents. However, the HHRA also conducted a margin-of-exposure evaluation and concluded that the intake of iron was within the allowable range.
- The SLERA suggested potential adverse impacts to wildlife due to modeled contact with barium, chromium, mercury, and Aroclor-1254 in surface soil. However, remedial measures solely to address ecological concerns are not considered warranted due to uncertainties of toxicity, the fact that no wildlife rare, threatened, or endangered species have been confirmed at the study area, and the relatively small size of the combined study area (4.1 acres). Furthermore, it is not clear that barium and chromium are significantly elevated above naturally occurring background levels.

2.3.6 Eastern HSA Groundwater Data Report, Shaw, 2006

Groundwater samples were collected from 13 wells located in the eastern end of the HSA as a data collection effort requested by the USAEC to support the performance-based contract acquisition process. Four wells (48MW1, 48MW2, 48MW3, and 48MW4) from the combined study area were sampled for target compound list (TCL) VOCs, TCL SVOCs, polynuclear aromatic hydrocarbons (PAHs), TCL pesticides/polychlorinated biphenyls (PCBs), explosives, TAL metals, and dioxins/furans. Results from the wells in the study area are shown in **Table 2-6** and are briefly discussed below.

SVOCs, including PAHs, pesticides, PCBs and explosives were not detected in the wells. Ten VOCs were detected. CT and TCE each exceeded their MCLs in two wells. CT exceeded its MCL (5 µg/L) in wells 48MW2 (29.2 µg/L) and 48MW3 (51.2 µg/L). TCE exceeded its MCL (5 µg/L) in wells 48MW1 (5.5 µg/L) and 48MW3 (7.4 µg/L). These compounds were also detected during the 1998 RFI sampling. Concentrations have decreased from 180 µg/L (CT) and 37 µg/L (TCE) in 1998. As shown in **Table 2-6**, chloroform and tetrachloroethene exceeded their tap water risk-based concentrations (tw-RBCs) in two and four wells, respectively. Three metals (aluminum, iron, and manganese) exceeded secondary MCLs and antimony, iron, and vanadium exceeded their tw-RBCs in one well each.

2.4 CONCEPTUAL SITE MODEL – SWMUs 48, 49, 50, AND 59

Potentially affected media include surface and subsurface soil, surface water, sediment, and groundwater. The SWMUs are located near the top of a hill in the eastern end of the HSA. A steep slope to the south separates the sites from the river terrace where SWMU 13 is located. Surface and subsurface soil are potentially impacted from former disposal practices at the four SWMUs. Groundwater is also potentially impacted from downward migration of constituents from the soil. Surface water and sediment are not present at the sites. Precipitation is expected to flow down the hill towards the south and infiltrate into the ground. Site workers, hypothetical

Table 2-6
2006 Groundwater Results
SWMUs 48, 49, 50, and 59
Radford AAP, Radford Virginia

Analyte		Sample ID	48MW1					48MW2					48MW3					48MW4					TM48MW1				
		Sample Date	4/13/06					4/13/06					4/13/06					4/11/06					4/13/06				
		Sample Depth	135-136					132-133					115-116					90-91					135-136				
	MCL	tw-RBC	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/L)																											
1,1,1-Trichloroethane	200	170	1.3		J	0.5	1	1	U		0.5	1	1	U		0.5	1	1	U		0.5	1	1.2		J	0.5	1
1,1-Dichloroethane	na	90	1.3		J	0.5	1	1	U		0.5	1	1	U		0.5	1	1	U		0.5	1	1.4		J	0.5	1
1,1-Dichloroethene	7	35	0.55	J	J	0.5	1	1	U		0.5	1	1	U		0.5	1	1	U		0.5	1	0.56	J	J	0.5	1
2-Butanone	na	700	5	U		2.5	5	4.5	J	B	2.5	5	5	U		2.5	5	5	U		2.5	5	5	U		2.5	5
Acetone	na	550	25	U		5	25	61.5		B	5	25	25	U		5	25	25	U		5	25	25	U		5	25
Carbon tetrachloride	5	0.16	1	U		0.5	1	29.2			0.5	1	51.2			0.5	1	1	U		0.5	1	1	U		0.5	1
Chloroform	80	0.15	1	U		0.5	1	5.9		B	0.5	1	5.5		B	0.5	1	1	U		0.5	1	1	U		0.5	1
cis-1,2-Dichloroethene	70	6.1	0.71	J	J	0.5	1	1	U		0.5	1	1	U		0.5	1	1	U		0.5	1	0.77	J	J	0.5	1
Tetrachloroethene	5	0.1	1.1		J	0.5	1	1.1		J	0.5	1	0.54	J	J	0.5	1	0.66	J	J	0.5	1	1		J	0.5	1
Trichloroethene	5	0.026	5.5			0.5	1	3			0.5	1	7.4			0.5	1	1	U		0.5	1	5.5			0.5	1
PAHs (ug/L)			None Detected																								
SVOCs (ug/L)			None Detected																								
Pesticides (ug/L)			None Detected																								
PCBs (ug/L)			None Detected																								
Explosives (ug/L)			None Detected																								
Herbicides (ug/L)			Samples were not tested for this group.																								
Metals (ug/L)																											
Aluminum	50	na	606			16	200	2630			16	200	82.6	J	B	16	200	113	J	B	16	200	452		B	16	200
Antimony	6	1.5	2.2	U		2.2	5	2.2	U		2.2	5	4.3	J	B	2.2	5	2.2	U		2.2	5	2.2	U		2.2	5
Barium	2000	730	105	J	J	0.5	200	615			0.5	200	50.4	J	J	0.5	200	167	J	J	0.5	200	92.6	J	J	0.5	200
Beryllium	4	7.3	1.8	J	B	0.7	4	2	J	B	0.7	4	2.2	J	B	0.7	4	2.1	J	B	0.7	4	2	J	B	0.7	4
Calcium	na	na	67400			26	1000	89700			26	1000	102000			26	1000	58600			26	1000	69900			26	1000
Chromium	100	11	1.7	J	J	0.5	10	6.4	J	J	0.5	10	1	J	J	0.5	10	0.86	J	J	0.5	10	1.2	J	J	0.5	10
Cobalt	na	na	0.4	U		0.4	50	1.3	J	B	0.4	50	0.4	U		0.4	50	0.4	U		0.4	50	0.4	U		0.4	50
Copper	1300	150	0.8	U		0.8	25	0.83	J	B	0.8	25	0.8	U		0.8	25	0.8	U		0.8	25	0.8	U		0.8	25
Iron	300	1100	617			7.5	300	2960			7.5	300	8.9	J	B	7.5	300	62.8	J	B	7.5	300	387			7.5	300
Lead	15	na	2	J	B	1.2	5	1.3	J	B	1.2	5	2.7	J	B	1.2	5	1.2	U		1.2	5	1.2	U		1.2	5
Magnesium	na	na	35300			5.8	5000	44800			5.8	5000	42800			5.8	5000	49600			5.8	5000	35400			5.8	5000
Manganese	50	73	10.3	J	J	0.2	15	50.7			0.2	15	1.8	J	B	0.2	15	2.6	J	B	0.2	15	5.6	J	J	0.2	15
Nickel	na	73	1.2	J	J	1.1	40	4.9	J	J	1.1	40	1.1	U		1.1	40	1.1	U		1.1	40	1.1	U		1.1	40
Potassium	na	na	2020	J	J	36	5000	1690	J	J	36	5000	1230	J	J	36	5000	1600	J	J	36	5000	2060	J	J	36	5000
Selenium	50	18	3.2	J	J	2.4	10	2.4	J	J	2.4	10	5.2	J	J	2.4	10	2.4	U		2.4	10	2.4	U		2.4	10
Sodium	na	na	13700			77	5000	311	J	B	77	5000	1030	J	B	77	5000	8230		L	77	5000	14900			77	5000
Vanadium	na	3.7	1.3	J	B	0.6	50	6.3	J	B	0.6	50	0.91	J	B	0.6	50	0.6	U		0.6	50	1.2	J	B	0.6	50
Zinc	5000	1100	3	J	J	0.8	20	11.7	J	J	0.8	20	0.8	U		0.8	20	1.4	J	J	0.8	20	1.7	J	J	0.8	20

future residents, and terrestrial biota are considered receptors. **Table 2-7** presents the exposure pathways for each human receptor. Ecological and human exposure pathways are shown on **Figure 2-7** (current) and **Figure 2-8** (future). The exposures pathways associated with each media type are described in more detail in the following paragraphs.

The potential presence of constituents in soil indicates that site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with impacted soil, and the inhalation of dust.

Subsurface soil is also potentially impacted. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil. Groundwater is also impacted and may impact future site workers or residents if groundwater were developed as a resource.

2.5 DATA GAP ANALYSIS

This section identifies data gaps in the current understanding of the sites and is the basis for the investigation approach described in the next section. Due to the small size and proximity of the sites, groundwater data gaps are considered for the entire study area. Soil data gaps are addressed at the individual sites within the study area. Surface water and sediment are not present at these four sites.

Groundwater: Data gaps exist in the locations of monitoring wells at the sites. With the current wells at the sites, it is difficult to assess the source and the extent of VOCs detected in groundwater. Additional wells are required to fill this data gap. Recent groundwater sampling (April 2006) analyzed samples for the full suite of analytes (TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, and dioxin/furans) with the exception of perchlorate and herbicides. These parameters are data gaps. Existing wells should also be samples for VOCs when the proposed wells are installed and sampled so that concentrations can be compared between wells at a single period if time.

Soil:

SWMU 48: The soil is considered sufficiently characterized to complete an RFI/CMS at this site. Screening level exceedances of explosives (2,4,6-TNT and DNT), metals (iron) and dioxin/furan TEs were either sporadically detected (dioxin/furans) or have been bound (explosives, metals).

SWMU 49: Additional soil samples are required at SWMU 49 to assess the extent of a PCB exceedance in surface soil. The data gaps for this site are the spatial distribution of samples. The data gap is primarily for TCL PCBs, however, samples should be analyzed for TCL VOCs, TCL SVOCs, PAHs, TCL pest/PCBs, explosives, herbicides, TAL metals, and dioxins/furans to provide a more complete data set for the site.

SWMU 50: This is the largest of the four sites and the data gap at this site is insufficient coverage of the site for surface and subsurface soil. Data gaps for soil in these areas include TCL VOCs, TCL SVOCs, PAHs, TCL pest/PCBs, explosives, herbicides, TAL metals, and dioxins/furans.

SWMU 59: Arsenic exceeded its industrial screening level in a surface soil sample at this site. A data gap exists in the horizontal and vertical extent of elevated arsenic. Additional samples

Table 2-7
Selection of Exposure Pathways - SWMUs 48, 49, 50, 59

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	SWMUs 48, 49, 50, 59	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to surface soil at SWMUs 48, 49, 50, 59 on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to surface soil at SWMUs 48, 49, 50, 59 on a daily basis.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMUs 48, 49, 50, 59	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMUs 48, 49, 50, 59.
				Industrial Worker	Adult	Inhalation	On-site	None	There are no workers currently exposed to airborne volatiles or particulates from surface soil at SWMUs 48, 49, 50, 59 on a daily basis.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMUs 48, 49, 50, 59	None	None	None	On-site	None	Current excavation or construction activities are not occurring at SWMUs 48, 49, 50, 59.
	Groundwater	Groundwater	SWMUs 48, 49, 50, 59	None	None	None	On-site	None	Groundwater is not currently being used at SWMUs 48, 49, 50, 59. Therefore, there is currently no direct exposure to groundwater.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
Future	Surface Soil	Surface Soil	SWMUs 48, 49, 50, 59	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact surface soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact surface soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMUs 48, 49, 50, 59	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMUs 48, 49, 50, 59.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMUs 48, 49, 50, 59.

Table 2-7
Selection of Exposure Pathways - SWMUs 48, 49, 50, 59

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Surface Soil	Surface Soil	SWMUs 48, 49, 50, 59	Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMUs 48, 49, 50, 59	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact soil at SWMUs 48, 49, 50, 59 and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
					Child	Ingestion	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMUs 48, 49, 50, 59	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from soils at SWMUs 48, 49, 50, 59.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from soils at SWMUs 48, 49, 50, 59.
				Excavation Worker	Adult	Inhalation	On-site	Quant	Excavation workers could be exposed to airborne volatiles or particulate matter released from soils at SWMUs 48, 49, 50, 59.
				Resident	Adult	Inhalation	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
					Child	Inhalation	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.

Table 2-7
Selection of Exposure Pathways - SWMUs 48, 49, 50, 59

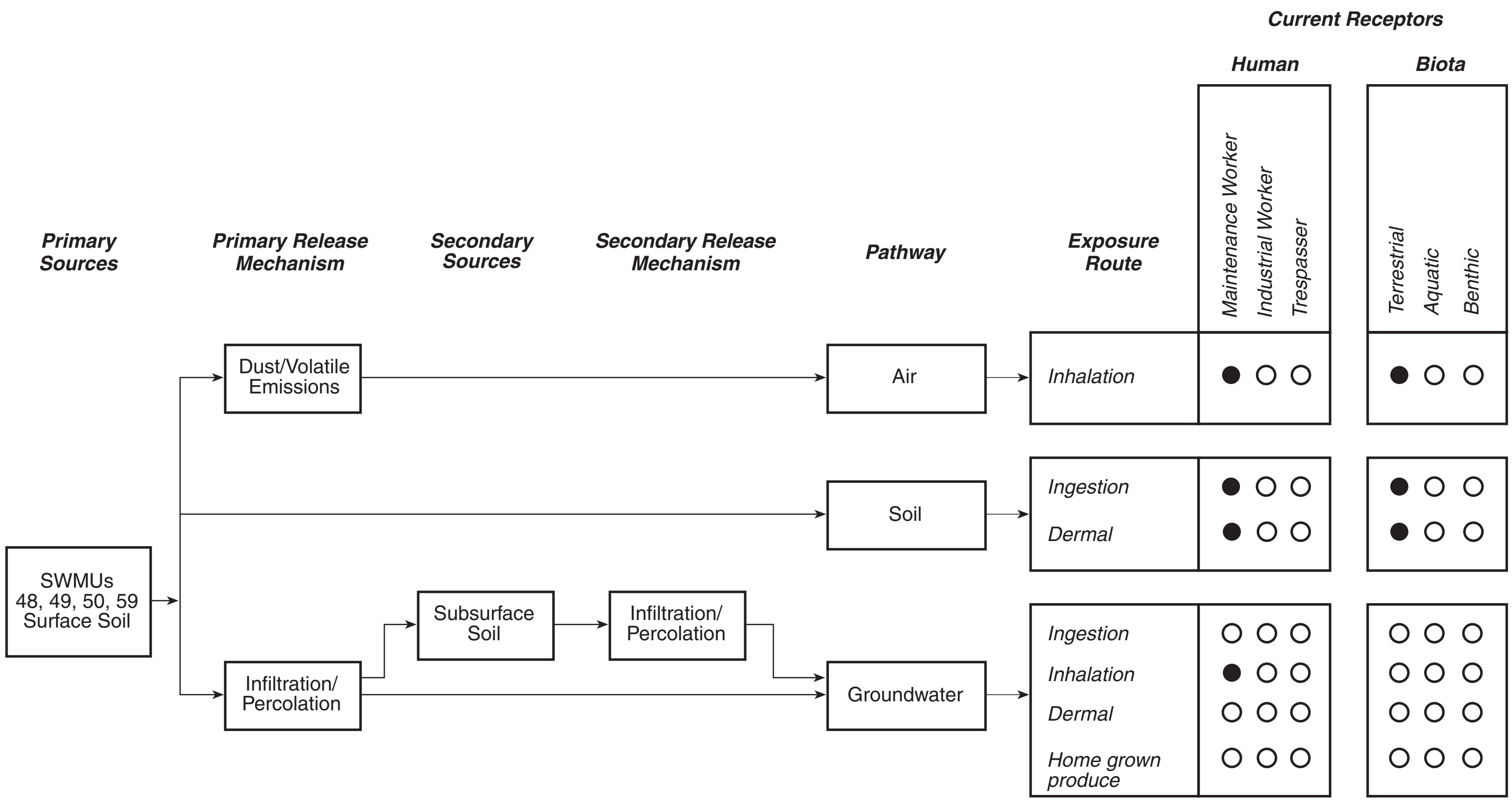
Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Total Soil (Surface and Subsurface)	Air	SWMUs 48, 49, 50, 59	Trespasser	Adolescent	Inhalation	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Groundwater	Groundwater	SWMUs 48, 49, 50, 59	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers would not contact groundwater at SWMUs 48, 49, 50, 59.
						Dermal	On-site	None	Maintenance workers would not contact groundwater at SWMUs 48, 49, 50, 59.
				Industrial Worker	Adult	Ingestion	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for industrial purposes and groundwater wells were installed at the site, site workers could be exposed to COPCs in groundwater via ingestion.
						Dermal	On-site	None	Although site worker dermal exposures to groundwater could occur, the exposed body surface area of a worker (i.e., hands and arms) would be small and exposures would be infrequent.
				Excavation Worker	Adult	Ingestion	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at SWMUs 48, 49, 50, 59.
						Dermal	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at SWMUs 48, 49, 50, 59.
				Resident	Adult	Ingestion	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMUs 48, 49, 50, 59 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
		Homegrown fruits and vegetables	SWMUs 48, 49, 50, 59	Resident	Adult	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into a construction or utility trench via vapor intrusion.

Table 2-7
Selection of Exposure Pathways - SWMUs 48, 49, 50, 59

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Volatiles at Showerhead	Resident	Adult	Inhalation	On-site	Quant	If groundwater wells were installed for residential purposes, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	On-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
					Child	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Groundwater	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Homegrown fruits and vegetables	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, volatiles could be released from groundwater into ambient air. Off-site maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into an off-site construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate to off-site wells in the future, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	Off-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.

Table 2-7
Selection of Exposure Pathways - SWMUs 48, 49, 50, 59

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Indoor Vapors	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
					Child	Inhalation	Off-site	Quant	If COPCs from SWMUs 48, 49, 50, 59 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	Off-site	None	The maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.



● Indicates pathway/receptor combinations to be evaluated

○ Indicates pathway/receptor combinations incomplete or no source

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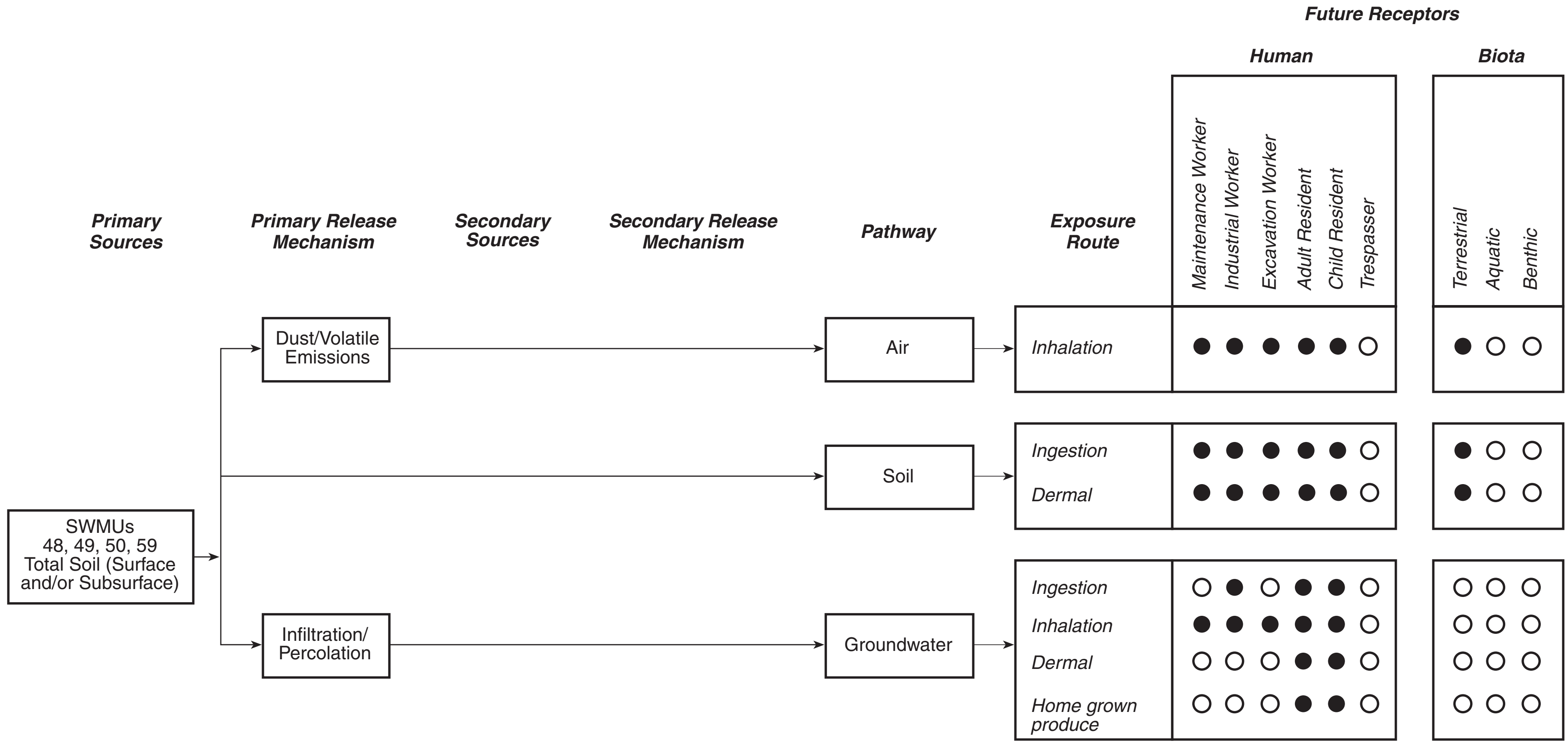
Figure 2-7. Current Land Use
Conceptual Site Model for SWMUs 48, 49, 50, 59
Radford Army Ammunition Plant, Virginia

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w



● Indicates pathway/receptor combinations to be evaluated

○ Indicates pathway/receptor combinations incomplete or no source

Shaw™ Shaw Environmental, Inc.

Figure 2-8. Future Land Use
Conceptual Site Model for SWMUs 48, 49, 50, 59
Radford Army Ammunition Plant, Virginia

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w

should be analyzed for TCL VOCs, TCL SVOCs, PAHs, TCL pest/PCBs, explosives, herbicides, TAL metals, and dioxins/furans to ensure adequate coverage of the site for these parameter groups.

2.6 INVESTIGATION APPROACH

The approach for these sites will consist of additional sampling to complete RFI/CMSs for four sites. Additional sampling is required to collect sufficient samples to complete risk assessments, further delineate identified "hotspots" in soil, provide additional coverage in lateral and vertical dimensions at the sites and further characterize groundwater so that a groundwater component can be added to the HHRA. **Table 2-8** provides a summary of the additional samples that will be collected. Proposed sample locations are presented on **Figure 2-2**.

Groundwater: Because the sites are fairly small and close together, the groundwater component of the investigations has been combined so that the extent of VOCs in groundwater can be assessed. Seven additional wells will be installed at the four SWMUs. These wells are intended to assess the groundwater conditions at each of the SWMUs and identify potential source areas. The wells will also be used to assess whether constituents in soil identified at the four SWMUs are migrating to groundwater. Proposed well locations are presented on **Figure 2-2**. Drilling and monitoring well installation will be performed in accordance with Section 5.2 and Standard Operating Procedures (SOPs) 20.1, 20.2, and 20.11 of the MWP (URS, 2003a).

One well (48MW07) will be installed upgradient of SWMU 48 and one well (59MW01) will be installed upgradient of SWMU 59. These wells will be used to assess groundwater entering the combined study area.

Two wells (48MW05 and 48MW06) will be installed downgradient of SWMU 48 and upgradient of SWMU 50. These wells are intended to:

- define the western extent of the VOCs detected in the existing wells.
- separate influences from SWMU 48 and SWMU 50 soil to area groundwater.

Two wells will be installed downgradient of SWMU 50 (and downgradient of the study area) to identify any impacts on groundwater from SWMU 50. One well will be installed at SWMU 49 (49MW01) to assess the impacts of the TPH detected in subsurface soil at that site.

Drilling will be performed with Hollow Stem Augers (HSA) to allow split spoon sampling. If water is encountered in the overburden, the well will be installed through the augers. If additional drilling into the bedrock is required, drilling will switch to Air rotary drilling and will continue until water is encountered. Wells will be constructed of two inch Schedule 40 PVC with 0.01 inch slot size screen. Ten feet of screened material will be used unless the rate of water production is low, in which case 15 to 20 ft of screen may be used. Number 1 sand will be used as a filter pack. The wells will be developed using a high capacity submersible pump, and will be periodically surged during development. Water quality parameters will be measured and recorded during development.

After well installation and development, the new wells and the four existing wells will be sampled for TCL VOCs, TCL SVOCs, PAHs, TCL pest/PCBs, explosives, herbicides, TAL metals, dioxins/furans, and perchlorate.

Table 2-8
Proposed Sampling and Analysis Plan
SWMUs 48, 49, 50, and 59
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
SWMU 48				
Groundwater	48MW4	84 ft bgs	existing onsite well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	48MW05	screened at first encountered water	proposed downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	48MW06	screened at first encountered water	proposed downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	49MW07	screened at first encountered water	proposed upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
SWMU 49				
Surface Soil	49SS02	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49SS03	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49SS04	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49SS05	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Subsurface Soil	49MW01A	4-6 ft bgs	well boring 49MW01	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49MW01B	10-12 ft bgs	well boring 49MW01	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	49MW01C	18-20 ft bgs	well boring 49MW01	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Groundwater	48MW1	125 ft bgs	existing upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	48MW2	123.7 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	48MW3	110 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	49MW01	screened at first encountered water	proposed onsite well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
SWMU 50				
Surface Soil	50SB06A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB07A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB08A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB09A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB10A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB11A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB12A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB13A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB14A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB15A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans

Table 2-8
Proposed Sampling and Analysis Plan
SWMUs 48, 49, 50, and 59
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
Subsurface Soil	50SB06B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB07B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB08B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB09B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB10B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB11B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB12B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB13B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB14B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	50SB15B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Groundwater	50MW01	screened at first encountered water	proposed downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	50MW02	screened at first encountered water	proposed downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
		SWMU 59		
Surface Soil	59SS06	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SS07	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SS08	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SS09	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SS10	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB02A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB03A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB04A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB05A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB06A	0-0.5 ft bgs	onsite surface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Subsurface Soil	59SB02B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB02C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB03B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB03C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB04B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB04C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB05B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB05C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB06B	4-6 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	59SB06C	8-10 ft bgs	onsite subsurface soil	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Groundwater	59MW01	screened at first encountered water	proposed upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate

Groundwater sampling will be performed using low-flow sampling techniques and a submersible pump in accordance with SOP 30.2 of the MWP (URS, 2003a). Water quality parameters will be monitored until stabilized (3 consecutive readings within 10%), the flow cell will be removed, the flow rate will be reduced to 100 ml/min and then sampling will be performed

Soil: Additional soil samples will be collected at three of the four SWMUs and are described below. The proposed samples and analyses are presented in **Table 2-8** and locations are shown on **Figure 2-2**. Sufficient samples have been collected at SWMU 48 to characterize the site for an RFI/CMS.

SWMU 49

Four surface soil samples and soil samples from three depths in the proposed well will be collected to provide sufficient sample coverage of the site for a statistical analysis of the on-site samples and the background dataset, as described in Section 1.2. The soil samples will be analyzed for TCL VOCs, TCL SVOCs, PAHs, TCL pest/PCBs, explosives, herbicides, TAL metals, and dioxins/furans. Soil sampling will follow the procedures in Section 5.2.9 and SOP 30.1 of the MWP (URS, 2003a).

SWMU 50

Advancement of ten soil borings to collect ten surface soil samples and ten subsurface soil samples to provide sufficient sample coverage for surface and subsurface soil for a statistical analysis of the on-site samples and the background dataset, as described in Section 1.2. These samples will be analyzed for TCL VOCs, TCL SVOCs, PAHs, TCL pest/PCBs, explosives, herbicides, TAL metals, and dioxins/furans. Soil sampling will follow the procedures in Section 5.2.9 and SOP 30.1 of the MWP (URS, 2003a).

SWMU 59

Ten surface soil samples and five soil borings are proposed for this site. The five soil borings will be located at five of the surface soil locations with subsurface samples collected from 4-6 and 8-10 ft bgs at each soil boring. These samples are intended to characterize the subsurface and to delineate the extent of elevated arsenic in surface soil. These samples will be analyzed for TCL VOCs, TCL SVOCs, PAHs, TCL pest/PCBs, explosives, herbicides, TAL metals, and dioxins/furans. Soil sampling will follow the procedures in Section 5.2.9 and SOP 30.1 of the MWP (URS, 2003a).

3.0 SWMU 41 RED WATER ASH BURIAL

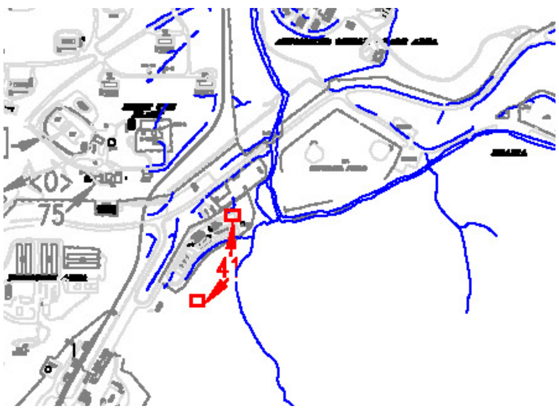
3.1 SITE DESCRIPTION AND HISTORY

3.1.1 Site Description

SWMU 41 is located in the southeast section of the MMA at RFAAP (**Figure 3-1**). **Figure 3-2** shows the layout of the site, which consists of two non-contiguous disposal areas (Areas A & B) for red water ash, a byproduct of combustion of TNT production wastewater (i.e., "red water").

Area A is an approximate 0.19-acre (approximately 93 ft by 109 ft) former unlined lagoon area, which has been backfilled with up to 15 ft of fill. This lagoon received rinsate from ash-transport vehicle rinsing (USEPA, 1987).

Area B is a natural clay-lined landfill, approximately 225 ft by 70 ft, containing red water ash. Clayey fill has been placed in an approximately 1.08 acre area at Area B. Prior to the construction of the red water treatment plant, red water was concentrated by evaporation and burned in four rotary kilns located in the TNT manufacturing area. The ash produced from these kilns was disposed of in SWMU 41 Area B from 1967 to 1971.



The closest structures to the site are two equalization basins located approximately 100 ft northwest of Area B and approximately 50 ft south-southwest of Area A. Each equalization basin consists of contiguous below grade reinforced concrete tanks. These units currently receive storm water from the inactive TNT Area (ATK, 2003). The equalization basins subsequently discharge to the RFAAP Industrial Wastewater Treatment Plant (ATK, 2003). Piping and associated appurtenances from the equalization basins traverse along the southern boundary of Area A. Other structures near SWMU 41 include a maintenance shop area adjacent to the north of Area A comprised of several small structures and storage areas (**Figure 3-2**).

Topography in the site area is characterized by gently to steeply sloping ridges and a general downward slope to the north (**Figure 3-2**). Area A is located approximately 100 ft west of Stroubles Creek at an elevation of approximately 1,730 to 1,735 ft msl. The ground surface slopes steeply from the edge of Area A toward the north and east toward Stroubles Creek. The burial area in Area B is approximately 550 ft southwest of Area A and approximately 70 to 100 ft west of an unnamed tributary of Stroubles Creek. The ground surface in Area B slopes toward the north, northeast, and northwest from an elevation of approximately 1,800 ft msl to a minimum elevation of approximately 1,776 ft msl. The land east and northwest of Area B slopes steeply toward a drainage ditch and an unnamed tributary of Stroubles Creek, respectively.

3.1.2 Site History

The RFA conducted by the USEPA in 1987 identified the site as having the potential to release contaminants into the environment. The site is included in the RFAAP RCRA Permit for Corrective Action (USEPA, 2000b). From approximately 1967 to 1974 and again from 1983 to 1986, RFAAP manufactured TNT by the continuous-type process (ATK, 2003), which employed

LEGEND

- SWMU 41 and 43, and Area O and P Boundaries
- Other SWMU Boundary
- Installation Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 500 1,000 2,000 Feet

U.S. Army Corps of Engineers

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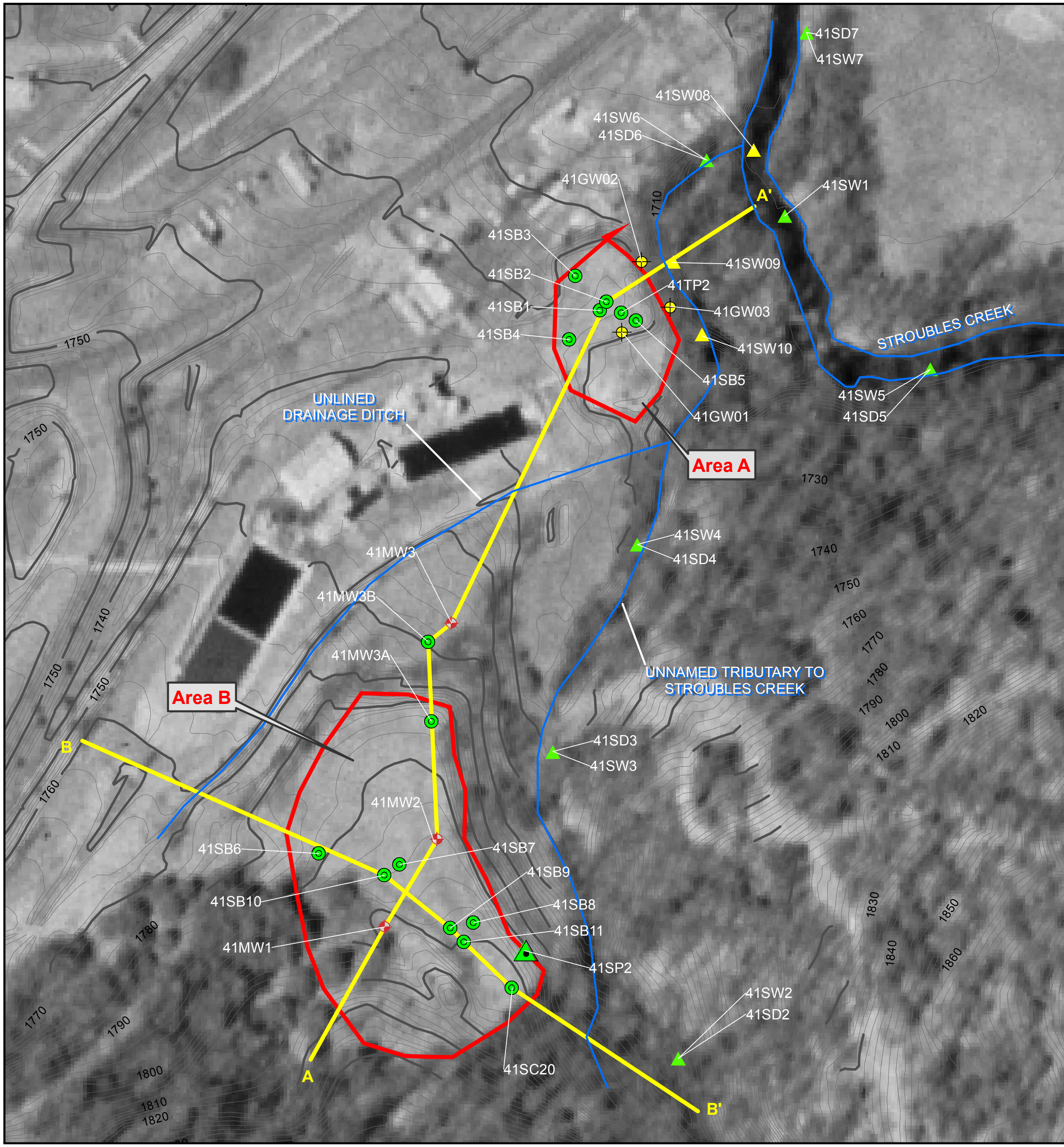
FIGURE 3-1
SWMU 41 and 43, and Areas O and P
Site Location Map
Radford Army Ammunition Plant,
Radford, VA

Date: 6/1/07 GIS File: RFAAP_003_Fig3-1_Workplan_O_P_41_43_SiteMap.mxd



LEGEND

- Monitoring Well Location
- Previous Investigation Soil Sample Location
- Previous Investigation Sediment/ Surface Water Sample Location
- Previous Investigation Seep Sample Location
- Proposed Surface Water Sample Location
- Proposed Direct Push Groundwater Location
- Geologic Cross-Section Line
- SWMU 41Boundary
- 10 ft Contour Line

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 75 150 300 Feet

U.S. Army Corps of Engineers

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FIGURE 3-2
SWMU 41 Sample Locations
Radford Army Ammunition Plant,
Radford, VA

Date: 7/11/07 GIS File: RFAAP_005_Fig3-2_Workplan_SWMU41_SampleLocations.mxd

chemical recycling and resulted in a smaller quantity of more concentrated waste than older batch-type operations. In TNT manufacture, a red-colored wastewater known as “red water” is produced (Department of the Army, 1987). Red water ash is identified as a USEPA hazardous waste (K047) solely for its reactivity (40 CFR 261.32). Red water generated from continuous-type TNT manufacturing (versus batch-type manufacture) at RFAAP was concentrated by evaporation and the residue burned in rotary kilns located in the former TNT manufacturing area (USATHMA, 1976). The ash produced from these kilns was disposed of in SWMU 41 from 1967 to 1971. Beginning in 1972, the red water was concentrated by evaporation to a 35%-liquor and sold to the paper industry (USATHMA, 1976).

3.2 SITE GEOLOLOGY, HYDROGEOLOGY AND HYDROLOGY

A comprehensive discussion of the regional physiography, soil, geology, and groundwater at RFAAP is included in the RFAAP MWP (URS, 2003a) and therefore is not discussed in this report.

3.2.1 Site Soil

Caneyville-Opequon-Rock Outcrop Complex is mapped within upland areas of the site and the Weaver soil is mapped along the floodplain of Stroubles Creek (URS, 2003b). The Caneyville-Opequon-Rock Outcrop Complex (25 to 60% slopes) consists of shallow, dominantly plastic clay soil with moderate organic content, slow to moderate permeability, and strongly acidic to neutral reaction. Weaver soil is present along the floodplain of Stroubles Creek and consists of moderately well drained and deep silt and clay loam soil, with low to moderate organic content, moderate permeability, and neutral to moderately alkaline reaction. A seasonally high water table occurs in the Weaver soil and the depth to bedrock is greater than 40 inches. Historical site activities have resulted in disturbance of native soil and placement of clayey fill [lean clay (CL) to fat clay (CH)] within Areas A and B. Soil samples are classified as lean to fat clay (CL to CH), with acidic to slightly alkaline pH (4.9 to 7.9 with distilled water), and low permeability (2.0E- 07 to 1.2E-08 centimeters per second). Total organic content of the soil samples range from 2.5 to 5.1%.

Fill material and residual soil at the site primarily consists of brown to reddish-yellow lean to fat clay (CL and CH) containing variable sand and gravel. Fill material covers both Areas A and B. The thickness of fill material at Area A is approximately 15 ft or less. At Area B, the thickness of fill ranges from 7 to approximately 20 ft with an increased thickness toward the north and northwest following the slope of bedrock and surface topography. A layer of clayey gravel (GC) or residual soil with saprolitic texture was encountered above bedrock in several borings completed at the site. A burial area of red water ash is present within Area B below approximately 4 to 9 ft of soil cover (clay). The observed thickness of this buried material ranged from approximately 0.1 to 4 ft.

3.2.2 Site Geology

Site geologic conditions were characterized during the 2005 RFI by completing 11 direct push soil borings at Area A (16 to 33 ft bgs) and 29 direct push soil borings at Area B (1 to 30 ft bgs) and physical testing of four soil samples. A geophysical survey was also completed at Area B prior to the RFI field investigation. Five of the borings at Area A and 19 of the borings at Area B were completed to refusal (presumed bedrock). A previous RCRA VI was conducted at the site in 1992 by Dames and Moore and included the completion of six borings (15 to 125 ft bgs), installation of bedrock monitoring wells in three of the borings (41MW1, 41MW2, and 41MW3), and physical testing of two soil samples. VI and RFI boring locations are shown on **Figure 3-2**. Subsurface data from site borings were used to construct two geologic cross-sections. A plan view of the cross section lines is presented on **Figure 3-2**. Cross-section A-A' is orientated northeast southwest across the site (**Figure 3-3**) and cross-section B-B' is orientated northwest southeast across Area B (**Figure 3-4**). Well construction diagrams and boring logs for the wells are presented in **Appendix B**.

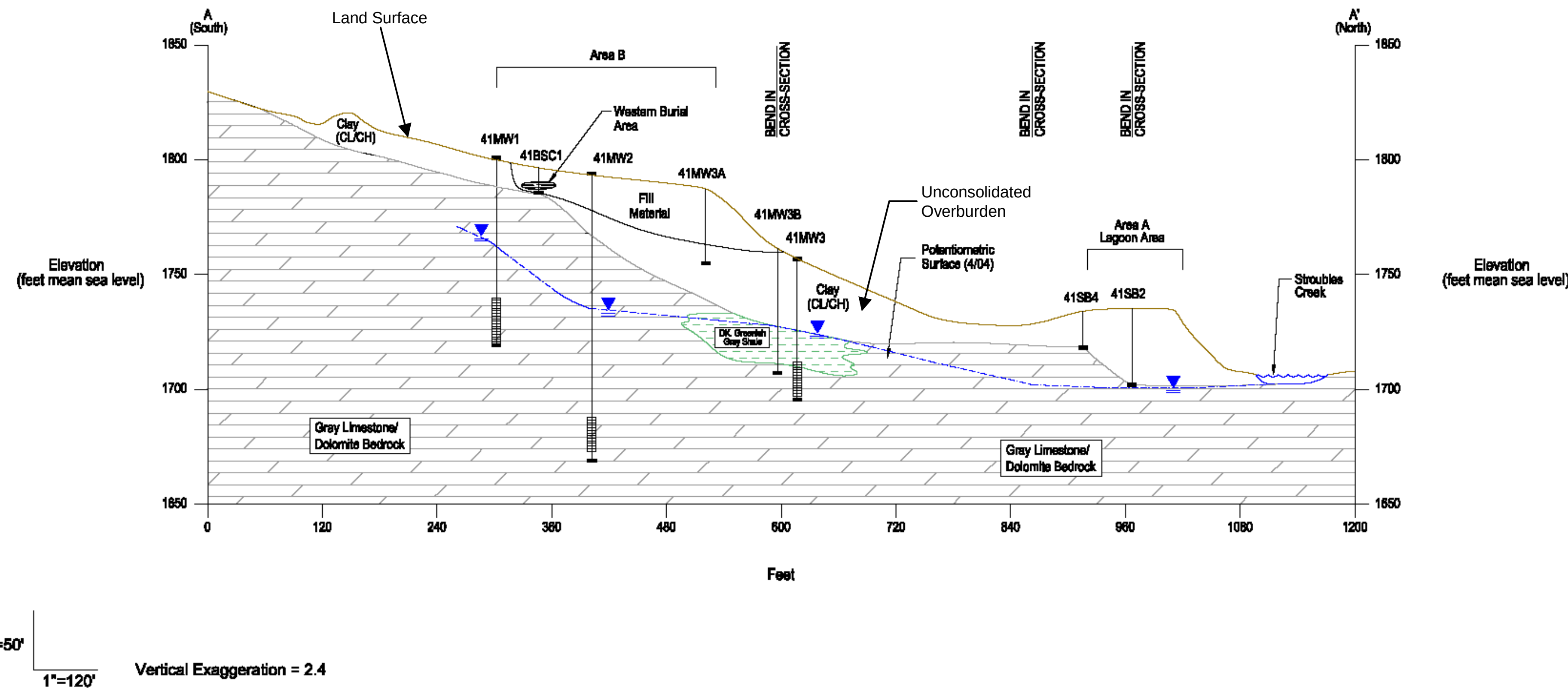
The site is underlain by the Cambrian Elbrook Formation, which consists of medium-gray, limestone and dolomite (collectively, carbonate rock). Bedrock cores in site borings were described as an interbedded argillaceous gray limestone and dolomite, with greenish-gray shale encountered in the uppermost 13 ft of bedrock in borings 41MW3 and 41MW3B. This shale was variably weathered with calcite veins and occasional layers of siltstone and pitted limestone. The limestone and dolomite has brecciated and conglomeratic zones and vuggy and pitted surfaces. Evidence of faulting and deformation of the limestone/dolomite bedrock is found in rock core samples and nearby road cuts, and is likely the result of intense deformation associated with the geologic thrust sheet fenster located immediately south and southeast of SWMU 41 (Dames and Moore, 1992). Bedrock outcrops south of Area B and along the access road northwest of Area B. The Draft Geologic Map of the Radford North Quadrangle indicates that the strike of bedrock at the southern outcrop near Area B is N45°W with an 80-degree dip (DMR, 2000). The bedrock surface slopes from the outcrop toward the north and northwest (**Figures 3-3 and 3-4**), and the depth to bedrock also increases in the same direction to a maximum observed depth of 32.5 ft in Area A and 30 ft bgs in Area B.

3.2.3 Site Hydrogeology

Groundwater at the site is present within fractured carbonate bedrock. Three bedrock monitoring wells (41MW1, 41MW2, and 41MW3) were installed within and downgradient of Area B as part of the 1992 VI conducted by Dames and Moore. Monitoring wells 41MW1 and 41MW2 were installed immediately upgradient and downgradient of the burial area, respectively, while 41MW3 was installed approximately 220 ft north of 41MW2. Stabilized potentiometric levels measured during the RFI ranged from 1,727.16 ft msl (41MW3) to 1,761.06 (41MW1). In the burial area, the potentiometric surface was approximately 23 to 25 ft below the top of bedrock, and downgradient of Area B it was approximately at the elevation of bedrock at 41MW3. The inferred groundwater flow direction in the area of monitoring wells 41MW1 and 41MW2 is toward the northeast at a hydraulic gradient in excess of 0.30 ft/ft based on limited triangulation between the three wells (**Figure 3-2**). Local groundwater flow patterns are likely a reflection of surface topography with local discharge occurring at Stroubles Creek and its unnamed tributary, which are perennial streams that receive their base flow from groundwater discharge.

3.2.4 Surface Water Hydrology

Stroubles Creek is a perennial stream located approximately 50 ft west of Area A. This creek splits into two channels approximately 150 ft upstream of Area A (southeast) and flows north past the site for a distance of approximately 250 ft before merging back into a single wider channel where it continues to flow north for approximately 2,800 ft until it discharges into the New River. Overland drainage from Area A flows toward the north, east, and south down a moderately sloped grass surface and then flows east toward Stroubles Creek. Overland storm water flow originates upgradient from the west of Area A in well-defined storm water drainage



Source: RCRA Facility Investigation Report for Solid Waste Management Unit 41 (URS, 2005)

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Baltimore District

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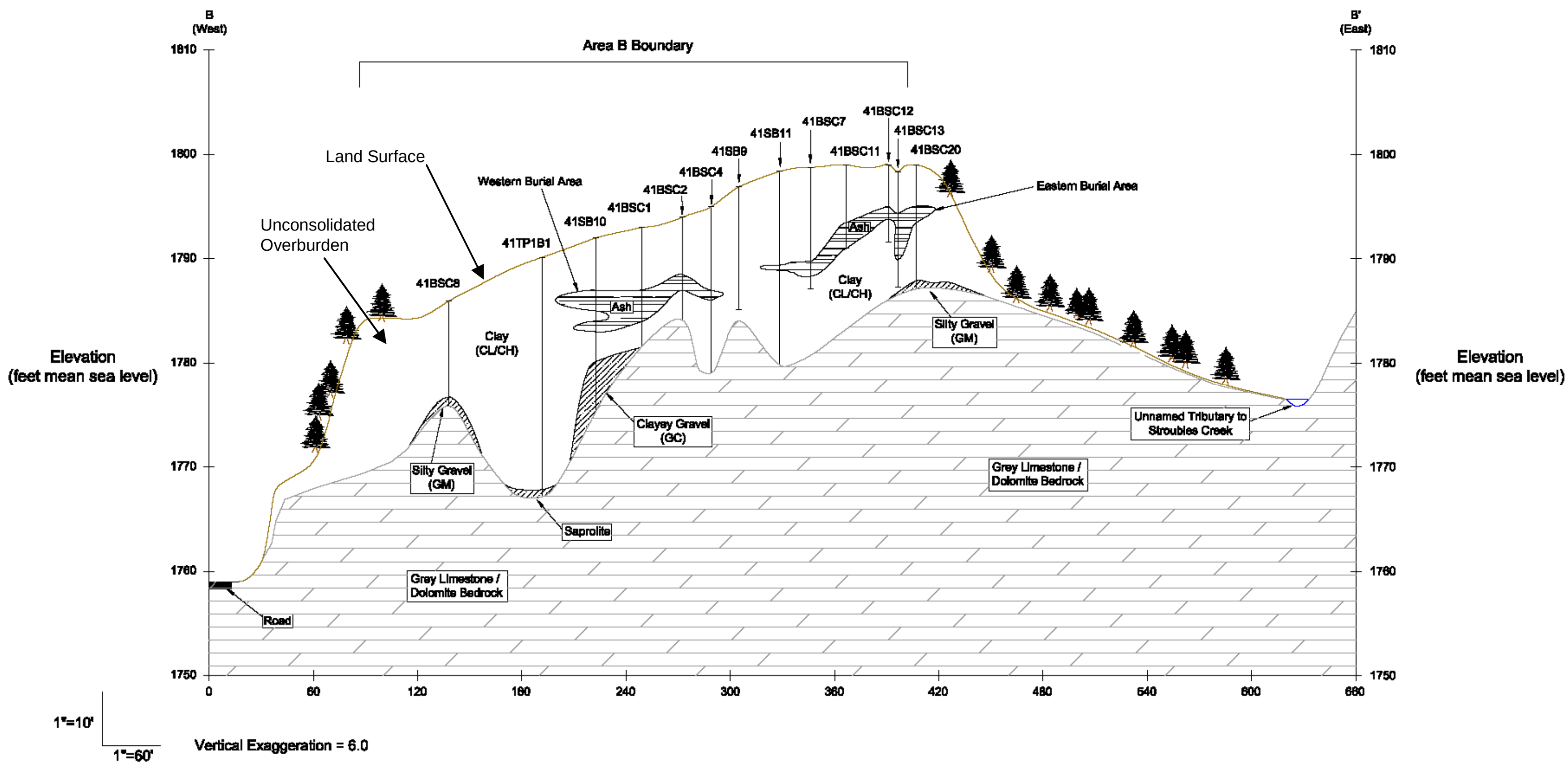
Figure 3-3
SWMU 41
Geologic Cross Section
A-A'

Radford AAP
Radford, Virginia



Source: RCRA Facility Investigation Report for Solid Waste Management Unit 41 (URS, 2005)

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Figure 3-4
SWMU 41
Geologic Cross Section
B-B'

Radford AAP
Radford, Virginia

ditches that flow along the perimeter of the equalization basins and on paved road surfaces along the western perimeter of Area A.

Overland drainage in the eastern half of Area B is toward the northeast and an unnamed tributary of Stroubles Creek located 70 to 100 ft northeast of Area B. This tributary originates approximately 0.7 miles southeast of the site and flows into Stroubles Creek approximately 150 ft upstream (southeast) of Area A. Overland drainage in the western half of Area B is northwest toward a storm water drainage ditch located south of the equalization basins, which receive storm water from the inactive TNT area (ATK, 2003). This drainage ditch discharges into the unnamed tributary approximately 375 ft north of Area B. Overland flow into Area B is from north via diffuse flow along vegetated surfaces. Seeps have occasionally flowed during prolonged wet periods at several locations along the base of the hill northwest of Area B. Discharges from these seeps were not observed during numerous site visits conducted during the RFI field program with the exception of one intermittent flowing seep observed at the northwest corner of Area B during the RFI; this seep emanated from the hillside where a small area of fill material has slumped away from the hillside.

Surface water flow measurements and water quality data were collected during the URS 2005 RFI. Measured flow in Stroubles Creek ranged from 0.6 cubic feet per second (ft^3/s) at station 41SW6/41SD6, where the creek was split into two channels, to 34.4 ft^3/s at the farthest downstream location. In the unnamed tributary, flow measurements ranged from 0.16 ft^3/s in the upstream sample to 0.90 ft^3/s in the farthest downstream sample. Measured levels of pH ranged from 8.13 to 8.72. Dissolved oxygen levels were in the range of 9.29 to 13.35 milligrams per liter with temperatures of 10 to 12.5°C. Specific conductance levels ranged from 0.285 to 0.376 siemens per centimeter.

3.3 PREVIOUS INVESTIGATIONS

In 1992, monitoring wells were installed and sampled and soil and surface water samples were collected. In 1997, sampling of Stroubles Creek for surface water and sediment near SWMU 41 was conducted. In 2002, a geophysical survey was performed to characterize both the lateral and vertical extent of the former burial area (Area B). In 2004, an RFI was conducted that defined the nature and extent of previous waste management practices through the collection and analysis of soil, groundwater, surface water, and sediment samples.

3.3.1 Installation Assessment (Air Photo Interpretation), 1992

Under the direction of USEPA, the Environmental Photographic Interpretation Center performed an assessment of multiple SWMUs at RFAAP (including SWMU 41) using selected aerial photographs from 1937 to 1986 (USEPA, 1992). Activity at SWMU 41 was first noted in a 1970 photograph and reportedly continued through the 1986 photographs (USEPA, 1992). A trench, a possible trench scar, and mounded material were visible on the 1971 photographs. The report noted that, “The trench appears to be empty at this time” (USEPA, 1992). “Between 1975 and 1981, the lagoon in the northern portion of this site had undergone filling and by 1981, [no more than] a small ground scar was visible in the southern portion of the site, which was undergoing revegetation” (USEPA, 1992). It was also noted that, “Between 1981 and 1986, the southern area had received a considerable amount of fill material” (USEPA, 1992). The 1986 photograph indicated that the majority of the site was “devoid of vegetation and significant filling appeared to have taken place” (USEPA, 1992).

3.3.2 VI, Dames and Moore, 1992

The VI completed by Dames and Moore in 1992 included sampling of soil, groundwater, and surface water as described below. Sample locations are shown on **Figure 3-2**.

Soil – One soil boring (41SB1) was completed to a depth 15 ft bgs near the center of Area A (**Figure 3-2** and **Table 3-1a**), and two soil samples were collected from this boring for chemical analysis of TAL metals, SVOCs, and explosives. Fill material described as potential red water ash was encountered in 41SB1 from approximately 6-13 ft bgs (Dames and Moore, 1992). One soil sample was collected at a depth of 8-10 ft bgs from this material and a second soil sample was collected below this material at the boring termination (14-15 ft bgs). Detected constituents included 16 metals and two tentatively identified compounds (TICs) in the SVOC library scan. Aluminum, chromium, manganese, and vanadium were detected at concentrations above current adjusted USEPA Region III residential risk-based concentrations (R-RBCs), and arsenic and iron were detected at concentrations above current adjusted USEPA Region III industrial risk-based concentrations (I-RBCs). Metals concentrations were below their RFAAP background point estimates (95% UTLs).

Groundwater – Three groundwater-monitoring wells (41MW1, 41MW2, and 41MW3) were installed at Area B to evaluate the potential impact of buried red water ash on the groundwater quality. Monitoring wells 41MW-1 and 41MW2 were installed immediately south and north of the burial area, respectively, and 41MW3 was installed approximately 220 ft north of 41MW2 (**Figure 3-2**). Groundwater samples were collected from these monitoring wells for analysis of TAL Metals, SVOCs, explosives, total organic carbon (TOC), total organic halides (TOX), and pH. Constituents detected in one or more groundwater samples included 11 metals, bis(2-ethylhexyl)phthalate, TOC, and TOX (**Table 3-1b**). Concentrations of antimony, vanadium and bis(2- ethylhexyl)phthalate in sample 41MW2 were above their adjusted tw-RBCs. Antimony also exceeded its MCL in the sample from 41MW2. Vanadium was also detected in sample 41MW3 at a concentration above its adjusted tw-RBC.

Surface Water – The planned VI program at Area A included the collection of a surface water sample from a seep along the bank of Area A prior to the seep entering Stroubles Creek. However, this seep was not active during the VI program, so a substitute sample of surface water was collected from Stroubles Creek for analysis of TAL metals, SVOCs, explosives, TOC, TOX, and pH. Detected constituents included seven metals, 2,4,6-TNT, TOC, and TOX (**Table 3-1c**). TNT was detected at a concentration (1.38 µg/L) below its current adjusted tw-RBC and USEPA Region III Biological Technical Assistance Group (BTAG) freshwater screening value. Metals concentrations were below adjusted tw-RBCs and BTAG screening values, with the exception of barium (55.9 µg/L), which was above its BTAG screening level.

3.3.3 New River and Tributaries Study, Parsons, 1997

Surface water and sediment sampling of Stroubles Creek near SWMU 41 was conducted by Parsons to support RFIs conducted at SWMUs 17, 31, 48, and 54. Sampling of Stroubles Creek was conducted in January 1995 (samples SCSW2/SCSE2) and November 1996 (samples SCSW4/SCSE4), and sampling results were reported in the New River and Tributaries Study dated December 1997 (Parsons, 1997). Results from this study cannot necessarily be attributed to a particular site, but are described in the section below.

Table 3-1a
1992 VI Detected Results for Soil at SWMU 41

SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	i-RBC	r-RBC	Background	41SB1 RVFS*44 25-OCT-91 8	41SB1 RVFS*45 25-OCT-91 14
Metals (mg/kg)					
Aluminum	na	na	40041	25400	20600
Arsenic	1.9	0.43	15.8	8.1	11.5
Barium	20000	1600	209	140	84.4
Calcium	na	na	na	62800	821
Chromium	310	23	65.3	32.6	60
Cobalt	na	na	72.3	12.8	15.9
Copper	4100	310	53.5	19.7	21.8
Iron	31000	2300	50962	24400	40000
Lead	800	400	26.8	**74.7**	**37.3**
Magnesium	na	na	na	40800	4950
Manganese	2000	160	2543	1560	885
Nickel	2000	160	62.8	20.8	25.2
Potassium	na	na	na	2080	1440
Sodium	na	na	na	2040	887
Vanadium	102	7.8	108	48.7	54.3
Zinc	31000	2300	202	**241**	87.7

Table 3-1b
1992 VI Detected Analytes for Groundwater at SWMU 41

SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	MCL	tw-RBC	41MW1 RDWC*69 03-MAR-92 65	41MW2 RDWC*70 03-MAR-92 100	41MW3 RDWC*68 04-MAR-92 45	41MW3 RDWC*71 04-MAR-92 45
Metals (ug/L)						
Antimony	6	1.5	nd	68	nd	nd
Barium	2000	730	19.9	81.8	16.5	15.7
Calcium	na	na	24000	232000	121000	122000
Lead	15	na	nd	1.41	nd	3.58
Magnesium	na	na	31400	214000	64000	65000
Manganese	50	73	45.4	39	10.1	10.2
Potassium	na	na	938	1710	2560	2940
Silver	100	18	0.321	0.962	nd	nd
Sodium	na	na	960000	6500000	221000	224000
Vanadium	na	3.7	nd	34.1	14.6	15.3
Zinc	5000	1100	nd	31.8	nd	nd
Organics (ug/L)						
Bis(2-ethylhexyl)phthalate	6	4.8	nd	5.6	nd	nd
Wet Chemistry						
pH	na	na	7.87	7.08	7.07	7.13
TOC	na	na	38000	82100	24400	23300
TOX	na	na	77.8	89.2	36.1	95

Table 3-1c
1992 VI Detected Results for Surface Water at SWMU 41

SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	MCL	tw-RBC	41SW1 RDWC*76 10-MAR-92 na
Metals (ug/L)			
Barium	2000	730	55.9
Calcium	na	na	58500
Iron	300	1100	199
Magnesium	na	na	29200
Manganese	50	73	27.8
Potassium	na	na	1850
Sodium	na	na	14900
Organics (ug/L)			
2,4,6-Trinitrotoluene	na	2.2	1.38
Wet Chemistry			
pH	1/1	na	7.99
TOC	1/1	1000.0	6010
TOX	1/1	1000.0	82.4

1995 Sample Results – One explosive, HMX, was detected in surface water sample SCSW2 collected from Stroubles Creek downstream from SWMU 41 at a concentration (5.3 µg/L) below its current tw-RBC and BTAG screening level. Dissolved metals were detected at concentrations below their tw-RBCs and BTAG screening levels. In the sediment sample (SCSE2), chromium was detected above its R-RBC and arsenic was detected above its I-RBC. Lead and nickel were detected in this sample at a concentrations above their BTAG screening levels.

1996 Sample Results – HMX was not detected in surface water sample SCSW4 collected from the same downstream location sampled in 1995 (SCSW2). Di-n-butylphthalate was detected in sample SCSW4 at a concentration above its BTAG screening level. Dissolved metals were detected in the 1996 samples at concentrations below their tw-RBCs and BTAG screening levels. Organic constituents were not detected in sediment sample SCSE4. In the sediment sample (SCSE4), manganese and vanadium were detected at concentrations above their R-RBCs, and arsenic and iron were detected at concentrations above their I-RBCs. Iron also exceeded its BTAG screening level.

3.3.4 Geophysical Survey, Argonne National Laboratory (ANL), 2002

ANL performed a geophysical survey of Area B during August and September 2002 to assist in the delineation of potential red water ash burial locations within Area B. Subsurface information obtained by the geophysical surveys was used to refine the CSM and focus RFI field investigations on characterizing the nature and extent of burial areas at Area B. Surface geophysical surveys were conducted using two-dimensional resistivity profiling, seismic refraction tomography, and electromagnetic-31 (EM-31) terrain-conductivity mapping. Vertical seismic profiles were also conducted in existing monitoring wells 41MW1, 41MW2, and 41MW3 at Area B to assist in guiding the seismic interpretations. USACE New England District personnel collected downhole electrical and natural-gamma logs to aid in constraining the resistivity models. The ANL geophysical report detailing the results of the surveys and methods used is included in the URS RFI report (URS, 2005). **Figure 3-5** is an EM-31 conductivity anomaly map that identifies two anomaly areas of higher electrical conductivity interpreted by ANL in their report as potential red water ash burial areas. The western anomaly area is approximately 120 ft in length and 20 to 30 ft in width and is orientated along a north-northwest south-southeast axis. The eastern area is approximately 30 ft in diameter. ANL estimated a 10 ft or less depth for the buried material based on the results of the conductivity survey and two-dimensional resistivity profiling. **Figure 3-6** shows seismic refraction profiling results that mapped bedrock at Area B as a surface sloping towards the north and northwest, with a slight decrease in velocity in the 50X and 115X on seismic profile 41-Seis-L1, which is also observed on seismic profile 41-Seis-L2. ANL interpreted this velocity change as a potential lithologic or structural break (consistent with a weaker bedrock zone modeled by 2D-ERI profile 41-Resist-L1). Other significant structural features were not indicated for the bedrock.

3.3.5 RFI, URS Corporation, 2005

The draft RFI was submitted to the Army, but the report was never submitted to the regulatory agencies. The RFI was designed to characterize chemical concentrations in soil at Areas A and B and the nature and extent of buried red water ash at Area B, evaluate potential releases to groundwater, surface water, and sediment in the site area, and evaluate potential risks to human health and the environment from identified chemicals of potential concern (COPCs). The chemical sampling and analysis program at Area A included 15 soil samples and three surface

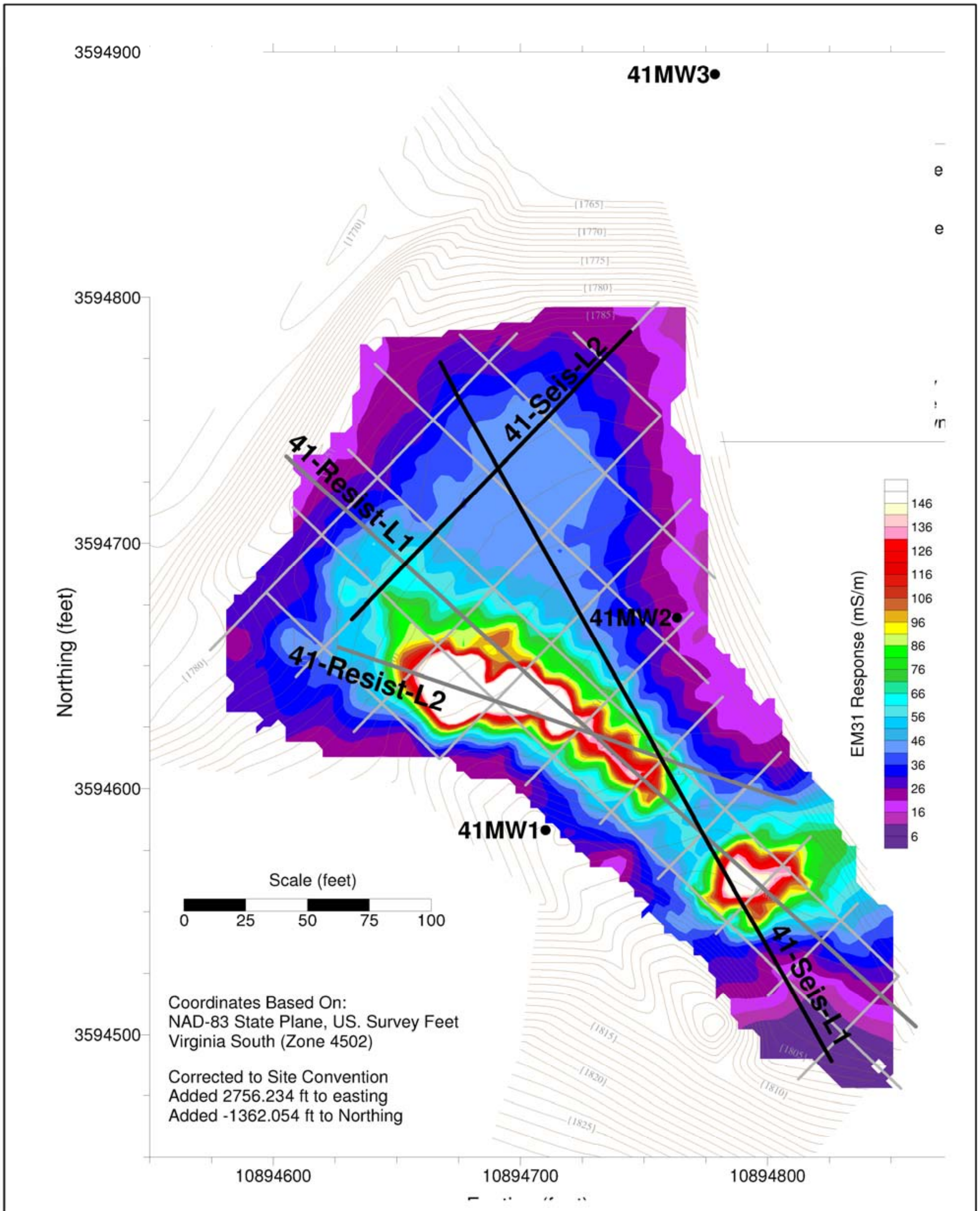

FIGURE 3-5 EM-31 Conductivity Anomoly Map Area B	
Date: August 2005	URS Project #: 21354893
Prepared by: LAM / DBC	Approved by: JOS
Scale: As Shown	File Name: Fig. 2-12

SWMU 41
RCRA Facility Investigation
Radford Army Ammunition Plant
Radford, Virginia

URS Group, Inc.
5540 Falmouth Street
Suite 201
Richmond, Virginia 23230

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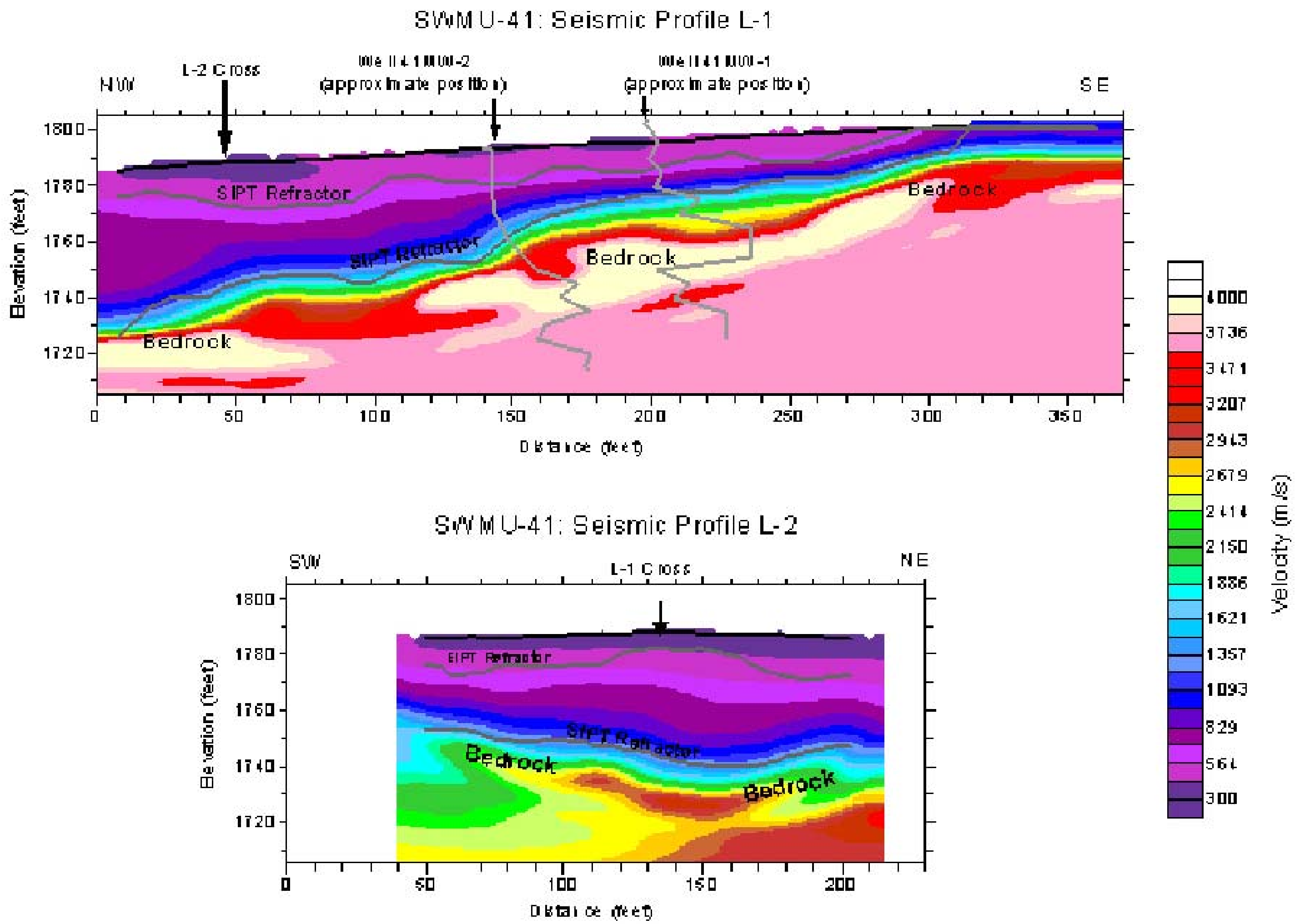

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FIGURE 3-6

Seismic Refraction Profiling Results
Area B

Date: August 2005	**URS Project #:** 21354683
Prepared by: LAM \ DBC	**Approved by:** JOS
Scale: As Shown	**File Name:** Fig. 2-13

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water/sediment sample pairs from nearby Stroubles Creek. At Area B, the chemical sampling and analysis program included: 22 samples of soil and buried material, three groundwater samples from existing monitoring wells 41MW1, 41MW, and 41MW3, and three surface water/sediment samples from the nearby unnamed tributary of Stroubles Creek. Results from these samples are presented in **Tables 3-2 through 3-5**, separated by media.

Nature and Extent Assessment at Area A

COPCs identified in Area A soil were aluminum, arsenic, barium, manganese, 1,1,2,2-tetrachloroethane (1,1,2,2-TCA), TCE, and total 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) equivalents concentration (TEQ).

Exceedances of adjusted R-RBCs for organic chemicals at Area A were limited to one "B" sample (41SB2B at 7.5 to 8 ft bgs) for total 2,3,7,8-TCDD as TEQ. No individual congener exceeded the applicable criteria in the sample. Vertical delineation of this exceedance was provided by the deeper "C" sample at this location (41SB2C at 15 to 16.5 ft bgs), which had a TEQ concentration below the adjusted R-RBC.

One soil sample for barium exceeded the USEPA Region III adjusted R-RBC. Other metal COPC concentrations were below their background point estimates, except for aluminum and arsenic in one terminal depth sample. 1,1,2,2-TCA and TCE were identified as COPCs based on single detections in soil samples at concentrations above their USEPA Region III default soil-transfer-to-groundwater screening level (SSL). It was concluded that 1,1,2,2-TCA and TCE were unlikely to leach to groundwater at levels of concern based on the lack of exceedances of calculated site-specific SSLs. Low-level organic detections and metal COPC concentrations in site soil were not indicative of significant impact from historical red water ash washout activities in the lagoon. No evidence of residual waste in the former lagoon area was observed in the 13 soil borings completed within Area A. Metals and dioxins concentrations in samples were not positively correlated, with metals concentrations below the background point estimate at the boring location of the R-RBC exceedance for total 2,3,7,8-TCDD as TEQ. Well-defined concentration patterns or trends were not apparent from the COPC data that would facilitate presentation of the soil data as isoconcentration maps. Surface water and sediment data from Stroubles Creek proximate to Area A were not indicative of significant impact from previous site activities at Area A. Human health COPCs were not identified in surface water samples, and metals COPCs were detected in sediment samples at concentrations below their soil background point estimates except for one slight exceedance of the arsenic background point estimate.

Nature and Extent Assessment at Area B

Four to nine feet of low permeability clay caps an estimated of 509 cubic yards of buried red water ash material within two adjacent burial areas with a combined area of 7,168 ft^2 (0.16 acre). At the northeast corner of Area B, a small area of buried material (less than 1 foot thick and 3 ft wide) is exposed underneath an overhang of fill material where a small area of fill material has slumped away. This exposed area has a seep, which intermittently flows after prolonged heavy precipitation events. A sample of this seep did not indicate detectable levels of organic constituents leaching from the buried material or levels of dissolved metals at concentrations above adjusted tw-RBCs. COPCs identified in Area B soil and/or buried material were aluminum, arsenic, iron, manganese, 1,2-dibromo-3-propane (SSL), 1,3-dichlorobenzene (SSL), benzene (SSL), TCE (SSL), and total 2,3,7,8-TCDD as TEQ. Metals were the primary COPCs in soil with the highest concentrations detected in intermediate depth samples that contained

Table 3-2
2004 RFI Detected Results for Soil at SWMU 41

Analyte	i-RBC	r-RBC	Background	41SB2A 3/30/04 0-1					41SB2B 3/30/04 7.5-8.5					41SB2C 3/30/04 31-32.9					41SB3A 3/31/04 0-1					41SB3B 3/31/04 9.8-10.5				
Sample ID / Sample Date / Sample Depth	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																												
1,1,2,2-Tetrachloroethane	14000	3200	na	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5	U		*0.084*	*5*	0.97	J		*0.084*	*5*
1,2-Dibromo-3-chloropropane	3600	200	na	10	U		*0.307*	*10*	10	U		*0.307*	*10*	10	U		*0.307*	*10*	10	U		*0.307*	*10*	10	U		*0.307*	*10*
1,2-Dibromoethane (EDB)	1400	320	na	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*
1,2-Dichloroethane	31000	7000	na	5	U		*0.18*	*5*	5	U		*0.18*	*5*	5	U		*0.18*	*5*	5	U		*0.18*	*5*	5	U		*0.18*	*5*
2-Butanone	61000000	4700000	na	5.5	J	B	*0.393*	*10*	4.6	J	B	*0.393*	*10*	2.1	J	B	*0.393*	*10*	9.3	J		*0.393*	*10*	5.8	J		*0.393*	*10*
2-Hexanone	4100000	310000	na	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*
4-Methyl-2-pentanone	8200000	630000	na	10	U		*0.181*	*10*	10	U		*0.181*	*10*	10	U		*0.181*	*10*	10	U		*0.181*	*10*	10	U		*0.181*	*10*
Acetone	92000000	7000000	na	37	J		*18.5*	*60*	26	J		*18.5*	*60*	60	U		*18.5*	*60*	55	J		*18.5*	*60*	31	J	J	*18.5*	*60*
Benzene	52000	12000	na	0.24	J		*0.136*	*5*	1.2	J		*0.136*	*5*	5	U		*0.136*	*5*	0.52	J		*0.136*	*5*	5	U		*0.136*	*5*
Bromoform	360000	81000	na	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*
Bromomethane	140000	11000	na	5	U		*0.158*	*5*	5	U		*0.158*	*5*	5	U		*0.158*	*5*	5	U		*0.158*	*5*	5	U		*0.158*	*5*
Carbon disulfide	10000000	780000	na	1.3	J		*0.172*	*5*	3.7	J		*0.172*	*5*	5	U		*0.172*	*5*	3.4	J		*0.172*	*5*	2.1	J		*0.172*	*5*
Chlorobenzene	2000000	160000	na	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*
cis-1,2-Dichloroethene	1000000	78000	na	5	U		*0.123*	*5*	5	U		*0.123*	*5*	1.2	J		*0.123*	*5*	5	U		*0.123*	*5*	5	U		*0.123*	*5*
cis-1,3-Dichloropropene	29	6.4	na	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*
Dibromochloromethane	34000	7600	na	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*
Ethylbenzene	10000000	780000	na	5	U		*0.145*	*5*	5	U		*0.145*	*5*	5	U		*0.145*	*5*	5	U		*0.145*	*5*	5	U		*0.145*	*5*
Methylene chloride	380000	85000	na	5	U		*0.857*	*5*	5	U		*0.857*	*5*	5	U		*0.857*	*5*	5	U		*0.857*	*5*	5	U		*0.857*	*5*
Styrene	20000000	1600000	na	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*
Tetrachloroethene	5300	1200	na	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*
Toluene	8200000	630000	na	0.18	J		*0.122*	*5*	1.2	J		*0.122*	*5*	5	U		*0.122*	*5*	0.49	J		*0.122*	*5*	5	U		*0.122*	*5*
trans-1,3-Dichloropropene	29	6.4	na	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*
Trichloroethene	7200	1600	na	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*
Trichlorofluoromethane	31000000	2300000	na	5	U		*0.1*	*5*	5	U		*0.1*	*5*	5	U		*0.1*	*5*	5	U		*0.1*	*5*	5	U		*0.1*	*5*
Vinyl chloride	4000	90	na	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*
Xylenes (total)	20000000	1600000	na	5	U		*0.139*	*5*	1.3	J		*0.139*	*5*	5	U		*0.139*	*5*	0.41	J		*0.139*	*5*	5	U		*0.139*	*5*
PAHs (ug/kg)																												
Acenaphthene	6100000	470000	na	100	U		*10.3*	*100*	100	U		*11.3*	*100*	100	U		*11.3*	*100*	100	U		*11.3*	*100*	100	U		*10.3*	*100*
Anthracene	31000000	2300000	na	21	U		*0.77*	*21*	21	U		*0.84*	*21*	21	U		*0.84*	*21*	21	U		*0.84*	*21*	21	U		*0.77*	*21*
Benz(a)anthracene	3900	220	na	21	U		*0.88*	*21*	21	U		*0.96*	*21*	21	U		*0.96*	*21*	21	U		*0.96*	*21*	21	U		*0.88*	*21*
Benzo(a)pyrene	390	22	na	21	U		*1.1*	*21*	21	U		*1.2*	*21*	21	U		*1.2*	*21*	21	U		*1.2*	*21*	21	U		*1.1*	*21*
Benzo(b)fluoranthene	3900	220	na	21	U		*1.43*	*21*	21	U		*1.56*	*21*	21	U		*1.56*	*21*	21	U		*1.56*	*21*	21	U		*1.43*	*21*
Benzo(g,h,i)perylene	3100000	230000	na	60	U		*13.8*	*60*	60	U		*15*	*60*	60	U		*15*	*60*	60	U		*15*	*60*	60	U		*13.8*	*60*
Benzo(k)fluoranthene	39000	2200	na	21	U		*1.1*	*21*	21	U		*1.2*	*21*	21	U		*1.2*	*21*	21	U		*1.2*	*21*	21	U		*1.1*	*21*
Chrysene	390000	22000	na	21	U		*1.32*	*21*	21	U		*1.44*	*21*	21	U		*1.44*	*21*	21	U		*1.44*	*21*	21	U		*1.32*	*21*
Fluoranthene	4100000	310000	na	6.4	J		*1.87*	*21*	21	U		*2.04*	*21*	21	U		*2.04*	*21*	21	U		*2.04*	*21*	21	U		*1.87*	*21*
Indeno(1,2,3-cd)pyrene	3900	220	na	21	U		*0.77*	*21*	21	U		*0.84*	*21*	21	U		*0.84*	*21*	21	U		*0.84*	*21*	21	U		*0.77*	*21*
Phenanthrene	3100000	230000	na	21	U		*0.66*	*21*	21	U		*0.72*	*21*	21	U		*0.72*	*21*	21	U		*0.72*	*21*	21	U		*0.66*	*21*
Pyrene	3100000	230000	na	3.8	J		*0.99*	*21*	21	U		*1.08*	*21*	21	U		*1.08*	*21*	21	U		*1.08*	*21*	21	U		*0.99*	*21*
SVOCs (ug/kg)																												
2,4-Dinitrotoluene	200000	16000	na	170	U		*11*	*170*	24	J		*12*	*170*	170	U		*12*	*170*	170	U		*12*	*170*	170	U		*11*	*170*
2,6-Dinitrotoluene	100000	7800	na	170	U		*10.9*	*170*	170	U		*11.9*	*170*	170	U		*11.9*	*170*	170	U		*11.9*	*170*	18	J		*10.9*	*170*
2-Methylnaphthalene	410000	31000	na	170	U		*9.72*	*170*	170	U		*10.6*	*170*	170	U		*10.6*	*170*	170	U		*10.6*	*170*	170	U		*9.72*	*170*
4-Chloro-3-methylphenol	na	na	na	170	U		*7.28*	*170*	170	U		*7.94*	*170*	170	U		*7.94*	*170*	170	U		*7.94*	*170*	170	U		*7.28*	*170*
4-Methylphenol	510000	39000	na	170	U		*4.24*	*170*	170	U		*4.62*	*170*	170	U		*4.62*	*170*	170	U		*4.62*	*170*	170	U		*4.24*	*170*
Benz(a)anthracene	3900	220	na	170	U		*10*	*170*	170	U		*10.9*	*170*	170	U		*10.9*	*170*	170	U		*10.9*	*170*	170	U		*10*	*170*
Benzo(b)fluoranthene	3900	220	na	170	U		*8.44*	*170*	170	U		*9.2*	*170*	170	U		*9.2*	*170*	170	U		*9.2*	*170*	170	U		*8.44*	*170*
Benzo(g,h,i)perylene	3100000	230000	na	170	U		*6.09*	*170*	170	U		*6.65*	*170*	170	U		*6.65*	*170*	170	U		*6.65*	*170*	170	U		*6.09*	*170*
Benzo(k)fluoranthene	39000	2200	na	170	U		*4.49*	*170*	170	U		*4.9*	*170*	170	U		*4.9*	*170*	170	U		*4.9*	*170*	170	U		*4.49*	*170*
bis(2-Ethylhexyl)phthalate	200000	46000	na	200			*10.4*	*170*	99	J		*11.3*	*170*	26	J		*11.3*	*170*	22	J		*11.3*	*170*	22	J		*10.4*	*170*
Butylbenzylphthalate	20000000	1600000	na	170	U		*8.69*	*170*	170	U		*9.48*	*170*	170	U		*9.48*	*170*	170	U		*9.48*	*170*	170	U		*8.69*	*170*
Chrysene	390000	22000	na	170	U		*8.06*	*170*	170	U		*8.8*	*170*	170	U		*8.8*	*170*	170	U		*8.8*	*170*	170	U		*8.06*	*170*
Diethylphthalate	82000000	6300000	na	170	U		*11.1*	*170*	170	U		*12.1*	*170*	170	U		*12.1*	*170*	170	U		*12.1*	*170*	170	U		*11.1*	*170*
Di-n-butylphthalate	10000000	780000	na	36	J		*7.82*	*170*	25	J		*8.53*	*170*	60	J		*8.53*	*170*	50	J		*8.53*	*170*	34	J		*7.82*	*170*
Fluoranthene	4100000	310000	na	7	J		*4.83*	*170*	170	U		*5.27*	*170*	170	U		*5.27*	*170*	170	U		*5.27*	*170*	170	U		*4.83*	*170*
Indeno(1,2,3-cd)pyrene	3900	220	na	170	U		*6.96*	*170*	170	U		*7.6*	*170*	170	U		*7.6*	*170*	170	U		*7.6*	*170*	170	U		*6.96*	*170*
Phenanthrene	3100000	230000	na	170	U		*8.37*	*170*	170	U		*9.13*	*170*	170	U		*9.13*	*170*	170	U		*9.13*	*170*	170	U		*8.37*	*170*
Pyrene	3100000	230000	na	6	J		*5.61*	*170*	170	U		*6.12*	*170*	170	U		*6.12*	*170*	170	U		*6.12*	*170*	170	U		*5.61*	*170*
Pesticides (ug/kg)																												
4,4'-DDT	8400	1900	na	1.2	J	J	*0.538*	*20*	NT					NT					NT					NT				
alpha-Chlordane	8200	1800	na	1.5	J	J	*0.449*	*20*	NT					NT					NT					NT				
Dieldrin	180	40	na	1.4	J	J	*0.471*	*20*	NT					NT					NT					NT				
Endosulfan II	610000	47000	na	1	J	J	*0.315*	*20*	NT					NT					NT					NT				
Endrin aldehyde	na	na	na	20	U		*0.434*	*20*	NT					NT					NT					NT				
Endrin ketone	na	na	na	1.7	J	J	*0.457*	*20*	NT					NT					NT					NT				
Endrin	31000	2300	na	6.4	J	J	*0.5*	*20*	NT					NT					NT					NT				
Heptachlor epoxide	310	70	na	1.8	J	J	*0.692*	*20*	NT					NT					NT					NT				
Heptachlor	640	140	na	20	U		*0.492*	*20*	NT					NT					NT					NT				
Methoxychlor	510000	39000	na	20	U		*0.933*	*20*	NT					NT					NT					NT				
PCBs (ug/kg)																												
PCB-1254	1400	156	na	150			*7.48*	*33*	NT					NT					NT					NT				
Explosives (mg/kg)	None detected																											
Herbicides (ug/kg)	None detected																											

Analyte	41SB3C 3/31/04 29.4-30.4					41SB4A 3/31/04 0-1					41SB4B 3/31/04 7-8					41SB4C 3/31/04 15-16					41SB5A 3/31/04 0-1				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																									
1,1,2,2-Tetrachloroethane	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5	U		*0.084*	*5*
1,2-Dibromo-3-chloropropane	10	U		*0.307*	*10*	10	U		*0.307*	*10*	10	U		*0.307*	*10*	10	U		*0.307*	*10*	10	U		*0.307*	*10*
1,2-Dibromoethane (EDB)	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*
1,2-Dichloroethane	5	U		*0.18*	*5*	5	U		*0.18*	*5*	5	U		*0.18*	*5*	5	U		*0.18*	*5*	5	U		*0.18*	*5*
2-Butanone	8.8	J		*0.393*	*10*	5.3	J		*0.393*	*10*	14			*0.393*	*10*	13			*0.393*	*10*	4.7	J		*0.393*	*10*
2-Hexanone	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*
4-Methyl-2-pentanone	10	U		*0.181*	*10*	10	U		*0.181*	*10*	10	U		*0.181*	*10*	10	U		*0.181*	*10*	10	U		*0.181*	*10*
Acetone	42	J	J	*18.5*	*60*	28	J	J	*18.5*	*60*	50	J	J	*18.5*	*60*	74		J	*18.5*	*60*	26	J	J	*18.5*	*60*
Benzene	0.59	J		*0.136*	*5*	0.47	J		*0.136*	*5*	0.22	J		*0.136*	*5*	0.25	J		*0.136*	*5*	0.27	J		*0.136*	*5*
Bromoform	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*
Bromomethane	5	U		*0.158*	*5*	5	U		*0.158*	*5*	5	U		*0.158*	*5*	2.7	J		*0.158*	*5*	5	U		*0.158*	*5*
Carbon disulfide	0.46	J		*0.172*	*5*	2.7	J		*0.172*	*5*	4.3	J		*0.172*	*5*	2.4	J		*0.172*	*5*	1.4	J		*0.172*	*5*
Chlorobenzene	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*
cis-1,2-Dichloroethene	5	U		*0.123*	*5*	5	U		*0.123*	*5*	5	U		*0.123*	*5*	5	U		*0.123*	*5*	5	U		*0.123*	*5*
cis-1,3-Dichloropropene	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*
Dibromochloromethane	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*
Ethylbenzene	5	U		*0.145*	*5*	5	U		*0.145*	*5*	5	U		*0.145*	*5*	5	U		*0.145*	*5*	5	U		*0.145*	*5*
Methylene chloride	5	U		*0.857*	*5*	5	U		*0.857*	*5*	5	U		*0.857*	*5*	5	U		*0.857*	*5*	5	U		*0.857*	*5*
Styrene	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*
Tetrachloroethene	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*
Toluene	0.55	J		*0.122*	*5*	0.37	J		*0.122*	*5*	0.25	J		*0.122*	*5*	0.82	J		*0.122*	*5*	0.24	J		*0.122*	*5*
trans-1,3-Dichloropropene	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*
Trichloroethene	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*
Trichlorofluoromethane	0.36	J		*0.1*	*5*	5	U		*0.1*	*5*	0.38	J		*0.1*	*5*	5	U		*0.1*	*5*	5	U		*0.1*	*5*
Vinyl chloride	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*
Xylenes (total)	5	U		*0.139*	*5*	5	U		*0.139*	*5*	5	U		*0.139*	*5*	5	U		*0.139*	*5*	5	U		*0.139*	*5*
PAHs (ug/kg)																									
Acenaphthene	100	U		*12.2*	*100*	100	U		*10.3*	*100*	100	U		*10.3*	*100*	100	U		*13.2*	*100*	100	U		*10.3*	*100*
Anthracene	21	U		*0.91*	*21*	21	U		*0.77*	*21*	21	U		*0.77*	*21*	21	U		*0.98*	*21*	21	U		*0.77*	*21*
Benz(a)anthracene	21	U		*1.04*	*21*	21	U		*0.88*	*21*	21	U		*0.88*	*21*	21	U		*1.12*	*21*	21	U		*0.88*	*21*
Benzo(a)pyrene	21	U		*1.3*	*21*	21	U		*1.1*	*21*	21	U		*1.1*	*21*	21	U		*1.4*	*21*	21	U		*1.1*	*21*
Benzo(b)fluoranthene	21	U		*1.69*	*21*	21	U		*1.43*	*21*	21	U		*1.43*	*21*	21	U		*1.82*	*21*	21	U		*1.43*	*21*
Benzo(g,h,i)perylene	60	U		*16.3*	*60*	60	U		*13.8*	*60*	60	U		*13.8*	*60*	60	U		*17.5*	*60*	60	U		*13.8*	*60*
Benzo(k)fluoranthene	21	U		*1.3*	*21*	21	U		*1.1*	*21*	21	U		*1.1*	*21*	21	U		*1.4*	*21*	21	U		*1.1*	*21*
Chrysene	21	U		*1.56*	*21*	21	U		*1.32*	*21*	21	U		*1.32*	*21*	21	U		*1.68*	*21*	21	U		*1.32*	*21*
Fluoranthene	21	U		*2.21*	*21*	21	U		*1.87*	*21*	21	U		*1.87*	*21*	21	U		*2.38*	*21*	21	U		*1.87*	*21*
Indeno(1,2,3-cd)pyrene	21	U		*0.91*	*21*	21	U		*0.77*	*21*	21	U		*0.77*	*21*	21	U		*0.98*	*21*	21	U		*0.77*	*21*
Phenanthrene	21	U		*0.78*	*21*	21	U		*0.66*	*21*	21	U		*0.66*	*21*	21	U		*0.84*	*21*	21	U		*0.66*	*21*
Pyrene	21	U		*1.17*	*21*	21	U		*0.99*	*21*	21	U		*0.99*	*21*	21	U		*1.26*	*21*	21	U		*0.99*	*21*
SVOCs (ug/kg)																									
2,4-Dinitrotoluene	170	U		*13*	*170*	170	U		*11*	*170*	170	U		*11*	*170*	170	U		*14*	*170*	170	U		*11*	*170*
2,6-Dinitrotoluene	170	U		*12.9*	*170*	170	U		*10.9*	*170*	170	U		*10.9*	*170*	170	U		*13.9*	*170*	170	U		*10.9*	*170*
2-Methylnaphthalene	170	U		*11.5*	*170*	170	U		*9.72*	*170*	170	U		*9.72*	*170*	170	U		*12.4*	*170*	170	U		*9.72*	*170*
4-Chloro-3-methylphenol	170	U		*8.61*	*170*	8	J		*7.28*	*170*	8	J		*7.28*	*170*	170	U		*9.27*	*170*	170	U		*7.28*	*170*
4-Methylphenol	170	U		*5.01*	*170*	170	U		*4.24*	*170*	170	U		*4.24*	*170*	170	U		*5.39*	*170*	170	U		*4.24*	*170*
Benz(a)anthracene	170	U		*11.8*	*170*	170	U		*10*	*170*	170	U		*10*	*170*	170	U		*12.7*	*170*	170	U		*10*	*170*
Benzo(b)fluoranthene	170	U		*9.97*	*170*	170	U		*8.44*	*170*	170	U		*8.44*	*170*	170	U		*10.7*	*170*	170	U		*8.44*	*170*
Benzo(g,h,i)perylene	170	U		*7.2*	*170*	170	U		*6.09*	*170*	170	U		*6.09*	*170*	170	U		*7.76*	*170*	170	U		*6.09*	*170*
Benzo(k)fluoranthene	170	U		*5.3*	*170*	170	U		*4.49*	*170*	170	U		*4.49*	*170*	170	U		*5.71*	*170*	170	U		*4.49*	*170*
bis(2-Ethylhexyl)phthalate	28	J		*12.3*	*170*	38	J		*10.4*	*170*	36	J		*10.4*	*170*	29	J		*13.2*	*170*	19	J		*10.4*	*170*
Butylbenzylphthalate	170	U		*10.3*	*170*	170	U		*8.69*	*170*	170	U		*8.69*	*170*	170	U		*11.1*	*170*	170	U		*8.69*	*170*
Chrysene	170	U		*9.53*	*170*	170	U		*8.06*	*170*	170	U		*8.06*	*170*	170	U		*10.3*	*170*	170	U		*8.06*	*170*
Diethylphthalate	170	U		*13.1*	*170*	170	U		*11.1*	*170*	170	U		*11.1*	*170*	170	U		*14.1*	*170*	170	U		*11.1*	*170*
Di-n-butylphthalate	55	J		*9.24*	*170*	48	J		*7.82*	*170*	40	J		*7.82*	*170*	36	J		*9.95*	*170*	40	J		*7.82*	*170*
Fluoranthene	170	U		*5.71*	*170*	170	U		*4.83*	*170*	170	U		*4.83*	*170*	170	U		*6.15*	*170*	170	U		*4.83*	*170*
Indeno(1,2,3-cd)pyrene	170	U		*8.23*	*170*	170	U		*6.96*	*170*	170	U		*6.96*	*170*	170	U		*8.86*	*170*	170	U		*6.96*	*170*
Phenanthrene	170	U		*9.89*	*170*	170	U		*8.37*	*170*	170	U		*8.37*	*170*	170	U		*10.7*	*170*	170	U		*8.37*	*170*
Pyrene	170	U		*6.63*	*170*	170	U		*5.61*	*170*	170	U		*5.61*	*170*	170	U		*7.14*	*170*	170	U		*5.61*	*170*
Pesticides (ug/kg)																									
4,4'-DDT	NT					NT					NT					NT					20	U		*0.538*	*20*
alpha-Chlordane	NT					NT					NT					NT					20	U		*0.449*	*20*
Dieldrin	NT					NT					NT					NT					20	U		*0.471*	*20*
Endosulfan II	NT					NT					NT					NT					20	U		*0.315*	*20*
Endrin aldehyde	NT					NT					NT					NT					20	U		*0.434*	*20*
Endrin ketone	NT					NT					NT					NT					20	U		*0.457*	*20*
Endrin	NT					NT					NT					NT					20	U		*0.5*	*20*
Heptachlor epoxide	NT					NT					NT					NT					20	U		*0.692*	*20*
Heptachlor	NT					NT					NT					NT					20	U		*0.492*	*20*
Methoxychlor	NT					NT					NT					NT					20	U		*0.933*	*20*
PCBs (ug/kg)																									
PCB-1254	NT					NT					NT					NT					33	U		*7.48*	*33*

Table 3-2
2004 RFI Detected Results for Soil at SWMU 41

Analyte	i-RBC	r-RBC	Background	41SB2A 3/30/04 0-1					41SB2B 3/30/04 7.5-8.5					41SB2C 3/30/04 31-32.9				
				Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)																		
Aluminum	na	na	40041	31100			*21*	*250*	27100			*21*	*250*	25900			*21*	*250*
Antimony	41	3.1	na	1.5			*0.0386*	*0.5*	0.24	J		*0.0386*	*0.5*	0.2	J		*0.0386*	*0.5*
Arsenic	1.9	0.43	15.8	12			*0.058*	*0.4*	4.3			*0.058*	*0.4*	2.8			*0.058*	*0.4*
Barium	20000	1600	209	113			*0.103*	*5*	100			*0.103*	*5*	100			*0.103*	*5*
Beryllium	200	16	1.02	0.73	J		*0.0267*	*1*	0.48	J		*0.0267*	*1*	**1.1**			*0.0267*	*1*
Cadmium	51	3.9	0.69	**2.2**			*0.25*	*1*	**1.7**			*0.25*	*1*	**1.6**			*0.25*	*1*
Calcium	na	na	na	59600			*87.5*	*1250*	23800			*87.5*	*1250*	1790			*17.5*	*250*
Chromium	310	23	65.3	23			*0.998*	*5*	22			*0.998*	*5*	32			*0.998*	*5*
Cobalt	na	na	72.3	11		J	*0.233*	*1*	12		J	*0.233*	*1*	13		J	*0.233*	*1*
Copper	4100	310	53.5	**69**			*0.516*	*5*	18			*0.516*	*5*	26			*0.516*	*5*
Iron	31000	2300	50962	43200			*36.6*	*500*	29100			*36.6*	*500*	20300			*18.3*	*250*
Lead	800	400	26.8	**125**			*1.94*	*25*	**37**			*0.0776*	*1*	25			*0.0776*	*1*
Magnesium	na	na	na	33300			*38.4*	*1250*	14200			*7.67*	*250*	9350			*7.67*	*250*
Manganese	2000	160	2543	517			*0.474*	*5*	961			*0.474*	*5*	92			*0.474*	*5*
Nickel	2000	160	62.8	21			*0.0775*	*0.5*	15			*0.0775*	*0.5*	24			*0.0775*	*0.5*
Potassium	na	na	na	2200			*7.79*	*100*	1650			*7.79*	*100*	2600			*7.79*	*100*
Selenium	510	39	na	0.67	J		*0.0486*	*1*	0.51	J		*0.0486*	*1*	0.61	J		*0.0486*	*1*
Silver	510	39	na	0.086	J		*0.0178*	*3*	0.068	J		*0.0178*	*3*	0.12	J		*0.0178*	*3*
Sodium	na	na	na	1730			*157*	*500*	36	J		*31.4*	*100*	221			*31.4*	*100*
Thallium	7.2	0.55	2.11	0.22	J		*0.0733*	*0.5*	0.24	J		*0.0733*	*0.5*	0.18	J		*0.0733*	*0.5*
Vanadium	102	7.8	108	50			*0.401*	*1.2*	54			*0.401*	*1.2*	37			*0.401*	*1.2*
Zinc	31000	2300	202	**1490**			*19.7*	*100*	102			*3.95*	*20*	86			*0.789*	*4*
Misc. (mg/kg)																		
Cyanide	2000	160	na	0.05	J	B	*0.009*	*0.5*	0.35	J		*0.009*	*0.5*	0.02	J	B	*0.009*	*0.5*
Dioxins/Furans (ng/kg)																		
2,3,7,8-TCDF	na	na	na	NT					4.65			*0.154*	*1.24*	1.1	U		*0.136*	*1.1*
2,3,7,8-TCDD	19	4.3	na	NT					0.327	J		*0.117*	*1.24*	1.1	U		*0.104*	*1.1*
1,2,3,7,8-PECDD	na	na	na	NT					1.78	J		*0.332*	*6.2*	5.5	U		*0.294*	*5.5*
1,2,3,4,7,8-HXCDD	460	100	na	NT					2.89	J		*0.267*	*6.2*	5.5	U		*0.237*	*5.5*
1,2,3,6,7,8-HXCDD	460	100	na	NT					7.09			*0.455*	*6.2*	0.482	J		*0.404*	*5.5*
1,2,3,7,8,9-HXCDD	460	100	na	NT					7.13			*0.558*	*6.2*	1.11	J		*0.495*	*5.5*
1,2,3,4,6,7,8-HPCDD	na	na	na	NT					159			*0.422*	*6.2*	6.7			*0.374*	*5.5*
OCDD	na	na	na	NT					2790	E	J	*1.12*	*12.4*	245			*0.992*	*11*
1,2,3,7,8-PECDF	na	na	na	NT					1.88	J		*0.193*	*6.2*	5.5	U		*0.171*	*5.5*
2,3,4,7,8-PECDF	na	na	na	NT					3.46	J		*0.232*	*6.2*	5.5	U		*0.206*	*5.5*
1,2,3,4,7,8-HXCDF	na	na	na	NT					2.07	J		*0.229*	*6.2*	5.5	U		*0.203*	*5.5*
1,2,3,6,7,8-HXCDF	na	na	na	NT					1.38	J		*0.116*	*6.2*	5.5	U		*0.103*	*5.5*
2,3,4,6,7,8-HXCDF	na	na	na	NT					1.84	J		*0.45*	*6.2*	5.5	U		*0.4*	*5.5*
1,2,3,7,8,9-HXCDF	na	na	na	NT					6.2	U		*0.553*	*6.2*	5.5	U		*0.491*	*5.5*
1,2,3,4,6,7,8-HPCDF	na	na	na	NT					29.2			*0.488*	*6.2*	5.5	U		*0.433*	*5.5*
1,2,3,4,7,8,9-HPCDF	na	na	na	NT					1.86	J		*0.435*	*6.2*	5.5	U		*0.386*	*5.5*
OCDF	na	na	na	NT					143			*0.708*	*12.4*	11	U		*0.628*	*11*
TOTAL TCDD	na	na	na	NT					12.5			*0.117*	*1.24*	1.1	U		*0.104*	*1.1*
TOTAL PECDD	na	na	na	NT					16.2			*0.332*	*6.2*	0.671	J		*0.294*	*5.5*
TOTAL HXCDD	460	100	na	NT					47.6			*0.267*	*6.2*	7.21			*0.237*	*5.5*
TOTAL HPCDD	na	na	na	NT					278			*0.422*	*6.2*	19.9			*0.374*	*5.5*
TOTAL TCDF	na	na	na	NT					70.9			*0.153*	*1.24*	1.1	U		*0.136*	*1.1*
TOTAL PECDF	na	na	na	NT					31.8			*0.193*	*6.2*	5.5	U		*0.171*	*5.5*
TOTAL HXCDF	na	na	na	NT					40.6			*0.116*	*6.2*	0.244	J		*0.103*	*5.5*
TOTAL HPCDF	na	na	na	NT					128			*0.435*	*6.2*	5.5	U		*0.386*	*5.5*

Analyte	41SB3A 3/31/04 0-1					41SB3B 3/31/04 9.8-10.5					41SB3C 3/31/04 29.4-30.4				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)															
Aluminum	23600			*4.2*	*50*	22200			*4.2*	*50*	27400			*21*	*250*
Antimony	0.36	J		*0.0386*	*0.5*	0.34	J		*0.0386*	*0.5*	0.29	J		*0.0386*	*0.5*
Arsenic	7.5			*0.058*	*0.4*	6.5			*0.058*	*0.4*	11			*0.058*	*0.4*
Barium	**432**			*0.103*	*5*	**318**			*0.103*	*5*	136			*0.103*	*5*
Beryllium	0.57	J		*0.0267*	*1*	0.79	J		*0.0267*	*1*	**1.1**			*0.0267*	*1*
Cadmium	**2.4**			*0.25*	*1*	**1.9**			*0.25*	*1*	**1.7**			*0.25*	*1*
Calcium	115000			*175*	*2500*	83500			*175*	*2500*	5230			*17.5*	*250*
Chromium	17			*0.998*	*5*	18			*0.998*	*5*	30			*0.998*	*5*
Cobalt	8.7		J	*0.233*	*1*	12		J	*0.233*	*1*	21		J	*0.233*	*1*
Copper	27			*0.516*	*5*	16			*0.516*	*5*	33			*0.516*	*5*
Iron	28600			*36.6*	*500*	21100			*18.3*	*250*	35400			*36.6*	*500*
Lead	**143**			*1.94*	*25*	**58**			*0.776*	*10*	**36**			*0.0776*	*1*
Magnesium	60100			*76.7*	*2500*	32700			*76.7*	*2500*	12300			*7.67*	*250*
Manganese	649			*0.474*	*5*	1170			*2.37*	*25*	873			*0.474*	*5*
Nickel	21			*0.0775*	*0.5*	21			*0.0775*	*0.5*	31			*0.0775*	*0.5*
Potassium	2220			*7.79*	*100*	3420			*7.79*	*100*	2660			*7.79*	*100*
Selenium	0.8	J		*0.0486*	*1*	0.89	J		*0.0486*	*1*	0.83	J		*0.0486*	*1*
Silver	0.77	J		*0.0178*	*3*	0.094	J		*0.0178*	*3*	0.14	J		*0.0178*	*3*
Sodium	525			*31.4*	*100*	215			*31.4*	*100*	71	J		*31.4*	*100*
Thallium	0.19	J		*0.0733*	*0.5*	0.22	J		*0.0733*	*0.5*	0.24	J		*0.0733*	*0.5*
Vanadium	37			*0.401*	*1.2*	35			*0.401*	*1.2*	54			*0.401*	*1.2*
Zinc	**357**			*3.95*	*20*	99			*0.789*	*4*	120			*3.95*	*20*
Misc. (mg/kg)															
Cyanide	0.07	J		*0.009*	*0.5*	0.42	J		*0.009*	*0.5*	0.05	J	B	*0.009*	*0.5*
Dioxins/Furans (ng/kg)															
2,3,7,8-TCDF	NT					NT					NT				
2,3,7,8-TCDD	NT					NT					NT				
1,2,3,7,8-PECDD	NT					NT					NT				
1,2,3,4,7,8-HXCDD	NT					NT					NT				
1,2,3,6,7,8-HXCDD	NT					NT					NT				
1,2,3,7,8,9-HXCDD	NT					NT					NT				
1,2,3,4,6,7,8-HPCDD	NT					NT					NT				
OCDD	NT					NT					NT				
1,2,3,7,8-PECDF	NT					NT					NT				
2,3,4,7,8-PECDF	NT					NT					NT				
1,2,3,4,7,8-HXCDF	NT					NT					NT				
1,2,3,6,7,8-HXCDF	NT					NT					NT				
2,3,4,6,7,8-HXCDF	NT					NT					NT				
1,2,3,7,8,9-HXCDF	NT					NT					NT				
1,2,3,4,6,7,8-HPCDF	NT					NT					NT				
1,2,3,4,7,8,9-HPCDF	NT					NT					NT				
OCDF	NT					NT					NT				
TOTAL TCDD	NT					NT					NT				
TOTAL PECDD	NT					NT					NT				
TOTAL HXCDD	NT					NT					NT				
TOTAL HPCDD	NT					NT					NT				
TOTAL TCDF	NT					NT					NT				
TOTAL PECDF	NT					NT					NT				
TOTAL HXCDF	NT					NT					NT				
TOTAL HPCDF	NT					NT					NT				

Analyte	41SB4A 3/31/04 0-1					41SB4B 3/31/04 7-8				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)										
Aluminum	29600			*42*	*500*	19300			*4.2*	*50*
Antimony	0.44	J		*0.0386*	*0.5*	0.28	J		*0.0386*	*0.5*
Arsenic	9.8			*0.058*	*0.4*	8			*0.058*	*0.4*
Barium	124			*0.103*	*5*	128			*0.103*	*5*
Beryllium	**1.2**			*0.0267*	*1*	0.74	J		*0.0267*	*1*
Cadmium	**2.6**			*0.25*	*1*	**1.5**			*0.25*	*1*
Calcium	53700			*175*	*2500*	2190			*17.5*	*250*
Chromium	23			*0.998*	*5*	19			*0.998*	*5*
Cobalt	14		J	*0.233*	*1*	14		J	*0.233*	*1*
Copper	35			*0.516*	*5*	18			*0.516*	*5*
Iron	37900			*36.6*	*500*	33200			*36.6*	*500*
Lead	**99**			*1.94*	*25*	**82**			*0.776*	*10*
Magnesium	34000			*76.7*	*2500*	2700			*7.67*	*250*
Manganese	826			*0.474*	*5*	1700			*2.37*	*25*
Nickel	26			*0.0775*	*0.5*	17			*0.0775*	*0.5*
Potassium	2680			*7.79*	*100*	1180			*7.79*	*100*
Selenium	0.77	J		*0.0486*	*1*	0.62	J		*0.0486*	*1*
Silver	0.12	J		*0.0178*	*3*	0.08	J		*0.0178*	*3*
Sodium	90	J	L	*31.4*	*100*	46	J	L	*31.4*	*100*
Thallium	0.26	J		*0.0733*	*0.5*	0.18	J		*0.0733*	*0.5*
Vanadium	51			*0.401*	*1.2*	34			*0.401*	*1.2*
Zinc	**242**			*3.95*	*20*	65			*3.95*	*4*
Misc. (mg/kg)										
Cyanide	0.06	J	B	*0.009*	*0.5*	0.02	J	B	*0.009*	*0.5*
Dioxins/Furans (ng/kg)										
2,3,7,8-TCDF	NT					NT				
2,3,7,8-TCDD	NT					NT				
1,2,3,7,8-PECDD	NT					NT				
1,2,3,4,7,8-HXCDD	NT					NT				
1,2,3,6,7,8-HXCDD	NT					NT				
1,2,3,7,8,9-HXCDD	NT					NT				
1,2,3,4,6,7,8-HPCDD	NT					NT				
OCDD	NT					NT				
1,2,3,7,8-PECDF	NT					NT				
2,3,4,7,8-PECDF	NT					NT				
1,2,3,4,7,8-HXCDF	NT					NT				
1,2,3,6,7,8-HXCDF	NT					NT				
2,3,4,6,7,8-HXCDF	NT					NT				
1,2,3,7,8,9-HXCDF	NT					NT				
1,2,3,4,6,7,8-HPCDF	NT					NT				
1,2,3,4,7,8,9-HPCDF	NT					NT				
OCDF	NT					NT				
TOTAL TCDD	NT					NT				
TOTAL PECDD	NT					NT				
TOTAL HXCDD	NT					NT				
TOTAL HPCDD	NT					NT				
TOTAL TCDF	NT					NT				
TOTAL PECDF	NT					NT				
TOTAL HXCDF	NT					NT				
TOTAL HPCDF	NT					NT				

Analyte	41SB4C 3/31/04 15-16					41SB5A 3/31/04 0-1				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)										
Aluminum	**40600**			*42*	*500*	18800			*4.2*	*50*
Antimony	0.64			*0.0386*	*0.5*	0.33	J		*0.0386*	*0.5*
Arsenic	**19**			*0.058*	*0.4*	6.9			*0.058*	*0.4*
Barium	74			*0.103*	*5*	**553**			*0.515*	*25*
Beryllium	**1.8**			*0.0267*	*1*	0.34	J		*0.0267*	*1*
Cadmium	**3**			*0.25*	*1*	**2.6**			*0.25*	*1*
Calcium	1720			*17.5*	*250*	156000			*438*	*6250*
Chromium	35			*0.998*	*5*	13			*0.998*	*5*
Cobalt	12		J	*0.233*	*1*	7.8		J	*0.233*	*1*
Copper	**63**			*0.516*	*5*	40			*0.516*	*5*
Iron	**75500**			*73.1*	*1000*	24300			*36.6*	*500*
Lead	**49**			*0.0776*	*1*	**125**			*1.94*	*25*
Magnesium	9100			*7.67*	*250*	82800			*192*	*6250*
Manganese	1330			*2.37*	*25*	918			*0.474*	*5*
Nickel	31			*0.0775*	*0.5*	18			*0.0775*	*0.5*
Potassium	1550			*7.79*	*100*	1980			*7.79*	*100*
Selenium	1.3			*0.0486*	*1*	0.78	J		*0.0486*	*1*
Silver	0.13	J		*0.0178*	*3*	0.13	J		*0.0178*	*3*
Sodium	31.4	U	UL	*31.4*	*100*	196			*31.4*	*100*
Thallium	0.44	J		*0.0733*	*0.5*	0.15	J		*0.0733*	*0.5*
Vanadium	69			*0.401*	*1.2*	29			*0.401*	*1.2*
Zinc	94			*0.789*	*4*	**480**			*7.89*	*40*
Misc. (mg/kg)										
Cyanide	0.03	J	B	*0.009*	*0.5*	0.06	J		*0.009*	*0.5*
Dioxins/Furans (ng/kg)										
2,3,7,8-TCDF	NT					NT				
2,3,7,8-TCDD	NT					NT				
1,2,3,7,8-PECDD	NT					NT				
1,2,3,4,7,8-HXCDD	NT					NT				
1,2,3,6,7,8-HXCDD	NT					NT				
1,2,3,7,8,9-HXCDD	NT					NT				
1,2,3,4,6,7,8-HPCDD	NT					NT				
OCDD	NT					NT				
1,2,3,7,8-PECDF	NT					NT				
2,3,4,7,8-PECDF	NT					NT				
1,2,3,4,7,8-HXCDF	NT					NT				
1,2,3,6,7,8-HXCDF	NT					NT				
2,3,4,6,7,8-HXCDF	NT					NT				
1,2,3,7,8,9-HXCDF	NT					NT				
1,2,3,4,6,7,8-HPCDF	NT					NT				
1,2,3,4,7,8,9-HPCDF	NT					NT				
OCDF	NT					NT				
TOTAL TCDD	NT					NT				
TOTAL PECDD	NT					NT				
TOTAL HXCDD	NT					NT				
TOTAL HPCDD	NT					NT				
TOTAL TCDF	NT					NT				
TOTAL PECDF	NT					NT				
TOTAL HXCDF	NT					NT				
TOTAL HPCDF	NT					NT				

Table 3-2
2004 RFI Detected Results for Soil at SWMU 41

Analyte			Sample ID	41SB5B					41SB5C					41SB6A				
			Sample Date	3/31/04					3/31/04					4/2/04				
			Sample Depth	15-16					28-29					0-1				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																		
1,1,2,2-Tetrachloroethane	14000	3200	na	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5.8		B	*0.084*	*5*
1,2-Dibromo-3-chloropropane	3600	200	na	10	U		*0.307*	*10*	10	U		*0.307*	*10*	9.4	J	B	*0.307*	*10*
1,2-Dibromoethane (EDB)	1400	320	na	5	U		*0.134*	*5*	5	U		*0.134*	*5*	0.96	J	B	*0.134*	*5*
1,2-Dichloroethane	31000	7000	na	5	U		*0.18*	*5*	5	U		*0.18*	*5*	0.57	J	B	*0.18*	*5*
2-Butanone	61000000	4700000	na	8	J		*0.393*	*10*	3.8	J		*0.393*	*10*	27		J	*0.393*	*10*
2-Hexanone	4100000	310000	na	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10			*0.37*	*10*
4-Methyl-2-pentanone	8200000	630000	na	10	U		*0.181*	*10*	10	U		*0.181*	*10*	7.7	J		*0.181*	*10*
Acetone	92000000	7000000	na	41	J	J	*18.5*	*60*	60	U		*18.5*	*60*	60	U		*18.5*	*60*
Benzene	52000	12000	na	0.2	J		*0.136*	*5*	5	U		*0.136*	*5*	0.26	J	B	*0.136*	*5*
Bromoform	360000	81000	na	5	U		*0.101*	*5*	5	U		*0.101*	*5*	1.2	J	B	*0.101*	*5*
Bromomethane	140000	11000	na	5	U		*0.158*	*5*	5	U		*0.158*	*5*	1.7	J	B	*0.158*	*5*
Carbon disulfide	10000000	780000	na	5	U		*0.172*	*5*	5	U		*0.172*	*5*	5	U	UJ	*0.172*	*5*
Chlorobenzene	2000000	160000	na	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	0.28	J	B	*0.0475*	*5*
cis-1,2-Dichloroethene	1000000	78000	na	5	U		*0.123*	*5*	5	U		*0.123*	*5*	5	U		*0.123*	*5*
cis-1,3-Dichloropropene	29	6.4	na	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	0.32	J	B	*0.0423*	*5*
Dibromochloromethane	34000	7600	na	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	0.55	J	B	*0.0527*	*5*
Ethylbenzene	10000000	780000	na	5	U		*0.145*	*5*	5	U		*0.145*	*5*	0.2	J	B	*0.145*	*5*
Methylene chloride	380000	85000	na	5	U		*0.857*	*5*	5	U		*0.857*	*5*	2.8	J	B	*0.857*	*5*
Styrene	20000000	1600000	na	5	U		*0.128*	*5*	5	U		*0.128*	*5*	2.7	J	B	*0.128*	*5*
Tetrachloroethene	5300	1200	na	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*
Toluene	8200000	630000	na	0.22	J		*0.122*	*5*	5	U		*0.122*	*5*	0.23	J	B	*0.122*	*5*
trans-1,3-Dichloropropene	29	6.4	na	5	U		*0.159*	*5*	5	U		*0.159*	*5*	0.46	J	B	*0.159*	*5*
Trichloroethene	7200	1600	na	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*
Trichlorofluoromethane	31000000	2300000	na	5	U		*0.1*	*5*	5	U		*0.1*	*5*	5	U		*0.1*	*5*
Vinyl chloride	4000	90	na	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*
Xylenes (total)	20000000	1600000	na	5	U		*0.139*	*5*	5	U		*0.139*	*5*	0.71	J	B	*0.139*	*5*
PAHs (ug/kg)																		
Acenaphthene	6100000	470000	na	100	U		*11.3*	*100*	100	U		*11.3*	*100*	100	U		*11.3*	*100*
Anthracene	31000000	2300000	na	21	U		*0.84*	*21*	21	U		*0.84*	*21*	21	U		*0.84*	*21*
Benz(a)anthracene	3900	220	na	21	U		*0.96*	*21*	21	U		*0.96*	*21*	21	U		*0.96*	*21*
Benzo(a)pyrene	390	22	na	21	U		*1.2*	*21*	21	U		*1.2*	*21*	21	U		*1.2*	*21*
Benzo(b)fluoranthene	3900	220	na	21	U		*1.56*	*21*	21	U		*1.56*	*21*	21	U		*1.56*	*21*
Benzo(g,h,i)perylene	3100000	230000	na	60	U		*15*	*60*	60	U		*15*	*60*	60	U		*15*	*60*
Benzo(k)fluoranthene	39000	2200	na	21	U		*1.2*	*21*	21	U		*1.2*	*21*	21	U		*1.2*	*21*
Chrysene	390000	22000	na	21	U		*1.44*	*21*	21	U		*1.44*	*21*	21	U		*1.44*	*21*
Fluoranthene	4100000	310000	na	21	U		*2.04*	*21*	21	U		*2.04*	*21*	21	U		*2.04*	*21*
Indeno(1,2,3-cd)pyrene	3900	220	na	21	U		*0.84*	*21*	21	U		*0.84*	*21*	21	U		*0.84*	*21*
Phenanthrene	3100000	230000	na	21	U		*0.72*	*21*	21	U		*0.72*	*21*	21	U		*0.72*	*21*
Pyrene	3100000	230000	na	21	U		*1.08*	*21*	21	U		*1.08*	*21*	21	U		*1.08*	*21*
SVOCs (ug/kg)																		
2,4-Dinitrotoluene	200000	16000	na	170	U		*12*	*170*	170	U		*10*	*170*	170	U		*12*	*170*
2,6-Dinitrotoluene	100000	7800	na	170	U		*11.9*	*170*	170	U		*9.94*	*170*	170	U		*11.9*	*170*
2-Methylnaphthalene	410000	31000	na	170	U		*10.6*	*170*	170	U		*8.84*	*170*	170	U		*10.6*	*170*
4-Chloro-3-methylphenol	na	na	na	170	U		*7.94*	*170*	170	U		*6.62*	*170*	170	U		*7.94*	*170*
4-Methylphenol	510000	39000	na	170	U		*4.62*	*170*	170	U		*3.85*	*170*	170	U		*4.62*	*170*
Benz(a)anthracene	3900	220	na	170	U		*10.9*	*170*	170	U		*9.09*	*170*	12	J		*10.9*	*170*
Benzo(b)fluoranthene	3900	220	na	170	U		*9.2*	*170*	170	U		*7.67*	*170*	14	J		*9.2*	*170*
Benzo(g,h,i)perylene	3100000	230000	na	170	U		*6.65*	*170*	170	U		*5.54*	*170*	7	J		*6.65*	*170*
Benzo(k)fluoranthene	39000	2200	na	170	U		*4.9*	*170*	170	U		*4.08*	*170*	7	J		*4.9*	*170*
bis(2-Ethylhexyl)phthalate	200000	46000	na	23	J		*11.3*	*170*	15	J		*9.44*	*170*	26	J		*11.3*	*170*
Butylbenzylphthalate	20000000	1600000	na	170	U		*9.48*	*170*	10	J		*7.9*	*170*	170	U		*9.48*	*170*
Chrysene	390000	22000	na	170	U		*8.8*	*170*	170	U		*7.33*	*170*	11	J		*8.8*	*170*
Diethylphthalate	82000000	6300000	na	170	U		*12.1*	*170*	170	U		*10.1*	*170*	14	J		*12.1*	*170*
Di-n-butylphthalate	10000000	780000	na	33	J		*8.53*	*170*	38	J		*7.11*	*170*	400			*8.53*	*170*
Fluoranthene	4100000	310000	na	170	U		*5.27*	*170*	170	U		*4.39*	*170*	18	J		*5.27*	*170*
Indeno(1,2,3-cd)pyrene	3900	220	na	170	U		*7.6*	*170*	170	U		*6.33*	*170*	170	U		*7.6*	*170*
Phenanthrene	3100000	230000	na	170	U		*9.13*	*170*	170	U		*7.61*	*170*	19	J		*9.13*	*170*
Pyrene	3100000	230000	na	170	U		*6.12*	*170*	170	U		*5.1*	*170*	26	J		*6.12*	*170*
Pesticides (ug/kg)																		
4,4'-DDT	8400	1900	na	NT					NT					NT				
alpha-Chlordane	8200	1800	na	NT					NT					NT				
Dieldrin	180	40	na	NT					NT					NT				
Endosulfan II	610000	47000	na	NT					NT					NT				
Endrin aldehyde	na	na	na	NT					NT					NT				
Endrin ketone	na	na	na	NT					NT					NT				
Endrin	31000	2300	na	NT					NT					NT				
Heptachlor epoxide	310	70	na	NT					NT					NT				
Heptachlor	640	140	na	NT					NT					NT				
Methoxychlor	510000	39000	na	NT					NT					NT				
PCBs (ug/kg)																		
PCB-1254	1400	156	na	NT					NT					NT				
Explosives (mg/kg)	None detected																	
Herbicides (ug/kg)	None detected																	

Analyte	41SB6B					41SB6C					41SB7A					41SB7B				
	4/2/04					4/2/04					3/30/04					3/30/04				
	0.7-2.1					21-21.5					0-1					14-16				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																				
1,1,2,2-Tetrachloroethane	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5	U		*0.084*	*5*
1,2-Dibromo-3-chloropropane	10	U		*0.307*	*10*	10	U	UJ	*0.307*	*10*	10	U		*0.307*	*10*	10	U		*0.307*	*10*
1,2-Dibromoethane (EDB)	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*
1,2-Dichloroethane	5	U		*0.18*	*5*	5	U		*0.18*	*5*	5	U		*0.18*	*5*	5	U		*0.18*	*5*
2-Butanone	29		J	*0.393*	*10*	28		B	*0.393*	*10*	2.9	J	B	*0.393*	*10*	2.9	J	B	*0.393*	*10*
2-Hexanone	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*
4-Methyl-2-pentanone	10	U		*0.181*	*10*	10	U		*0.181*	*10*	10	U		*0.181*	*10*	10	U		*0.181*	*10*
Acetone	120			*18.5*	*60*	60	U	UJ	*18.5*	*60*	60	U		*18.5*	*60*	60	U		*18.5*	*60*
Benzene	0.72	J	B	*0.136*	*5*	5	U		*0.136*	*5*	0.86	J		*0.136*	*5*	5	U		*0.136*	*5*
Bromoform	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*
Bromomethane	1.5	J	B	*0.158*	*5*	1.6	J	B	*0.158*	*5*	5	U		*0.158*	*5*	5	U		*0.158*	*5*
Carbon disulfide	9.4		B	*0.172*	*5*	5	U		*0.172*	*5*	1.1	J		*0.172*	*5*	5	U		*0.172*	*5*
Chlorobenzene	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*
cis-1,2-Dichloroethene	5	U		*0.123*	*5*	5	U		*0.123*	*5*	5	U		*0.123*	*5*	5	U		*0.123*	*5*
cis-1,3-Dichloropropene	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*
Dibromochloromethane	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*
Ethylbenzene	5	U		*0.145*	*5*	0.25	J		*0.145*	*5*	5	U		*0.145*	*5*	5	U		*0.145*	*5*
Methylene chloride	5	U		*0.857*	*5*	4.2	J	B	*0.857*	*5*	5	U		*0.857*	*5*	5	U		*0.857*	*5*
Styrene	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*
Tetrachloroethene	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*
Toluene	0.66	J	B	*0.122*	*5*	5	U		*0.122*	*5*	0.94	J		*0.122*	*5*	5	U		*0.122*	*5*
trans-1,3-Dichloropropene	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*
Trichloroethene	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*
Trichlorofluoromethane	5	U		*0.1*	*5*	0.91	J		*0.1*	*5*	5	U		*0.1*	*5*	5	U		*0.1*	*5*
Vinyl chloride	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*
Xylenes (total)	0.51	J	B	*0.139*	*5*	0.83	J		*0.139*	*5*	0.49	J		*0.139*	*5*	5	U		*0.139*	*5*
PAHs (ug/kg)																				
Acenaphthene	100	U		*11.3*	*100*	100	U		*14.1*	*100*	100	U		*13.2*	*100*	100	U		*13.2*	*100*
Anthracene	21	U		*0.84*	*21*	21	U		*1.05*	*21*	21	U		*0.98*	*21*	21	U		*0.98*	*21*
Benz(a)anthracene	21	U		*0.96*	*21*	21	U		*1.2*	*21*	21	U		*1.12*	*21*	21	U		*1.12*	*21*
Benzo(a)pyrene	21	U		*1.2*	*21*	21	U		*1.5*	*21*	21	U		*1.4*	*21*	21	U		*1.4*	*21*
Benzo(b)fluoranthene	21	U		*1.56*	*21*	21	U		*1.95*	*21*	21	U		*1.82*	*21*	21	U		*1.82*	*21*
Benzo(g,h,i)perylene	60	U		*15*	*60*	60	U		*18.8*	*60*	60	U		*17.5*	*60*	60	U		*17.5*	*60*
Benzo(k)fluoranthene	21	U		*1.2*	*21*	21	U		*1.5*	*21*	21	U		*1.4*	*21*	21	U		*1.4*	*21*
Chrysene	21	U		*1.44*	*21*	21	U		*1.8*	*21*	21	U		*1.68*	*21*	21	U		*1.68*	*21*
Fluoranthene	21	U		*2.04*	*21*	21			*2.55*	*21*	21	U		*2.38*	*21*	21	U		*2.38*	*21*
Indeno(1,2,3-cd)pyrene	21	U		*0.84*	*21*	21	U		*1.05*	*21*	21	U		*0.98*	*21*	21	U		*0.98*	*21*
Phenanthrene	21	U		*0.72*	*21*	6.9	J		*0.9*	*21*	21	U		*0.84*	*21*	21	U		*0.84*	*21*
Pyrene	21	U		*1.08*	*21*	7.7	J		*1.35*	*21*	21	U		*1.26*	*21*	21	U		*1.26*	*21*
SVOCs (ug/kg)																				
2,4-Dinitrotoluene	170	U		*12*	*170*	170	U		*15*	*170*	170	U		*14*	*170*	170	U		*14*	*170*
2,6-Dinitrotoluene	170	U		*11.9*	*170*	170	U		*14.9*	*170*	170	U		*13.9*	*170*	170	U		*13.9*	*170*
2-Methylnaphthalene	16	J		*10.6*	*170*	170	U		*13.3*	*170*	170	U		*12.4*	*170*	170	U		*12.4*	*170*
4-Chloro-3-methylphenol	170	U		*7.94*	*170*	170	U		*9.93*	*170*	170	U		*9.27*	*170*	170	U		*9.27*	*170*
4-Methylphenol	170	U		*4.62*	*170*	170	U		*5.78*	*170*	170	U		*5.39*	*170*	170	U		*5.39*	*170*
Benz(a)anthracene	170	U		*10.9*	*170*	170	U		*13.6*	*170*	170	U		*12.7*	*170*	170	U		*12.7*	*170*
Benzo(b)fluoranthene	170	U		*9.2*	*170*	170	U		*11.5*	*170*	170	U		*10.7*	*170*	170	U		*10.7*	*170*
Benzo(g,h,i)perylene	170	U		*6.65*	*170*	170	U		*8.31*	*170*	170	U		*7.76*	*170*	170	U		*7.76*	*170*
Benzo(k)fluoranthene	170	U		*4.9*	*170*	170	U		*6.12*	*170*	170	U		*5.71*	*170*	170	U		*5.71*	*170*
bis(2-Ethylhexyl)phthalate	21	J		*11.3*	*170*	22	J		*14.2*	*170*	17	J		*13.2*	*170*	16	J		*13.2*	*170*
Butylbenzylphthalate	170	U		*9.48*	*170*	170	U		*11.9*	*170*	170	U		*11.1*	*170*	170	U		*11.1*	*170*
Chrysene	170	U		*8.8*	*170*	170	U		*11*	*170*	170	U		*10.3*	*170*	170	U		*10.3*	*170*
Diethylphthalate	33	J		*12.1*	*170*	170	U		*15.2*	*170*	170	U		*14.1*	*170*	170	U		*14.1*	*170*
Di-n-butylphthalate	48	J		*8.53*	*170*	83	J		*10.7*	*170*	26	J		*9.95*	*170*	35	J		*9.95*	*170*
Fluoranthene	170	U		*5.27*	*170*	170	U		*6.59*	*170*	170	U		*6.15*	*170*	170	U		*6.15*	*170*
Indeno(1,2,3-cd)pyrene	170	U		*7.6*	*170*	170	U		*9.5*	*170*	170	U		*8.86*	*170*	170	U		*8.86*	*170*
Phenanthrene	16	J		*9.13*	*170*	170	U		*11.4*	*170*	170	U		*10.7*	*170*	170	U		*10.7*	*170*
Pyrene	170	U		*6.12*	*170*	170	U		*7.65*	*170*	170	U		*7.14*	*170*	170	U		*7.14*	*170*
Pesticides (ug/kg)																				
4,4'-DDT	NT					NT					20	U		*0.538*	*20*	NT				
alpha-Chlordane	NT					NT					20	U		*0.449*	*20*	NT				
Dieldrin	NT					NT					20	U		*0.471*	*20*	NT				
Endosulfan II	NT					NT					20	U		*0.315*	*20*	NT				
Endrin aldehyde	NT					NT					20	U		*0.434*	*20*	NT				
Endrin ketone	NT					NT					20	U		*0.457*	*20*	NT				
Endrin	NT					NT					20	U		*0.5*	*20*	NT				
Heptachlor epoxide	NT					NT					20	U		*0.692*	*20*	NT				
Heptachlor	NT					NT					0.51	J	J	*0.492*	*20*	NT				
Methoxychlor	NT					NT					20	U		*0.933*	*20*	NT				
PCBs (ug/kg)																				
PCB-1254	NT					NT					33	U		*9.52*	*33*	NT				

Analyte	41SB7C					41SB8A					41SB8B				
	3/30/04					4/1/04					4/1/04				
	23-24					0-1					8-12				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)															
1,1,2,2-Tetrachloroethane	5	U		*0.084*	*5*	5	U		*0.084*	*5*	5	U		*0.084*	*5*
1,2-Dibromo-3-chloropropane	10	U		*0.307*	*10*	10	U		*0.307*	*10*	10	U		*0.307*	*10*
1,2-Dibromoethane (EDB)	5	U		*0.134*	*5*	5	U		*0.134*	*5*	5	U		*0.134*	*5*
1,2-Dichloroethane	5	U		*0.18*	*5*	5	U	UJ	*0.18*	*5*	5	U	UJ	*0.18*	*5*
2-Butanone	9.5	J		*0.393*	*10*	7.1	J	J	*0.393*	*10*	16		J	*0.393*	*10*
2-Hexanone	10	U		*0.37*	*10*	10	U		*0.37*	*10*	10	U		*0.37*	*10*
4-Methyl-2-pentanone	10	U		*0.181*	*10*	10	U	UJ	*0.181*	*10*	10	U	UJ	*0.181*	*10*
Acetone	41	J		*18.5*	*60*	31	J	J	*18.5*	*60*	88		J	*18.5*	*60*
Benzene	5	U		*0.136*	*5*	1.1	J		*0.136*	*5*	1.2	J		*0.136*	*5*
Bromoform	5	U		*0.101*	*5*	5	U		*0.101*	*5*	5	U		*0.101*	*5*
Bromomethane	5	U		*0.158*	*5*	1.9	J	B	*0.158*	*5*	1.8	J	B	*0.158*	*5*
Carbon disulfide	5	U		*0.172*	*5*	1.2	J	B	*0.172*	*5*	17		J	*0.172*	*5*
Chlorobenzene	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*	5	U		*0.0475*	*5*
cis-1,2-Dichloroethene	5	U		*0.123*	*5*	5	U		*0.123*	*5*	5	U		*0.123*	*5*
cis-1,3-Dichloropropene	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*	5	U		*0.0423*	*5*
Dibromochloromethane	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*	5	U		*0.0527*	*5*
Ethylbenzene	5	U		*0.145*	*5*	5	U		*0.145*	*5*	5	U		*0.145*	*5*
Methylene chloride	5	U		*0.857*	*5*	5	U	UJ	*0.857*	*5*	5	U	UJ	*0.857*	*5*
Styrene	5	U		*0.128*	*5*	5	U		*0.128*	*5*	5	U		*0.128*	*5*
Tetrachloroethene	5	U		*0.129*	*5*	5	U		*0.129*	*5*	5	U		*0.129*	*5*
Toluene	5	U		*0.122*	*5*	1.2	J		*0.122*	*5*	1.2	J		*0.122*	*5*
trans-1,3-Dichloropropene	5	U		*0.159*	*5*	5	U		*0.159*	*5*	5	U		*0.159*	*5*
Trichloroethene	5	U		*0.154*	*5*	5	U		*0.154*	*5*	5	U		*0.154*	*5*
Trichlorofluoromethane	5	U		*0.1*	*5*	0.17	J		*0.1*	*5*	5	U		*0.1*	*5*
Vinyl chloride	5	U		*0.115*	*5*	5	U		*0.115*	*5*	5	U		*0.115*	*5*
Xylenes (total)	5	U		*0.139*	*5*	0.86	J		*0.139*	*5*	5	U		*0.139*	*5*
PAHs (ug/kg)															
Acenaphthene	100	U		*13.2*	*100*	100	U		*11.3*	*100*	20	J		*11.3*	*100*
Anthracene	21	U		*0.98*	*21*	21	U		*0.84*	*21*	1.3	J		*0.84*	*21*
Benz(a)anthracene	21	U		*1.12*	*21*	21	U		*0.96*	*21*	39			*0.96*	*21*
Benzo(a)pyrene	21	U		*1.4*	*21*	21	U		*1.2*	*21*	13	J		*1.2*	*21*
Benzo(b)fluoranthene	21	U		*1.82*	*21*	21	U		*1.56*	*21*	16	J		*1.56*	*21*
Benzo(g,h,i)perylene	60	U		*17.5*	*60*	60	U		*15*	*60*	25	J		*15*	*60*
Benzo(k)fluoranthene	21	U		*1.4*	*21*	21	U		*1.2*	*21*	8.4	J		*1.2*	*21*
Chrysene	21	U		*1.68*	*21*	21	U		*1.44*	*21*	14	J		*1.44*	*21*
Fluoranthene	21	U		*2.38*	*21*	21	U		*2.04*	*21*	33			*2.04*	*21*
Indeno(1,2,3-cd)pyrene	21	U		*0.98*	*21*	21	U		*0.84*	*21*	13	J		*0.84*	*21*
Phenanthrene	21	U		*0.84*	*21*	21	U		*0.72*	*21*	12	J		*0.72*	*21*
Pyrene	21	U		*1.26*	*21*	21	U		*1.08*	*21*	21			*1.08*	*21*
SVOCs (ug/kg)															
2,4-Dinitrotoluene	170	U		*14*	*170*	170	U		*12*	*170*	170	U		*12*	*170*
2,6-Dinitrotoluene	170	U		*13.9*	*170*	170	U		*11.9*	*170*	170	U		*11.9*	*170*
2-Methylnaphthalene	170	U		*12.4*	*170*	170	U		*10.6*	*170*	170	U		*10.6*	*170*
4-Chloro-3-methylphenol	170	U		*9.27*	*170*	170	U		*7.94*	*170*	11	J		*7.94*	*170*
4-Methylphenol	170	U		*5.39*	*170*	170	U		*4.62*	*170*	170	U		*4.62*	*170*
Benz(a)anthracene	170	U		*12.7*	*170*	170	U		*10.9*	*170*	170	U		*10.9*	*170*
Benzo(b)fluoranthene	170	U		*10.7*	*170*	170	U		*9.2*	*170*	19	J		*9.2*	*170*
Benzo(g,h,i)perylene	170	U		*7.76*	*170*	170	U		*6.65*	*170*	9	J		*6.65*	*170*
Benzo(k)fluoranthene	170	U		*5.71*	*170*	170	U		*4.9*	*170*	9	J		*4.9*	*170*
bis(2-Ethylhexyl)phthalate	17	J		*13.2*	*170*	17	J		*11.3*	*170*	45	J		*11.3*	*170*
Butylbenzylphthalate	170	U		*11.1*	*170*	170	U		*9.48*	*170*	170	U		*9.48*	*170*
Chrysene	170	U		*10.3*	*170*	170	U		*8.8*	*170*	16	J		*8.8*	*170*
Diethylphthalate	170	U		*14.1*	*170*	170	U		*12.1*	*170*	13	J		*12.1*	*170*
Di-n-butylphthalate	44	J		*9.95*	*170*	29	J		*8.53*	*170*	48	J		*8.53*	*170*
Fluoranthene	170	U		*6.15*	*170*	170	U		*5.27*	*170*	23	J		*5.27*	*170*
Indeno(1,2,3-cd)pyrene	170	U		*8.86*	*170*	170	U		*7.6*	*170*	170	U		*7.6*	*170*
Phenanthrene	170	U		*10.7*	*170*	170	U		*9.13*	*170*	170	U		*9.13*	*170*
Pyrene	170	U		*7.14*	*170*	170	U		*6.12*	*170*	32	J		*6.12*	*170*
Pesticides (ug/kg)															
4,4'-DDT	NT					NT					NT				
alpha-Chlordane	NT					NT					NT				
Dieldrin	NT					NT					NT				
Endosulfan II	NT					NT					NT				
Endrin aldehyde	NT					NT					NT				
Endrin ketone	NT					NT					NT				
Endrin	NT					NT					NT				
Heptachlor epoxide	NT					NT					NT				
Heptachlor	NT					NT					NT				
Methoxychlor	NT					NT					NT				
PCBs (ug/kg)															
PCB-1254	NT					NT					NT				

Table 3-2
2004 RFI Detected Results for Soil at SWMU 41

Analyte			Sample ID / Sample Date / Sample Depth	41SB5B 3/31/04 15-16					41SB5C 3/31/04 28-29					41SB6A 4/2/04 0-1				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)																		
Aluminum	na	na	40041	22700			*4.2*	*50*	20000			*4.2*	*50*	22500			*4.2*	*50*
Antimony	41	3.1	na	0.77			*0.0386*	*0.5*	0.18	J		*0.0386*	*0.5*	0.54		B	*0.0386*	*0.5*
Arsenic	1.9	0.43	15.8	11			*0.058*	*0.4*	7.3			*0.058*	*0.4*	14			*0.058*	*0.4*
Barium	20000	1600	209	**293**			*0.103*	*5*	118			*0.103*	*5*	143			*0.103*	*5*
Beryllium	200	16	1.02	0.93	J		*0.0267*	*1*	0.93	J		*0.0267*	*1*	0.81	J		*0.0267*	*1*
Cadmium	51	3.9	0.69	**2.2**			*0.25*	*1*	**2**			*0.25*	*1*	**1.6**			*0.25*	*1*
Calcium	na	na	na	77400			*175*	*2500*	2360			*17.5*	*250*	28400			*175*	*2500*
Chromium	310	23	65.3	19			*0.998*	*5*	22			*0.998*	*5*	19		K	*0.998*	*5*
Cobalt	na	na	72.3	15		J	*0.233*	*1*	17		J	*0.233*	*1*	11			*0.233*	*1*
Copper	4100	310	53.5	29			*0.516*	*5*	24			*0.516*	*5*	38			*0.516*	*5*
Iron	31000	2300	50962	37400			*366*	*5000*	28200			*36.6*	*500*	31700			*36.6*	*500*
Lead	800	400	26.8	**41**		**J**	*0.0776*	*1*	21			*0.0776*	*1*	**41**			*0.0776*	*1*
Magnesium	na	na	na	16200			*7.67*	*250*	6530			*7.67*	*250*	20900		K	*7.67*	*250*
Manganese	2000	160	2543	1060			*2.37*	*25*	273			*0.474*	*5*	912			*0.474*	*5*
Nickel	2000	160	62.8	35			*0.0775*	*0.5*	24			*0.0775*	*0.5*	17			*0.0775*	*0.5*
Potassium	na	na	na	2690			*7.79*	*100*	1800			*7.79*	*100*	1400			*7.79*	*100*
Selenium	510	39	na	0.62	J		*0.0486*	*1*	0.54	J		*0.0486*	*1*	0.61	J		*0.0486*	*1*
Silver	510	39	na	0.099	J		*0.0178*	*3*	0.093	J		*0.0178*	*3*	0.083	J		*0.0178*	*3*
Sodium	na	na	na	514			*31.4*	*100*	95	J	L	*31.4*	*100*	98	J	L	*31.4*	*100*
Thallium	7.2	0.55	2.11	0.16	J		*0.0733*	*0.5*	0.16	J		*0.0733*	*0.5*	0.27	J		*0.0733*	*0.5*
Vanadium	102	7.8	108	34			*0.401*	*1.2*	34			*0.401*	*1.2*	47			*0.401*	*1.2*
Zinc	31000	2300	202	109			*3.95*	*20*	83			*0.789*	*4*	110		K	*3.95*	*20*
Misc. (mg/kg)																		
Cyanide	2000	160	na	0.07	J	B	*0.009*	*0.5*	0.01	J	B	*0.009*	*0.5*	0.07	J	B	*0.009*	*0.5*
Dioxins/Furans (ng/kg)																		
2,3,7,8-TCDF	na	na	na	1.15	U		*0.141*	*1.15*	1.21	U		*0.149*	*1.21*	NT				
2,3,7,8-TCDD	19	4.3	na	1.15	U		*0.108*	*1.15*	1.21	U		*0.114*	*1.21*	NT				
1,2,3,7,8-PECDD	na	na	na	5.73	U		*0.307*	*5.73*	6.03	U		*0.322*	*6.03*	NT				
1,2,3,4,7,8-HXCDD	460	100	na	5.73	U		*0.247*	*5.73*	6.03	U		*0.26*	*6.03*	NT				
1,2,3,6,7,8-HXCDD	460	100	na	5.73	U		*0.421*	*5.73*	6.03	U		*0.442*	*6.03*	NT				
1,2,3,7,8,9-HXCDD	460	100	na	10.5			*0.516*	*5.73*	1.21	J		*0.542*	*6.03*	NT				
1,2,3,4,6,7,8-HPCDD	na	na	na	11.2			*0.39*	*5.73*	9.79			*0.41*	*6.03*	NT				
OCDD	na	na	na	1200			*1.03*	*11.5*	394			*1.09*	*12.1*	NT				
1,2,3,7,8-PECDF	na	na	na	5.73	U		*0.178*	*5.73*	6.03	U		*0.187*	*6.03*	NT				
2,3,4,7,8-PECDF	na	na	na	5.73	U		*0.214*	*5.73*	6.03	U		*0.225*	*6.03*	NT				
1,2,3,4,7,8-HXCDF	na	na	na	5.73	U		*0.212*	*5.73*	6.03	U		*0.222*	*6.03*	NT				
1,2,3,6,7,8-HXCDF	na	na	na	5.73	U		*0.107*	*5.73*	6.03	U		*0.113*	*6.03*	NT				
2,3,4,6,7,8-HXCDF	na	na	na	5.73	U		*0.417*	*5.73*	6.03	U		*0.438*	*6.03*	NT				
1,2,3,7,8,9-HXCDF	na	na	na	5.73	U		*0.511*	*5.73*	6.03	U		*0.537*	*6.03*	NT				
1,2,3,4,6,7,8-HPCDF	na	na	na	5.73	U		*0.452*	*5.73*	6.03	U		*0.475*	*6.03*	NT				
1,2,3,4,7,8,9-HPCDF	na	na	na	5.73	U		*0.402*	*5.73*	6.03	U		*0.423*	*6.03*	NT				
OCDF	na	na	na	11.5	U		*0.654*	*11.5*	12.1	U		*0.688*	*12.1*	NT				
TOTAL TCDD	na	na	na	1.15	U		*0.108*	*1.15*	1.21	U		*0.114*	*1.21*	NT				
TOTAL PECDD	na	na	na	0.619	J		*0.307*	*5.73*	0.528	J		*0.322*	*6.03*	NT				
TOTAL HXCDD	460	100	na	12.7			*0.247*	*5.73*	11.8			*0.26*	*6.03*	NT				
TOTAL HPCDD	na	na	na	25.4			*0.39*	*5.73*	30.5			*0.41*	*6.03*	NT				
TOTAL TCDF	na	na	na	1.15	U		*0.141*	*1.15*	1.21	U		*0.149*	*1.21*	NT				
TOTAL PECDF	na	na	na	5.73	U		*0.178*	*5.73*	6.03	U		*0.187*	*6.03*	NT				
TOTAL HXCDF	na	na	na	0.346	J		*0.107*	*5.73*	0.248	J		*0.113*	*6.03*	NT				
TOTAL HPCDF	na	na	na	5.73	U		*0.402*	*5.73*	6.03	U		*0.423*	*6.03*	NT				

Analyte	41SB6B 4/2/04 0.7-2.1					41SB6C 4/2/04 21-21.5					41SB7A 3/30/04 0-1				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)															
Aluminum	17000			*4.2*	*50*	32500			*42*	*500*	26500			*21*	*250*
Antimony	0.57		B	*0.0386*	*0.5*	0.69		B	*0.0386*	*0.5*	0.66			*0.0386*	*0.5*
Arsenic	**18**			*0.058*	*0.4*	**17**			*0.058*	*0.4*	**21**			*0.058*	*0.4*
Barium	156			*0.103*	*5*	147			*0.103*	*5*	85			*0.103*	*5*
Beryllium	0.68	J		*0.0267*	*1*	**1.6**			*0.0267*	*1*	0.77	J		*0.0267*	*1*
Cadmium	**2.1**			*0.25*	*1*	**2.7**			*0.25*	*1*	**2.3**			*0.25*	*1*
Calcium	20700			*17.5*	*250*	5350			*17.5*	*250*	88700		J	*175*	*2500*
Chromium	16		K	*0.998*	*5*	26		K	*0.998*	*5*	22			*0.998*	*5*
Cobalt	11			*0.233*	*1*	18			*0.233*	*1*	11		J	*0.233*	*1*
Copper	38			*0.516*	*5*	41			*0.516*	*5*	**55**			*0.516*	*5*
Iron	29000			*36.6*	*500*	47100			*73.1*	*1000*	45200			*73.1*	*1000*
Lead	**39**			*0.0776*	*1*	**132**			*1.94*	*25*	**44**			*0.0776*	*1*
Magnesium	13100		K	*7.67*	*250*	17300		K	*7.67*	*250*	40300			*38.4*	*1250*
Manganese	873			*2.37*	*25*	1110			*2.37*	*25*	1630			*2.37*	*25*
Nickel	18			*0.0775*	*0.5*	25			*0.0775*	*0.5*	27			*0.0775*	*0.5*
Potassium	1120			*7.79*	*100*	1170			*7.79*	*100*	1190			*7.79*	*100*
Selenium	0.68	J		*0.0486*	*1*	0.47	J		*0.0486*	*1*	0.9	J		*0.0486*	*1*
Silver	0.076	J		*0.0178*	*3*	0.089	J		*0.0178*	*3*	0.13	J		*0.0178*	*3*
Sodium	198			*31.4*	*100*	432			*31.4*	*100*	103			*31.4*	*100*
Thallium	0.17	J		*0.0733*	*0.5*	0.25	J		*0.0733*	*0.5*	0.13	J		*0.0733*	*0.5*
Vanadium	36			*0.401*	*1.2*	59			*0.401*	*1.2*	42			*0.401*	*1.2*
Zinc	96		K	*3.95*	*20*	**521**		**K**	*7.89*	*40*	**218**			*3.95*	*20*
Misc. (mg/kg)															
Cyanide	1.1			*0.009*	*0.5*	0.08	J	B	*0.009*	*0.5*	0.11	J		*0.009*	*0.5*
Dioxins/Furans (ng/kg)															
2,3,7,8-TCDF	NT					NT					NT				
2,3,7,8-TCDD	NT					NT					NT				
1,2,3,7,8-PECDD	NT					NT					NT				
1,2,3,4,7,8-HXCDD	NT					NT					NT				
1,2,3,6,7,8-HXCDD	NT					NT					NT				
1,2,3,7,8,9-HXCDD	NT					NT					NT				
1,2,3,4,6,7,8-HPCDD	NT					NT					NT				
OCDD	NT					NT					NT				
1,2,3,7,8-PECDF	NT					NT					NT				
2,3,4,7,8-PECDF	NT					NT					NT				
1,2,3,4,7,8-HXCDF	NT					NT					NT				
1,2,3,6,7,8-HXCDF	NT					NT					NT				
2,3,4,6,7,8-HXCDF	NT					NT					NT				
1,2,3,7,8,9-HXCDF	NT					NT					NT				
1,2,3,4,6,7,8-HPCDF	NT					NT					NT				
1,2,3,4,7,8,9-HPCDF	NT					NT					NT				
OCDF	NT					NT					NT				
TOTAL TCDD	NT					NT					NT				
TOTAL PECDD	NT					NT					NT				
TOTAL HXCDD	NT					NT					NT				
TOTAL HPCDD	NT					NT					NT				
TOTAL TCDF	NT					NT					NT				
TOTAL PECDF	NT					NT					NT				
TOTAL HXCDF	NT					NT					NT				
TOTAL HPCDF	NT					NT					NT				

Analyte	41SB7B 3/30/04 14-16					41SB7C 3/30/04 23-24					41SB8A 4/1/04 0-1					41SB8B 4/1/04 8-12				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)																				
Aluminum	**42400**			*21*	*250*	20500			*4.2*	*50*	17300			*4.2*	*50*	24100			*21*	*250*
Antimony	1.2			*0.0386*	*0.5*	0.94			*0.0386*	*0.5*	0.7		B	*0.0386*	*0.5*	1.1			*0.0386*	*0.5*
Arsenic	**31**			*0.058*	*0.4*	**27**			*0.058*	*0.4*	**19**			*0.058*	*0.4*	13			*0.058*	*0.4*
Barium	178			*0.103*	*5*	139			*0.103*	*5*	58			*0.103*	*5*	165			*0.103*	*5*
Beryllium	0.92	J		*0.0267*	*1*	**1.4**			*0.0267*	*1*	0.57	J		*0.0267*	*1*	1			*0.0267*	*1*
Cadmium	0.6	J	L	*0.25*	*1*	**3.2**			*0.25*	*1*	**3**			*0.25*	*1*	**2.5**			*0.25*	*1*
Calcium	751			*17.5*	*250*	6230			*17.5*	*250*	138000			*87.5*	*12500*	44700			*87.5*	*1250*
Chromium	23			*0.998*	*5*	39			*0.998*	*5*	15		K	*0.998*	*5*	23		K	*0.998*	*5*
Cobalt	18		J	*0.233*	*1*	13		J	*0.233*	*1*	7.5			*0.233*	*1*	20			*0.233*	*1*
Copper	47			*0.516*	*5*	43			*0.516*	*5*	42			*0.516*	*5*	41			*0.516*	*5*
Iron	**66200**			*73.1*	*1000*	47000			*36.6*	*500*	34000			*36.6*	*500*	36400			*36.6*	*500*
Lead	**86**			*0.776*	*10*	**230**			*1.94*	*25*	**33**			*0.0776*	*1*	**143**			*1.94*	*25*
Magnesium	1970			*7.67*	*250*	9660			*7.67*	*250*	57100		K	*38.4*	*1250*	23200		K	*7.67*	*250*
Manganese	1500			*2.37*	*25*	1200			*2.37*	*25*	1190			*2.37*	*25*	1420			*2.37*	*25*
Nickel	20			*0.0775*	*0.5*	41			*0.0775*	*0.5*	16			*0.0775*	*0.5*	19			*0.0775*	*0.5*
Potassium	924			*7.79*	*100*	839			*7.79*	*100*	664			*7.79*	*100*	1440			*7.79*	*100*
Selenium	0.42	J		*0.0486*	*1*	1.4			*0.0486*	*1*	0.5	J		*0.0486*	*1*	0.62	J		*0.0486*	*1*
Silver	0.067	J		*0.0178*	*3*	0.16	J		*0.0178*	*3*	0.064	J		*0.0178*	*3*	0.093	J		*0.0178*	*3*
Sodium	2140			*157*	*500*	48	J	L	*31.4*	*100*	122			*31.4*	*100*	1550			*157*	*500*
Thallium	0.27	J		*0.0733*	*0.5*	0.34	J		*0.0733*	*0.5*	0.0733	U		*0.0733*	*0.5*	0.26	J		*0.0733*	*0.5*
Vanadium	70			*0.401*	*1.2*	68			*0.401*	*1.2*	29			*0.401*	*1.2*	53			*0.401*	*1.2*
Zinc	**357**			*3.95*	*20*	**1440**			*39.5*	*200*	156		K	*3.95*	*20*	140		K	*3.95*	*20*
Misc. (mg/kg)																				
Cyanide	0.13	J		*0.009*	*0.5*	0.27	J		*0.009*	*0.5*	0.08	J	B	*0.009*	*0.5*	0.1	J	B	*0.009*	*0.5*
Dioxins/Furans (ng/kg)																				
2,3,7,8-TCDF	1.42	U		*0.175*	*1.42*	1.19	U		*0.147*	*1.19*	NT					NT				
2,3,7,8-TCDD	1.42	U		*0.134*	*1.42*	1.19	U		*0.113*	*1.19*	NT					NT				
1,2,3,7,8-PECDD	7.09	U		*0.379*	*7.09*	5.97	U		*0.319*	*5.97*	NT					NT				
1,2,3,4,7,8-HXCDD	7.09	U		*0.306*	*7.09*	0.44	J		*0.258*	*5.97*	NT					NT				
1,2,3,6,7,8-HXCDD	7.09	U		*0.52*	*7.09*	5.97	U		*0.438*	*5.97*	NT					NT				
1,2,3,7,8,9-HXCDD	1.05	J		*0.638*	*7.09*	0.98	J		*0.538*	*5.97*	NT					NT				
1,2,3,4,6,7,8-HPCDD	20.8			*0.482*	*7.09*	13.1			*0.406*	*5.97*	NT					NT				
OCDD	3590	E	J	*1.28*	*14.2*	1490			*1.08*	*11.9*	NT					NT				
1,2,3,7,8-PECDF	7.09	U		*0.22*	*7.09*	5.97	U		*0.186*	*5.97*	NT					NT				
2,3,4,7,8-PECDF	7.09	U		*0.265*	*7.09*	5.97	U		*0.223*	*5.97*	NT					NT				
1,2,3,4,7,8-HXCDF	7.09	U		*0.262*	*7.09*	5.97	U		*0.221*	*5.97*	NT					NT				
1,2,3,6,7,8-HXCDF	7.09	U		*0.133*	*7.09*	5.97	U		*0.112*	*5.97*	NT					NT				
2,3,4,6,7,8-HXCDF	7.09	U		*0.515*	*7.09*	5.97	U		*0.434*	*5.97*	NT					NT				
1,2,3,7,8,9-HXCDF	7.09	U		*0.632*	*7.09*	5.97	U		*0.533*	*5.97*	NT					NT				
1,2,3,4,6,7,8-HPCDF	7.09	U		*0.558*	*7.09*	5.97	U		*0.47*	*5.97*	NT					NT				
1,2,3,4,7,8,9-HPCDF	7.09	U		*0.497*	*7.09*	5.97	U		*0.419*	*5.97*	NT					NT				
OCDF	14.2	U		*0.809*	*14.2*	11.9	U		*0.682*	*11.9*	NT					NT				
TOTAL TCDD	1.42	U		*0.134*	*1.42*	1.19	U		*0.113*	*1.19*	NT					NT				
TOTAL PECDD	7.09	U		*0.379*	*7.09*	5.97	U		*0.319*	*5.97*	NT					NT				
TOTAL HXCDD	3.86	J		*0.306*	*7.09*	8.26			*0.258*	*5.97*	NT					NT				
TOTAL HPCDD	46.6			*0.482*	*7.09*	28			*0.406*	*5.97*	NT					NT				
TOTAL TCDF	1.42	U		*0.175*	*1.42*	1.19	U		*0.147*	*1.19*	NT					NT				
TOTAL PECDF	7.09	U		*0.22*	*7.09*	5.97	U		*0.186*	*5.97*	NT					NT				
TOTAL HXCDF	7.09	U		*0.133*	*7.09*	5.97	U		*0.112*	*5.97*	NT					NT				
TOTAL HPCDF	7.09	U		*0.497*	*7.09*	5.97	U		*0.419*	*5.97*	NT					NT				

Table 3-2
2004 RFI Detected Results for Soil at SWMU 41

Analyte	Sample ID / Sample Date / Sample Depth			41SB8C 4/1/04 18-21					41SB9A 4/1/04 0-1				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)													
1,1,2,2-Tetrachloroethane	14000	3200	na	5	U		0.084	5	5	U		0.084	5
1,2-Dibromo-3-chloropropane	3600	200	na	10	U		0.307	10	10	U		0.307	10
1,2-Dibromoethane (EDB)	1400	320	na	5	U		0.134	5	5	U		0.134	5
1,2-Dichloroethane	31000	7000	na	5	U	UJ	0.18	5	5	U	UJ	0.18	5
2-Butanone	61000000	4700000	na	23		J	0.393	10	8.8	J	J	0.393	10
2-Hexanone	4100000	310000	na	10	U		0.37	10	10	U		0.37	10
4-Methyl-2-pentanone	8200000	630000	na	10	U	UJ	0.181	10	10	U	UJ	0.181	10
Acetone	92000000	7000000	na	95		J	18.5	60	32	J	J	18.5	60
Benzene	52000	12000	na	0.3	J		0.136	5	0.84	J		0.136	5
Bromoform	360000	81000	na	5	U		0.101	5	5	U		0.101	5
Bromomethane	140000	11000	na	1.9	J	B	0.158	5	1.7	J	B	0.158	5
Carbon disulfide	10000000	780000	na	2.7	J	J	0.172	5	1.1	J	B	0.172	5
Chlorobenzene	2000000	160000	na	5	U		0.0475	5	5	U		0.0475	5
cis-1,2-Dichloroethene	1000000	78000	na	5	U		0.123	5	5	U		0.123	5
cis-1,3-Dichloropropene	29	6.4	na	5	U		0.0423	5	5	U		0.0423	5
Dibromochloromethane	34000	7600	na	5	U		0.0527	5	5	U		0.0527	5
Ethylbenzene	10000000	780000	na	5	U		0.145	5	5	U		0.145	5
Methylene chloride	380000	85000	na	5	U	UJ	0.857	5	5	U	UJ	0.857	5
Styrene	20000000	1600000	na	5	U		0.128	5	5	U		0.128	5
Tetrachloroethene	5300	1200	na	5	U		0.129	5	5	U		0.129	5
Toluene	8200000	630000	na	0.44	J		0.122	5	0.76	J		0.122	5
trans-1,3-Dichloropropene	29	6.4	na	5	U		0.159	5	5	U		0.159	5
Trichloroethene	7200	1600	na	5	U		0.154	5	5	U		0.154	5
Trichlorofluoromethane	31000000	2300000	na	5	U		0.1	5	5	U		0.1	5
Vinyl chloride	4000	90	na	5	U		0.115	5	5	U		0.115	5
Xylenes (total)	20000000	1600000	na	5	U		0.139	5	5	U		0.139	5
PAHs (ug/kg)													
Acenaphthene	6100000	470000	na	100	U		11.3	100	100	U		11.3	100
Anthracene	31000000	2300000	na	21	U		0.84	21	21	U		0.84	21
Benz(a)anthracene	3900	220	na	21	U		0.96	21	21	U		0.96	21
Benzo(a)pyrene	390	22	na	21	U		1.2	21	21	U		1.2	21
Benzo(b)fluoranthene	3900	220	na	21	U		1.56	21	21	U		1.56	21
Benzo(g,h,i)perylene	3100000	230000	na	60	U		15	60	60	U		15	60
Benzo(k)fluoranthene	39000	2200	na	21	U		1.2	21	21	U		1.2	21
Chrysene	390000	22000	na	21	U		1.44	21	21	U		1.44	21
Fluoranthene	4100000	310000	na	21	U		2.04	21	21	U		2.04	21
Indeno(1,2,3-cd)pyrene	3900	220	na	21	U		0.84	21	21	U		0.84	21
Phenanthrene	3100000	230000	na	21	U		0.72	21	21	U		0.72	21
Pyrene	3100000	230000	na	21	U		1.08	21	21	U		1.08	21
SVOCs (ug/kg)													
2,4-Dinitrotoluene	200000	16000	na	170	U		12	170	170	U		12	170
2,6-Dinitrotoluene	100000	7800	na	170	U		11.9	170	170	U		11.9	170
2-Methylnaphthalene	410000	31000	na	170	U		10.6	170	170	U		10.6	170
4-Chloro-3-methylphenol	na	na	na	170	U		7.94	170	20	J		7.94	170
4-Methylphenol	510000	39000	na	6	J		4.62	170	170	U		4.62	170
Benz(a)anthracene	3900	220	na	170	U		10.9	170	170	U		10.9	170
Benzo(b)fluoranthene	3900	220	na	170	U		9.2	170	170	U		9.2	170
Benzo(g,h,i)perylene	3100000	230000	na	170	U		6.65	170	170	U		6.65	170
Benzo(k)fluoranthene	39000	2200	na	170	U		4.9	170	170	U		4.9	170
bis(2-Ethylhexyl)phthalate	200000	46000	na	170	U		11.3	170	39	J		11.3	170
Butylbenzylphthalate	20000000	1600000	na	20	J		9.48	170	170	U		9.48	170
Chrysene	390000	22000	na	170	U		8.8	170	170	U		8.8	170
Diethylphthalate	82000000	6300000	na	170	U		12.1	170	23	J		12.1	170
Di-n-butylphthalate	10000000	780000	na	170	U		8.53	170	63	J		8.53	170
Fluoranthene	4100000	310000	na	170	U		5.27	170	170	U		5.27	170
Indeno(1,2,3-cd)pyrene	3900	220	na	170	U		7.6	170	170	U		7.6	170
Phenanthrene	3100000	230000	na	170	U		9.13	170	170	U		9.13	170
Pyrene	3100000	230000	na	170	U		6.12	170	170	U		6.12	170
Pesticides (ug/kg)													
4,4'-DDT	8400	1900	na	NT					NT				
alpha-Chlordane	8200	1800	na	NT					NT				
Dieldrin	180	40	na	NT					NT				
Endosulfan II	610000	47000	na	NT					NT				
Endrin aldehyde	na	na	na	NT					NT				
Endrin ketone	na	na	na	NT					NT				
Endrin	31000	2300	na	NT					NT				
Heptachlor epoxide	310	70	na	NT					NT				
Heptachlor	640	140	na	NT					NT				
Methoxychlor	510000	39000	na	NT					NT				
PCBs (ug/kg)													
PCB-1254	1400	156	na	NT					NT				
Explosives (mg/kg)	None detected												
Herbicides (ug/kg)	None detected												

Analyte	41SB9B 4/1/04 8-12					41SB9C 4/1/04 11.5-12.5				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)										
1,1,2,2-Tetrachloroethane	5	U		0.084	5	5	U		0.084	5
1,2-Dibromo-3-chloropropane	6.9	J	B	0.307	10	10	U		0.307	10
1,2-Dibromoethane (EDB)	5	U	UJ	0.134	5	5	U		0.134	5
1,2-Dichloroethane	5	U		0.18	5	5	U	UJ	0.18	5
2-Butanone	8	J		0.393	10	12			0.393	10
2-Hexanone	10	U		0.37	10	10	U		0.37	10
4-Methyl-2-pentanone	10	U		0.181	10	10	U		0.181	10
Acetone	60	U	UJ	18.5	60	36	J	J	18.5	60
Benzene	0.92	J		0.136	5	5	U		0.136	5
Bromoform	5	U		0.101	5	5	U		0.101	5
Bromomethane	1.6	J	B	0.158	5	1.4	J	B	0.158	5
Carbon disulfide	5.1			0.172	5	12			0.172	5
Chlorobenzene	5	U		0.0475	5	5	U		0.0475	5
cis-1,2-Dichloroethene	5	U		0.123	5	5	U		0.123	5
cis-1,3-Dichloropropene	5	U		0.0423	5	5	U		0.0423	5
Dibromochloromethane	5	U		0.0527	5	5	U		0.0527	5
Ethylbenzene	0.3	J		0.145	5	5	U		0.145	5
Methylene chloride	1.2	J		0.857	5	5	U		0.857	5
Styrene	5	U		0.128	5	5	U		0.128	5
Tetrachloroethene	5	U		0.129	5	5	U		0.129	5
Toluene	58		J	0.122	5	1	J		0.122	5
trans-1,3-Dichloropropene	5	U		0.159	5	5	U		0.159	5
Trichloroethene	4.3	J		0.154	5	0.22	J		0.154	5
Trichlorofluoromethane	0.55	J		0.1	5	0.23	J		0.1	5
Vinyl chloride	5	U		0.115	5	5	U		0.115	5
Xylenes (total)	1.1	J	J	0.139	5	5	U		0.139	5
PAHs (ug/kg)										
Acenaphthene	100	U		12.2	100	100	U		11.3	100
Anthracene	21	U		0.91	21	21	U		0.84	21
Benz(a)anthracene	21	U		1.04	21	21	U		0.96	21
Benzo(a)pyrene	21	U		1.3	21	21	U		1.2	21
Benzo(b)fluoranthene	21	U		1.69	21	21	U		1.56	21
Benzo(g,h,i)perylene	60	U		16.3	60	60	U		15	60
Benzo(k)fluoranthene	21	U		1.3	21	21	U		1.2	21
Chrysene	21	U		1.56	21	21	U		1.44	21
Fluoranthene	21	U		2.21	21	2.4	J		2.04	21
Indeno(1,2,3-cd)pyrene	21	U		0.91	21	21	U		0.84	21
Phenanthrene	21	U		0.78	21	3.3	J		0.72	21
Pyrene	21	U		1.17	21	21	U		1.08	21
SVOCs (ug/kg)										
2,4-Dinitrotoluene	170	U		13	170	170	U		12	170
2,6-Dinitrotoluene	170	U		12.9	170	170	U		11.9	170
2-Methylnaphthalene	170	U		11.5	170	170	U		10.6	170
4-Chloro-3-methylphenol	170	U		8.61	170	170	U		7.94	170
4-Methylphenol	170	U		5.01	170	170	U		4.62	170
Benz(a)anthracene	170	U		11.8	170	170	U		10.9	170
Benzo(b)fluoranthene	170	U		9.97	170	170	U		9.2	170
Benzo(g,h,i)perylene	170	U		7.2	170	170	U		6.65	170
Benzo(k)fluoranthene	170	U		5.3	170	170	U		4.9	170
bis(2-Ethylhexyl)phthalate	20	J		12.3	170	19	J		11.3	170
Butylbenzylphthalate	170	U		10.3	170	170	U		9.48	170
Chrysene	170	U		9.53	170	170	U		8.8	170
Diethylphthalate	170	U		13.1	170	170	U		12.1	170
Di-n-butylphthalate	56	J		9.24	170	480			8.53	170
Fluoranthene	170	U		5.71	170	170	U		5.27	170
Indeno(1,2,3-cd)pyrene	170	U		8.23	170	170	E	NJ	7.6	170
Phenanthrene	170	U		9.89	170	170	U		9.13	170
Pyrene	170	U		6.63	170	170	U		6.12	170
Pesticides (ug/kg)										
4,4'-DDT	NT					NT				
alpha-Chlordane	NT					NT				
Dieldrin	NT					NT				
Endosulfan II	NT					NT				
Endrin aldehyde	NT					NT				
Endrin ketone	NT					NT				
Endrin	NT					NT				
Heptachlor epoxide	NT					NT				
Heptachlor	NT					NT				
Methoxychlor	NT					NT				
PCBs (ug/kg)										
PCB-1254	NT					NT				

Analyte	41SB10A 3/30/04 0-1					41SB10B 3/30/04 8.5-11				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)										
1,1,2,2-Tetrachloroethane	5	U		0.084	5	5	U		0.084	5
1,2-Dibromo-3-chloropropane	10	U		0.307	10	10	U		0.307	10
1,2-Dibromoethane (EDB)	5	U		0.134	5	5	U		0.134	5
1,2-Dichloroethane	5	U		0.18	5	5	U		0.18	5
2-Butanone	6.7	J	B	0.393	10	15			0.393	10
2-Hexanone	10	U		0.37	10	10	U		0.37	10
4-Methyl-2-pentanone	10	U		0.181	10	10	U		0.181	10
Acetone	49	J	J	18.5	60	78		J	18.5	60
Benzene	1.6	J		0.136	5	0.32	J		0.136	5
Bromoform	5	U		0.101	5	5	U		0.101	5
Bromomethane	5	U		0.158	5	2.1	J		0.158	5
Carbon disulfide	2.4	J		0.172	5	1.1	J		0.172	5
Chlorobenzene	5	U		0.0475	5	5	U		0.0475	5
cis-1,2-Dichloroethene	5	U		0.123	5	5	U		0.123	5
cis-1,3-Dichloropropene	5	U		0.0423	5	5	U		0.0423	5
Dibromochloromethane	5	U		0.0527	5	5	U		0.0527	5
Ethylbenzene	5	U		0.145	5	5	U		0.145	5
Methylene chloride	5	U		0.857	5	5	U		0.857	5
Styrene	5	U		0.128	5	5	U		0.128	5
Tetrachloroethene	5	U		0.129	5	0.51	J		0.129	5
Toluene	1.6	J		0.122	5	5	U		0.122	5
trans-1,3-Dichloropropene	5	U		0.159	5	5	U		0.159	5
Trichloroethene	5	U		0.154	5	2.5	J		0.154	5
Trichlorofluoromethane	5	U		0.1	5	5	U		0.1	5
Vinyl chloride	5	U		0.115	5	5	U		0.115	5
Xylenes (total)	0.9	J		0.139	5	5	U		0.139	5
PAHs (ug/kg)										
Acenaphthene	100	U		13.2	100	100	U		12.2	100
Anthracene	21	U		0.98	21	21	U		0.91	21
Benz(a)anthracene	21	U		1.12	21	21	U		1.04	21
Benzo(a)pyrene	21	U		1.4	21	21	U		1.3	21
Benzo(b)fluoranthene	21	U		1.82	21	21	U		1.69	21
Benzo(g,h,i)perylene	60	U		17.5	60	60	U		16.3	60
Benzo(k)fluoranthene	21	U		1.4	21	21	U		1.3	21
Chrysene	21	U		1.68	21	21	U		1.56	21
Fluoranthene	5	J		2.38	21	21	U		2.21	21
Indeno(1,2,3-cd)pyrene	21	U		0.98	21	21	U		0.91	21
Phenanthrene	1.7	J		0.84	21	21	U		0.78	21
Pyrene	3.8	J		1.26	21	21	U		1.17	21
SVOCs (ug/kg)										
2,4-Dinitrotoluene	170	U		14	170	170	U		13	170
2,6-Dinitrotoluene	170	U		13.9	170	170	U		12.9	170
2-Methylnaphthalene	170	U		12.4	170	170	U		11.5	170
4-Chloro-3-methylphenol	170	U		9.27	170	170	U		8.61	170
4-Methylphenol	170	U		5.39	170	170	U		5.01	170
Benz(a)anthracene	170	U		12.7	170	170	U		11.8	170
Benzo(b)fluoranthene	170	U		10.7	170	170	U		9.97	170
Benzo(g,h,i)perylene	170	U		7.76	170	170	U		7.2	170
Benzo(k)fluoranthene	170	U		5.71	170	170	U		5.3	170
bis(2-Ethylhexyl)phthalate	240			13.2	170	460			12.3	170
Butylbenzylphthalate	170	U		11.1	170	170	U		10.3	170
Chrysene	170	U	UJ	10.3	170	170	U		9.53	170
Diethylphthalate	170	U		14.1	170	170	U		13.1	170
Di-n-butylphthalate	55	J		9.95	170	320			9.24	170
Fluoranthene	170	U		6.15	170	170	U		5.71	170
Indeno(1,2,3-cd)pyrene	170	U		8.86	170	170	U		8.23	170
Phenanthrene	170	U		10.7	170	170	U		9.89	170
Pyrene	170	U		7.14	170	170	U		6.63	170
Pesticides (ug/kg)										
4,4'-DDT	20	U		0.538	20	NT				
alpha-Chlordane	3.8	J	J	0.449	20	NT				
Dieldrin	20	U		0.471	20	NT				
Endosulfan II	0.42	J	J	0.315	20	NT				
Endrin aldehyde	0.6	J	J	0.434	20	NT				
Endrin ketone	20	U		0.457	20	NT				
Endrin	20	U		0.5	20	NT				
Heptachlor epoxide	20	U		0.692	20	NT				
Heptachlor	20	U		0.492	20	NT				
Methoxychlor	1.1	J	J	0.933	20	NT				
PCBs (ug/kg)										
PCB-1254	41			9.52	33	NT				

Analyte	41SB10C 3/30/04 15-16					41SB11A 4/1/04 0-1				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)										
1,1,2,2-Tetrachloroethane	5	U		0.084	5	5	U		0.084	5
1,2-Dibromo-3-chloropropane	10	U		0.307	10	10	U		0.307	10
1,2-Dibromoethane (EDB)	5	U		0.134	5	5	U		0.134	5
1,2-Dichloroethane	5	U		0.18	5	5	U	UJ	0.18	5
2-Butanone	6.6	J	B	0.393	10	7.3	J	J	0.393	10
2-Hexanone	10	U		0.37	10	10	U		0.37	10
4-Methyl-2-pentanone	10	U		0.181	10	10	U	UJ	0.181	10
Acetone	96			18.5	60	28	J	J	18.5	60
Benzene	12			0.136	5	1.1	J		0.136	5
Bromoform	5	U		0.101	5	5	U		0.101	5
Bromomethane	5	U		0.158	5	1.8	J	B	0.158	5
Carbon disulfide	5	U		0.172	5	1	J	B	0.172	5
Chlorobenzene	5	U		0.0475	5	5	U		0.0475	5
cis-1,2-Dichloroethene	5	U		0.123	5	5	U		0.123	5
cis-1,3-Dichloropropene	5	U		0.0423	5	5	U		0.0423	5
Dibromochloromethane	5	U		0.0527	5	5	U		0.0527	5
Ethylbenzene	1.7	J		0.145	5	5	U		0.145	5
Methylene chloride	0.98	J		0.857	5	5	U	UJ	0.857	5
Styrene	5	U		0.128	5	5	U		0.128	5
Tetrachloroethene	5	U		0.129	5	5	U		0.129	5
Toluene	15			0.122	5	1	J		0.122	5
trans-1,3-Dichloropropene	5	U		0.159	5	5	U		0.159	5
Trichloroethene	5	U		0.154	5	5	U		0.154	5
Trichlorofluoromethane	5	U		0.1	5	5	U		0.1	5
Vinyl chloride	5	U		0.115	5	5	U		0.115	5
Xylenes (total)	6.3			0.139	5	0.7	J		0.139	5
PAHs (ug/kg)										
Acenaphthene	100	U		11.3	100	100	U		11.3	100
Anthracene	21	U		0.84	21	21	U		0.84	21
Benz(a)anthracene	21	U		0.96	21	21	U		0.96	21
Benzo(a)pyrene	21	U		1.2	21	21	U		1.2	21
Benzo(b)fluoranthene	21	U		1.56	21	21	U		1.56	21
Benzo(g,h,i)perylene	60	U		15	60	60	U		15	60
Benzo(k)fluoranthene	21	U		1.2	21	21	U		1.2	21
Chrysene	21	U		1.44	21	21	U		1.44	21
Fluoranthene	21	U		2.04	21	21	U		2.04	21
Indeno(1,2,3-cd)pyrene	21	U		0.84	21	21	U		0.84	21
Phenanthrene	21	U		0.72	21	21	U		0.72	21
Pyrene	21	U		1.08	21	21	U		1.08	21
SVOCs (ug/kg)										
2,4-Dinitrotoluene	170	U		12	170	170	U		12	170
2,6-Dinitrotoluene	170	U		11.9	170	170	U		11.9	170
2-Methylnaphthalene	170	U		10.6	170	170	U		10.6	170
4-Chloro-3-methylphenol	170	U		7.94	170	170	U		7.94	170
4-Methylphenol	170	U		4.62	170	170	U		4.62	170
Benz(a)anthracene	170	U		10.9	170	170	U		10.9	170
Benzo(b)fluoranthene	170	U		9.2	170	170	U		9.2	170
Benzo(g,h,i)perylene	170	U		6.65	170	170	U		6.65	170
Benzo(k)fluoranthene	170	U		4.9	170	170	U		4.9	170
bis(2-Ethylhexyl)phthalate	21	J		11.3	170	16	J		11.3	170
Butylbenzylphthalate	170	U		9.48	170	170	U		9.48	170
Chrysene	170	U		8.8	170	170	U		8.8	170
Diethylphthalate	170	U		12.1	170	170	U		12.1	170
Di-n-butylphthalate	27	J		8.53	170	46	J		8.53	170
Fluoranthene	170	U		5.27	170	170	U		5.27	170
Indeno(1,2,3-cd)pyrene	170	U		7.6	170	170	U		7.6	170
Phenanthrene	170	U		9.13	170	170	U		9.13	170
Pyrene	170	U		6.12	170	170	U		6.12	170
Pesticides (ug/kg)										
4,4'-DDT	NT					NT				
alpha-Chlordane	NT					NT				
Dieldrin	NT					NT				
Endosulfan II	NT					NT				
Endrin aldehyde	NT					NT				
Endrin ketone	NT					NT				
Endrin	NT					NT				
Heptachlor epoxide	NT					NT				
Heptachlor	NT					NT				
Methoxychlor	NT					NT				
PCBs (ug/kg)										
PCB-1254	NT					NT				

Analyte	41SB11B 4/1/04 8-12					41SB11C 4/1/04 16-18.4				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)										
1,1,2,2-Tetrachloroethane	5	U		0.084	5	5	U		0.084	5
1,2-Dibromo-3-chloropropane	10	U		0.307	10	10	U		0.307	10
1,2-Dibromoethane (EDB)	5	U		0.134	5	5	U		0.134	5
1,2-Dichloroethane	5	U	UJ	0.18	5	5	U	UJ	0.18	5
2-Butanone	16		J	0.393	10	14		J	0.393	10
2-Hexanone	10	U		0.37	10	10	U		0.37	10
4-Methyl-2-pentanone	10	U	UJ	0.181	10	10	U	UJ	0.181	10
Acetone	52	J	J	18.5	60	56	J	J	18.5	60
Benzene	0.65	J		0.136	5	5	U		0.136	5
Bromoform	5	U		0.101	5	5	U		0.101	5
Bromomethane	1.9	J	B	0.158	5	1.9	J	B	0.158	5
Carbon disulfide	0.96	J	B	0.172	5	1.1	J	B	0.172	5
Chlorobenzene	5	U		0.0475	5	5	U		0.0475	5
cis-1,2-Dichloroethene	5	U		0.123	5	5	U		0.123	5
cis-1,3-Dichloropropene	5	U		0.0423	5	5	U		0.0423	5
Dibromochloromethane	5	U		0.0527	5	5	U		0.0527	5
Ethylbenzene	5	U		0.145	5	5	U		0.145	5
Methylene chloride	5	U	UJ	0.857	5	5	U	UJ	0.857	5
Styrene	5	U		0.128	5	5	U		0.128	5
Tetrachloroethene	5	U		0.129	5	5	U		0.129	5
Toluene	0.26	J		0.122	5	5	U		0.122	5
trans-1,3-Dichloropropene	5	U		0.159	5	5	U		0.159	5
Trichloroethene	5	U		0.154	5	5	U		0.154	5
Trichlorofluoromethane	0.87	J		0.1	5	5	U		0.1	5
Vinyl chloride	5	U		0.115	5	5	U		0.115	5
Xylenes (total)	5	U		0.139	5	5	U		0.139	5
PAHs (ug/kg)										
Acenaphthene	100	U		11.3	100	100	U		13.2	100
Anthracene	21	U		0.84	21	21	U		0.98	21
Benz(a)anthracene	21	U		0.96	21	21	U		1.12	21
Benzo(a)pyrene	21	U		1.2	21	21	U		1.4	21
Benzo(b)fluoranthene	21	U		1.56	21	21	U		1.82	21
Benzo(g,h,i)perylene	60	U		15	60	60	U		17.5	60
Benzo(k)fluoranthene	21	U		1.2	21	21	U		1.4	21
Chrysene	21	U		1.44	21	21	U		1.68	21
Fluoranthene	21	U		2.04	21	21	U		2.38	21
Indeno(1,2,3-cd)pyrene	21	U		0.84	21	21	U		0.98	21
Phenanthrene	1.7	J		0.72	21	21	U		0.84	21
Pyrene	3.2	J		1.08	21	21	U		1.26	21
SVOCs (ug/kg)										
2,4-Dinitrotoluene	170	U		12	170	170	U		14	170
2,6-Dinitrotoluene	170	U		11.9	170	170	U		13.9	170
2-Methylnaphthalene	170	U		10.6	170	170	U		12.4	170
4-Chloro-3-methylphenol	10	J		7.94	170	12	J		9.27	170
4-Methylphenol	170	U		4.62	170	170	U		5.39	170
Benz(a)anthracene	170	U		10.9	170	170	U		12.7	170
Benzo(b)fluoranthene	170	U		9.2	170	170	U		10.7	170
Benzo(g,h,i)perylene	170	U		6.65	170	170	U		7.76	170
Benzo(k)fluoranthene	170	U		4.9	170	170	U		5.71	170
bis(2-Ethylhexyl)phthalate	46	J		11.3	170	23	J		13.2	170
Butylbenzylphthalate	170	U		9.48	170	170	U		11.1	170
Chrysene	170	U		8.8	170	170	U		10.3	170
Diethylphthalate	13	J		12.1	170	170	U		14.1	170
Di-n-butylphthalate	55	J		8.53	170	39	J		9.95	170
Fluoranthene	170	U		5.27	170	170	U		6.15	170
Indeno(1,2,3-cd)pyrene	170	U		7.6	170	170	U		8.86	170
Phenanthrene	170	U		9.13	170	170	U		10.7	170
Pyrene	170	U		6.12	170	170	U		7.14	170
Pesticides (ug/kg)										
4,4'-DDT	NT					NT				
alpha-Chlordane	NT					NT				
Dieldrin	NT					NT				
Endosulfan II	NT					NT				
Endrin aldehyde	NT					NT				
Endrin ketone	NT					NT				
Endrin	NT					NT				
Heptachlor epoxide	NT					NT				
Heptachlor	NT					NT				
Methoxychlor	NT					NT				
PCBs (ug/kg)										
PCB-1254	NT					NT				

Analyte	i-RBC	r-RBC	Background	41SB8C 4/1/04 18-21 Result	Lab Q	Val Q	MDL	MRL	41SB9A 4/1/04 0-1 Result	Lab Q	Val Q	MDL	MRL	41SB9B 4/1/04 8-12 Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)																		
Aluminum	na	na	40041	14400			42	500	21500			4.2	50	23900		J	21	250
Antimony	41	3.1	na	0.76		B	0.0386	0.5	0.59		B	0.0386	0.5	0.98			0.0386	0.5
Arsenic	1.9	0.43	15.8	**20**			0.058	0.4	**22**			0.058	0.4	**32**			0.058	0.4
Barium	20000	1600	209	**215**			0.103	5	79			0.103	5	204			0.103	5
Beryllium	200	16	1.02	**1.1**			0.0267	1	0.97	J		0.0267	1	0.996	J		0.0267	1
Cadmium	51	3.9	0.69	**2.2**			0.25	1	**2.7**			0.25	1	**2.9**			0.25	1
Calcium	na	na	na	1550			17.5	250	107000			175	2500	51500		J	175	2500
Chromium	310	23	65.3	20		K	0.998	5	17		K	0.998	5	19		K	0.998	5
Cobalt	na	na	72.3	20			0.233	1	7.9			0.233	1	10		J	0.233	1
Copper	4100	310	53.5	29			0.516	5	**57**			0.516	5	**54**			0.516	5
Iron	31000	2300	50962	27600			366	5000	39300			73.1	1000	43300			73.1	1000
Lead	800	400	26.8	**70**			1.94	25	**34**			0.0776	1	**62**		**J**	0.776	10
Magnesium	na	na	na	1470		K	7.67	250	45700		K	76.7	2500	30500		K	76.7	2500
Manganese	2000	160	2543	**3140**			4.74	50	1360			2.37	25	1070			2.37	25
Nickel	2000	160	62.8	11			0.0775	0.5	19			0.0775	0.5	20			0.0775	0.5
Potassium	na	na	na	456			7.79	100	944			7.79	100	862		J	7.79	100
Selenium	510	39	na	0.68	J		0.0486	1	0.58	J		0.0486	1	0.87	J		0.0486	1
Silver	510	39	na	0.071	J		0.0178	3	0.088	J		0.0178	3	0.086	J		0.0178	3
Sodium	na	na	na	31.4	U	UL	31.4	100	86	J	L	31.4	100	2000			157	500
Thallium	7.2	0.55	2.11	0.25	J		0.0733	0.5	0.095	J		0.0733	0.5	0.26	J		0.0733	0.5
Vanadium	102	7.8	108	37			0.401	1.2	34			0.401	1.2	53			0.401	1.2
Zinc	31000	2300	202	85		K	0.789	4	179		K	3.95	20	186		K	3.95	20
Misc. (mg/kg)																		
Cyanide	2000	160	na	0.04	J	B	0.009	0.5	0.06	J	B	0.009	0.5	0.18	J		0.009	0.5
Dioxins/Furans (ng/kg)																		
2,3,7,8-TCDF	na	na	na	NT					NT					NT				
2,3,7,8-TCDD	19	4.3	na	NT					NT					NT				
1,2,3,7,8-PECDD	na	na	na	NT					NT					NT				
1,2,3,4,7,8-HXCDD	460	100	na	NT					NT					NT				
1,2,3,6,7,8-HXCDD	460	100	na	NT					NT					NT				
1,2,3,7,8,9-HXCDD	460	100	na	NT					NT					NT				
1,2,3,4,6,7,8-HPCDD	na	na	na	NT					NT					NT				
OCDD	na	na	na	NT					NT					NT				
1,2,3,7,8-PECDF	na	na	na	NT					NT					NT				
2,3,4,7,8-PECDF	na	na	na	NT					NT					NT				
1,2,3,4,7,8-HXCDF	na	na	na	NT					NT					NT				
1,2,3,6,7,8-HXCDF	na	na	na	NT					NT					NT				
2,3,4,6,7,8-HXCDF	na	na	na	NT					NT					NT				
1,2,3,7,8,9-HXCDF	na	na	na	NT					NT					NT				
1,2,3,4,6,7,8-HPCDF	na	na	na	NT					NT					NT				
1,2,3,4,7,8,9-HPCDF	na	na	na	NT					NT					NT				
OCDF	na	na	na	NT					NT					NT				
TOTAL TCDD	na	na	na	NT					NT					NT				
TOTAL PECDD	na	na	na	NT					NT					NT				
TOTAL HXCDD	460	100	na	NT					NT					NT				
TOTAL HPCDD	na	na	na	NT					NT					NT				
TOTAL TCDF	na	na	na	NT					NT					NT				
TOTAL PECDF	na	na	na	NT					NT					NT				
TOTAL HXCDF	na	na	na	NT					NT					NT				
TOTAL HPCDF	na	na	na	NT					NT					NT				

Analyte	41SB9C 4/1/04 11.5-12.5 Result	Lab Q	Val Q	MDL	MRL	41SB10A 3/30/04 0-1 Result	Lab Q	Val Q	MDL	MRL	41SB10B 3/30/04 8.5-11 Result	Lab Q	Val Q	MDL	MRL	41SB10C 3/30/04 15-16 Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)																				
Aluminum	39000			42	500	24300			210	2500	35500			21	250	2770			4.2	50
Antimony	0.55		B	0.0386	0.5	0.47	J		0.0386	0.5	1.3			0.0386	0.5	0.5			0.0386	0.5
Arsenic	14			0.058	0.4	14			0.058	0.4	**29**			0.058	0.4	13			0.058	0.4
Barium	145			0.103	5	82			0.103	5	130			0.103	5	35			0.103	5
Beryllium	1			0.0267	1	0.44	J		0.0267	1	**1.1**			0.0267	1	0.057	J	B	0.0267	1
Cadmium	**3**			0.25	1	**1.8**			0.25	1	**1.9**			0.25	1	**1.7**			0.25	1
Calcium	26100			175	2500	70700			875	12500	4940			17.5	250	185000			438	6250
Chromium	26		K	0.998	5	23			0.998	5	20			0.998	5	0.998	U		0.998	5
Cobalt	17			0.233	1	12		J	0.233	1	12		J	0.233	1	5.8		J	0.233	1
Copper	52			0.516	5	38			0.516	5	**66**			0.516	5	12			0.516	5
Iron	42600			73.1	1000	39500			366	5000	**61400**			73.1	1000	12500			18.3	250
Lead	**149**			1.94	25	**41**			0.0776	1	**55**			0.776	10	22			0.0776	1
Magnesium	25800		K	76.7	2500	24700			384	12500	3540			7.67	250	107000			192	6250
Manganese	776			0.474	5	1020			2.37	25	637			0.474	5	472			0.474	5
Nickel	27			0.0775	0.5	22			0.0775	0.5	26			0.0775	0.5	8.4			0.0775	0.5
Potassium	3920			7.79	100	1130			7.79	100	1210			7.79	100	198			7.79	100
Selenium	0.74	J		0.0486	1	0.76	J		0.0486	1	0.74	J		0.0486	1	0.96	J		0.0486	1
Silver	0.15	J		0.0178	3	0.067	J		0.0178	3	0.083	J		0.0178	3	0.072	J		0.0178	3
Sodium	2260			157	500	647			31.4	100	24200			785	2500	6290			314	1000
Thallium	0.31	J		0.0733	0.5	0.19	J		0.0733	0.5	0.32	J		0.0733	0.5	0.092	J		0.0733	0.5
Vanadium	64			0.401	1.2	44			0.401	1.2	60			0.401	1.2	16			0.401	1.2
Zinc	**295**		**K**	3.95	20	138			3.95	20	**380**			3.95	20	**357**			7.89	40
Misc. (mg/kg)																				
Cyanide	0.19	J		0.009	0.5	0.22	J		0.009	0.5	4.9			0.018	0.5	0.07	J		0.009	0.5
Dioxins/Furans (ng/kg)																				
2,3,7,8-TCDF	NT					NT					4.14			0.175	1.41	1.06	U		0.131	1.06
2,3,7,8-TCDD	NT					NT					0.22	J	J	0.133	1.41	1.06	U		0.1	1.06
1,2,3,7,8-PECDD	NT					NT					0.882	J		0.377	7.05	5.31	U		0.284	5.31
1,2,3,4,7,8-HXCDD	NT					NT					1.53	J		0.304	7.05	5.31	U		0.229	5.31
1,2,3,6,7,8-HXCDD	NT					NT					3.71	J		0.517	7.05	5.31	U		0.39	5.31
1,2,3,7,8,9-HXCDD	NT					NT					3.91	J		0.634	7.05	1.45	J		0.478	5.31
1,2,3,4,6,7,8-HPCDD	NT					NT					98.5			0.479	7.05	3.1	J		0.361	5.31
OCDD	NT					NT					3930	E	J	1.27	14.1	245			0.958	10.6
1,2,3,7,8-PECDF	NT					NT					0.984	J		0.219	7.05	5.31	U		0.165	5.31
2,3,4,7,8-PECDF	NT					NT					1.29	J		0.264	7.05	5.31	U		0.199	5.31
1,2,3,4,7,8-HXCDF	NT					NT					2.01	J		0.26	7.05	5.31	U		0.196	5.31
1,2,3,6,7,8-HXCDF	NT					NT					1.41	J		0.132	7.05	5.31	U		0.0993	5.31
2,3,4,6,7,8-HXCDF	NT					NT					1.51	J		0.512	7.05	5.31	U		0.386	5.31
1,2,3,7,8,9-HXCDF	NT					NT					7.05	U		0.628	7.05	5.31	U		0.474	5.31
1,2,3,4,6,7,8-HPCDF	NT					NT					31.5			0.555	7.05	5.31	U		0.418	5.31
1,2,3,4,7,8,9-HPCDF	NT					NT					1.78	J		0.494	7.05	5.31	U		0.373	5.31
OCDF	NT					NT					88.8			0.804	14.1	10.6	U		0.606	10.6
TOTAL TCDD	NT					NT					0.22	J	J	0.133	1.41	1.06	U		0.1	1.06
TOTAL PECDD	NT					NT					2.62	J		0.377	7.05	5.31	U		0.284	5.31
TOTAL HXCDD	NT					NT					25.3			0.304	7.05	3.09	J		0.229	5.31
TOTAL HPCDD	NT					NT					172			0.479	7.05	5.75			0.361	5.31
TOTAL TCDF	NT					NT					20.5			0.174	1.41	1.06	U		0.131	1.06
TOTAL PECDF	NT					NT					13.8			0.219	7.05	5.31	U		0.165	5.31
TOTAL HXCDF	NT					NT					40.8			0.132	7.05	5.31	U		0.0993	5.31
TOTAL HPCDF	NT					NT					99.2			0.494	7.05	5.31	U		0.373	5.31

Analyte	41SB11A 4/1/04 0-1 Result	Lab Q	Val Q	MDL	MRL	41SB11B 4/1/04 8-12 Result	Lab Q	Val Q	MDL	MRL	41SB11C 4/1/04 16-18.4 Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)															
Aluminum	14400			4.2	50	23900			4.2	50	26400			21	250
Antimony	0.56		B	0.0386	0.5	0.42	J	B	0.0386	0.5	1			0.0386	0.5
Arsenic	**23**			0.058	0.4	6.5			0.058	0.4	**24**			0.058	0.4
Barium	64			0.103	5	100			0.103	5	**335**			0.103	5
Beryllium	0.097	J	B	0.0267	1	0.74	J		0.0267	1	**1.4**			0.0267	1
Cadmium	**2.8**			0.25	1	**2.5**			0.25	1	**3.2**			0.25	1
Calcium	154000			438	6250	78700			175	2500	30100			87.5	1250
Chromium	12		K	0.998	5	23		K	0.998	5	22		K	0.998	5
Cobalt	7.2			0.233	1	12			0.233	1	10			0.233	1
Copper	37			0.516	5	30			0.516	5	48			0.516	5
Iron	29500			36.6	500	28100			36.6	500	43700			73.1	1000
Lead	**38**			0.0776	1	**45**			0.0776	1	**57**			0.776	10
Magnesium	58000		K	192	6250	33900		K	76.7	2500	20300		K	7.67	250
Manganese	1080			2.37	25	671			0.474	5	1390			2.37	25
Nickel	16			0.0775	0.5	18			0.0775	0.5	21			0.0775	0.5
Potassium	546			7.79	100	2300			7.79	100	913			7.79	100
Selenium	0.56	J		0.0486	1	0.58	J		0.0486	1	0.93	J		0.0486	1
Silver	0.079	J		0.0178	3	0.05	J		0.0178	3	0.15	J		0.0178	3
Sodium	143			31.4	100	1730			157	500	4660			785	2500
Thallium	0.0733	U		0.0733	0.5	0.18	J		0.0733	0.5	0.25	J		0.0733	0.5
Vanadium	26			0.401	1.2	47			0.401	1.2	56			0.401	1.2
Zinc	174		K	3.95	20	126		K	3.95	20	126		K	3.95	20
Misc. (mg/kg)															
Cyanide	0.14	J		0.009	0.5	0.09	J	B	0.009	0.5	0.03	J	B	0.009	0.5
Dioxins/Furans (ng/kg)															
2,3,7,8-TCDF	NT					NT					NT				
2,3,7,8-TCDD	NT					NT					NT				
1,2,3,7,8-PECDD	NT					NT					NT				
1,2,3,4,7,8-HXCDD	NT					NT					NT				
1,2,3,6,7,8-HXCDD	NT					NT					NT				
1,2,3,7,8,9-HXCDD	NT					NT					NT				
1,2,3,4,6,7,8-HPCDD	NT					NT					NT				
OCDD	NT					NT					NT				
1,2,3,7,8-PECDF	NT					NT					NT				
2,3,4,7,8-PECDF	NT					NT					NT				
1,2,3,4,7,8-HXCDF	NT					NT					NT				
1,2,3,6,7,8-HXCDF	NT					NT					NT				
2,3,4,6,7,8-HXCDF	NT					NT					NT				
1,2,3,7,8,9-HXCDF	NT					NT					NT				
1,2,3,4,6,7,8-HPCDF	NT					NT					NT				
1,2,3,4,7,8,9-HPCDF	NT					NT					NT				
OCDF	NT					NT					NT				
TOTAL TCDD	NT					NT					NT				
TOTAL PECDD	NT					NT					NT				
TOTAL HXCDD	NT					NT					NT				
TOTAL HPCDD	NT					NT					NT				
TOTAL TCDF	NT					NT					NT				
TOTAL PECDF	NT					NT					NT				
TOTAL HXCDF	NT					NT					NT				
TOTAL HPCDF	NT					NT					NT				

Table 3-2
2004 RFI Detected Results for Soil at SWMU 41

Analyte			Sample ID / Sample Date / Sample Depth	41SC20A 4/8/04 0-1					41SC20B 4/8/04 4.2-5.1					41SC20C 4/8/04 11-11.6				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																		
1,1,2,2-Tetrachloroethane	14000	3200	na	5	U		0.084	5	83	U		39.1	83	5	U		0.084	5
1,2-Dibromo-3-chloropropane	3600	200	na	10	U		0.307	10	83	U		342	83	10	U	UJ	0.307	10
1,2-Dibromoethane (EDB)	1400	320	na	5	U		0.134	5	5	U	UJ	0.134	5	5	U		0.134	5
1,2-Dichloroethane	31000	7000	na	5	U		0.18	5	5	U	UJ	0.18	5	5	U		0.18	5
2-Butanone	61000000	4700000	na	40		B	0.393	10	30		B	0.393	10	16		B	0.393	10
2-Hexanone	4100000	310000	na	10	U	UJ	0.37	10	10	U	UJ	0.37	10	10	U		0.37	10
4-Methyl-2-pentanone	8200000	630000	na	10	U	UJ	0.181	10	10	U	UJ	0.181	10	10	U		0.181	10
Acetone	92000000	7000000	na	60	U		18.5	60	88		J	18.5	60	47	J	J	18.5	60
Benzene	52000	12000	na	0.6	J		0.136	5	5.2		J	0.136	5	0.45	J		0.136	5
Bromoform	360000	81000	na	5	U		0.101	5	5	U	UJ	0.101	5	5	U		0.101	5
Bromomethane	140000	11000	na	5	U		0.158	5	1.7	J	B	0.158	5	5	U		0.158	5
Carbon disulfide	10000000	780000	na	4.2	J	B	0.172	5	5.8		J	0.172	5	3.6	J		0.172	5
Chlorobenzene	2000000	160000	na	5	U		0.0475	5	5	U	UJ	0.0475	5	5	U		0.0475	5
cis-1,2-Dichloroethene	1000000	78000	na	0.78	J		0.123	5	5	U	UJ	0.123	5	5	U		0.123	5
cis-1,3-Dichloropropene	29	6.4	na	5	U		0.0423	5	5	U	UJ	0.0423	5	5	U		0.0423	5
Dibromochloromethane	34000	7600	na	5	U		0.0527	5	5	U	UJ	0.0527	5	5	U		0.0527	5
Ethylbenzene	10000000	780000	na	5	U		0.145	5	5	U	UJ	0.145	5	0.15	J		0.145	5
Methylene chloride	380000	85000	na	4.4	J	B	0.857	5	2.1	J	B	0.857	5	1.6	J	B	0.857	5
Styrene	20000000	1600000	na	5	U		0.128	5	5	U	UJ	0.128	5	5	U		0.128	5
Tetrachloroethene	5300	1200	na	5	U		0.129	5	5	U	UJ	0.129	5	5	U		0.129	5
Toluene	8200000	630000	na	0.53	J		0.122	5	6.5		J	0.122	5	12			0.122	5
trans-1,3-Dichloropropene	29	6.4	na	5	U		0.159	5	5	U	UJ	0.159	5	5	U		0.159	5
Trichloroethene	7200	1600	na	5	U		0.154	5	1.5	J	J	0.154	5	5	U		0.154	5
Trichlorofluoromethane	31000000	2300000	na	0.52	J		0.1	5	0.47	J	J	0.1	5	0.45	J		0.1	5
Vinyl chloride	4000	90	na	5	U		0.115	5	5	U	UJ	0.115	5	5	U		0.115	5
Xylenes (total)	20000000	1600000	na	0.54	J		0.139	5	2.8	J	J	0.139	5	0.55	J		0.139	5
PAHs (ug/kg)																		
Acenaphthene	6100000	470000	na	100	U		11.3	100	100	U		16	100	100	U		9.4	100
Anthracene	31000000	2300000	na	21	U		0.84	21	21	U		1.19	21	21	U		0.7	21
Benz(a)anthracene	3900	220	na	21	U		0.96	21	21	U		1.36	21	21	U		0.8	21
Benzo(a)pyrene	390	22	na	21	U		1.2	21	21	U		1.7	21	21	U		1	21
Benzo(b)fluoranthene	3900	220	na	21	U		1.56	21	21	U		2.21	21	21	U		1.3	21
Benzo(g,h,i)perylene	3100000	230000	na	60	U		15	60	60	U		21.3	60	60	U		12.5	60
Benzo(k)fluoranthene	39000	2200	na	21	U		1.2	21	21	U		1.7	21	21	U		1	21
Chrysene	390000	22000	na	21	U		1.44	21	21	U		2.04	21	21	U		1.2	21
Fluoranthene	4100000	310000	na	21	U		2.04	21	21	U		2.89	21	21	U		1.7	21
Indeno(1,2,3-cd)pyrene	3900	220	na	21	U		0.84	21	21	U		1.19	21	21	U		0.7	21
Phenanthrene	3100000	230000	na	21	U		0.72	21	21	U		1.02	21	21	U		0.6	21
Pyrene	3100000	230000	na	21	U		1.08	21	21	U		1.53	21	21	U		0.9	21
SVOCs (ug/kg)																		
2,4-Dinitrotoluene	200000	16000	na	170	U		12	170	170	U		17	170	170	U		10	170
2,6-Dinitrotoluene	100000	7800	na	170	U		11.9	170	170	U		16.9	170	170	U		9.94	170
2-Methylnaphthalene	410000	31000	na	170	U		10.6	170	170	U		15	170	170	U		8.84	170
4-Chloro-3-methylphenol	na	na	na	170	U		7.94	170	170	U		11.3	170	170	U		6.62	170
4-Methylphenol	510000	39000	na	170	U		4.62	170	170	U		6.55	170	170	U		3.85	170
Benz(a)anthracene	3900	220	na	170	U		10.9	170	170	U		15.5	170	170	U		9.09	170
Benzo(b)fluoranthene	3900	220	na	170	U		9.2	170	170	U		13	170	170	U		7.67	170
Benzo(g,h,i)perylene	3100000	230000	na	170	U		6.65	170	170	U		9.42	170	170	U		5.54	170
Benzo(k)fluoranthene	39000	2200	na	170	U		4.9	170	170	U		6.94	170	170	U		4.08	170
bis(2-Ethylhexyl)phthalate	200000	46000	na	19	J		11.3	170	21	J		16	170	10	J		9.44	170
Butylbenzylphthalate	20000000	1600000	na	170	U		9.48	170	170	U		13.4	170	170	U		7.9	170
Chrysene	390000	22000	na	170	U		8.8	170	170	U		12.5	170	170	U		7.33	170
Diethylphthalate	82000000	6300000	na	170	U		12.1	170	170	U		17.2	170	170	U		10.1	170
Di-n-butylphthalate	10000000	780000	na	29	J		8.53	170	53	J		12.1	170	19	J		7.11	170
Fluoranthene	4100000	310000	na	170	U		5.27	170	170	U		7.46	170	170	U		4.39	170
Indeno(1,2,3-cd)pyrene	3900	220	na	170	U		7.6	170	170	U		10.8	170	170	U		6.33	170
Phenanthrene	3100000	230000	na	170	U		9.13	170	170	U		12.9	170	170	U		7.61	170
Pyrene	3100000	230000	na	170	U		6.12	170	170	U		8.67	170	170	U		5.1	170
Pesticides (ug/kg)																		
4,4'-DDT	8400	1900	na	NT					20	U		0.898	20	NT				
alpha-Chlordane	8200	1800	na	NT					20	U		0.75	20	NT				
Dieldrin	180	40	na	NT					20	U		0.787	20	NT				
Endosulfan II	610000	47000	na	NT					20	U		0.526	20	NT				
Endrin aldehyde	na	na	na	NT					20	U		0.725	20	NT				
Endrin ketone	na	na	na	NT					20	U		0.763	20	NT				
Endrin	31000	2300	na	NT					20	U		0.835	20	NT				
Heptachlor epoxide	310	70	na	NT					20	U		1.16	20	NT				
Heptachlor	640	140	na	NT					20	U		0.822	20	NT				
Methoxychlor	510000	39000	na	NT					20	U		1.56	20	NT				
PCBs (ug/kg)																		
PCB-1254	1400	156	na	NT					66	U		11.6	66	NT				
Explosives (mg/kg)	None detected																	
Herbicides (ug/kg)	None detected																	

Analyte	41SP2 soil 4/14/04 0-1					41TP2A 4/8/04 0-1					41TP2B 4/8/04 11-13					41TP2C 4/8/04 30.5-31.9				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																				
1,1,2,2-Tetrachloroethane	5	U		0.084	5	5	U		0.084	5	5	U		0.084	5	5	U		0.084	5
1,2-Dibromo-3-chloropropane	10	U		0.307	10	10	U		0.307	10	10	U	UJ	0.307	10	10	U		0.307	10
1,2-Dibromoethane (EDB)	5	U		0.134	5	5	U		0.134	5	5	U		0.134	5	5	U		0.134	5
1,2-Dichloroethane	5	U		0.18	5	5	U		0.18	5	5	U		0.18	5	5	U		0.18	5
2-Butanone	33		B	0.393	10	38		B	0.393	10	16		B	0.393	10	28		B	0.393	10
2-Hexanone	10	U	UJ	0.37	10	10	U	UJ	0.37	10	10	U		0.37	10	10	U		0.37	10
4-Methyl-2-pentanone	10	U	UJ	0.181	10	10	U	UJ	0.181	10	10	U		0.181	10	10	U		0.181	10
Acetone	73			18.5	60	24	J		18.5	60	57	J	J	18.5	60	60	U		18.5	60
Benzene	2.8	J		0.136	5	5	U		0.136	5	0.26	J		0.136	5	5	U		0.136	5
Bromoform	5	U		0.101	5	5	U		0.101	5	5	U		0.101	5	5	U		0.101	5
Bromomethane	5	U		0.158	5	5	U		0.158	5	5	U		0.158	5	1.3	J	B	0.158	5
Carbon disulfide	6		B	0.172	5	5		B	0.172	5	5.7			0.172	5	5	U		0.172	5
Chlorobenzene	5	U		0.0475	5	5	U		0.0475	5	5	U		0.0475	5	5	U		0.0475	5
cis-1,2-Dichloroethene	5	U		0.123	5	11			0.123	5	5	U		0.123	5	5	U		0.123	5
cis-1,3-Dichloropropene	5	U		0.0423	5	5	U		0.0423	5	5	U		0.0423	5	5	U		0.0423	5
Dibromochloromethane	5	U		0.0527	5	5	U		0.0527	5	5	U		0.0527	5	5	U		0.0527	5
Ethylbenzene	5	U		0.145	5	5	U		0.145	5	5	U		0.145	5	5	U		0.145	5
Methylene chloride	4.7	J	B	0.857	5	5.9		B	0.857	5	3.6	J	B	0.857	5	9.1		B	0.857	5
Styrene	5	U		0.128	5	5	U		0.128	5	5	U		0.128	5	5	U	UJ	0.128	5
Tetrachloroethene	5	U		0.129	5	5.1			0.129	5	5	U		0.129	5	5	U		0.129	5
Toluene	3.3	J		0.122	5	0.28	J		0.122	5	1.3	J		0.122	5	0.15	J		0.122	5
trans-1,3-Dichloropropene	5	U		0.159	5	5	U		0.159	5	5	U		0.159	5	5	U		0.159	5
Trichloroethene	5	U		0.154	5	0.89	J		0.154	5	5	U		0.154	5	1.4	J		0.154	5
Trichlorofluoromethane	0.44	J		0.1	5	0.57	J		0.1	5	0.64	J		0.1	5	0.73	J		0.1	5
Vinyl chloride	5	U		0.115	5	1.2	J		0.115	5	5	U		0.115	5	5	U		0.115	5
Xylenes (total)	1.9	J		0.139	5	5	U		0.139	5	0.67	J		0.139	5	5	U		0.139	5
PAHs (ug/kg)																				
Acenaphthene	100	U		14.1	100	100	U		11.3	100	100	U		11.3	100	100	U		11.3	100
Anthracene	21	U		1.05	21	21	U		0.84	21	21	U		0.84	21	21	U		0.84	21
Benz(a)anthracene	21	U		1.2	21	21	U		0.96	21	21	U		0.96	21	21	U		0.96	21
Benzo(a)pyrene	21	U		1.5	21	21	U		1.2	21	21	U		1.2	21	21	U		1.2	21
Benzo(b)fluoranthene	21	U		1.95	21	21	U		1.56	21	21	U		1.56	21	21	U		1.56	21
Benzo(g,h,i)perylene	60	U		18.8	60	60	U		15	60	60	U		15	60	60	U		15	60
Benzo(k)fluoranthene	21	U		1.5	21	21	U		1.2	21	21	U		1.2	21	21	U		1.2	21
Chrysene	21	U		1.8	21	21	U		1.44	21	21	U		1.44	21	21	U		1.44	21
Fluoranthene	21	U		2.55	21	21	U		2.04	21	21	U		2.04	21	21	U		2.04	21
Indeno(1,2,3-cd)pyrene	21	U		1.05	21	21	U		0.84	21	21	U		0.84	21	21	U		0.84	21
Phenanthrene	21	U		0.9	21	21	U		0.72	21	21	U		0.72	21	21	U		0.72	21
Pyrene	21	U		1.35	21	21	U		1.08	21	21	U		1.08	21	21	U		1.08	21
SVOCs (ug/kg)																				
2,4-Dinitrotoluene	170	U		15	170	170	U		12	170	170	U		12	170	170	U		12	170
2,6-Dinitrotoluene	170	U		14.9	170	170	U		11.9	170	170	U		11.9	170	170	U		11.9	170
2-Methylnaphthalene	170	U		13.3	170	170	U		10.6	170	170	U		10.6	170	170	U		10.6	170
4-Chloro-3-methylphenol	170	U		9.93	170	170	U		7.94	170	170	U		7.94	170	170	U		7.94	170
4-Methylphenol	170	U		5.78	170	170	U		4.62	170	170	U		4.62	170	170	U		4.62	170
Benz(a)anthracene	170	U		13.6	170	170	U		10.9	170	170	U		10.9	170	170	U		10.9	170
Benzo(b)fluoranthene	170	U		11.5	170	170	U		9.2	170	170	U		9.2	170	170	U		9.2	170
Benzo(g,h,i)perylene	170	U		8.31	170	170	U		6.65	170	170	U		6.65	170	170	U		6.65	170
Benzo(k)fluoranthene	170	U		6.12	170	170	U		4.9	170	170	U		4.9	170	170	U		4.9	170
bis(2-Ethylhexyl)phthalate	17	J		14.2	170	16	J		11.3	170	13	J		11.3	170	17	J		11.3	170
Butylbenzylphthalate	170	U		11.9	170	170	U		9.48	170	170	U		9.48	170	170	U		9.48	170
Chrysene	170	U		11	170	170	U		8.8	170	170	U		8.8	170	170	U		8.8	170
Diethylphthalate	170	U		15.2	170	170	U		12.1	170	170	U		12.1	170	170	U		12.1	170
Di-n-butylphthalate	24	J		10.7	170	210			8.53	170	24	J		8.53	170	200			8.53	170
Fluoranthene	170	U		6.59	170	170	U		5.27	170	170	U		5.27	170	170	U		5.27	170
Indeno(1,2,3-cd)pyrene	170	U		9.5	170	170	U		7.6	170	170	U		7.6	170	170	U		7.6	170
Phenanthrene	170	U		11.4	170	170	U		9.13	170	170	U		9.13	170	170	U		9.13	170
Pyrene	170	U		7.65	170	170	U		6.12	170	170	U		6.12	170	170	U		6.12	170
Pesticides (ug/kg)																				
4,4'-DDT	20	U		0.538	20	NT					20	U		0.646	20	NT				
alpha-Chlordane	20	U		0.449	20	NT					20	U		0.539	20	NT				
Dieldrin	20	U		0.471	20	NT					20	U		0.565	20	NT				
Endosulfan II	0.44	J		0.315	20	NT					20	U		0.378	20	NT				
Endrin aldehyde	0.69	J	J	0.434	20	NT					20	U		0.521	20	NT				
Endrin ketone	0.86	J	J	0.457	20	NT					20	U		0.548	20	NT				
Endrin	20	U		0.5	20	NT					20	U		0.6	20	NT				
Heptachlor epoxide	20	U		0.692	20	NT					20	U		0.83	20	NT				
Heptachlor	20	U		0.492	20	NT					20	U		0.59	20	NT				
Methoxychlor	20	U		0.933	20	NT					20	U		1.12	20	NT				
PCBs (ug/kg)																				
PCB-1254	33	U		10.2	33	NT					66	U		8.16	66	NT				
Explosives (mg/kg)																				
Herbicides (ug/kg)																				

Table 3-2
2004 RFI Detected Results for Soil at SWMU 41

Analyte			Sample ID	41SC20A					41SC20B					41SC20C					41SP2 soil				
			Sample Date	4/8/04					4/8/04					4/8/04					4/14/04				
			Sample Depth	0-1					4.2-5.1					11-11.6					0-1				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)																							
Aluminum	na	na	40041	15300			4.2	50	16700			4.2	2500	23200			4.2	50	21100			105	1250
Antimony	41	3.1	na	0.52			0.0386	0.5	0.49	J		0.0386	0.5	0.11	J		0.0386	0.5	0.499	J		0.0386	0.5
Arsenic	1.9	0.43	15.8	**20**		J	0.058	0.4	**21**		J	0.058	0.4	3.2		J	0.058	0.4	**21**			0.058	0.4
Barium	20000	1600	209	84			0.103	5	**326**		J	0.515	25	102			0.103	5	**281**			0.103	125
Beryllium	200	16	1.02	0.18	J		0.0267	1	0.56	J		0.0267	1	0.97	J		0.0267	1	0.95	J		0.0267	1
Cadmium	51	3.9	0.69	**3.5**			0.25	1	**1.3**			0.25	1	**2.3**			0.25	1	**3.5**			0.25	1
Calcium	na	na	na	140000			1750	25000	39000		J	175	2500	1290			17.5	250	68800			438	6250
Chromium	310	23	65.3	14			0.998	5	23			0.998	5	30			0.998	5	22			0.998	5
Cobalt	na	na	72.3	7.6			0.233	1	12			0.233	1	13			0.233	1	12			0.233	1
Copper	4100	310	53.5	50			0.516	5	27			0.516	5	25			0.516	5	31			0.516	5
Iron	31000	2300	50962	33500			73.1	1000	35800			73.1	1000	24700			73.1	1000	39400			73.1	1000
Lead	800	400	26.8	**42**			0.0776	1	**74**		J	1.94	25	21			0.0776	1	**75**			1.94	25
Magnesium	na	na	na	39200			38.4	1250	20400			76.7	2500	8120			7.67	250	36000			192	6250
Manganese	2000	160	2543	1430			2.37	25	**2660**		J	4.74	50	99			0.474	5	2340			11.9	125
Nickel	2000	160	62.8	17		J	0.0775	0.5	18		J	0.0775	0.5	20		J	0.0775	0.5	20			0.0775	0.5
Potassium	na	na	na	711			7.79	100	990		J	7.79	100	2040			7.79	100	1440			7.79	100
Selenium	510	39	na	0.54	J		0.0486	1	0.74	J		0.0486	1	0.44	J		0.0486	1	0.65	J		0.0486	1
Silver	510	39	na	0.22	J		0.0178	3	0.25	J		0.0178	3	0.17	J		0.0178	3	0.075	J		0.0178	3
Sodium	na	na	na	99.6	J	J	31.4	100	2960		J	314	1000	1270		J	157	500	3730			785	2500
Thallium	7.2	0.55	2.11	0.092	J	L	0.0733	0.5	0.16	J	L	0.0733	0.5	0.19	J	L	0.0733	0.5	0.17	J		0.0733	0.5
Vanadium	102	7.8	108	28			0.401	1.2	38			0.401	1.2	35			0.401	1.2	43			0.401	1.2
Zinc	31000	2300	202	159			3.95	20	187		J	3.95	20	81			0.789	4	**234**			19.7	100
Misc. (mg/kg)																							
Cyanide	2000	160	na	0.04	J	B	0.009	0.5	0.23	J		0.009	0.5	0.06	J		0.009	0.5	0.37	J		0.009	0.5
Dioxins/Furans (ng/kg)																							
2,3,7,8-TCDF	na	na	na	NT					0.458	J		0.239	1.93	NT					0.322	J		0.186	1.5
2,3,7,8-TCDD	19	4.3	na	NT					1.93	U		0.183	1.93	NT					0.168	J		0.142	1.5
1,2,3,7,8-PECDD	na	na	na	NT					9.66	U		0.516	9.66	NT					7.5	U		0.401	7.5
1,2,3,4,7,8-HXCDD	460	100	na	NT					0.464	J		0.416	9.66	NT					7.5	U		0.323	7.5
1,2,3,6,7,8-HXCDD	460	100	na	NT					9.66	U		0.708	9.66	NT					7.5	U		0.55	7.5
1,2,3,7,8,9-HXCDD	460	100	na	NT					2.03	J		0.869	9.66	NT					2.6	J		0.675	7.5
1,2,3,4,6,7,8-HPCDD	na	na	na	NT					14.2			0.657	9.66	NT					20.3			0.51	7.5
OCDD	na	na	na	NT					1040			1.74	19.3	NT					2010			1.35	15
1,2,3,7,8-PECDF	na	na	na	NT					9.66	U		0.3	9.66	NT					0.258	J		0.233	7.5
2,3,4,7,8-PECDF	na	na	na	NT					9.66	U		0.361	9.66	NT					7.5	U		0.281	7.5
1,2,3,4,7,8-HXCDF	na	na	na	NT					9.66	U		0.357	9.66	NT					0.294	J		0.277	7.5
1,2,3,6,7,8-HXCDF	na	na	na	NT					0.29	J		0.181	9.66	NT					0.261	J		0.261	7.5
2,3,4,6,7,8-HXCDF	na	na	na	NT					9.66	U		0.702	9.66	NT					7.5	U		0.545	7.5
1,2,3,7,8,9-HXCDF	na	na	na	NT					9.66	U		0.861	9.66	NT					7.5	U		0.669	7.5
1,2,3,4,6,7,8-HPCDF	na	na	na	NT					1.3	J		0.761	9.66	NT					1.93	J		0.591	7.5
1,2,3,4,7,8,9-HPCDF	na	na	na	NT					9.66	U		0.677	9.66	NT					7.5	U		0.526	7.5
OCDF	na	na	na	NT					3.05	J		1.1	19.3	NT					5.17	J		0.856	15
TOTAL TCDD	na	na	na	NT					1.93	U		0.183	1.93	NT					0.168	J		0.142	1.5
TOTAL PECDD	na	na	na	NT					9.66	U		0.516	9.66	NT					0.714	J		0.401	7.5
TOTAL HXCDD	460	100	na	NT					7.51	J		0.416	9.66	NT					6.49	J		0.323	7.5
TOTAL HPCDD	na	na	na	NT					29.9			0.657	9.66	NT					41.4			0.51	7.5
TOTAL TCDF	na	na	na	NT					2.17			0.238	1.93	NT					0.948	J		0.185	1.5
TOTAL PECDF	na	na	na	NT					1.65	J		0.3	9.66	NT					1.33	J		0.233	7.5
TOTAL HXCDF	na	na	na	NT					2.26	J		0.181	9.66	NT					2.44	J		0.14	7.5
TOTAL HPCDF	na	na	na	NT					3.06	J		0.677	9.66	NT					5.16	J		0.526	7.5

Analyte	41TP2A					41TP2B					41TP2C				
Sample Date	4/8/04					4/8/04					4/8/04				
Sample Depth	0-1					11-13					30.5-31.9				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)															
Aluminum	25900			21	250	24400			4.2	50	22400			4.2	50
Antimony	0.21	J		0.0386	0.5	0.4	J		0.0386	0.5	0.089	J		0.0386	0.5
Arsenic	6		J	0.058	0.4	8.2		J	0.058	0.4	3.5		J	0.058	0.4
Barium	110			0.103	5	72			0.103	5	89			0.103	5
Beryllium	0.44	J		0.0267	1	0.49	J		0.0267	1	0.81	J		0.0267	1
Cadmium	**2.9**			0.25	1	**2.5**			0.25	1	**2.2**			0.25	1
Calcium	33100			87.5	1250	15400			17.5	250	1180			17.5	250
Chromium	25			0.998	5	25			0.998	5	29			0.998	5
Cobalt	11			0.233	1	14			0.233	1	13			0.233	1
Copper	26			0.516	5	19			0.516	5	23			0.516	5
Iron	30600			73.1	1000	30200			73.1	1000	22400			73.1	1000
Lead	**89**			0.776	10	**234**			1.94	25	20			0.0776	1
Magnesium	23000			38.4	1250	16300			7.67	250	8300			7.67	250
Manganese	835			0.474	5	659			0.474	5	97			0.474	5
Nickel	17		J	0.0775	0.5	19		J	0.0775	0.5	19		J	0.0775	0.5
Potassium	1890			7.79	100	2140			7.79	100	2130			7.79	100
Selenium	0.52	J		0.0486	1	0.56	J		0.0486	1	0.4	J		0.0486	1
Silver	0.14	J		0.0178	3	0.16	J		0.0178	3	0.81	J		0.0178	3
Sodium	50	J	J	31.4	100	1640		J	157	500	1160		J	157	500
Thallium	0.23	J	L	0.0733	0.5	0.19	J	L	0.0733	0.5	0.14	J	L	0.0733	0.5
Vanadium	49			0.401	1.2	41			0.401	1.2	33			0.401	1.2
Zinc	**324**			3.95	20	**337**			3.95	20	76			0.789	4
Misc. (mg/kg)															
Cyanide	0.06	J	B	0.009	0.5	0.01	J	B	0.009	0.5	0.03	J	B	0.009	0.5
Dioxins/Furans (ng/kg)															
2,3,7,8-TCDF	NT					0.176	J		0.154	1.24	NT				
2,3,7,8-TCDD	NT					0.157	J		0.118	1.24	NT				
1,2,3,7,8-PECDD	NT					0.371	J		0.333	6.22	NT				
1,2,3,4,7,8-HXCDD	NT					0.68	J		0.268	6.22	NT				
1,2,3,6,7,8-HXCDD	NT					0.886	J		0.457	6.22	NT				
1,2,3,7,8,9-HXCDD	NT					2.67	J		0.56	6.22	NT				
1,2,3,4,6,7,8-HPCDD	NT					44.1			0.423	6.22	NT				
OCDD	NT					6520	E	J	1.12	12.4	NT				
1,2,3,7,8-PECDF	NT					6.22	U		0.194	6.22	NT				
2,3,4,7,8-PECDF	NT					6.22	U		0.233	6.22	NT				
1,2,3,4,7,8-HXCDF	NT					6.22	U		0.23	6.22	NT				
1,2,3,6,7,8-HXCDF	NT					0.189	J			6.22	NT				
2,3,4,6,7,8-HXCDF	NT					6.22	U		0.452	6.22	NT				
1,2,3,7,8,9-HXCDF	NT					6.22	U		0.555	6.22	NT				
1,2,3,4,6,7,8-HPCDF	NT					0.769	J			6.22	NT				
1,2,3,4,7,8,9-HPCDF	NT					6.22	U		0.436	6.22	NT				
OCDF	NT					2.09	J			12.4	NT				
TOTAL TCDD	NT					0.157	J			1.24	NT				
TOTAL PECDD	NT					0.747	J			6.22	NT				
TOTAL HXCDD	NT					15.3				6.22	NT				
TOTAL HPCDD	NT					102				6.22	NT				
TOTAL TCDF	NT					0.172	J			1.24	NT				
TOTAL PECDF	NT					0.48	J			6.22	NT				
TOTAL HXCDF	NT					0.896	J			6.22	NT				
TOTAL HPCDF	NT					0.769	J			6.22	NT				

Table 3-3
2004 RFI Detected Results for Groundwater at SWMu 41
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Analyte		Sample ID	41MW1					41MW1-Diss					41MW2				
		Sample Date	4/13/04					4/13/04					4/13/04				
	MCL	**tw-RBC**	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/L)																	
1,2,4-Trichlorobenzene	70	6.1	1	U		*0.223*	*1*	NT					1	U		*0.223*	*1*
PAHs (ug/L)		None detected															
SVOCs (ug/L)																	
bis(2-Ethylhexyl)phthalate	6	4.8	5	U		*1.07*	*5*	NT					2.7	J		*1.07*	*5*
Diethylphthalate	na	2900	0.66	J		*0.15*	*5*	NT					0.3	J		*0.15*	*5*
Explosives (ug/L)		None detected															
Metals (ug/L)																	
Aluminum	50	na	200	U	UL	*41.1*	*200*	200	U	UL	*41.1*	*200*	200	U	UL	*41.1*	*200*
Arsenic	10	0.045	1.7			*0.209*	*1*	0.95	J		*0.209*	*1*	3.2			*0.209*	*1*
Barium	2000	730	20			*4.69*	*20*	28			*4.69*	*20*	8	J		*4.69*	*20*
Calcium	na	na	48000			*464*	*5000*	53000			*464*	*5000*	134000			*1160*	*12500*
Chromium	100	11	4			*0.261*	*1*	1.9			*0.261*	*1*	5.3			*0.261*	*1*
Copper	1300	150	20	U		*6.6*	*20*	20	U		*6.6*	*20*	11	J		*6.6*	*20*
Iron	300	1100	110			*7.72*	*100*	23	J	K	*7.72*	*100*	220			*7.72*	*100*
Lead	15	na	0.7	J		*0.231*	*1*	1	U		*0.231*	*1*	1.5			*0.231*	*1*
Magnesium	na	na	67000			*635*	*50000*	65000			*635*	*5000*	130000			*1590*	*12500*
Manganese	50	73	48			*1.64*	*10*	23		L	*1.64*	*10*	28			*1.64*	*10*
Nickel	na	73	5.3			*0.23*	*1*	3.2			*0.23*	*1*	7			*0.23*	*1*
Potassium	na	na	990		J	*51.5*	*200*	730		J	*51.5*	*200*	2400		J	*51.5*	*200*
Selenium	50	18	0.9	J		*0.249*	*2*	0.7	J		*0.249*	*2*	2	U		*0.249*	*2*
Sodium	na	na	1300000			*46200*	*140000*	916000			*23100*	*70000*	3950000			*231000*	*700000*
Thallium	2	0.26	0.3	J		*0.041*	*1*	0.2	J		*0.041*	*1*	0.5	J		*0.041*	*1*
Zinc	5000	1100	6	J	B	*4.44*	*20*	11	J	B	*4.44*	*20*	15	J	B	*4.44*	*20*
Misc. (ug/L)																	
Cyanide	200	73	2	J	B	*0.9*	*10*	NT					4	J	B	*0.9*	*10*

Table 3-3
2004 RFI Detected Results for Groundwater at SWMu 41

Analyte	Sample ID / Sample Date		41MW2-Diss 4/13/04					41MW3 4/14/04					41MW3-Diss 4/14/04				
	MCL	**tw-RBC**	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/L)																	
1,2,4-Trichlorobenzene	70	6.1	NT					0.59	J		*0.223*	*1*	NT				
PAHs (ug/L)		None detect															
SVOCs (ug/L)																	
bis(2-Ethylhexyl)phthalate	6	4.8	NT					5	U		*1.07*	*5*	NT				
Diethylphthalate	na	2900	NT					0.24	J		*0.15*	*5*	NT				
Explosives (ug/L)		None detect															
Metals (ug/L)																	
Aluminum	50	na	200	U	UL	*41.1*	*200*	99	J	L	*41.1*	*200*	200	U	UL	*41.1*	*200*
Arsenic	10	0.045	3.7			*0.209*	*1*	1	U		*0.209*	*1*	1	U		*0.209*	*1*
Barium	2000	730	7	J		*4.69*	*20*	24			*4.69*	*20*	18	J		*4.69*	*20*
Calcium	na	na	137000			*1160*	*12500*	126000			*1160*	*12500*	124000			*1160*	*12500*
Chromium	100	11	2.1			*0.261*	*1*	3.1			*0.261*	*1*	1.7			*0.261*	*1*
Copper	1300	150	14	J		*6.6*	*20*	20	U		*6.6*	*20*	20	U		*6.6*	*20*
Iron	300	1100	25	J	K	*7.72*	*100*	240			*7.72*	*100*	51	J	K	*7.72*	*100*
Lead	15	na	0.3	J		*0.231*	*1*	2.4			*0.231*	*1*	0.5	J		*0.231*	*1*
Magnesium	na	na	132000			*1590*	*12500*	66000			*635*	*5000*	68000			*635*	*5000*
Manganese	50	73	27			*1.64*	*10*	10	U	UL	*1.64*	*10*	10	U	UL	*1.64*	*10*
Nickel	na	73	5.4			*0.23*	*1*	5.6			*0.23*	*1*	4.7			*0.23*	*1*
Potassium	na	na	2100		J	*51.5*	*200*	2100		J	*51.5*	*200*	2000		J	*51.5*	*200*
Selenium	50	18	2	U		*0.249*	*2*	0.5	J		*0.249*	*2*	0.7	J		*0.249*	*2*
Sodium	na	na	4150000			*231000*	*700000*	182000			*5780*	*17500*	185000			*5780*	*17500*
Thallium	2	0.26	0.5	J		*0.041*	*1*	1	U		*0.041*	*1*	1	U		*0.041*	*1*
Zinc	5000	1100	12	J	B	*4.44*	*20*	18	J	B	*4.44*	*20*	21		B	*4.44*	*20*
Misc. (ug/L)																	
Cyanide	200	73	NT					2	J	B	*0.9*	*10*	NT				

Table 3-4
2004 RFI Detected Results for Surface Water at SWMU 41
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Analyte		Sample ID Sample Date	**41SW2** **4/6/04**					**41SW2-Diss** **4/6/04**					**41SW3** **4/6/04**				
	MCL	**tw-RBC**	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/L)																	
Chloroform	80	0.15	0.59	J		*0.241*	*1*	NT					0.35	J		*0.241*	*1*
PAHs (ug/L)		None detected															
SVOCs (ug/L)																	
Diethylphthalate	na	2900	0.32	J	B	*0.15*	*5*	NT					0.21	J	B	*0.15*	*5*
Explosives (ug/L)		None detected															
Metals (ug/L)																	
Aluminum	50	na	110	J		*41.1*	*200*	200	U	UL	*41.1*	*200*	110	J		*41.1*	*200*
Arsenic	10	0.045	0.24	J		*0.209*	*1*	1	U		*0.209*	*1*	1	U		*0.209*	*1*
Barium	2000	730	60			*4.69*	*20*	60			*4.69*	*20*	62			*4.69*	*20*
Beryllium	4	7.3	4	U		*0.27*	*4*	4	U		*0.27*	*4*	4	U		*0.27*	*4*
Cadmium	5	1.8	0.5	U		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*
Calcium	na	na	49000			*464*	*5000*	51000			*464*	*5000*	52000			*464*	*5000*
Chromium	100	11	0.7	J		*0.261*	*1*	0.99	J		*0.261*	*1*	1.1			*0.261*	*1*
Copper	1300	150	20	U		*6.6*	*20*	20	U		*6.6*	*20*	20	U		*6.6*	*20*
Iron	300	1100	280			*7.72*	*100*	100	U		*7.72*	*100*	230			*7.72*	*100*
Lead	15	na	0.4	J		*0.231*	*1*	0.3	J		*0.231*	*1*	0.3	J		*0.231*	*1*
Magnesium	na	na	30000			*635*	*5000*	32000			*635*	*5000*	31000			*635*	*5000*
Manganese	50	73	24			*1.64*	*10*	10	U	UL	*1.64*	*10*	20		L	*1.64*	*10*
Nickel	na	73	1	U	UL	*0.23*	*1*	0.4	J	B	*0.23*	*1*	1	U	UL	*0.23*	*1*
Potassium	na	na	1500			*51.5*	*200*	1600		J	*51.5*	*200*	1600			*51.5*	*200*
Selenium	50	18	2	U		*0.249*	*2*	2	U		*0.249*	*2*	2	U		*0.249*	*2*
Sodium	na	na	4300			*231*	*700*	4400			*231*	*700*	7600			*231*	*700*
Thallium	2	0.26	1	U		*0.041*	*1*	1	U		*0.041*	*1*	1	U		*0.041*	*1*
Vanadium	na	3.7	25	U		*7.93*	*25*	25	U		*7.93*	*25*	25	U		*7.93*	*25*
Zinc	5000	1100	20	U		*4.44*	*20*	20	U		*4.44*	*20*	20	U		*4.44*	*20*
Misc. (ug/L)																	
Hardness	na	na	253000			*1620*	*5000*	NT					251000			*1620*	*5000*
Cyanide	200	73	2	J	B	*0.9*	*10*	NT					2	J	B	*0.9*	*10*

Table 3-4
2004 RFI Detected Results for Surface Water at SWMU 41

Analyte	Sample ID / Sample Date		41SW3-Diss 4/6/04					41SW4 4/6/04					41SW4-Diss 4/6/04				
	MCL	tw-RBC	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/L)																	
Chloroform	80	0.15	NT					0.3	J		*0.241*	*1*	NT				
PAHs (ug/L)		None detect															
SVOCs (ug/L)																	
Diethylphthalate	na	2900	NT					0.23	J	B	*0.15*	*5*	NT				
Explosives (ug/L)		None detect															
Metals (ug/L)																	
Aluminum	50	na	200	U	UL	*41.1*	*200*	170	J		*41.1*	*200*	200	U	UL	*41.1*	*200*
Arsenic	10	0.045	1	U		*0.209*	*1*	0.22	J		*0.209*	*1*	1	U		*0.209*	*1*
Barium	2000	730	65			*4.69*	*20*	62			*4.69*	*20*	62			*4.69*	*20*
Beryllium	4	7.3	4	U		*0.27*	*4*	4	U		*0.27*	*4*	4	U	UL	*0.27*	*4*
Cadmium	5	1.8	0.5	U		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*
Calcium	na	na	52000			*464*	*5000*	51000			*464*	*5000*	53000			*464*	*5000*
Chromium	100	11	0.8	J		*0.261*	*1*	1.1			*0.261*	*1*	0.7	J		*0.261*	*1*
Copper	1300	150	20	U		*6.6*	*20*	20	U		*6.6*	*20*	20	U		*6.6*	*20*
Iron	300	1100	100	U		*7.72*	*100*	350			*7.72*	*100*	100	U		*7.72*	*100*
Lead	15	na	1	U		*0.231*	*1*	0.6	J		*0.231*	*1*	0.3	J		*0.231*	*1*
Magnesium	na	na	33000			*635*	*5000*	31000			*635*	*5000*	32000			*635*	*5000*
Manganese	50	73	10	U	UL	*1.64*	*10*	29			*1.64*	*10*	10	U	UL	*1.64*	*10*
Nickel	na	73	1	U	UL	*0.23*	*1*	1	U	UL	*0.23*	*1*	1	U	UL	*0.23*	*1*
Potassium	na	na	1600		J	*51.5*	*200*	1600			*51.5*	*200*	1700		L	*51.5*	*200*
Selenium	50	18	2	U		*0.249*	*2*	2	U		*0.249*	*2*	2	U		*0.249*	*2*
Sodium	na	na	7900			*231*	*700*	9200			*231*	*700*	9800			*231*	*700*
Thallium	2	0.26	1	U		*0.041*	*1*	1	U		*0.041*	*1*	1	U		*0.041*	*1*
Vanadium	na	3.7	25	U		*7.93*	*25*	25	U		*7.93*	*25*	25	U		*7.93*	*25*
Zinc	5000	1100	4.5	J		*4.44*	*20*	20	U		*4.44*	*20*	7	J	L	*4.44*	*20*
Misc. (ug/L)																	
Hardness	na	na	NT					255000			*1620*	*5000*	NT				
Cyanide	200	73	NT					2	J	B	*0.9*	*10*	NT				

Table 3-4
2004 RFI Detected Results for Surface Water at SWMU 41

Analyte	Sample ID	Sample Date	**41SW5**					**41SW5-Diss**					**41SW6**				
			4/6/04					**4/6/04**					**4/6/04**				
	MCL	**tw-RBC**	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/L)																	
Chloroform	80	0.15	1	U		*0.241*	*1*	NT					1	U		*0.241*	*1*
PAHs (ug/L)		None detect															
SVOCs (ug/L)																	
Diethylphthalate	na	2900	0.18	J	B	*0.15*	*5*	NT					0.18	J	B	*0.15*	*5*
Explosives (ug/L)		None detect															
Metals (ug/L)																	
Aluminum	50	na	200	U	UL	*41.1*	*200*	200	U	UL	*41.1*	*200*	83	J	L	*41.1*	*200*
Arsenic	10	0.045	1	U		*0.209*	*1*	1	U		*0.209*	*1*	1	U		*0.209*	*1*
Barium	2000	730	48			*4.69*	*20*	49			*4.69*	*20*	59			*4.69*	*20*
Beryllium	4	7.3	4	U		*0.27*	*4*	4	U		*0.27*	*4*	4	U		*0.27*	*4*
Cadmium	5	1.8	0.5	U		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*
Calcium	na	na	40000			*464*	*5000*	40000			*464*	*5000*	53000			*464*	*5000*
Chromium	100	11	0.9	J		*0.261*	*1*	1.1			*0.261*	*1*	0.9	J		*0.261*	*1*
Copper	1300	150	20	U		*6.6*	*20*	20	U		*6.6*	*20*	20	U		*6.6*	*20*
Iron	300	1100	66	J		*7.72*	*100*	100	U		*7.72*	*100*	200			*7.72*	*100*
Lead	15	na	1	U		*0.231*	*1*	0.3	J		*0.231*	*1*	0.3	J		*0.231*	*1*
Magnesium	na	na	18000			*318*	*2500*	18000			*318*	*2500*	32000			*635*	*5000*
Manganese	50	73	2.1	J	L	*1.64*	*10*	10	U	UL	*1.64*	*10*	10		L	*1.64*	*10*
Nickel	na	73	1	U	UL	*0.23*	*1*	1	U	UL	*0.23*	*1*	1	U	UL	*0.23*	*1*
Potassium	na	na	2000			*51.5*	*200*	2100		J	*51.5*	*200*	1500			*51.5*	*200*
Selenium	50	18	2	U		*0.249*	*2*	2	U		*0.249*	*2*	2	U		*0.249*	*2*
Sodium	na	na	15000			*1160*	*3500*	15000			*1160*	*3500*	11000			*462*	*1400*
Thallium	2	0.26	1	U		*0.041*	*1*	1	U		*0.041*	*1*	1	U		*0.041*	*1*
Vanadium	na	3.7	25	U		*7.93*	*25*	25	U		*7.93*	*25*	25	U		*7.93*	*25*
Zinc	5000	1100	20	U	UL	*4.44*	*20*	20	U	UL	*4.44*	*20*	20	U	UL	*4.44*	*20*
Misc. (ug/L)																	
Hardness	na	na	161000			*1620*	*5000*	NT					261000			*1620*	*5000*
Cyanide	200	73	2	J	B	*0.9*	*10*	NT					2	J	B	*0.9*	*10*

Table 3-4
2004 RFI Detected Results for Surface Water at SWMU 41

Analyte	Sample ID / Sample Date		41SW6-Diss 4/6/04					41SW7 4/6/04					41SW7-Diss 4/6/04				
	MCL	tw-RBC	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/L)																	
Chloroform	80	0.15	NT					1	U		*0.241*	*1*	NT				
PAHs (ug/L)		None detect															
SVOCs (ug/L)																	
Diethylphthalate	na	2900	NT					0.21	J	B	*0.15*	*5*	NT				
Explosives (ug/L)		None detect															
Metals (ug/L)																	
Aluminum	50	na	200	U	UL	*41.1*	*200*	200	U	UL	*41.1*	*200*	200	U	UL	*41.1*	*200*
Arsenic	10	0.045	1	U		*0.209*	*1*	1	U		*0.209*	*1*	1	U		*0.209*	*1*
Barium	2000	730	59			*4.69*	*20*	50			*4.69*	*20*	45			*4.69*	*20*
Beryllium	4	7.3	4	U		*0.27*	*4*	4	U		*0.27*	*4*	4	U		*0.27*	*4*
Cadmium	5	1.8	0.5	U		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*
Calcium	na	na	54000			*464*	*5000*	41000			*464*	*5000*	37000			*464*	*5000*
Chromium	100	11	0.9	J		*0.261*	*1*	0.98	J		*0.261*	*1*	1.1			*0.261*	*1*
Copper	1300	150	20	U		*6.6*	*20*	20	U		*6.6*	*20*	20	U		*6.6*	*20*
Iron	300	1100	100	U		*7.72*	*100*	54	J		*7.72*	*100*	100	U		*7.72*	*100*
Lead	15	na	0.3	J		*0.231*	*1*	1	U		*0.231*	*1*	1	U		*0.231*	*1*
Magnesium	na	na	32000			*635*	*5000*	18000			*318*	*2500*	16000			*318*	*2500*
Manganese	50	73	10	U	UL	*1.64*	*10*	10	U	UL	*1.64*	*10*	10	U	UL	*1.64*	*10*
Nickel	na	73	1	U	UL	*0.23*	*1*	1	U	UL	*0.23*	*1*	1	U	UL	*0.23*	*1*
Potassium	na	na	1600		J	*51.5*	*200*	2100			*51.5*	*200*	1900		J	*51.5*	*200*
Selenium	50	18	2	U		*0.249*	*2*	2	U		*0.249*	*2*	2	U		*0.249*	*2*
Sodium	na	na	11000			*462*	*1400*	16000			*1160*	*3500*	14000			*1160*	*3500*
Thallium	2	0.26	1	U		*0.041*	*1*	1	U		*0.041*	*1*	1	U		*0.041*	*1*
Vanadium	na	3.7	25	U		*7.93*	*25*	25	U		*7.93*	*25*	25	U		*7.93*	*25*
Zinc	5000	1100	9.9	J	L	*4.44*	*20*	20	U	UL	*4.44*	*20*	7	J	L	*4.44*	*20*
Misc. (ug/L)																	
Hardness	na	na	NT					165000			*1620*	*5000*	NT				
Cyanide	200	73	NT					3	J	B	*0.9*	*10*	NT				

Table 3-4
2004 RFI Detected Results for Surface Water at SWMU 41

Analyte	Sample ID / Sample Date		41SP2 4/13/04					41SP2-Diss 4/13/04				
	MCL	tw-RBC	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/L)												
Chloroform	80	0.15	1	U		*0.241*	*1*	NT				
PAHs (ug/L)		None detect										
SVOCs (ug/L)												
Diethylphthalate	na	2900	5	U		*0.15*	*5*	NT				
Explosives (ug/L)		None detect										
Metals (ug/L)												
Aluminum	50	na	9270			*82.2*	*400*	200	U	UL	*41.1*	*200*
Arsenic	10	0.045	7.1			*0.209*	*1*	1	U		*0.209*	*1*
Barium	2000	730	230			*4.69*	*20*	110			*4.69*	*20*
Beryllium	4	7.3	0.6	J	L	*0.27*	*4*	4	U	UL	*0.27*	*4*
Cadmium	5	1.8	0.3	J		*0.0568*	*0.5*	0.5	U		*0.0568*	*0.5*
Calcium	na	na	89000			*1160*	*12500*	65000			*464*	*5000*
Chromium	100	11	9.4			*0.261*	*1*	0.6	J	K	*0.261*	*1*
Copper	1300	150	19	J		*6.6*	*20*	20	U		*6.6*	*20*
Iron	300	1100	10400			*193*	*2500*	23	J	K	*7.72*	*100*
Lead	15	na	29			*0.231*	*1*	1	U		*0.231*	*1*
Magnesium	na	na	32000			*635*	*5000*	21000			*635*	*5000*
Manganese	50	73	410			*1.64*	*10*	10	U	UL	*1.64*	*10*
Nickel	na	73	10			*0.23*	*1*	1	U		*0.23*	*1*
Potassium	na	na	1100		J	*51.5*	*200*	180	J	L	*51.5*	*200*
Selenium	50	18	0.4	J		*0.249*	*2*	2	U		*0.249*	*2*
Sodium	na	na	13000			*462*	*1400*	15000			*1160*	*3500*
Thallium	2	0.26	0.09	J		*0.041*	*1*	1	U		*0.041*	*1*
Vanadium	na	3.7	17	J		*7.93*	*25*	25	U		*7.93*	*25*
Zinc	5000	1100	75			*4.44*	*20*	14	J	B	*4.44*	*20*
Misc. (ug/L)												
Hardness	na	na	NT					NT				
Cyanide	200	73	2	J	B	*0.9*	*10*	NT				

Table 3-5
2004 RFI Detected Results in Sediment at SWMU 41

Analyte			Sample ID Sample Date Sample Depth	41SD2 4/6/04 0-1					41SD3 4/6/04 0-1					41SD4 4/6/04 0-1					41SD5 4/6/04 0-1					41SD6 4/6/04 0-1					41SD7 4/6/04 0-1				
	i-RBC	r-RBC	Background	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																																	
1,2,4-Trichlorobenzene	1000000	78000	na	5	U		0.732	5	5	U		0.732	5	5	U		0.732	5	5	U		0.732	5	3.9	J	B	0.732	5	4.4	J	B	0.732	5
2-Butanone	61000000	4700000	na	11		B	2.91	10	16		B	2.91	10	27		B	2.91	10	30		B	2.91	10	27		B	2.91	10	26	J	B	2.91	10
Benzene	52000	12000	na	0.2	J		0.178	5	0.22	J		0.178	5	5	U		0.178	5	0.28	J		0.178	5	0.2	J		0.178	5	0.28	J		0.178	5
Bromomethane	140000	11000	na	5	U		0.154	5	5	U		0.154	5	5	U		0.154	5	5	U		0.154	5	5	U		0.154	5	1.5	J	B	0.154	5
Carbon disulfide	10000000	780000	na	5	U		0.0742	5	5.7		B	0.0742	5	5	U		0.0742	5	6.7		B	0.0742	5	5	U		0.0742	5	5.5		B	0.0742	5
Chloroform	1000000	78000	na	1.8	J		0.0915	5	5	U		0.0915	5	5	U		0.0915	5	5	U		0.0915	5	0.54	J		0.0915	5	5	U		0.0915	5
Methylene chloride	380000	85000	na	4.2	J	B	0.117	5	7.1		B	0.117	5	4.5	J	B	0.117	5	3.8	J	B	0.117	5	7.8		B	0.117	5	5.2		B	0.117	5
Toluene	8200000	630000	na	5	U		0.258	5	0.31	J		0.258	5	5	U		0.258	5	1.1	J		0.258	5	0.26	J		0.258	5	0.48	J		0.258	5
PAHs (ug/kg)																																	
Acenaphthene	6100000	470000	na	100	U		13.2	100	100	U		14.1	100	100	U		13.2	100	17	J		14.1	100	100	U		13.2	100	100	U		14.1	100
Anthracene	31000000	2300000	na	21	U		0.98	21	21	U		1.05	21	21	U		0.98	21	19	J		1.05	21	1.1	J		0.98	21	1.9	J		1.05	21
Benz(a)anthracene	3900	220	na	21	U		1.12	21	21	U		1.2	21	21	U		1.12	21	67			1.2	21	18	J		1.12	21	17	J		1.2	21
Benzo(a)pyrene	390	22	na	21	U		1.4	21	21	U		1.5	21	21	U		1.4	21	79			1.5	21	20	J		1.4	21	17	J		1.5	21
Benzo(b)fluoranthene	3900	220	na	21	U		1.82	21	21	U		1.95	21	21	U		1.82	21	78			1.95	21	21			1.82	21	21	U		1.95	21
Benzo(g,h,i)perylene	3100000	230000	na	60	U		17.5	60	60	U		18.8	60	60	U		17.5	60	100			18.8	60	32	J		17.5	60	31	J		18.8	60
Benzo(k)fluoranthene	39000	2200	na	21	U		1.4	21	21	U		1.5	21	21	U		1.4	21	47			1.5	21	9.1	J		1.4	21	8.4	J		1.5	21
Chrysene	390000	22000	na	21	U		1.68	21	21	U		1.8	21	21	U		1.68	21	67			1.8	21	19	J		1.68	21	19	J		1.8	21
Fluoranthene	4100000	310000	na	21	U		2.38	21	21	U		2.55	21	21	U		2.38	21	200			2.55	21	34			2.38	21	50			2.55	21
Fluorene	4100000	310000	na	21	U		1.82	21	21	U		1.95	21	21	U		1.82	21	10	J		1.95	21	21	U		1.82	21	21	U		1.95	21
Indeno(1,2,3-cd)pyrene	3900	220	na	21	U		0.98	21	21	U		1.05	21	21	U		0.98	21	52			1.05	21	17	J		0.98	21	15	J		1.05	21
Phenanthrene	3100000	230000	na	21	U		0.84	21	21	U		0.9	21	1.6	J		0.84	21	110			0.9	21	6.3	J		0.84	21	32			0.9	21
Pyrene	3100000	230000	na	21	U		1.26	21	21	U		1.35	21	21	U		1.26	21	150			1.35	21	28			1.26	21	33			1.35	21
SVOCs (ug/kg)																																	
4-Chloro-3-methylphenol	na	na	na	170	U		9.27	170	170	U		9.93	170	170	U		9.27	170	17	J		9.93	170	170	U		9.27	170	170	U		9.93	170
Benz(a)anthracene	3900	220	na	170	U		12.7	170	170	U		13.6	170	170	U		12.7	170	42	J		13.6	170	170	U		12.7	170	170	U		13.6	170
Benzo(a)pyrene	390	22	na	170	U		17.2	170	170	U		18.5	170	170	U		17.2	170	42	J		18.5	170	170	U		17.2	170	170	U		18.5	170
Benzo(b)fluoranthene	3900	220	na	170	U		10.7	170	170	U		11.5	170	170	U		10.7	170	84	J		11.5	170	170	U		10.7	170	17	J		11.5	170
Benzo(g,h,i)perylene	3100000	230000	na	170	U		7.76	170	170	U		8.31	170	170	U		7.76	170	29	J		8.31	170	170	U		7.76	170	10	J		8.31	170
Benzo(k)fluoranthene	39000	2200	na	170	U		5.71	170	170	U		6.12	170	170	U		5.71	170	32	J		6.12	170	170	U		5.71	170	12	J		6.12	170
bis(2-Ethylhexyl)phthalate	200000	46000	na	30	J		13.2	170	44	J		14.2	170	22	J		13.2	170	47	J		14.2	170	23	J		13.2	170	33	J		14.2	170
Butylbenzylphthalate	20000000	1600000	na	170	U		11.1	170	14	J		11.9	170	170	U		11.1	170	170	U		11.9	170	170	U		11.1	170	170	U		11.9	170
Chrysene	390000	22000	na	170	U		10.3	170	170	U		11	170	170	U		10.3	170	54	J		11	170	170	U		10.3	170	14	J		11	170
Di-n-butylphthalate	10000000	780000	na	44	J		9.95	170	240			10.7	170	57	J		9.95	170	69	J		10.7	170	48	J		9.95	170	49	J		10.7	170
Fluoranthene	4100000	310000	na	170	U		6.15	170	8	J		6.59	170	170	U		6.15	170	100	J		6.59	170	10	J		6.15	170	25	J		6.59	170
Indeno(1,2,3-cd)pyrene	3900	220	na	170	U		8.86	170	170	U		9.5	170	170	U		8.86	170	21	J		9.5	170	170	U		8.86	170	170	U		9.5	170
Phenanthrene	3100000	230000	na	170	U		10.7	170	170	U		11.4	170	170	U		10.7	170	45	J		11.4	170	170	U		10.7	170	170	U		11.4	170
Pyrene	3100000	230000	na	170	U		7.14	170	13	J		7.65	170	170	U		7.14	170	120	J		7.65	170	9	J		7.14	170	29	J		7.65	170
Pesticides (ug/kg)																																	
4,4'-DDT	8400	1900	na	20	U		0.753	20	3.23	J	J	0.807	20	20	U		3.71	20	20	U		3.93	20	1.04	J	J	3.66	20	1.98	J	J	0.807	20
Endrin aldehyde	na	na	na	1.74	J	J	0.608	20	2.19	J	J	0.651	20	20	U		2.99	20	20	U		3.17	20	20	U		2.95	20	2.45	J	J	0.651	20
PCBs (mg/kg)																																	
PCB-1254	1.4	0.16	na	66	U		9.52	66	23	J		10.2	66	66	U		9.52	66	66	U		10.2	66	66	U		9.52	66	66	U		10.2	66
Explosives (mg/kg)																																	
Nitroglycerin	1700	130	na	10	U		1.69	10	10	U		1.82	10	10	U		1.69	10	10	U		1.82	10	5.8			1.69	10	10	U		1.82	10
Herbicides (ug/kg)		None detected																															
Metals (mg/kg)																																	
Aluminum	na	na	40041	15900			4.2	50	14600			4.2	50	14700			210	2500	7460			4.2	50	14600			4.2	50	15500			4.2	50
Antimony	41	3.1	na	0.36	J		0.0386	0.5	0.25	J		0.0386	0.5	0.23	J		0.0386	0.5	0.18	J		0.0386	0.5	0.45	J		0.0386	0.5	0.38	J		0.0386	0.5
Arsenic	1.9	0.43	15.8	13		J	0.058	0.4	13		J	0.058	0.4	15		J	0.058	0.4	5.2		J	0.058	0.4	**18**		J	0.058	0.4	6.8		J	0.058	0.4
Barium	20000	1600	209	183			0.103	5	136			0.103	5	146			0.103	5	83			0.103	5	195			0.103	5	130			0.103	5
Beryllium	200	16	1.02	0.66	J		0.0267	1	0.69	J		0.0267	1	0.73	J		0.0267	1	0.23	J		0.0267	1	0.86	J		0.0267	1	0.72	J		0.0267	1
Cadmium	51	3.9	0.69	**1.7**			0.25	1	**2.2**			0.25	1	**2.5**			0.25	1	0.56	J		0.25	1	**2.2**			0.25	1	**2.1**			0.25	1
Calcium	na	na	na	9330		J	17.5	250	31900		J	87.5	1250	35200		J	175	2500	10100		J	17.5	250	19200		J	17.5	250	14700		J	17.5	250
Chromium	310	23	65.3	32		L	0.998	5	31		L	0.998	5	32		L	0.998	5	12		L	0.998	5	33		L	0.998	5	22		L	0.998	5
Cobalt	na	na	72.3	20			0.233	1	16			0.233	1	17			0.233	1	9.1			0.233	1	20			0.233	1	14			0.233	1
Copper	4100	310	53.5	30			0.516	5	29			0.516	5	30			0.516	5	13			0.516	5	26			0.516	5	24			0.516	5
Iron	31000	2300	50962	40000			73.1	1000	35900			73.1	1000	42800			73.1	1000	20900			18.3	250	47900			73.1	1000	31000			73.1	1000
Lead	800	400	26.8	26			0.0776	1	**31**			0.0776	1	**42**			0.0776	1	15			0.0776	1	**28**			0.0776	1	**35**			0.0776	1
Magnesium	na	na	na	6840		J	7.67	250	18500		J	7.67	250	19000		J	76.7	2500	4720		J	7.67	250	10900		J	7.67	250	10700		J	7.67	250
Manganese	2000	160	2543	2100			2.37	25	1600			2.37	25	2100			23.7	250	359			0.474	5	1640			2.37	25	935			0.474	5
Mercury	31	2.3	0.13	0.037	J		0.0077	0.1	0.031	J		0.0077	0.1	0.037	J		0.0077	0.1	0.03	J		0.0077	0.1	0.024	J		0.0077	0.1	0.033	J		0.0077	0.1
Nickel	2000	160	62.8	21		J	0.0775	0.5	22		J	0.0775	0.5	17		J	0.0775	0.5	15		J	0.0775	0.5	25		J	0.0775	0.5	19		J	0.0775	0.5
Potassium	na	na	na	1880			7.79	100	1750			7.79	100	1660			7.79	100	968			7.79	100	1630			7.79	100	1820			7.79	100
Selenium	510	39	na	0.68	J		0.0486	1	0.5	J		0.0486	1	0.54	J		0.0486	1	0.34	J		0.0486	1	0.37	J		0.0486	1	0.38	J		0.0486	1
Silver	510	39	na	0.11	J		0.0178	3	0.11	J		0.0178	3	0.1	J		0.0178	3	0.16	J		0.0178	3	0.12	J		0.0178	3	0.13	J		0.0178	3
Sodium	na	na	na	51	J		31.4	100	71	J		31.4	100	79	J		31.4	100	36	J		31.4	100	54	J		31.4	100	66	J		31.4	100
Thallium	7.2	0.55	2.11	0.11	J	L	0.0733	0.5	0.12	J	L	0.0733	0.5	0.13	J	L	0.0733	0.5	0.5	U	UL	0.0733	0.5	0.088	J	L	0.0733	0.5	0.13	J	L	0.0733	0.5
Vanadium	102	7.8	108	29		L	0.401	1.2	32		L	0.401	1.2	39		L	0.401	1.2	13		L	0.401	1.2	36		L	0.401	1.2	29		L	0.401	1.2
Zinc	31000	2300	202	96			0.789	4	107			3.95	20	155			3.95	20	58			0.789	4	121			3.95	20	94			0.789	4
Misc. (mg/kg)																																	
Cyanide	2000	160	na	2			0.009	0.5	0.15	J	B	0.009	0.5	0.17	J		0.009	0.5	0.08	J	B	0.009	0.5	0.13	J	B	0.009	0.5	0.13	J	B	0.009	0.5

buried material and at the same depth interval adjacent to the burial areas. One sample of buried material exceeded the adjusted R-RBC for total 2,3,7,8-TCDD as TEQ. COPCs identified in groundwater samples collected from Area B were arsenic and thallium; these metals were detected in the two groundwater samples collected from the burial area at concentrations above their adjusted tw-RBCs but below MCLs. COPCs detected in soil at concentrations above default SSLs were not detected in groundwater; this data coupled with the lack of detections above calculated site-specific SSLs and/or vertical bounding of default SSL exceedances indicated that leaching of organic constituents to groundwater was unlikely to occur at levels of concern. Dissolved arsenic and thallium concentrations in groundwater in the immediate burial area were potentially attributable to leaching from soil or buried material based on soil data and the lack of detections of these COPCs in the groundwater sample collected downgradient of Area B. Comparison of the 1992 VI and 2004 RFI groundwater sample results indicated stable or decreasing chemical concentrations in groundwater. Surface water and sediment samples collected from the unnamed tributary of Stroubles Creek proximate to Area B were not indicative of significant impact from former site activities at Area B. Dissolved metals COPCs were not identified in surface water and organic COPCs related to the site were not identified.

Human Health Risk Assessment

An HHRA was performed to evaluate the potential human health effects associated with previous activities at the site. Media evaluated for the HHRA included soil, groundwater, surface water, and sediment. Receptors evaluated for HHRA included: current/future maintenance worker, future excavation worker, future adult resident, and the future child resident. The total risk calculated for each receptor was below or within USEPA's target risk range for Superfund sites (1E-06 to 1E-04), and the total HI for all receptors except the future Area A and Area B child residents were equal to or below the USEPA reference HI of 1E+00. Both Area A and Area B passed margin of exposure evaluations for iron for the future child resident scenario. When excluding metals COPCs detected below background at Area A, the HI decreased to less than 1E+00 for the future excavation worker and future adult resident and decreased to 2E+00 for future child resident. Target organ HIs for the future child resident at Area A were below 1E+00. When excluding metals COPCs detected below background at Area B, the HI decreased to less than 1E+00 for the future adult resident. Target organ HIs for the future child resident at Area B were 3E+00 for blood and 2E+00 gastrointestinal (GI) tract, with the remaining HIs less than or equal to 1E+00. When incorporating the passing margin of exposure results for iron into the hazard calculation at Area B, the child resident HI decreased from 5E+00 to 3E+00; the segregated HIs for blood, liver, and GI tract were reduced to 1E+00 or less, with skin and vascular remaining at 2E+00. In summary for Area A, the results of the HHRA indicate that the calculated cancer risks and hazards are within USEPA target ranges for each of the receptors evaluated when considering background and target organs. Thus, the risk assessment results would support future commercial/industrial or residential use of Area A without restriction. At Area B, the results of the risk assessment indicate that the calculated cancer risks and hazards are within USEPA target ranges for each of the receptors evaluated, except for the future child resident, when considering background and target organs. Thus, the risk assessment results would support future commercial/industrial use of Area B without restriction; however, future development of Area B for residential use would require implementation of measures to limit exposure of future residents.

Screening Level Ecological Risk Assessment

A SLERA was performed to evaluate potential ecological risks associated with previous activities at the site. Direct contact and wildlife ingestion pathways were evaluated for soil, surface water, and sediment. Terrestrial receptors evaluated included: soil invertebrates and microbes, American robin, red-tailed hawk, meadow vole, fox, and short-tailed shrew. Aquatic and semi-aquatic receptors evaluated included: aquatic macroinvertebrates, benthic invertebrates, mallard duck, belted kingfisher, and raccoon. The SLERA did not identify any elevated risks (HQ > 1) to ecological receptors in Area A. After consideration of chemical bioavailability, spatial distribution of data at the site and mean concentrations, the only chemical/receptor combination with an HQ of greater than one was exposure of the short-tail shrew to arsenic in surface soil in Area B. The HQs for the 95% UCL and mean site arsenic concentrations were 2.9 and 2.6, respectively. When arsenic bioavailability was considered, the mean HQ value was reduced to 2.5. Based on the spatial distribution of the data and fill characteristics, the arsenic levels in surface soil at Area B were potentially ambient levels contained in the off-site fill material used to cap the 1.08 acre area rather than related to historical waste disposal activities. Based on this information, the potential for lower adverse effects to the shrew, lack of potential risk to higher trophic level receptors, and severe short-term disruption of habitat from remedial activities, the SLERA recommended no action be taken to remediate soil at Area B to mitigate potential risks posed by arsenic in soil.

3.4 CONCEPTUAL SITE MODEL

Potentially affected media at SWMU 41 include surface and subsurface soil, surface water, sediment, and groundwater. Surface and subsurface soil are potentially impacted in Areas A and B from disposal activities and vehicle washdown. Groundwater is potentially impacted from downward migration of constituents from soil. Area A at SWMU 41 is adjacent to a small stream that drains into Stroubles Creek. This stream is the likely discharge point for groundwater from the site. Surface water and sediment are present in the stream and are potentially impacted by groundwater discharge to the stream. Precipitation is expected to follow topography and infiltrate into the ground. Site workers, hypothetical future residents, and terrestrial and aquatic biota are considered receptors. **Table 3-6** presents the exposure pathways for human receptors. Exposure pathways for human and ecological receptors are presented in **Figure 3-7** (current) and **Figure 3-8** (future).

The potential presence of red water ash constituents in soil near the leak area indicates that site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with impacted soil, and the inhalation of dust.

Subsurface soil is also potentially impacted. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil. Groundwater is also impacted and may impact future site workers or residents if groundwater were developed as a resource. Surface water and sediment in the stream could also potentially impact site workers, terrestrial biota and future residents through incidental ingestion, dermal absorption or inhalation of dust or volatiles.

The CSM will be refined using information gathered during the current investigation and updated, if necessary, for the resulting RFI report.

Table 3-6
Selection of Exposure Pathways - SWMU 41

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	SWMU 41	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at SWMU 41 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to surface soil at SWMU 41 on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to surface soil at SWMU 41 on a daily basis.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMU 41	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 41.
				Industrial Worker	Adult	Inhalation	On-site	None	There are no workers currently exposed to airborne volatiles or particulates from surface soil at SWMU 41 on a daily basis.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMU 41	None	None	None	On-site	None	Current excavation or construction activities are not occurring at SWMU 41.
	Sediment	Sediment	SWMU 41	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact sediment at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact sediment at SWMU 41 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to sediment at SWMU 41 on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to sediment at SWMU 41 on a daily basis.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Surface Water	Surface Water	SWMU 41	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers could contact surface water at SWMU 41 while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Maintenance workers could contact surface water at SWMU 41 and be exposed to COPCs via dermal absorption while wading.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to surface water at SWMU 41 on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to surface water at SWMU 41 on a daily basis.

Table 3-6
Selection of Exposure Pathways - SWMU 41

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current (cont.)	Surface Water	Surface Water	SWMU 41	Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Groundwater	Groundwater	SWMU 41	None	None	None	On-site	None	Groundwater is not currently being used at SWMU 41. Therefore, there is currently no direct exposure to groundwater.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
Future	Surface Soil	Surface Soil	SWMU 41	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at SWMU 41 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact surface soil at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact surface soil at SWMU 41 and be exposed to COPCs via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMU 41	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 41.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 41.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMU 41	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact soil at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact soil at SWMU 41 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact soil at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact soil at SWMU 41 and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact soil at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact soil at SWMU 41 and be exposed to COPCs via dermal absorption.

Table 3-6
Selection of Exposure Pathways - SWMU 41

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMU 41	Resident	Adult	Ingestion	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
					Child	Ingestion	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMU 41	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 41.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 41.
				Excavation Worker	Adult	Inhalation	On-site	Quant	Excavation workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 41.
				Resident	Adult	Inhalation	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
					Child	Inhalation	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
				Trespasser	Adolescent	Inhalation	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Sediment	Sediment	SWMU 41	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact sediment at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact sediment at SWMU 41 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact sediment at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact sediment at SWMU 41 and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact sediment at SWMU 41 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact sediment at SWMU 41 and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	Adult residents could contact sediment at SWMU 41 and be exposed to COPCs via incidental ingestion during wading or swimming.

Table 3-6
Selection of Exposure Pathways - SWMU 41

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Sediment	Sediment	SWMU 41	Resident	Adult	Dermal	On-site	Quant	Adult residents could contact sediment at SWMU 41 and be exposed to COPCs via dermal absorption during wading or swimming.
					Child	Ingestion	On-site	Quant	Child residents could contact sediment at SWMU 41 and be exposed to COPCs via incidental ingestion during wading or swimming.
						Dermal	On-site	Quant	Child residents could contact sediment at SWMU 41 and be exposed to COPCs via dermal absorption during wading or swimming.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Surface Water	Surface Water	SWMU 41	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers could contact surface water at SWMU 41 while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Maintenance workers could contact surface water at SWMU 41 and be exposed to COPCs via dermal absorption while wading.
				Industrial Worker	Adult	Ingestion	On-site	None	Industrial workers could contact surface water at SWMU 41 while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Industrial workers could contact surface water at SWMU 41 and be exposed to COPCs via dermal absorption while wading.
				Excavation Worker	Adult	Ingestion	On-site	None	Excavation workers could contact surface water at SWMU 41 while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Excavation workers could contact surface water at SWMU 41 and be exposed to COPCs via dermal absorption while wading.
				Resident	Adult	Ingestion	On-site	Quant	Residents could contact surface water at SWMU 41 while wading or swimming. Surface water ingestion while wading is considered unlikely.
						Dermal	On-site	Quant	Adult residents could contact surface water at SWMU 41 and be exposed to COPCs via dermal absorption while wading or swimming.
					Child	Ingestion	On-site	Quant	Residents could contact surface water at SWMU 41 while wading or swimming. Surface water ingestion while wading is considered unlikely. Surface water ingestion while swimming is evaluated.
						Dermal	On-site	Quant	Child residents could contact surface water at SWMU 41 and be exposed to COPCs via dermal absorption while wading or swimming.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

Table 3-6
Selection of Exposure Pathways - SWMU 41

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Groundwater	SWMU 41	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers would not contact groundwater at SWMU 41.
						Dermal	On-site	None	Maintenance workers would not contact groundwater at SWMU 41.
				Industrial Worker	Adult	Ingestion	On-site	Quant	If SWMU 41 were to be further developed for industrial purposes and groundwater wells were installed at the site, site workers could be exposed to COPCs in groundwater via ingestion.
						Dermal	On-site	None	Although site worker dermal exposures to groundwater could occur, the exposed body surface area of a worker (i.e., hands and arms) would be small and exposures would be infrequent.
				Excavation Worker	Adult	Ingestion	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at SWMU 41.
						Dermal	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at SWMU 41.
				Resident	Adult	Ingestion	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 41 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
		Homegrown fruits and vegetables	SWMU 41	Resident	Adult	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into a construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	On-site	Quant	If groundwater wells were installed for residential purposes, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	On-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.

Table 3-6
Selection of Exposure Pathways - SWMU 41

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Indoor Vapors	Resident	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
					Child	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Groundwater	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Homegrown fruits and vegetables	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, volatiles could be released from groundwater into ambient air. Off-site maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into an off-site construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate to off-site wells in the future, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	Off-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
					Child	Inhalation	Off-site	Quant	If COPCs from SWMU 41 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	Off-site	None	The maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

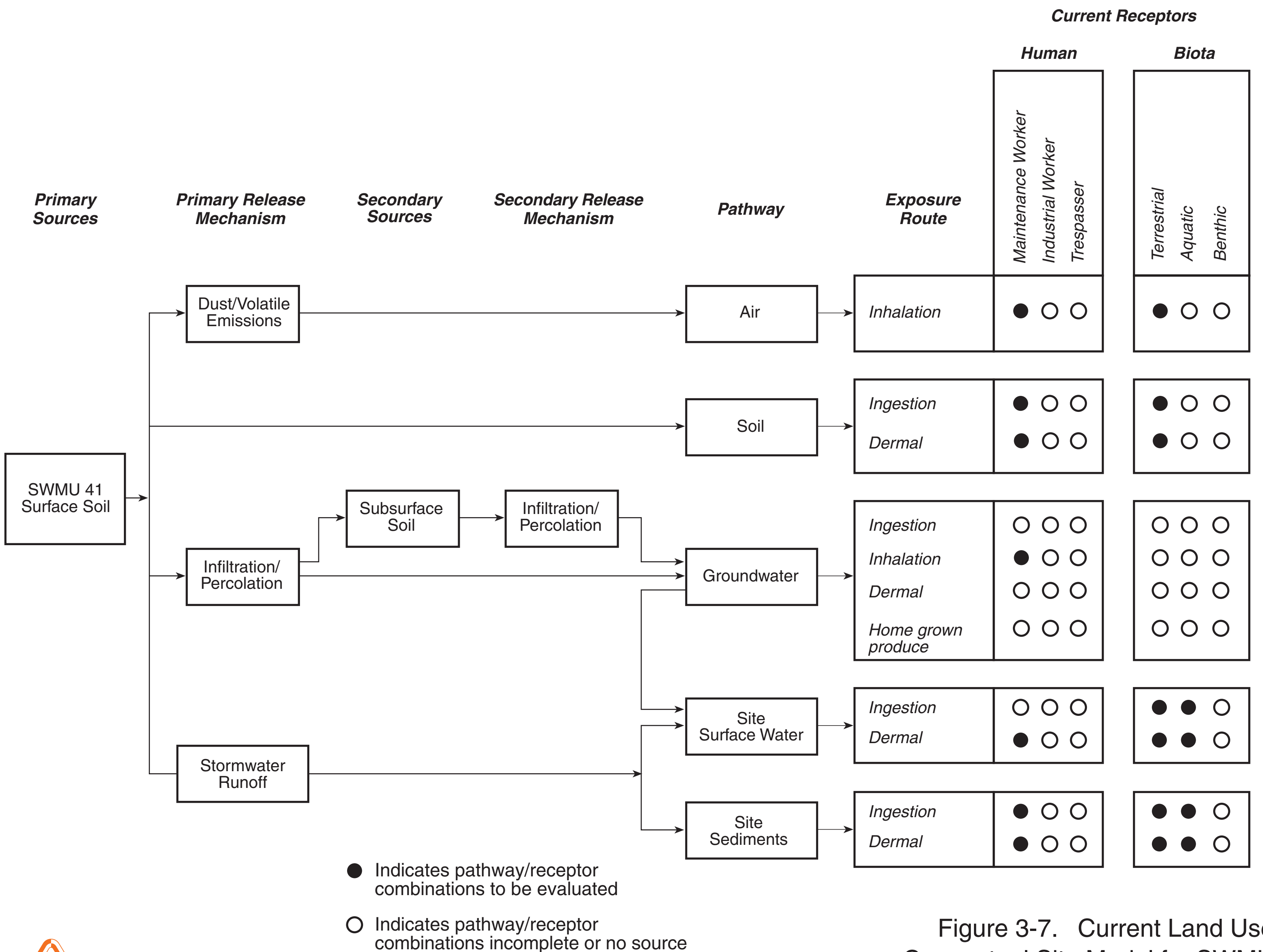

Figure 3-7. Current Land Use Conceptual Site Model for SWMU 41 Radford Army Ammunition Plant, Virginia

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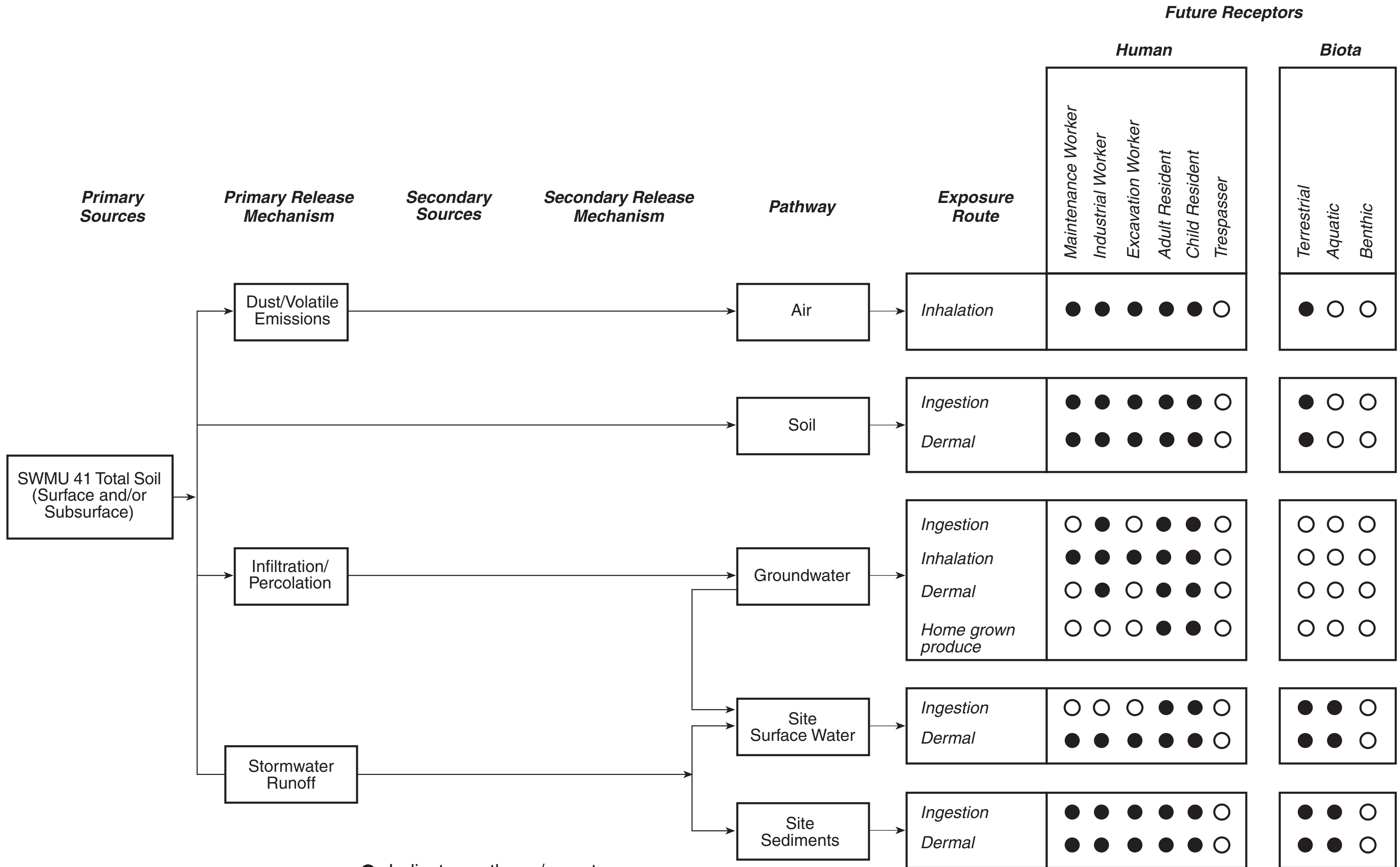
DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w



● Indicates pathway/receptor combinations to be evaluated

○ Indicates pathway/receptor combinations incomplete or no source

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Figure 3-8. Future Land Use Conceptual Site Model for SWMU 41 Radford Army Ammunition Plant, Virginia

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w

3.5 DATA GAP ANALYSIS

This section identifies data gaps in the current understanding of the sites and is the basis for the investigation approach described in the next section.

Area A: Although groundwater is unlikely to have been impacted based on soil and surface water data, the lack of groundwater data is a data gap. The following analyte classes are data gaps for Area A groundwater: TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, and perchlorate.

Soil is adequately characterized at Area A. Surface water is also adequately characterized at Area A. Additional surface water samples that are contemporaneous with the groundwater samples would allow for an analysis of the relationship between groundwater and the adjacent creek.

Area B: There are no data gaps associated with Area B. Additional samples from the wells and the seep at Area B can be compared to existing data to establish trends in the groundwater concentrations over time.

3.6 INVESTIGATION APPROACH

The following sections summarize the proposed samples at SWMU 41. Sample locations are presented on **Figure 3-2** and the analytical parameters are presented in **Table 3-7**.

Area A: Three groundwater samples will be collected with a direct push rig to demonstrate that site soil is not impacting groundwater. One sample will be collected from the center of the former lagoon area (41GW01) and two samples will be collected downgradient from the site, between Stroubles Creek and the former lagoon area (41GW02 and 41GW03). The advantage of the direct push sampling is that it will allow samples to be collected from closer to the edge of the steep slope at the downgradient edge of the site. As shown in **Table 3-7**, these samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, and perchlorate. Direct push groundwater sampling will be conducted in accordance with Section 5.2 and SOP 20.11 of the MWP (URS, 2003a).

Three collocated surface water/sediment samples (41SW/SD08 – 41SW/SD10) from the unnamed tributary to Stroubles Creek will also be collected to evaluate groundwater conditions at Area A. Due to its proximity to Area A and the steep bank adjacent to the site, this unnamed tributary is the expected groundwater discharge point for Area A groundwater and these samples are intended to characterize any impacts from groundwater to surface water. These samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, and perchlorate.

Area B: Site media is currently well characterized at Area B. The three existing wells and the seep (41SW11) will be resampled to obtain current groundwater data in Area B to complete the RFI/CMS. A sediment sample (41SD11) will also be collected from the seep. These samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, and perchlorate.

Table 3-7
Proposed Sampling and Analysis Plan
SWMU 41
Radford AAP, Radford, VA

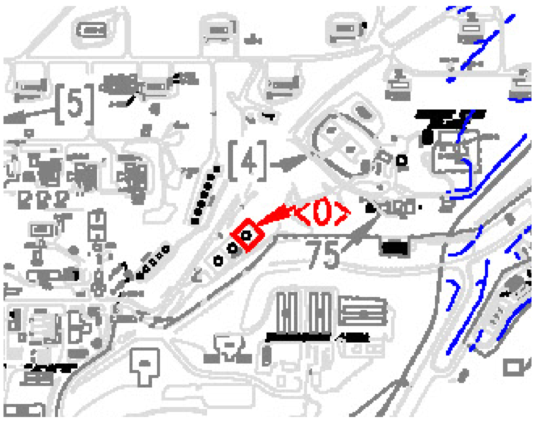
Media	Sampling ID	Depth	Location	Analytes
SWMU 41				
Groundwater	41GW01	at water table	Area A, direct push GW	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41GW02	at water table	Area A, direct push GW	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41GW03	at water table	Area A, direct push GW	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41MW1	70 ft bgs	Area B, existing upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41MW2	113 ft bgs	Area B, existing downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41MW3	52.5 ft bgs	Area B, existing downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
SurfaceWater	41SW08	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41SW09	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41SW10	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	41SW11	NA	Area B, seep sample	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
Sediment	41SD08	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	41SD09	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	41SD10	NA	Area A, downgradient stream	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	41SD11	NA	Area B, seep sample	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans

4.0 AREA O – UNDERGROUND FUEL OIL SPILL

4.1 SITE DESCRIPTION AND HISTORY

4.1.1 Site Description

Area O (RAAP-038) consists of one 269,000-gallon fuel oil aboveground storage tank (AST) that is situated on a concrete base and surrounded by a concrete secondary containment system. The site is located in the east section of the MMA, southwest of the Inert Gas Plant (**Figure 4-1**), located on the southeast side of a northeastward sloping drainage valley. Elevations range from 1,775 ft msl near well P-1 to 1,740 ft msl at the asphalt road northeast of the tanks. The base of the tank containment structure has an elevation of 1,771 ft msl.



The southeast side of the valley remains relatively level for 300 ft north of the tanks. The ground surface drops more abruptly at that point and the scarp in the hillside has a 30-foot drop over approximately 150 ft. A road cuts across the valley at the base of this scarp and there is a drainage ditch along the road where oily water reportedly discharged from the hillside in the 1980s.

4.1.2 Site History

An Oil Audit was conducted by USACE in 1982. This audit placed fuel leakage of an underground pipeline connecting a filling station to the fuel tank at approximately 3,000 gallons. In 1983, four monitoring wells were installed to characterize groundwater flow and quality at the site. A Facility Visit by plant personnel in 1990 indicated that the leaking fuel line was not connected to the filling station as described in 1982, but was a discharge line connecting the northeastern-most fuel tank to a pumping station. This line was replaced with an above ground line. In 1992, an RFI was conducted that performed a soil gas survey, sampled soil, groundwater, surface water, and sediment. In 1994, during Phase II of the RFI, additional soil and groundwater samples were collected from the site.

4.2 SITE GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

A comprehensive discussion of the regional physiography, soil, geology, and groundwater at RFAAP is included in the RFAAP MWP (URS, 2003a) and therefore is not discussed in this report.

4.2.1 Site Soil

The U.S. Department of Agriculture has mapped Unison-Urban soils as underlying Area O with slope modifiers of two to seven percent at the tank area and 15 to 25 percent under the hill and steep slope area to the northeast (SCS, 1985). Unison soil makes up roughly half, Urban land a quarter, and other soils a quarter of the total unit. A typical profile of Unison soil has a surface layer of dark brown and brown loam about 15 inches thick, a yellowish-red sticky and plastic clay subsoil about 43 inches thick, and the substratus is red sandy clay loam below 58 inches. The surface soil layer is classified in the Unified Soil Classification System (USCS) as CL, ML,

LEGEND

SWMU 41 and 43, and Area O and P Boundaries

Other SWMU Boundary

Installation Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 500 1,000 2,000 Feet

U.S. Army Corps of Engineers

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FIGURE 4-1
SWMU 41 and 43, and Areas O and P
Site Location Map
Radford Army Ammunition Plant,
Radford, VA

GIS File: RFAAP_010_Fig4-1_Workplan_O_P_41_43_SiteMap.mxd

Date: 6/1/07

and CL-ML; the subsoil is CL and CH; and the substratum classifications are CL-ML, CL, ML, and GM-GC (USCS).

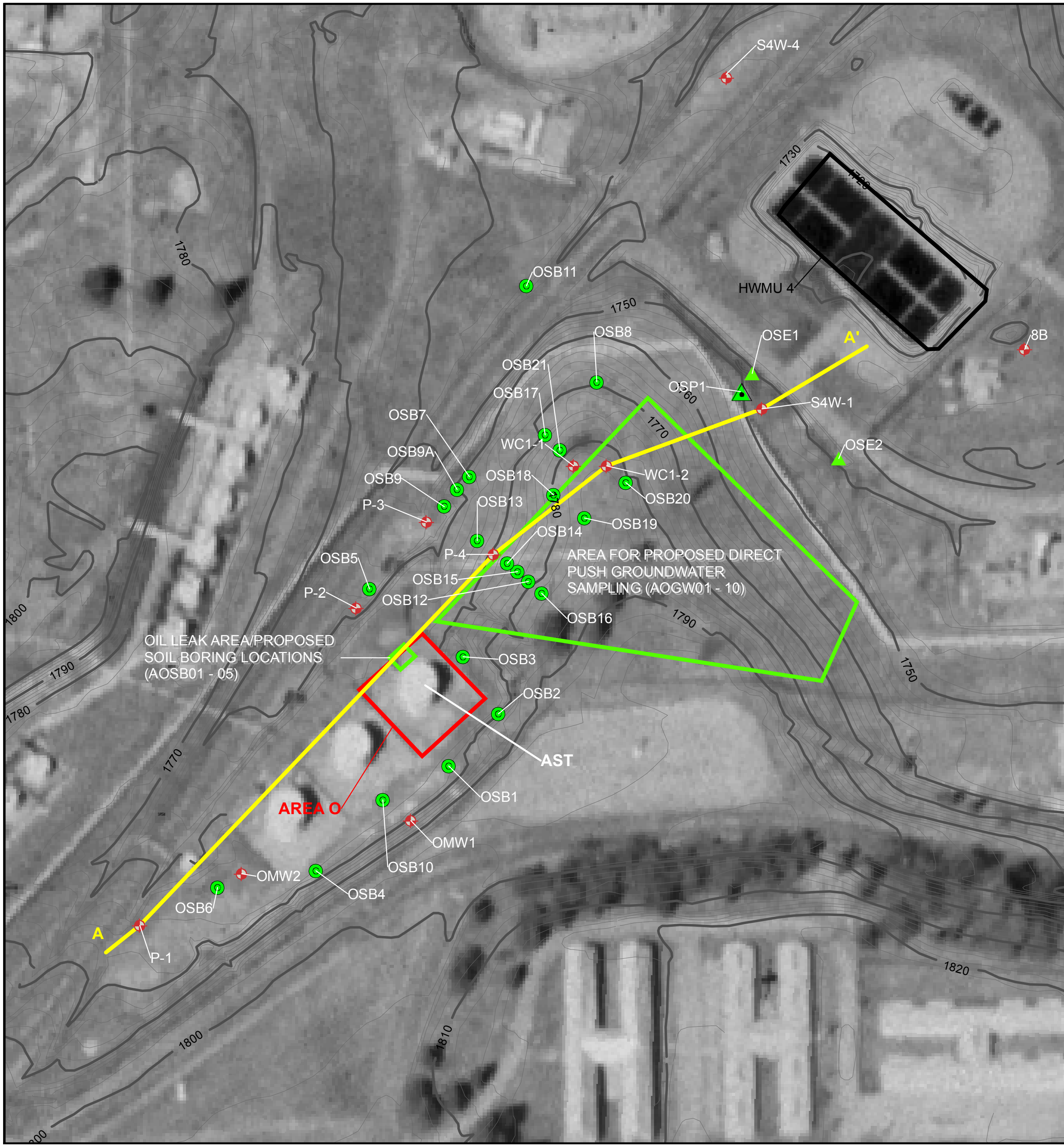
4.2.2 Site Geology

A cross-section running roughly north-south through the site (**Figure 4-2**) is presented on **Figure 4-3**. Boring logs for the wells at Area O are presented in **Appendix B**. The site is underlain by 10 to 37 ft of unconsolidated soil deposits consisting principally of terrace alluvial deposits. The primary unconsolidated soil deposits below Area O consist of a brown to yellowish-brown, fine-grained, plastic silt and clay. These deposits are highly interbedded in most locations below the site with occasional thin sand and gravel zones. Unconsolidated soil deposits were usually described as being stiff in consistency and moist. Where the silts and clays exhibited a higher plasticity (MH-CH), the soils were usually more soft and moist. Borings performed in the area of the ASTs (OMW1, OSB4, OSB2, OSB10) encountered fill associated with the construction of the ASTs and the parking lot bordering the site to the east. The deposits of river jack overlying bedrock which were encountered in boring S4W-1 during a previous investigation were noticeably absent from the exploratory borings performed for RFI (USAEHA, 1981). However, a 3-foot layer of gravel and cobbles was encountered above bedrock in boring OSB13 performed about 10 ft west of monitoring well P-4. Thin layers of river jack were encountered in borings OSB11 and OSB19. Minor amounts of gravel were encountered in other borings; therefore, it is likely that the thicker gravel deposits encountered in S4W-1 are localized along the steep slope in the vicinity of the scarp at the north end of the site.

Underlying the terrace deposits in some areas of the site (noticeably in the area of OSB5 and OSB8) are fine-grained residual soils weathered from the underlying limestone/dolostone bedrock. Residual soils usually consist of a yellowish-brown, silt (ML) which is stiff in consistency. The extent of residual deposits is apparently limited due to the erosion and deposition of alluvial deposits over bedrock in most areas below the site.

Underlying the unconsolidated soils in Area O is the gray limestone/dolostone of the Elbrook Formation. Previous investigations at Area O penetrated from 7 to 25 ft of bedrock using NX rock coring. The limestone/dolostone below the site is finally laminated, argillaceous, with frequent brecciated, conglomeratic, and vuggy zones. The bedrock is highly weathered and fractured with small quartz and calcite veins (BCM, 1984; USACE, 1988). The observation of bedrock outcropping at the western border of the site along a steep scarp confirms the above descriptions of bedrock below the site. The apparent dip of bedrock from this outcrop is approximately 30 degrees to the southeast with a strike trending northeast-southwest. Extensive exposures of bedrock were also observed in the excavation for the new neutralization basins in the Hazardous Waste Management Unit (HWMU) 4 area. Bedrock was penetrated during the RFI to a depth of 3 ft during the installation of monitoring well OMW1. The bedrock was soft and highly weathered as indicated by the rapid penetration of the roller bit used during drilling.

The bedrock surface below Area O generally follows the surface topography. Two apparent bedrock lows are present below Area O; the first near the southwestern end of the ASTs, the second in the vicinity of borings OSB12 and OSB16. The depth to bedrock in these areas ranges from about 33 to 37 ft bgs, significantly greater than other areas at Area O.



LEGEND

- Monitoring Well Location
- Previous Investigation Soil Sample Location
- Previous Investigation Sediment Sample Location
- Previous Investigation Seep Sample Location
- Geologic Cross-Section Line
- 10 ft Contour Line
- Area O Boundary
- Other SWMU Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 75 150 300 Feet

U.S. Army Corps of Engineers

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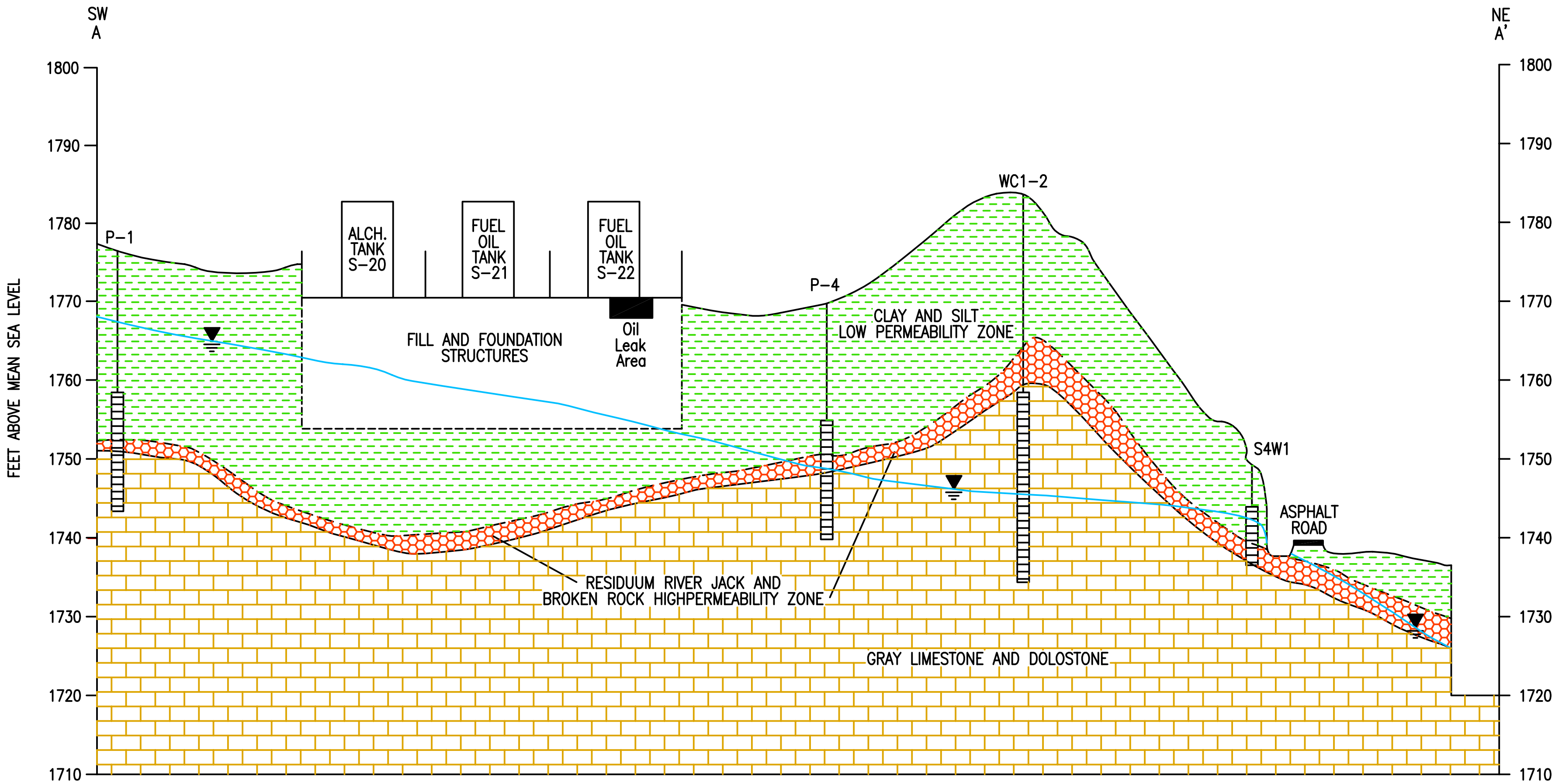
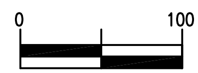
FIGURE 4-2
Area O Sample Locations and
Cross-Section Line
Radford Army Ammunition Plant,
Radford, VA

GIS File: RFAAP_004_Fig4-2_Workplan_AreaO_SampleLocations.mxd
Date: 1/24/07





LEGEND

- BEDROCK (DOLOSTONE, LIMESTONE AND INTERLAYERED SHALE)
- UNDIFFERENTIATED SILTS, CLAYS, THIN SAND LAYERS
- RIVERJACK (FINE TO COURSE GRAVEL, VARYING SAND, SILT)
- MONITORING WELL
- SCREEN INTERVAL
- GROUNDWATER ELEVATION

NOTE: CROSS SECTION LINE IS SHOWN ON FIGURE 4-2
ADAPTED FROM DAMES & MOORE, 1994

RADFORD AAP		Figure 4-3
PREPARED BY: SHAW	TASK NO: -	CROSS-SECTION A-A' AREA O RADFORD ARMY AMMUNITION PLANT
CHECKED: TL	SHAW DWG NO: Figure 4-3	
DATE: JANUARY 2007		

4.2.3 Site Hydrogeology

A relatively shallow groundwater table is present below the site at a depth ranging from 2 to 24 ft bgs. Based on groundwater measurements obtained on March 13, 1992, the unconfined water table gradient slopes northeast at an average gradient of 5 percent in the southern half of the site, and an average gradient of 2 percent in the northern half of the site, except at the extreme northern border of the site where the gradient steepens to approximately 11 percent. Because of the low hydraulic gradient over most of the site and the considerable bedrock elevation differences below the site, water table conditions may be found in either unconsolidated-consolidated materials or only within consolidated bedrock. Groundwater flow occurs through bedrock only in the areas of highest bedrock elevation. The measured water table does not appear to be significantly affected by whether it is in soil or bedrock.

A local groundwater discharge zone for the site occurs along the steep scarp bordering the site on the north. Several seeps/springs discharge along nearly the entire length of this scarp. This seep/spring has apparently been formed as the result of an outcropping of a gravel and cobble lens present between the clay soil and the bedrock. Based on information from previous investigations conducted at the site, this discharge zone (seep/spring) was created when the scarp hillside was excavated after the discovery of liquid hydrocarbons in monitoring well S4W-1. Apparently, the surging during development of this well flushed liquid hydrocarbons out of the seep and into the drainage ditch bordering Area O (BCM, 1984; USACE, 1988). Another possible groundwater discharge zone is located just west of the site across the asphalt road in the drainage ditch area. Wells located in this area have groundwater levels close to the ground surface with water frequently observed in this drainage ditch.

Because groundwater is present within the unconsolidated deposits above bedrock at the suspected source area for liquid and dissolved phase petroleum hydrocarbon contamination at Area O, knowing the flow velocity for the saturated sediment layer and consolidated bedrock is important for evaluating potential contaminant pathways from the source area at Area O.

4.2.4 Surface Water Hydrology

Area O is located on the southeast side of a northeastward sloping drainage valley in the east section of the MMA, southwest of the Inert Gas Plant. Elevations at the site range from 1,775 ft msl near well P-1 to 1,740 ft msl at the asphalt road northeast of the tanks. The base of the tank containment structure has an elevation of 1,771 ft msl.

The southeast side of the valley remains relatively level for 300 ft north of the tanks. The ground surface drops more abruptly at that point and the scarp in the hillside has a 30-foot drop over approximately 150 ft. A road cuts across the valley at the base of this scarp and there is a drainage ditch along the road where oily water reportedly discharged from the hillside in the 1980s. Across the road from the scarp is the site of the former Acidic Wastewater Lagoon (HWMU 4).

Surface water drainage at the site is expected to flow northeastward down the valley towards Stroubles Creek and ultimately the New River. There are several engineered drainage ditches along the roads near the site that would channel storm water runoff in the same general direction.

4.3 PREVIOUS INVESTIGATIONS

There has been one previous investigation conducted at Area O. Contamination was originally detected when wells were installed for the 1982 investigation of downgradient HWMU 4, The

Former Acidic Wastewater Lagoon. Dames and Moore incorporated relevant data from HWMU 4 investigations into their 1994 RFI report (Dames and Moore, 1994), and it is discussed below.

4.3.1 RFI, Dames and Moore, 1994

Samples were collected from groundwater, soil, surface water, and sediment to evaluate the migration of oil constituents for the 1994 RFI. Results from these samples are presented in **Tables 4-1 through 4-4**. The results of the RFI boring and well installation program, in conjunction with data acquired in previous investigations, have been used to define the hydrogeologic conditions at the site. The RFI made the following conclusions:

- The most likely path for contaminant migration appears to have been first via shallow groundwater through unconsolidated soil (near the source area) and then second via groundwater flowing through fractured bedrock downgradient of the source area. Contaminants flowing through bedrock eventually became trapped in gravelly and low permeability sediments which intersected the water table in the hillside area near well S4W-1. Based on the boring and well sampling program, the migration pathway extended in a nearly straight line from the source area through the area of borings OSB12 and OSB15 until reaching the hillside in the vicinity of well S4W-1.
- Several VOCs were detected in the 1992 groundwater samples but only sporadically at concentrations below MCLs. TCL SVOCs were only detected in the groundwater sample from well S4W-1 with five of the eight SVOCs exceeding tw-RBCs (n-nitrosodiphenylamine, phenanthrene, fluorene, fluoranthene, and 2-methylnaphthalene). SVOC TICs were detected in eight of the nine wells sampled.
- Several SVOCs were detected in two of the three 1993 groundwater samples (OMW1 and S4W-1) with dibenzofuran, fluorene, naphthalene, and 2-methylnaphthalene slightly exceeding their tw-RBCs. SVOC TICs were identified in samples OMW1 and S4W-1. Unknown TICs were identified in all three samples collected.

  TOC was reported in 1993 samples OMW1 and S4W-1 at concentrations about four times less than the results reported for corresponding 1992 samples. TOX was reported in all three 1993 samples, but at concentrations about three to four times greater than the results reported for corresponding 1992 samples. TPH was also reported in samples OMW1 (175 µg/L) and S4W-1 (6,610 µg/L). The elevated concentrations of TPH and TOC reported in downgradient sample S4W-1 indicate that middle to high boiling point petroleum hydrocarbons associated with the oil leak remain in groundwater near the oil seep location.
- Nitrite/nitrate was reported at concentrations about 3 times greater than its MCL (10,000 µg/L) in 1993 samples OMW1 and S4W-1. Nitrite/nitrate was reported at concentrations of about one order of magnitude less than the MCL criterion in sample OMW-2.
- Of the 23 soil samples collected during the 1991/1992 boring program, only those next to the tanks and two downgradient of the tanks had detectable VOCs and SVOCs.
- Seven VOCs and 35 SVOCs, including VOC and SVOC TICS, were detected in the sample from the seep adjacent to well S4W-1.
- Only trace levels (near the practical quantitation limit) of a few VOCs and SVOCs were detected in sediment collected from the ditch near the seep.

Table 4-1
Detected Results for Soil at Area O
1994 RFI - Dames and Moore

SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	i-RBC	r-RBC	OSB2 RFIS*88 23-OCT-91 14-16	OSB3 RFIS*90 23-OCT-91 16-18	OSB4 RFIS*92 02-NOV-91 20.5-22.5	OSB10 RFIS*101 24-OCT-91 30-32	OSB10 RFIS*104 24-OCT-91 14-16	OSB12 RDSX*43 18-AUG-93 31-33	OSB15 RDSX*46 18-AUG-93 27-29	OSB17 RDSX*48 20-AUG-93 10.5-12.5	OSB20 RDSX*51 19-AUG-93 15-17
Organics (ug/kg)											
2-Chlorophenol	510000	39000	nd	nd	nd	nd	nd	190	nd	nd	nd
2-Methylnaphthalene	410000	31000	nd	291	26500	144	10500	330	nd	nd	nd
Acenaphthene	6100000	470000	nd	nd	2300	nd	nd	nd	nd	nd	nd
Acenaphthylene	3100000	230000	nd	nd	nd	nd	184	nd	nd	nd	nd
Acetone	92000000	7000000	nd	nd	nd	28	nd	nt	nt	nt	nt
Anthracene	31000000	2300000	nd	nd	808	nd	nd	nd	nd	nd	nd
Bis(2-ethylhexyl)phthalate	200000	46000	nd	nd	nd	nd	nd	nd	2200	nd	nd
Chloroform	1000000	78000	2	nd	nd	nd	nd	nt	nt	nt	nt
Dibenzofuran	100000	7800	nd	nd	991	nd	425	nd	nd	nd	nd
Di-n-butylphthalate	10000000	780000	nd	nd	nd	nd	nd	nd	140	130	520
Ethylbenzene	10000000	780000	nd	nd	nd	nd	3	nt	nt	nt	nt
Fluorene	4100000	310000	nd	99	3080	87	1030	110	130	nd	nd
Naphthalene	2000000	160000	nd	nd	2220	nd	1890	210	nd	nd	nd
Phenanthrene	3100000	230000	nd	205	4680	230	1980	380	310	nd	nd
Pyrene	3100000	230000	nd	nd	399	nd	122	nd	nd	nd	nd

Table 4-2
Detected Results for Groundwater at Area O
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SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	MCL	tw-RBC	8B RDWC*47 25-FEB-92 25	P-1 RDWC*43 24-FEB-92 23	P-2 RDWC*48 20-FEB-92 13	P-3 RDWC*49 20-FEB-92 15	P-4 RDWC*50 20-FEB-92 26
Organics (ug/L)							
2-Methylnaphthalene	na	2.4	nd	nd	nd	nd	nd
Acenaphthene	na	36	nd	nd	nd	nd	nd
Benzene	5	0.34	nd	nd	nd	nd	nd
Bis(2-ethylhexyl)phthalate	6	4.8	nd	nd	nd	nd	nd
Carbon disulfide	na	100	4.8	nd	nd	nd	nd
Chloroform	80	0.15	nd	2.67	nd	nd	nd
Chloromethane	na	19	6.8	nd	nd	nd	nd
Dibenzofuran	na	3.7	nd	nd	nd	nd	nd
Ethylbenzene	700	130	nd	nd	nd	nd	nd
Fluoranthene	150	0.04	nd	nd	nd	nd	nd
Fluorene	24	3	nd	nd	nd	nd	nd
N-Nitrosodiphenylamine	na	14	nd	nd	nd	nd	nd
Naphthalene	na	0.65	nd	nd	nd	nd	nd
Phenanthrene	na	18	nd	nd	nd	nd	nd
Pyrene	na	18	nd	nd	nd	nd	nd
Toluene	1000	75	nd	5.2	nd	nd	nd
Total petroleum hydrocarbons	na	na	nd	nd	nd	nd	nd
Wet Chemistry							
Chlorine	na	na	nd	nd	nd	nd	nd
Nitrate/Nitrite	10000	na	nd	nd	nd	nd	nd
pH	na	na	7.67	6.96	7.04	7.02	7.27
Phosphate	na	na	nd	nd	nd	nd	nd
Sulfate	na	na	nd	nd	nd	nd	nd
TOC	na	na	6570	6340	1940	2060	nd
TOX	na	na	102	41.2	58.8	60.7	134

Table 4-2
Detected Results for Groundwater at Area O
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SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	MCL	tw-RBC	OMW1 RDWC*51 24-FEB-92 30	OMW1 RDWX*46 28-JUL-93 35	OMW2 RDWX*47 29-JUL-93 25	WC1-2 RDWC*45 28-FEB-92 43	S4W-1 RDWC*44 24-FEB-92 13	S4W-1 RDWX*48 28-JUL-93 13	S4W-4 RDWC*46 28-FEB-92 17
Organics (ug/L)									
2-Methylnaphthalene	na	2.4	nd	4	nd	nd	53.3	nd	6
Acenaphthene	na	36	nd	2.7	nd	nd	18	nd	nd
Benzene	5	0.34	2.18	nd	nd	nd	nd	nd	nd
Bis(2-ethylhexyl)phthalate	6	4.8	nd	nd	nd	nd	4.45	nd	nd
Carbon disulfide	na	100	nd	nd	nd	nd	nd	nd	0.794
Chloroform	80	0.15	0.697	nd	nd	nd	nd	nd	nd
Chloromethane	na	19	nd	nd	nd	5.99	nd	nd	nd
Dibenzofuran	na	3.7	nd	3.8	nd	nd	nd	nd	nd
Ethylbenzene	700	130	0.895	nd	nd	nd	nd	nd	nd
Fluoranthene	150	0.04	nd	nd	nd	nd	4.02	nd	nd
Fluorene	24	3	nd	5.3	nd	nd	42.7	8.2	nd
N-Nitrosodiphenylamine	na	14	nd	nd	nd	nd	46	nd	nd
Naphthalene	na	0.65	nd	6.6	nd	nd	nd	0.84	nd
Phenanthrene	na	18	nd	3.1	nd	nd	87	3.4	nd
Pyrene	na	18	nd	nd	nd	nd	5.53	nd	nd
Toluene	1000	75	nd	nd	nd	nd	nd	nd	nd
Total petroleum hydrocarbons	na	na	nd	175	nd	nd	nd	6610	nd
Wet Chemistry									
Chlorine	na	na	nd	46000	53000	nd	nd	30400	nd
Nitrate/Nitrite	10000	na	nd	30000	1200	nd	nd	33000	nd
pH	na	na	7.13	nt	nt	7.42	7.28	nt	7.49
Phosphate	na	na	nd	86	420	nd	nd	110	nd
Sulfate	na	na	nd	16400	156000	nd	nd	nd	nd
TOC	na	na	7110	1760	nd	18300	9930	2500	14900
TOX	na	na	36	176	232	60.3	46.1	150	75

Table 4-3
Detected Results for Surface Water Samples at Area O
1994 RFI - Dames and Moore

SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	MCL	tw-RBC	OSP1 RDWA*37 26-SEP-91 na
Organics (ug/L)			
2-Methylnaphthalene	na	2.4	2.1
Acenaphthene	na	36	2.4
Chloromethane	na	19	10
Dibenzofuran	na	3.7	1.8
Fluorene	na	24	5.2
Methylene Chloride	5	4.1	4.9
Naphthalene	na	0.65	2.3
Phenanthrene	na	18	2.2

Table 4-4
Detected Results for Sediment at Area O
1994 RFI - Dames and Moore

SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	i-RBC	r-RBC	OSE1 RFIS*106 26-SEP-91 0-0.5	OSE2 RFIS*107 26-SEP-91 0-0.5
Organics				
Acetone	92000000	7000000	61	122

- Soil contamination appears to be limited to three areas at Area O which include: the tank area and points immediately downgradient (northeast), the bedrock low in the vicinity of borings OSB12 and OSB15, and the seepage area near well S4W-1. Except for the seepage area where oil probably remains trapped in sediments, the levels of soil contamination are generally low and limited to SVOCs that are associated with weathered petroleum products.
- No health or environmental risk was identified for RFAAP workers under current or expected future conditions.

4.4 CONCEPTUAL SITE MODEL

Potentially affected media include surface and subsurface soil, surface water, sediment, and groundwater. Area O is located in on the southeast side of a drainage valley that slopes gently to the northeast. At the northern edge of Area O there is a steep scarp that cuts across the drainage valley. Surface and subsurface soil are potentially impacted in the area of the former leaking pipe. Groundwater is potentially impacted between the leak area and the steep scarp to the north. Surface water and sediment are present in the drainage ditch at the base of the scarp that appears to be a groundwater discharge point. Precipitation is expected to flow down the hill sides and infiltrate into the ground. Site workers, hypothetical future residents, and terrestrial biota are considered receptors. **Table 4-5** presents the exposure pathways for each human receptor. **Figure 4-4** (current) and **Figure 4-5** (future) present exposure pathways for ecological and human receptors. The exposures pathways associated with each media type are described in more detail in the following paragraphs.

The potential presence of oil constituents in soil near the leak area indicates that site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with impacted soil, and the inhalation of dust.

Subsurface soil is also potentially impacted. Oil constituents are mobile in the environment and would negatively impact the subsurface soil. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil. Groundwater is also impacted and may impact future site workers or residents if groundwater were developed as a resource. Surface water and sediment in the ditch could also potentially impact site workers, terrestrial biota and future residents through incidental ingestion, dermal absorption or inhalation of dust or volatiles. The ditch is man-made, is bordered by a road, and is unlikely to provide habitat for aquatic biota.

4.5 DATA GAP ANALYSIS

This section identifies data gaps in the current understanding of the site and is the basis for the investigation approach described in the next section.

Characterization of the soil (surface and subsurface) in the area where the pipe leaked is a data gap. Previous investigations have focused on groundwater contamination and identification of flow pathways. Soil samples in this area will identify whether oil-contaminated soil is acting as a continuing source for groundwater. Data gaps for soil include TCL VOCs, TCL SVOCs, and PAHs.

Table 4-5
Selection of Exposure Pathways - Area O

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	Area O	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at Area O and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to surface soil at Area O on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to surface soil at Area O on a daily basis.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	Area O	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at Area O.
				Industrial Worker	Adult	Inhalation	On-site	None	There are no workers currently exposed to airborne volatiles or particulates from surface soil at Area O on a daily basis.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	Area O	None	None	None	On-site	None	Current excavation or construction activities are not occurring at Area O.
	Sediment	Sediment	Area O	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact sediment at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact sediment at Area O and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to sediment at Area O on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to sediment at Area O on a daily basis.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Surface Water	Surface Water	Area O	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers could contact surface water at Area O while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Maintenance workers could contact surface water at Area O and be exposed to COPCs via dermal absorption while wading.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to surface water at Area O on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to surface water at Area O on a daily basis.

Table 4-5
Selection of Exposure Pathways - Area O

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current (cont.)	Surface Water	Surface Water	Area O	Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Groundwater	Groundwater	Area O	None	None	None	On-site	None	Groundwater is not currently being used at Area O. Therefore, there is currently no direct exposure to groundwater.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
Future	Surface Soil	Surface Soil	Area O	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at Area O and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact surface soil at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact surface soil at Area O and be exposed to COPCs via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	Area O	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at Area O.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from surface soil at Area O.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	Area O	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact soil at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact soil at Area O and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact soil at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact soil at Area O and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact soil at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact soil at Area O and be exposed to COPCs via dermal absorption.

Table 4-5
Selection of Exposure Pathways - Area O

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	Area O	Resident	Adult	Ingestion	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
					Child	Ingestion	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	Area O	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from soils at Area O.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from soils at Area O.
				Excavation Worker	Adult	Inhalation	On-site	Quant	Excavation workers could be exposed to airborne volatiles or particulate matter released from soils at Area O.
				Resident	Adult	Inhalation	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
					Child	Inhalation	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
				Trespasser	Adolescent	Inhalation	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Sediment	Sediment	Area O	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact sediment at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact sediment at Area O and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact sediment at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact sediment at Area O and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact sediment at Area O and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact sediment at Area O and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	Adult residents could contact sediment at Area O and be exposed to COPCs via incidental ingestion during wading or swimming.

Table 4-5
Selection of Exposure Pathways - Area O

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Sediment	Sediment	Area O	Resident	Adult	Dermal	On-site	Quant	Adult residents could contact sediment at Area O and be exposed to COPCs via dermal absorption during wading or swimming.
					Child	Ingestion	On-site	Quant	Child residents could contact sediment at Area O and be exposed to COPCs via incidental ingestion during wading or swimming.
						Dermal	On-site	Quant	Child residents could contact sediment at Area O and be exposed to COPCs via dermal absorption during wading or swimming.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Surface Water	Surface Water	Area O	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers could contact surface water at Area O while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Maintenance workers could contact surface water at Area O and be exposed to COPCs via dermal absorption while wading.
				Industrial Worker	Adult	Ingestion	On-site	None	Industrial workers could contact surface water at Area O while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Industrial workers could contact surface water at Area O and be exposed to COPCs via dermal absorption while wading.
				Excavation Worker	Adult	Ingestion	On-site	None	Excavation workers could contact surface water at Area O while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Excavation workers could contact surface water at Area O and be exposed to COPCs via dermal absorption while wading.
				Resident	Adult	Ingestion	On-site	Quant	Residents could contact surface water at Area O while wading or swimming. Surface water ingestion while wading is considered unlikely.
						Dermal	On-site	Quant	Adult residents could contact surface water at Area O and be exposed to COPCs via dermal absorption while wading or swimming.
					Child	Ingestion	On-site	Quant	Residents could contact surface water at Area O while wading or swimming. Surface water ingestion while wading is considered unlikely. Surface water ingestion while swimming is evaluated.
						Dermal	On-site	Quant	Child residents could contact surface water at Area O and be exposed to COPCs via dermal absorption while wading or swimming.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

Table 4-5
Selection of Exposure Pathways - Area O

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Groundwater	Area O	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers would not contact groundwater at Area O.
						Dermal	On-site	None	Maintenance workers would not contact groundwater at Area O.
				Industrial Worker	Adult	Ingestion	On-site	Quant	If Area O were to be further developed for industrial purposes and groundwater wells were installed at the site, site workers could be exposed to COPCs in groundwater via ingestion.
						Dermal	On-site	None	Although site worker dermal exposures to groundwater could occur, the exposed body surface area of a worker (i.e., hands and arms) would be small and exposures would be infrequent.
				Excavation Worker	Adult	Ingestion	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at Area O.
						Dermal	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at Area O.
				Resident	Adult	Ingestion	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If Area O were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
		Homegrown fruits and vegetables	Area O	Resident	Adult	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into a construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	On-site	Quant	If groundwater wells were installed for residential purposes, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	On-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.

Table 4-5
Selection of Exposure Pathways - Area O

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Indoor Vapors	Resident	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
					Child	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Groundwater	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Homegrown fruits and vegetables	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, volatiles could be released from groundwater into ambient air. Off-site maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into an off-site construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from Area O groundwater were to migrate to off-site wells in the future, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	Off-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
					Child	Inhalation	Off-site	Quant	If COPCs from Area O groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	Off-site	None	The maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

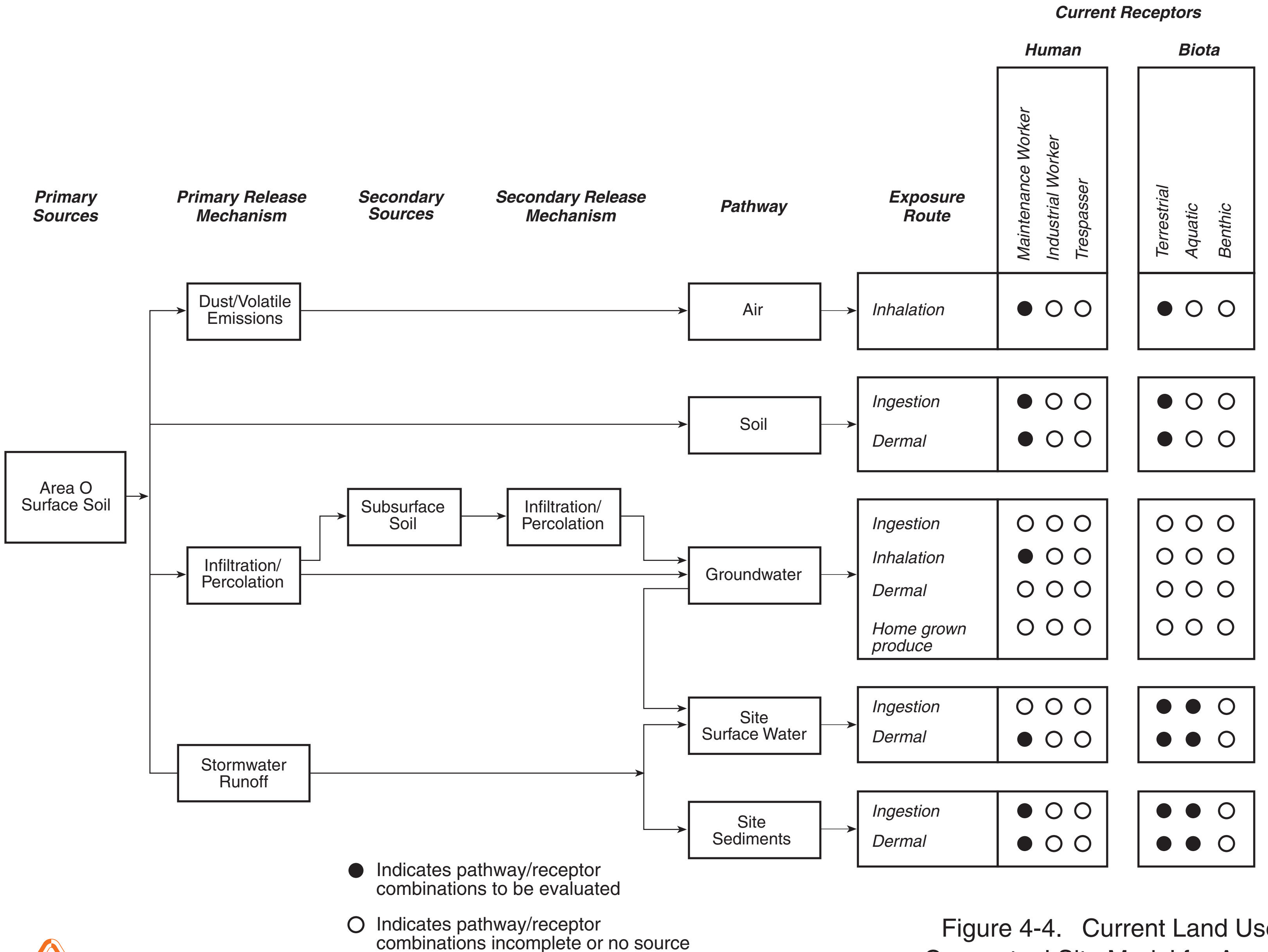

Figure 4-4. Current Land Use Conceptual Site Model for Area O Radford Army Ammunition Plant, Virginia

Shaw™ Shaw Environmental, Inc.

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w

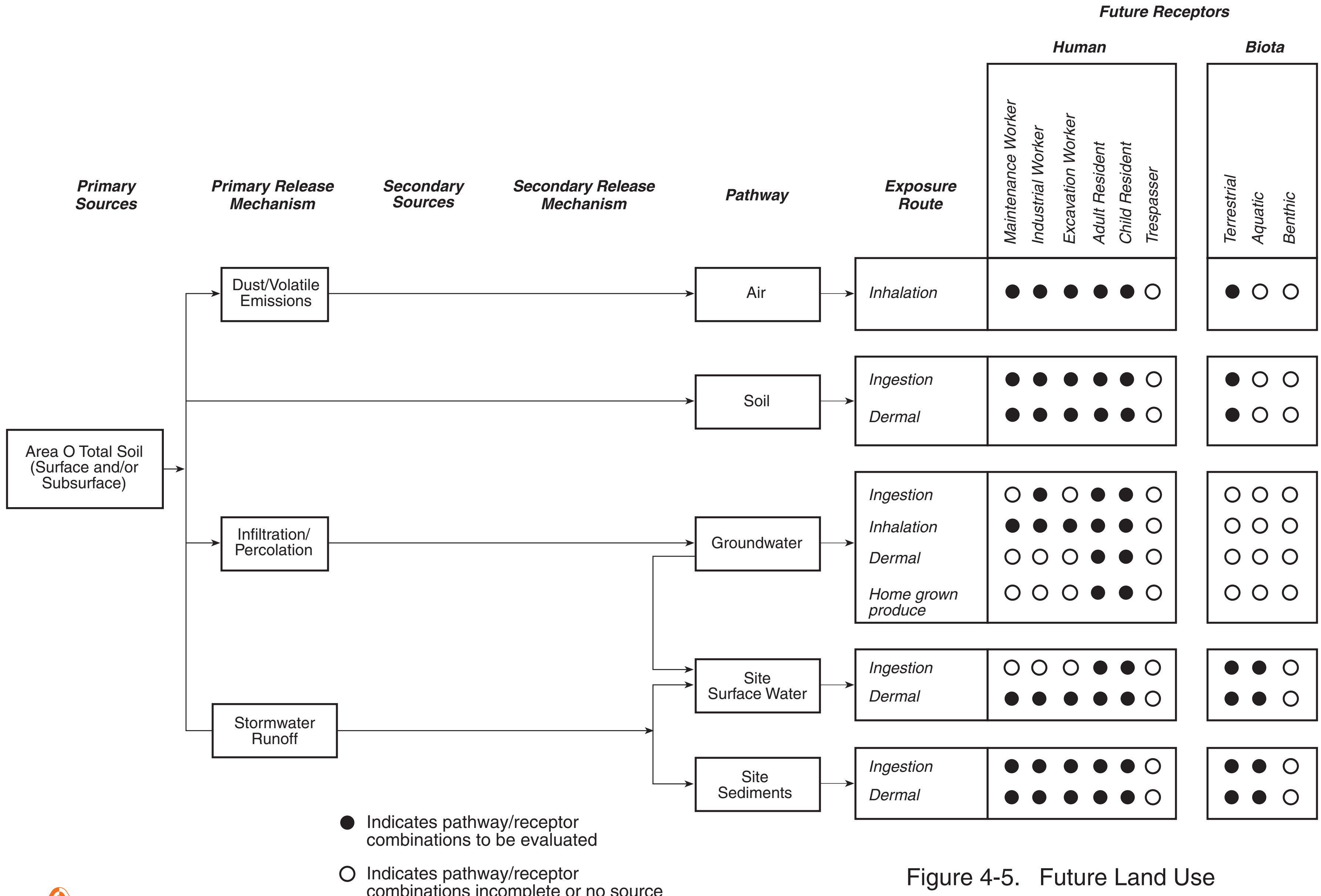

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Figure 4-5. Future Land Use
Conceptual Site Model for Area O
Radford Army Ammunition Plant, Virginia

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w

Groundwater sampling has not been conducted recently at the site. The lack of current groundwater data from existing wells at the site is a data gap. An additional groundwater data gap is in the area between the source area and the drainage ditch (identified as "Area of proposed direct push groundwater sampling" on **Figure 4-2**). Additional groundwater sampling in this area will further define the groundwater flow pathway. Data gaps for groundwater (existing wells and direct push samples) include TCL VOCs, TCL SVOCs, and PAHs.

Surface water and sediment exist in the drainage ditch downgradient from the site. The data gaps for these media are the lack of recent sampling. Data gaps for surface water and sediment include TCL VOCs, TCL SVOCs, and PAHs.

4.6 INVESTIGATION APPROACH

In order to complete the RFI/CMS at the site, additional samples need to be collected to characterize the current state of potentially impacted media. Proposed samples and analyses are presented in **Table 4-6**. Proposed sample locations are shown on **Figure 4-2**.

<u>Soil:</u> Soil samples will be collected at five locations with samples at three depth intervals per location around the AST and former leak area to confirm that a contaminated soil is not acting as a continuing source for groundwater contamination. Soil samples will be collected using direct push methods. At each location, a sample will be collected at the surface (0-0.5 ft bgs; "A" interval); at the depth of the leak (assumed to be no greater than 4-6 ft bgs; "B" interval) and beneath any impacted soil that is encountered (assumed to be no greater than 8-10 ft bgs; "C" interval). The depth of the leak will be determined in the field by the presence of visible contamination or the highest photoionization detector reading measured during boring advancement. If evidence of contamination is not encountered, the "C" interval will be collected immediately above the water table and the "B" interval will be collected halfway between the surface and the water table. This sample strategy is designed to bound the extent of fuel-containing soil in both horizontal and vertical dimensions so that the volume can be measured for the CMS. Soil samples will be analyzed for TCL VOCs, SVOCs, and PAHs.

<u>Groundwater:</u> Existing wells at Area O and downgradient HWMU 4 will be resampled to evaluate the current concentrations of fuel-related constituents in groundwater. It is anticipated that samples will be obtained from ten existing wells (S4W-1, P-1, P-2, P-3, P-4, OMW-1, OMW2, WC1-1, WC1-2, and B8). Current data will allow an analysis of concentration trends over time by comparison to existing groundwater data. Groundwater samples will be analyzed for TCL VOCs, SVOCs, PAHs, and monitored natural attenuation (MNA) parameters. The MNA parameters will examine changes in geochemical parameters that directly correlate to the indigenous microbiology. Field parameters (DO, ORP, pH, temperature, and conductivity) will be collected during groundwater sampling as part of the low-flow sampling procedures. Biodegradation parameters (nitrate, sulfate, ferrous iron, chloride, methane, ethene, ethane, alkalinity, TOC, and DHC) will be collected from the monitoring wells to be analyzed.

In addition to the monitoring wells, groundwater samples will also be collected from ten direct push borings located downgradient from the spill area and upgradient from monitoring well S4W-1. These samples will be used to establish whether pockets of contamination are present in sand and gravel stringers within the silt and clay overburden layers. These samples will also be analyzed for TCL VOCs, SVOCs, PAHs, and MNA parameters.

Surface Water/Sediment: Two surface water/sediment sample pairs will be collected from the drainage ditch that appears to be the groundwater discharge point for the area. Oily water was reported to discharge to the ditch from the steep scarp downgradient from Area O after periods of heavy rain up through 1994 (Dames and Moore, 1994). During a recent site visit, RFAAP personnel indicated that oily water no longer visibly discharged to the ditch. The surface water/sediment samples will be analyzed for TCL VOCs, SVOCs, and PAHs to assess the sediment at the seep location and the surface water within the ditch.

Table 4-6
Proposed Sampling and Analysis Plan
Area O
Radford AAP, Radford, VA

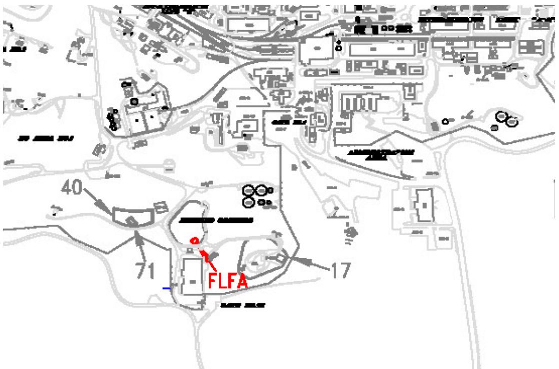
Media	Sampling ID	Depth	Location	Analytes
Area O				
Surface Soil	AOSB01A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB02A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB03A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB04A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB05A	0-0.5 ft bgs	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
Subsurface Soil	AOSB01B	4-6 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB01C	8-10 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB02B	4-6 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB02C	8-10 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB03B	4-6 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB03C	8-10 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB04B	4-6 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB04C	8-10 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB05B	4-6 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
	AOSB05C	8-10 ft bgs*	Around AST and former leak area	TCL VOCs, SVOCs, PAHs
Groundwater	AOGW01	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, Monitored Natural Attenuation Parameters (MNA), TOC
	AOGW02	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW03	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW04	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW05	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW06	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW07	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW08	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW09	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	AOGW10	water table	Direct Push GW Sample Area (see Figure 4-2)	TCL VOCs, SVOCs, PAHs, MNA, TOC
	S4W-1	10	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	WC1-1	39	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	WC1-2	25	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	8B	25 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	P-1	25 ft bgs	exising upgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	P-2	11 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	P-3	18 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	P-4	23 ft bgs	existing downgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	OMW1	31 ft bgs	existing onsite well	TCL VOCs, SVOCs, PAHs, MNA, TOC
	OMW2	31 ft bgs	existing upgradient well	TCL VOCs, SVOCs, PAHs, MNA, TOC
Surface Water	AOSW01	NA	downgradient drainage ditch	TCL VOCs, SVOCs, PAHs
	AOSW02	NA	downgradient drainage ditch	TCL VOCs, SVOCs, PAHs
Sediment	AOSD01	NA	downgradient drainage ditch	TCL VOCs, SVOCs, PAHs
	AOSD02	NA	downgradient drainage ditch	TCL VOCs, SVOCs, PAHs

* Subsurface soil sample depths are estimated. Actual depths will be determined based on field conditions (PID readings, odors, visible contamination).

5.0 FORMER LEAD FURNACE AREA

5.1 SITE DESCRIPTION AND HISTORY

5.1.1 Site Description



The FLFA is an approximately 1,100 ft^2 area located in the MMA at the bottom of a steeply sloping hillside in the southeast portion of SWMU 17A, the Stage and Burn Area (**Figure 5-1**). Building foundations and surrounding soil have been removed and replaced by clean fill. The FLFA was built into the sloping side of the sinkhole. The elevation of the top of the slope above the FLFA is approximately 1,892 ft msl, while the bottom of the slope is approximately 1,874 ft msl. The location of the former waste oil tank (SWMU 76) is upslope to the east of the FLFA at an elevation of approximately 1,895 ft msl. The area immediately surrounding the FLFA is a maintained grassy area and the gravel burn area of SWMU 17A. There are paved and gravel roads in the vicinity.

5.1.2 Site History

The primary function of the lead furnace was to melt and cast recovered lead into ingots for salvage. Although little is known about the operations at the FLFA, typical smelter operations involved melting the lead in a tank with an overhead heater, then pouring the molten lead into molds. The location of lead slag remnants suggests that the lead was off-loaded at the top of the hill. Although exact furnace operation dates are not available, the historical records and document search conducted in conjunction with the VI (Dames and Moore, 1992) date its operation during World War II. A concrete retaining wall was visible at the base of the slope at the commencement of the 1998 RFI site activities. Additional structures discovered during the 1998 RFI included a foundation, brick flue, cement retaining wall, and a stone retaining wall. Based on 1998 RFI soil and debris removal activities, it was determined that the FLFA structures encompassed an area that was 35 ft long (north-south) by 30 ft wide (east-west). These structures more clearly delineate the area of former lead furnace activities.

Environmental interest in the FLFA occurred as the result of underground storage tank (UST) removal activities that occurred in 1991 at SWMU 76 (Waste Oil UST). Solid lead slag was observed in the soil around and below the tank at the time of the UST removal. Associated soil samples were found to contain lead at concentrations of 3,200 and 63,000 mg/kg. It was assumed that the high lead concentrations were attributed to the FLFA because of the proximity to the lead furnace. Based on these observations, additional activity was performed at the FLFA between March and May of 1998. Structure, debris, and soil removal was performed to assess lead contamination at the site and to access subsurface soil at the level of the furnace structures, where lead associated with the operations of the lead furnace would be expected to be present. Structure and debris removal was required to adequately characterize the extent of FLFA-related lead contamination.

LEGEND

Former Lead Furnace Area Boundary

Other SWMU Boundary

Installation Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 750 1,500 3,000 Feet

U.S. Army Corps of Engineers

Shaw® Shaw Environmental, Inc.

FIGURE 5-1
Former Lead Furnace Area
Site Location Map
Radford Army Ammunition Plant,
Radford, VA

GIS File: RFAAP_008_Fig5-1_Workplan_FLFA_SiteMap.mxd

Date: 1/24/07

5.2 SITE GEOLOLGY, HYDROGEOLOGY AND HYDROLOGY

A comprehensive discussion of the regional physiography, soil, geology, and groundwater at RFAAP is included in the RFAAP MWP (URS, 2003a) and therefore is not discussed in this report.

5.2.1 Site Soil

Soil at the FLFA has been extensively reworked during the history of the site. The majority of the existing soil is fill that has been brought in during construction activities and clean-up activities at the site. Soil at the site is mapped as Unison-Urban Land Complex (SCS, 1985). It is described as having moderate permeability, low organic content and medium acidity. In unworked areas, the soils have a 15-inch thick top soil of dark brown loam, and a 43-inch subsoil of yellowish-red sticky clay, which is underlain by red sandy clay to a depth of 58 inches.

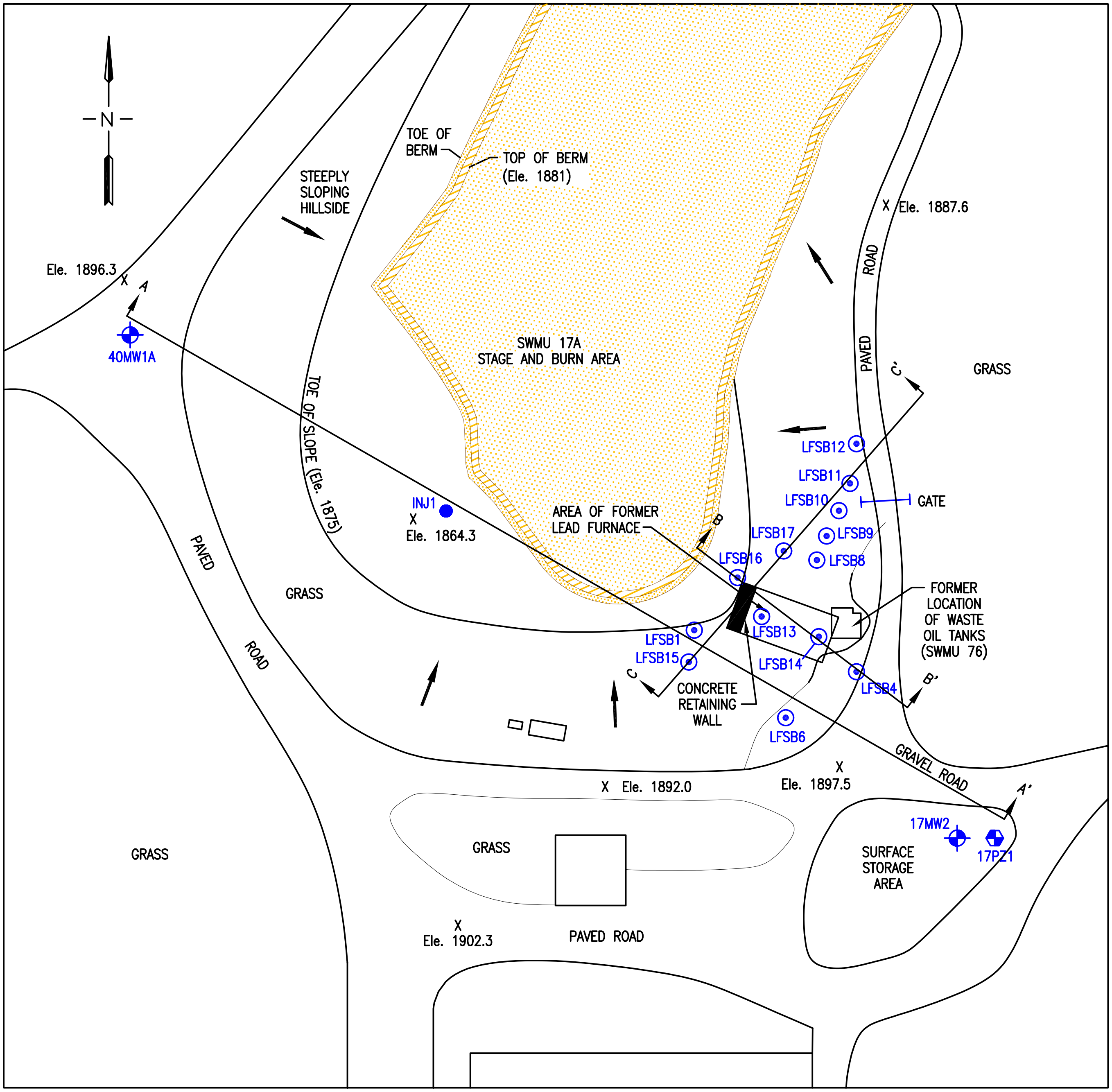
5.2.2 Site Geology

Stratigraphic characterization of the subsurface in the vicinity of the FLFA was performed during the advancement of soil borings. Three geologic cross-sections (A-A', B-B' and C-C') were developed based on data from previous investigations. A plan view of the cross-section lines is presented on **Figure 5-2**. The cross-sections are presented as **Figure 5-3** (A-A'), **Figure 5-4** (B-B'), and **Figure 5-5** (C-C'). Well boring logs are presented in **Appendix B**.

Cross-section A-A' depicts the geology of the overburden on a line crossing through the sinkhole. Cross-section B-B' is parallel to A-A', but crosses directly through the 1998 RFI excavation and shows the extent of clean fill at the FLFA. Cross-section C-C' is perpendicular to A-A' and shows a cut across the side of the sinkhole wall. Bedrock under the site is a grayish-brown argillaceous limestone. Depth to bedrock ranges from less than 2 ft at the top of the slope to the east of the site (e.g., LFSB8 and LFSB9) to more than 10 ft at the base of the slope (e.g., LFSB1). The top 10 ft of bedrock has turned to saprolite – a dense, clay-rich, weathered limestone. The overburden at the FLFA has been extensively reworked during the history of the site. Native material was excavated during initial construction of the furnace, which was anchored to bedrock. Fill material was added to fill in the foundation after the furnace was no longer used. Railroad ties, ash, and other man-made debris were encountered during the 1998 RFI excavation. The installation and removal of the waste oil tank at the adjacent SWMU 76 caused further reworking of the soil. The excavation at the FLFA during the 1998 RFI resulted in another excavation and fill at the site. Finally, soil was reworked throughout the entire sinkhole area, including the FLFA, during the construction of the burn cap at SWMU 17A in 2002. Fill material used during the various excavations ranged from debris and ash (initial filling of the furnace foundation) to yellowish-brown and orange brown silt and clay with varying amounts of sand and fine gravel (possibly during the SWMU 76 closure) to a red compactable clay and silt (1998 RFI). Deeper samples from the base of the sinkhole (boring LFSB1) suggest that the original, native material at the site was brownish-yellow clay with moderate plasticity. This material is present now at deeper intervals from borings within the sinkhole.

5.2.3 Site Hydrogeology

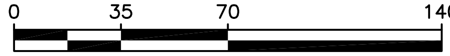
There have been no hydrogeologic studies conducted specifically for the FLFA. A dye-trace study was conducted at adjacent SWMU 17A (Engineering Science, Inc, 1994). This study injected dye using an injection point located within the sinkhole where SWMU 17A (and the FLFA) is located. Dye was recovered in a spring (SPG3) along the New River and showed a



NOTE: 1. DIRECTION OF GROUNDWATER FLOW IS UNKNOWN.
2. CROSS SECTION A–A' EXTENDS BEYOND THE CUT SHOWN HERE.

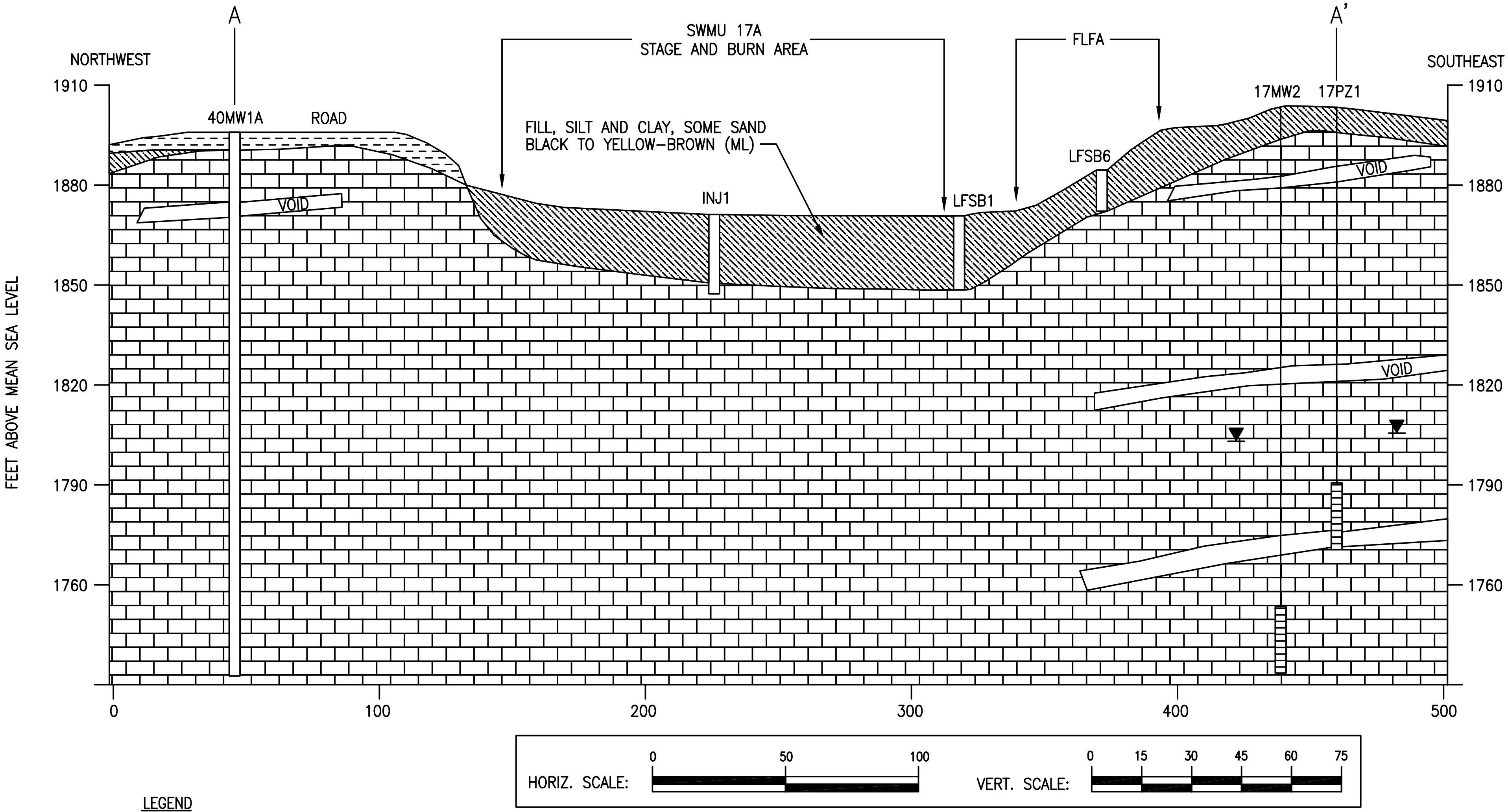
LEGEND:

- PIEZOMETER, 1994 DYE TRACE STUDY (PARSONS ENGINEERING)
- MONITORING WELL, 1994 DYE–TRACE STUDY (PARSONS ENGINEERING)
- INJECTION POINT, 1994 DYE TRACE STUDY (PARSONS ENGINEERING)
- SOIL BORING
- X SURVEYED ELEVATION (FEET MEAN SEA LEVEL)
- SLOPE DIRECTION



SCALE IN FEET

RADFORD AAP		FIGURE 5–2
PREPARED BY: SHAW	TASK NO: 12346110000002	GEOLOGIC CROSS–SECTION LINES A–A', B–B' AND C–C' FORMER LEAD FURNACE AREA
CHECKED BY: MT	SHAW DWG NO: FIG5–2.dwg	
DATE: REVISED AUGUST 2005		



LEGEND

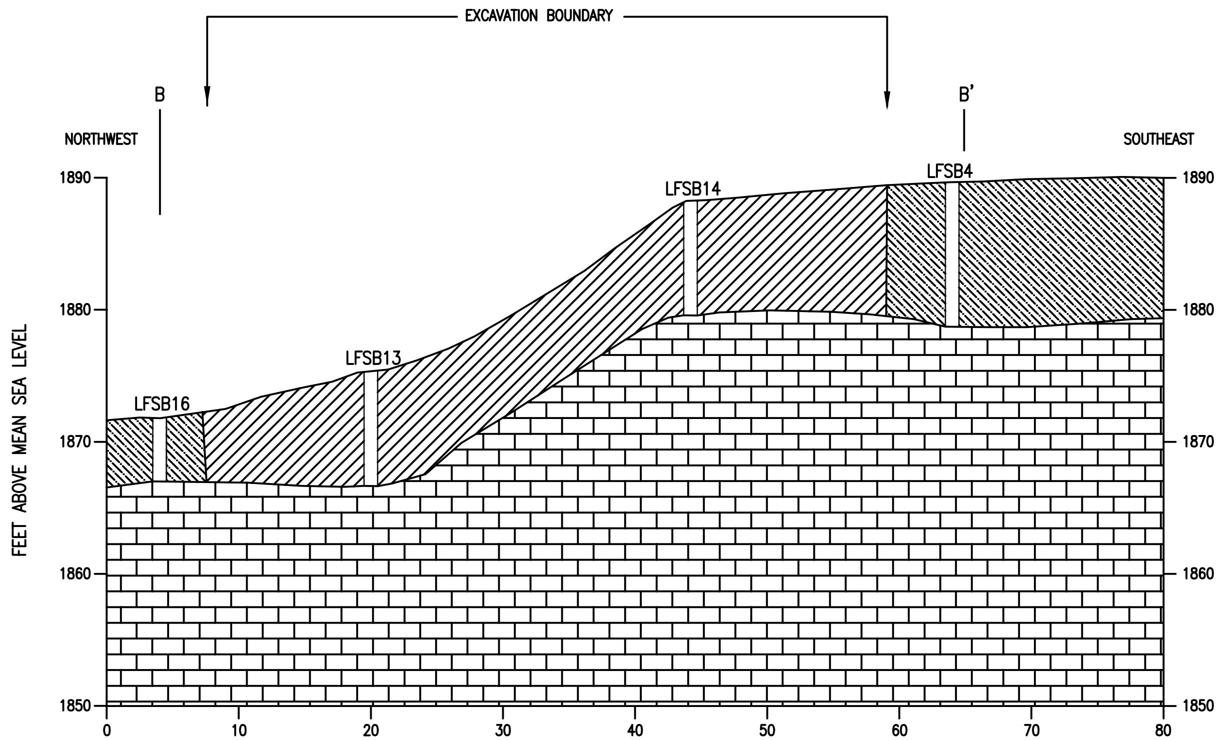
- CLAY AND SILT, LITTLE SAND, RED-BROWN (CL)
- SILT AND CLAY (ML/CL)
- LIMESTONE, GRAY-BROWN, ARGILLACEOUS (LMSN)
- ▼ STATIC GROUNDWATER LEVEL

NOTES

1) WATER LEVELS MEASURED JULY 1995.
2) SOME DATA POINTS ARE PROJECTED ONTO PROFILE.
3) 40MW1A AND 17PZ1 LITHOLOGY FROM DAMES AND MOORE.
4) 40MW1A IS A BORING.
5) INJECTION WELL IS AN OPEN HOLE AT THE BEDROCK INTERFACE.

SOURCE: PARSONS ENGINEERING SCIENCE INC

RADFORD AAP		FIGURE 5-3
PREPARED BY: SHAW	TASK NO: 12346110000002	GEOLOGIC CROSS-SECTION A-A' FORMER LEAD FURNACE AREA
CHECKED BY: MT	SHAW DWG NO: FIG5-3.dwg	
DATE:REVISED AUGUST 2005		



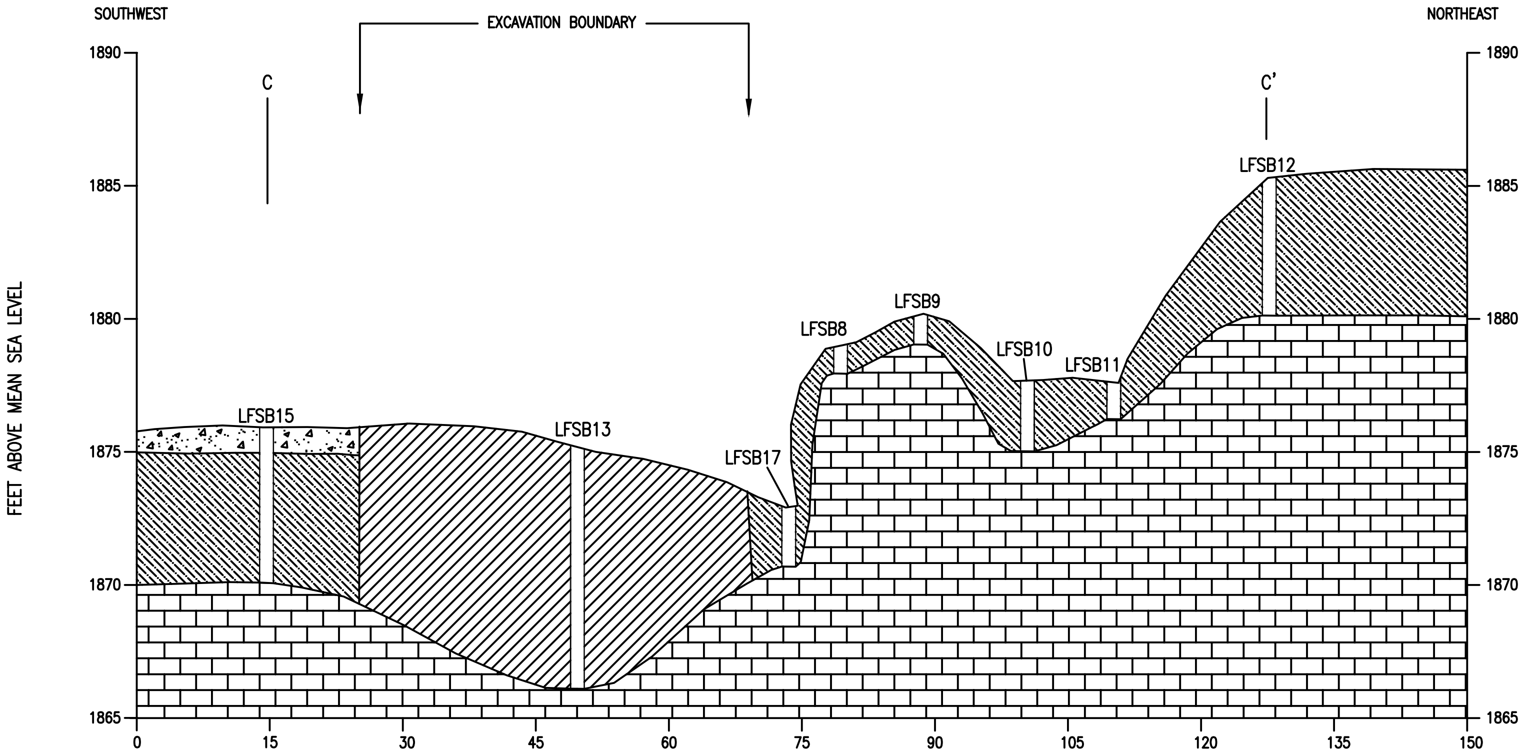
HORIZ. SCALE: 0 10 20

VERT. SCALE: 0 10 20

LEGEND

- FILL, SILT, SOME SAND, SOME CLAY, ORANGE-BROWN (ML)
- LIMESTONE, GRAY-BROWN, ARGILLACEOUS (LMSN)
- SILT AND CLAY (ML/CL)

RADFORD AAP		FIGURE 5-4
PREPARED BY: SHAW	TASK NO: 12346110000002	GEOLOGIC CROSS-SECTION B-B' FORMER LEAD FURNACE AREA
CHECKED BY: MT	SHAW DWG NO: FIG5-4.dwg	
DATE:REVISED AUGUST 2005		



HORIZ. SCALE: 0 15 30

VERT. SCALE: 0 5 10

LEGEND

- FILL, SILT, SOME SAND, SOME CLAY, ORANGE-BROWN (ML)
- LIMESTONE, GRAY-BROWN, ARGILLACEOUS (LMSN)
- SILT, SAND, AND GRAVEL, ORANGE-BROWN (GM)
- SILT AND CLAY (ML/CL)

RADFORD AAP		FIGURE 5-5
PREPARED BY: SHAW	TASK NO: 12346110000002	GEOLOGIC CROSS-SECTION C-C' FORMER LEAD FURNACE AREA
CHECKED BY: MT	SHAW DWG NO: FIG5-5.dwg	
DATE:REVISED AUGUST 2005		

direct link between the sinkhole and the New River. Groundwater in the vicinity of the FLFA is expected to follow this flow path (likely a solutionally-enhanced west-northwest trending fracture) and discharge

5.2.4 Surface Water Hydrology

Based on topography, surface water in the area of the FLFA would flow from the surrounding hillsides to the base of the new burn cap where stage and burn activities currently occur on an intermittent, emergency basis at SWMU 17A (located over the previous SWMU 17A burning area). This water runoff would probably percolate into the hillsides and subsurface and eventually enter the water table or would migrate to the adjacent sink hole, ultimately discharging to the New River. RFAAP utility maps predate the construction of the burn cap at SWMU 17A and do not show manholes, catch basins, or storm drains in the vicinity of the FLFA. The engineered burn cap contains porous pipe to collect precipitation that falls on the capped area. The piping system directs runoff into a 7,000-gallon tank that can be pumped out through a manhole adjacent to the cap. The drainage system for the burn cap; however, does not collect runoff from the hill sides adjacent to the burn cap, where the FLFA is located.

5.3 PREVIOUS INVESTIGATIONS

There have been three previous investigations at the FLFA: the 1992 VI, the 1998 RFI, and the 2002 draft RFI. These investigations are discussed in the following sections.

5.3.1 VI, Dames and Moore, 1992

Three borings were drilled for subsurface soil sampling at SWMU 17A during the VI. Two of the soil borings for this investigation (17SB1 and 17SB2) were advanced upslope of the FLFA. The third boring (17SB3) was advanced downslope from the FLFA. 17SB2 was advanced to 10 ft bgs and samples were collected from 4-6 ft bgs and 8-10 ft bgs. The other borings were advanced to depths of 9 ft bgs (17SB1) and 7 ft bgs (17SB3). Two samples were collected from each of these borings as well. A Baseline Risk Assessment (BRA) was also performed during the VI program. VI sample locations are presented on **Figure 5-6**. Soil samples were analyzed for TAL metals and TCLP metals. Detected analytical results are presented in **Table 5-1**. Sample results indicated that concentrations of antimony, lead, mercury, and thallium exceeded industrial screening levels. Antimony, lead, and mercury exceeded their respective industrial screening levels of 41 mg/kg, 800 mg/kg, and 31 mg/kg in one sample [17SB2 (7.5-10 ft bgs)], with reported concentrations of 249 mg/kg (antimony), 100,000 mg/kg (lead), and 64 mg/kg (mercury).

The lead concentration in the 7.5-10 ft bgs sample from 17SB2 (100,000 mg/kg) was greater than the residential screening level (400 mg/kg). The TCLP concentration for lead in this sample also exceeded the Toxicity Characteristic Leachate Procedure Regulatory Limit (TCLPRL; 5,000 µg/L). The TCLP results demonstrated that lead, when present at high concentrations in soil (100,000 mg/kg), can be mobilized at a high concentration and may have impacted underlying soil or groundwater at the site. TCLP results for the remaining samples were below the TCLPRL. Thallium exceeded its industrial screening level (7.2 mg/kg) and background (2.11 mg/kg) in five of the six samples, with a maximum reported concentration of 96.7 mg/kg. Aluminum and copper exceeded their respective background concentrations, as well as the residential screening levels.

LEGEND

- Monitoring Well Location
- Previous Investigation Soil Sample Location
- Proposed Geoprobe Groundwater Sample Location
- 10 ft Contour Line
- Excavation Boundary
- Former Lead Furnace Area Boundary
- Other SWMU Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 50 100 200 Feet

U.S. Army Corps of Engineers

Shaw® Shaw Environmental, Inc.

FIGURE 5-6
Former Lead Furnace Area
Sample Locations
Radford Army Ammunition Plant,
Radford, VA

Date: 12/5/06 GIS File: RFAAP_009_Fig5-6_Workplan_FLFA_SampleLocations.mxd

Table 5-1
Former Lead Furnace Area - VI Detected Soil Results - 1992

SITE ID	Comparison Criteria				17SB1	17SB1	17SB2	17SB2	17SB3	17SB3
FIELD ID					RFIS*75	RFIS*80	RFIS*82	RFIS*83	RFIS*84	RFIS*85
SAMPLING DATE	Industrial	Residential	Facility-Wide	SSL Transfers	05-NOV-91	05-NOV-91	05-NOV-91	05-NOV-91	05-NOV-91	05-NOV-91
DEPTH (ft)	RBC	RBC	Background	Soil to GW	6.5-8	8-9	2.5-5	7.5-10	2.5-5	5.5-7
Metals (mg/kg)										
Aluminum	100000	7800	40041	na	15800	23400	15500	7460	33200	**42300**
Antimony	41	3.1	na	13	nd	nd	nd	**249**	nd	nd
Arsenic	1.9	0.43	15.8	0.026	3.46	3.06	5.6	5.77	2.65	3.84
Barium	7200	550	209	2100	93	70.9	27	183	73.6	106
Beryllium	200	16	1.02	1200	**1.09**	**1.09**	nd	nd	**2.45**	**2.71**
Cadmium	51	3.9	0.69	27	nd	nd	nd	**2.57**	nd	nd
Calcium	na	na	na	na	3910	2000	1150	13900	1860	3890
Chromium	310	23	65.3	42	43.2	38.7	24.1	36.1	45.3	50.4
Cobalt	2000	160	72.3	na	14.5	21.2	2.97	7.92	15.4	10.3
Copper	4100	310	53.5	11000	19.7	16.3	4.95	**2260**	38.2	23.8
Iron	31000	2300	50962	na	20700	33900	22200	22200	45300	49000
Lead	800	400	26.8	na	25.3	19.9	20.9	**100000**	**372**	nd
Magnesium	na	na	na	na	12400	13900	846	11100	8880	49100
Manganese	2000	160	2543	950	426	577	130	246	453	575
Mercury	31	2.3	0.13	na	nd	nd	0.0615	**64**	0.104	nd
Nickel	2000	160	62.8	na	22.4	25.8	4.13	52	45.3	35.2
Potassium	na	na	na	na	1450	1980	494	855	2580	8210
Silver	510	39	na	31	0.985	0.97	nd	23.9	nd	nd
Sodium	na	na	na	na	300	171	180	278	172	227
Thallium	7.2	0.55	2.11	3.6	**12.9**	**14.2**	nd	**96.7**	**21.5**	**26.9**
Vanadium	102	7.8	108	730	56.6	67.2	53.8	26.5	83.3	90.5
Zinc	31000	2300	202	14000	68.6	60	23.5	**801**	124	67.6
TCLP Metals (ug/L)	**TCLP Criteria (ug/L)**									
Barium	100000				311	209	222	1240	329	220
Lead	5000				nd	nd	nd	500000	2230	63.3

For an explanation of symbols and codes, see the soil/sediment master legend.

The BRA conducted during the VI stated that workers do not frequently enter the area; however, burn activities occurred approximately once per week at SWMU 17A. Due to the nature of operations conducted in this area, the dust inhalation pathway was considered to be the most viable and significant exposure pathway; exposure via incidental ingestion and dermal absorption was expected to be low. Lead exposure to site workers via inhalation was expected to be moderate to high because of the high lead concentrations assumed to be present in the surface soil.

Conclusions from the BRA indicated that because this site is located in a sinkhole at the bottom of a steep hill within an active, weekly burn area, it is unlikely that environmental receptors frequent this area. Therefore, potential exposure to environmental receptors was estimated to be low.

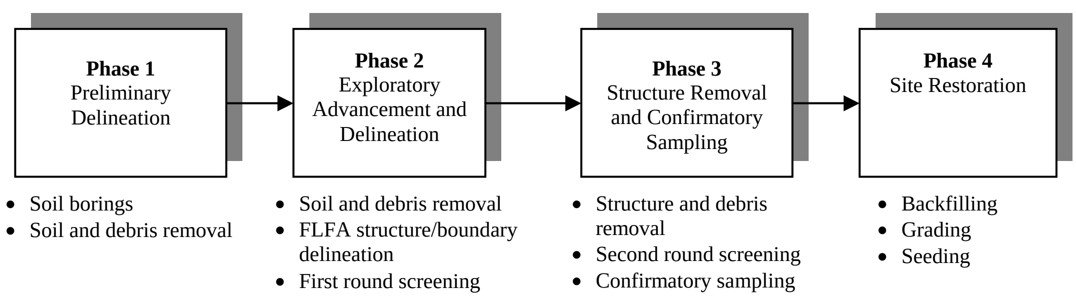
5.3.2 RFI, ICF KE, 1998

An RFI was performed to delineate the extent of lead-contaminated soil associated with the FLFA. Several assumptions guided FLFA activities, including:

- Lead contamination associated with the furnace was limited to the FLFA boundaries.
- Lead was the principal contaminant of concern at the area.
- Removal of contaminated soil would result in reduction in risk through source elimination.

A phased-focused approach was selected to investigate lead contamination at the FLFA and to ensure that project schedules and objectives were met. Four phases representing critical process junctures associated with the CSM were identified and are depicted in **Figure 5-7**.

Figure 5-7
Flowchart of 1998 RFI Activities



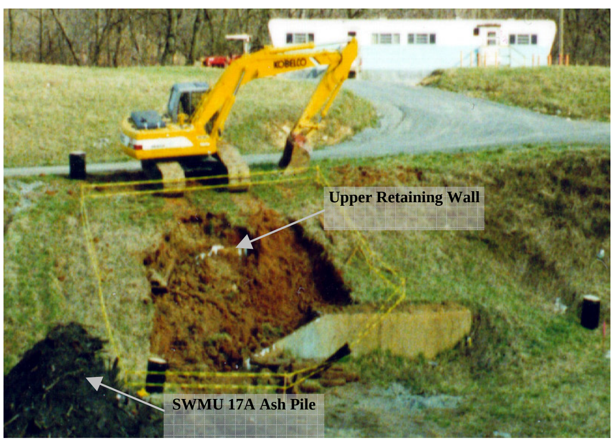
5.3.2.1 Phase 1: Preliminary Delineation

The purpose of this activity was to assess (1) the lateral and vertical extent of lead contamination at the FLFA, and (2) the appropriate test pit dimensions necessary to remove the affected soil. Site activities conducted in support of this phase included:

- Shallow and deep subsurface soil sampling.
- Preliminary soil and debris removal for additional subsurface sampling.

Seven soil borings (LFSB1 through LFSB7) were advanced to delineate the lateral and vertical extent of lead contamination (**Figure 5-6**). Sampling locations were selected based on previous investigation results, field observations, and topographic constraints. Samples were analyzed for lead content; the results are presented in **Table 5-2a**.

Preliminary soil and debris removal north of the retaining wall (northeast view).



Preliminary soil and debris removal phase completed. (southeast view)

Preliminary soil and debris removal was then performed. This was necessary to provide access to subsurface soil for lead field screening purposes. An area of soil and debris north and east of the exposed lower retaining wall was removed using a trackhoe. Several items, which appeared to be remnants of the Former Lead Furnace, were unearthed behind the retaining wall (i.e., into the slope, east-southeast) including a piece of lead slag, railroad ties, round wooden poles, and a metal pipe.

Based on the presence of debris items encountered in soil behind the exposed lower retaining wall, it was determined that the soil was fill material and not native soil. This theory is further supported by the observations made in boring 17SB2, in which contamination was present at 10 ft bgs, but not at the surface in the boring (i.e., contamination was deposited and fill material added later).

As the excavation progressed eastward into the hillside, another concrete retaining wall, roughly the size and shape of the lower wall, was discovered buried in the hillside. It was also discovered that the exposed lower retaining wall was attached to a horizontal concrete slab, which extended into the hillside and appeared to be a building foundation.

Although no lead slag was observed on the surface (as reported during the waste oil tank removal), a large piece of lead slag, approximately 1.5 ft long, was unearthed in the fill material between the retaining walls at approximately 6 ft bgs. Bedrock was encountered at approximately 8 ft bgs on the north side of the foundation and was at an elevation higher than the floor of the sinkhole.

The preliminary delineation and removal results demonstrated that:

- Lead concentrations exceeding the residential screening criterion were found at 0-2 ft bgs (two of four samples at this depth interval) and at the 4-6 ft bgs (one of three samples collected between 2 and 7 ft bgs). Samples collected at intervals below 7 ft bgs had lead concentrations less than the background concentration.

Table 5-2a
Former Lead Furnace Area - RFI Preliminary Soil Delineation Results - 1998

Sample	Sample Depth (ft)	Lead (mg/kg)
LFSB1A	0-1	**128**
LFSB1B	10-12	18
LFSB2A	0-2	**580**
LFSB2B	6-7	10.2
LFSB3A	0-2	**51.1**
LFSB3B	12-14	23.4
LFSB4A	8-10	15
LFSB5A	4-6	**2070**
LFSB5B	8-10	22.4
LFSB6A	2-4	**27.5**
LFSB6B	10-12	10
LFSB7A	0-2	**943**

Table 5-2b
Former Lead Furnace Area - RFI Soil Confirmation Results - 1998

Sample	Associated Screening Sample	Sample Depth (ft)	Lead (mg/kg)
LFTP1	SS11	5-6	15.3
LFTP2	SS1	4-5	**29.2**
LFTP3	SS3	6-8	10.8
LFTP4	SS7	5-7	**103**
LFTP5	SS9/SS10	5-7	12.8
LFTP6	na	8-10	12.5
LFTP7	na	8-10	11
LFTP8	SS5	5-6	**866**

Table 5-2c
Former Lead Furnace Area - RFI Boundary Delineation Soil Boring Results - 1998

Sample	Sample Depth (ft)	Lead (mg/kg)	TCLP Lead (µg/L)
LFSB8A	0.5-1	**86.9**	507
LFSB9A	0.5-1	**189**	NA
LFSB10A	0.5-1	**279**	NA
LFSB10B	2-2.5	**326**	NA
LFSB11A	0.5-1	**179**	NA

For an explanation of symbols and codes, see the soil/sediment master legend.

- Additional (unknown) FLFA structures existed besides the exposed lower retaining wall.
- Soil and debris removal was necessary to further enhance the CSM and access the subsurface soil for lead field screening.

5.3.2.2 Phase 2: Exploratory Advancement and Delineation

The purpose of this phase was to (1) further enhance the CSM by delineating FLFA structures, (2) identify visible contamination and debris related to FLFA activities, and (3) to qualitatively define the presence of lead within FLFA-related soil. Site activities conducted in support of this phase included:

- Soil and debris removal
- On-site lead screening

Based on the discovery of the buried upper retaining wall and debris items encountered during the preliminary phase, soil and debris removal was required on the east and south/southeast sides of the retaining walls and foundation to further identify FLFA structures and related soil contamination.

This phase began with the removal of soil in a southeast to a southerly direction around the upper retaining wall. As the upper retaining wall was being uncovered, it was discovered that the wall was anchored directly into the bedrock. South of the wall, a brick structure, approximately 6 ft by 6 ft, was discovered at the rear of the foundation. The brick structure contained coal, coal ash, and black ash, and appeared to be a flue that was once connected to the cement foundation.

A layer of black material about 0.5-foot thick originated at the flue and extended under the foundation slab. Several steel I-beams, assumed to be railroad track sections, were found in the rubble of the flue. The flue was flanked on the north by the upper retaining wall and on the south by a thick stone wall. Soil was removed to a depth of 4 ft bgs on the south side of the foundation; bedrock was not encountered.

View of concrete retaining walls during soil removal activities (northeast view)

Exposed building foundation attached to lower retaining wall (northeast view)

Lead field-screening was used to refine the CSM as removal progressed to avoid removing uncontaminated soil and to track the subsurface location of contaminants. Samples with concentrations of lead below 400 mg/kg (FL2 and FL6) were collected from the black layer encountered beneath the foundation and from the southern portion of the site (west of the rock wall), respectively. Lead was detected above the residential screening criterion in screening samples from soil above and north of the foundation.

The exploratory advancement and delineation results demonstrated that:

- Lead contamination existed above and north of the foundation.
- Additional soil removal and lead screening was required to adequately characterize the extent of lead contamination.

5.3.2.3 Phase 3: Structure Removal and Confirmatory Sampling

Foundation destruction and removal (northwest view)

Soil removal from beneath and surrounding the foundation (northeast view).

Destruction and removal of upper retaining wall. (northeast view)

The purpose of this phase was to quantitatively verify the removal of lead-contaminated soil following Phase 2 screening and removal activities. Site activities conducted in support of this phase included:

- Structure, debris, and contaminated soil removal.
- On-site lead screening (second round).
- Confirmatory sampling.

FLFA structures, remaining debris, and soil with lead concentrations exceeding the residential screening criterion (as indicated during Phase 2 field screening) were removed during this phase. Structure and debris removal was required to adequately characterize the extent of FLFA-related lead contamination.

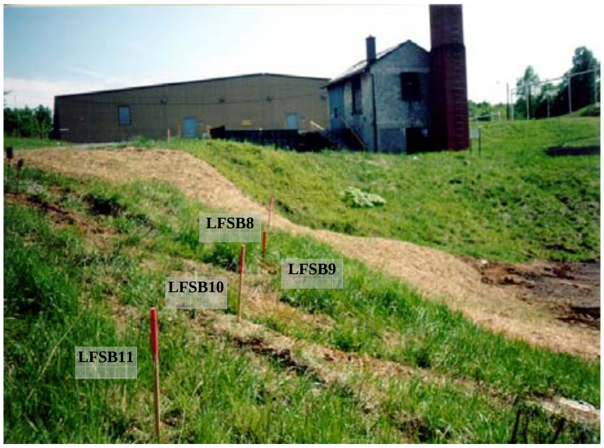
Structures and associated soil and debris were removed with a trackhoe. During destruction and removal of the flue, it was discovered that the flue was constructed directly onto bedrock. Rubble, including bricks and cinders uncovered east of the flue, which remained from Phase 2 activities, was removed. The 0.5-foot thick layer of black ash discovered in the soil surrounding the hole where the flue had been was traced laterally for several feet and removed.

A substantial amount of debris, including cinder blocks and burned metal pieces, was uncovered and removed from soil north of the former flue and east of the upper retaining wall. A 0.3- to 0.5-foot layer of soil with a silver sheen and petroleum odor (probably attributable to the former waste oil tank of SWMU 76) was uncovered in this area. This soil was traced and removed until the layer pinched out and the odor was no longer present.

Eight confirmation samples (LFTP1 through LFTP8) were collected for laboratory analysis from the bottom and sidewalls of the removal area to verify that soil with lead concentrations exceeding the residential screening level had been removed (**Figure 5-6**). The results from this sampling are presented in **Table 5-2b**. Results demonstrated that the samples exhibited lead concentrations below residential screening level, except LFTP8 (866 mg/kg), which was collected from the northern side wall of the excavation.

In response to the elevated lead detection in confirmation sample LFTP8, four soil borings (LFSB8, LFSB9, LFSB10, and LFSB11) were advanced to the north of the excavation to assess whether elevated lead concentrations existed beyond the FLFA boundary (**Figure 5-6**). The borings were advanced into the hill slope at approximately 10-foot intervals (perpendicular to the boundary) beginning 3 ft north of the northern border of the removal area.

Lead confirmatory sampling north of the FLFA (northeast view)



Lead confirmatory sample locations (south view).

Clean soil backfill and grading activities (east view)

Topsoil backfill and grading activities (northeast view).

Samples were collected at 0.5-1 ft bgs from each boring and an additional sample was collected from 2-2.5 ft bgs from boring LFSB10. Borings were advanced with a hand auger; and were terminated at refusal. The samples were analyzed for lead content; the results are presented in **Table 5-2c**. Lead concentrations were reported below the residential screening criterion (400 mg/kg). The deeper sample from boring LFSB10 (2-2.5 ft bgs) had the highest lead concentration (326 mg/kg). Based on these results, it was concluded that the lead-containing soil (as indicated by sample LFTP8), was primarily present at the same horizon as the FLFA structures and pinches out at the bedrock surface north of the excavated area. Surface and near surface samples collected outside the excavated area (LFSB8-LFSB11) contained lead at concentrations below the residential screening level and approximately one half the concentration detected in LFTP8. Conclusions from this phase were:

- Lead-contaminated soil was removed from areas impacted by lead furnace activities.
- Additional low concentrations of lead exist beyond the FLFA boundary and may be present at these locations due to other sources and the extensive filling and reworking of soil in the vicinity of the FLFA.

5.3.2.4 Phase 4: Site Restoration

The objective of this phase was to restore the site to an aesthetic state, natural with the local surroundings. Activities conducted in support of this phase included backfilling, grading, and seeding.

Following the completion of FLFA structure, debris, and contaminated soil removal, the removal area was backfilled with highly compactable clay, and graded to a slope less than 45 degrees. The slope terminated approximately 7 ft from the edge of the asphalt road located east of the site. A layer of topsoil was added and the slope was seeded to complement the local flora and fauna and maintain slope stability.

5.3.3 RFI, Shaw, 2002

Additional samples were collected by Shaw during the 2002 RFI to further delineate lead-containing soil and characterize site media for previously untested parameters. The draft RFI report was submitted to the Army in August 2005, but was never finalized. This assessment indicated that VOCs, SVOCs, PAHs, pesticides, herbicides, and explosives compounds did not exceed industrial (or residential) screening levels. Metals (including lead), dioxins/furans, and PCBs, mostly in surface soil, are the constituents of concern at the FLFA based on exceedances of residential screening criteria. Results from the 2002 sampling are presented in **Tables 5-3 and 5-4** (dioxin/furan results). The relatively lower concentrations of lead (maximum of 3,150 mg/kg) detected in the 2002 investigation as compared to a previous lead concentration of 100,000 mg/kg (source removed), and the lack of elevated concentrations in subsurface soil indicate that the major source area is no longer present. The extensive reworking of soil in the area, and the close association with SWMU 17A, has lead to a mix of constituents in surface soil in the area from both sites. Metals in the soil are likely the result of operations at both sites. Organic constituents (dioxins/furans and PCBs) are likely due to burning operations at the adjacent SWMU 17A.

An HHRA was conducted at the FLFA to identify potential risks at the site for the following scenarios: current maintenance workers, future maintenance workers, future industrial workers, future excavation workers, future adult residents, and future child residents. The potential cumulative risk for each scenario was within the USEPA's target risk range. The potential cumulative HI for the current and future maintenance worker, the future industrial worker (total soil), and the adult resident were less than 1. The potential cumulative HI for the future industrial worker (surface soil) was equal to 1; no individual chemical HI was equal to or greater than 1. The potential cumulative HI for the future excavation worker and child resident was greater than 1. For the industrial worker scenario, site concentrations of lead in surface soil were

Table 5-3
Analytes Detected in Soil - 2002 RFI

Analyte	i-RBC	r-RBC	Background	SSL Transfer	LFSS01 6/26/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	LFSS02 6/26/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	LFSS03 6/26/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																			
Toluene	20000000	1600000	na	8800	5.7	U		0.37	5.7	5.2	U		0.34	5.2	0.77	J	B	0.53	8.1
PAHs (ug/kg)																			
2-Methylnaphthalene	410000	31000	na	4400	4.2			0.59	1.8	9			0.59	1.8	46			0.58	1.7
Acenaphthene	6100000	470000	na	100000	1.4	J	B	0.97	1.8	1.2	J	B	0.97	1.8	1.5	J	B	0.96	1.7
Acenaphthylene	3100000	230000	na	680000	0.76	J	J	0.23	1.8	1.8	U		0.23	1.8	2.6			0.23	1.7
Anthracene	31000000	2300000	na	470000	3.3			0.19	1.8	2.2			0.19	1.8	5.6			0.19	1.7
Benzo(a)anthracene	3900	870	na	1500	24			0.23	1.8	12			0.23	1.8	24			0.23	1.7
Benzo(a)pyrene	390	87	na	370	25			0.2	1.8	11			0.2	1.8	28			0.19	1.7
Benzo(b)fluoranthene	3900	870	na	4500	44			0.33	1.8	18			0.33	1.8	67			0.33	1.7
Benzo(g,h,i)perylene	3100000	230000	na	680000	17		L	0.62	1.8	4.8		L	0.62	1.8	25		L	0.61	1.7
Benzo(k)fluoranthene	39000	8700	na	45000	16			0.31	1.8	7.4			0.31	1.8	15			0.3	1.7
Chrysene	390000	87000	na	150000	26			0.28	1.8	12			0.28	1.8	37			0.28	1.7
Dibenz(a,h)anthracene	390	87	na	1400	3.4		J	0.6	1.8	1.8	U		0.6	1.8	3.5		J	0.59	1.7
Fluoranthene	4100000	310000	na	6300000	41			0.3	1.8	18			0.3	1.8	33			0.3	1.7
Fluorene	4100000	310000	na	140000	1.3	J	J	0.46	1.8	1.2	J	J	0.47	1.8	4.4			0.46	1.7
Indeno(1,2,3-cd)pyrene	3900	870	na	13000	20			0.56	1.8	6.3			0.56	1.8	26			0.55	1.7
Naphthalene	2000000	160000	na	150	3		B	0.68	1.8	5.4		B	0.68	1.8	34			0.67	1.7
Phenanthrene	3100000	230000	na	680000	19			0.27	1.8	17			0.27	1.8	55			0.26	1.7
Pyrene	3100000	230000	na	680000	40			0.39	1.8	19			0.4	1.8	37			0.39	1.7
SVOCs (ug/kg)																			
1,2,4-Trichlorobenzene	1000000	78000	na	280	170	U		7.2	170	170	U		7.2	170	170	U		7.1	170
1,2-Dichlorobenzene	9200000	700000	na	4600	170	U		4.9	170	170	U		5	170	170	U		4.9	170
1,3-Dichlorobenzene	310000	23000	na	290	170	U		5.4	170	170	U		5.4	170	170	U		5.3	170
1,4-Dichlorobenzene	120000	27000	na	7.1	170	U		5.9	170	170	U		6	170	170	U		5.8	170
2,4,5-Trichlorophenol	10000000	780000	na	na	170	U		6.3	170	170	U		6.3	170	170	U		6.2	170
2,4,6-Trichlorophenol	260000	58000	na	na	170	U		4.9	170	170	U		5	170	170	U		4.9	170
2,4-Dichlorophenol	310000	23000	na	1200	170	U		4.1	170	170	U		4.1	170	170	U		4	170
2,4-Dinitrotoluene	200000	16000	na	570	13	J	J	5.9	170	7.6	J	J	5.9	170	36	J	J	5.8	170
2-Chloronaphthalene	8200000	630000	na	32000	170	U		4.4	170	170	U		4.5	170	170	U		4.4	170
2-Chlorophenol	510000	39000	na	na	170	U		4.1	170	170	U		4.2	170	170	U		4.1	170
2-Methylnaphthalene	410000	31000	na	4400	170	U		6.6	170	170	U		6.7	170	69	J	J	6.6	170
2-Methylphenol	5100000	390000	na	na	170	U	UL	7	170	170	U	UL	7	170	170	U	UL	6.9	170
2-Nitrophenol	na	na	na	na	170	U		5.7	170	170	U		5.8	170	170	U		5.7	170
4-Chloro-3-methylphenol	na	na	na	na	170	U		8.3	170	170	U		8.3	170	170	U		8.2	170
4-Chlorophenyl phenyl ether	na	na	na	na	170	U		5.4	170	170	U		5.5	170	170	U		5.4	170
4-Methylphenol	510000	39000	na	na	170	U	UL	6.1	170	170	U	UL	6.1	170	170	U	UL	6	170
Acenaphthene	6100000	470000	na	100000	170	U		4.8	170	170	U		4.8	170	170	U		4.8	170
Acenaphthylene	3100000	230000	na	680000	170	U		4.7	170	170	U		4.7	170	170	U		4.6	170
Benzo(a)anthracene	3900	870	na	1500	30	J	J	5	170	14	J	J	5	170	32	J	J	4.9	170
Benzo(a)pyrene	390	87	na	370	27	J	J	4.3	170	11	J	J	4.3	170	39	J	J	4.2	170
Benzo(b)fluoranthene	3900	870	na	4500	42	J	J	3.7	170	17	J	J	3.7	170	53	J	J	3.6	170
Benzo(g,h,i)perylene	3100000	230000	na	680000	30	J	J	4.9	170	170	U		4.9	170	50	J	J	4.8	170
Benzo(k)fluoranthene	39000	8700	na	45000	15	J	J	4.9	170	7.1	J	J	4.9	170	19	J	J	4.9	170
bis(2-Chloroethoxy)methane	na	na	na	na	170	U		5.3	170	170	U		5.3	170	170	U		5.2	170
bis(2-Chloroethyl)ether	2600	580	na	0.044	170	U		3.9	170	170	U		3.9	170	170	U		3.9	170
bis(2-Chloroisopropyl)ether	41000	9100	na	1.7	170	U		3.9	170	170	U		3.9	170	170	U		3.8	170
bis(2-Ethylhexyl)phthalate	200000	46000	na	2900000	30	J	B	12	170	27	J	B	12	170	32	J	B	11	170
Butylbenzylphthalate	1500000	340000	na	81000	170	U		6.8	170	170	U		6.8	170	14	J	B	6.7	170
Chrysene	390000	87000	na	150000	33	J	J	4	170	10	J	J	4	170	40	J	J	4	170
Dibenzofuran	200000	16000	na	3800	170	U		5	170	170	U		5	170	13	J	J	4.9	170
Diethylphthalate	82000000	6300000	na	450000	10	J	B	5	170	170	U		5.1	170	170	U		5	170
Di-n-butylphthalate	10000000	780000	na	5000000	170	U		50	170	170	U		50	170	160	J	B	50	170
Di-n-octylphthalate	4100000	310000	na	4.9E+09	170	U		7.8	170	170	U		7.8	170	170	U		7.7	170
Fluoranthene	4100000	310000	na	6300000	58	J	J	5.7	170	9.4	J	J	5.7	170	38	J	J	5.6	170
Fluorene	4100000	310000	na	140000	170	U		5.7	170	170	U		5.7	170	170	U		5.6	170
Hexachlorobenzene	1800	400	na	52	170	U		6.5	170	170	U		6.5	170	170	U		6.4	170
Hexachlorobutadiene	20000	1600	na	1800	170	U		5.8	170	170	U		5.8	170	170	U		5.7	170
Hexachloroethane	102000	7800	na	360	170	U		4.6	170	170	U		4.6	170	170	U		4.6	170
Indeno(1,2,3-cd)pyrene	3900	870	na	13000	32	J	J	6.7	170	15	J	J	6.7	170	41	J	J	6.6	170
Isophorone	3000000	670000	na	410	170	U		4.3	170	170	U		4.3	170	170	U		4.3	170
Naphthalene	2000000	160000	na	150	170	U		6.4	170	170	U		6.4	170	53	J	J	6.3	170
Nitrobenzene	51000	3900	na	23	170	U		8.5	170	170	U		8.6	170	170	U		8.4	170
N-nitrosodiphenylamine	580000	130000	na	760	170	U		8.2	170	170	U		8.3	170	150	J	J	8.1	170
Phenanthrene	3100000	230000	na	680000	27	J	J	5.4	170	12	J	J	5.4	170	57	J	J	5.3	170
Pyrene	3100000	230000	na	680000	47	J	J	5.3	170	8.2	J	J	5.3	170	38	J	J	5.2	170

Analyte	LFSB12A 6/26/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL	LFSB12B 6/26/02 2-4 Result	Lab Q	Val Q	MDL	MRL	LFSB12C 6/26/02 4-5.4 Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)															
Toluene	5.1	U		0.33	5.1	6.6	U		0.43	6.6	5.5	U		0.36	5.5
PAHs (ug/kg)															
2-Methylnaphthalene	62			0.58	1.7	2.2	U		0.75	2.2	2.1	U		0.7	2.1
Acenaphthene	1.7	U		0.96	1.7	2.2	U		1.2	2.2	2.1	U		1.2	2.1
Acenaphthylene	1.1	J	J	0.23	1.7	2.2	U		0.3	2.2	2.1	U		0.28	2.1
Anthracene	1.9			0.19	1.7	2.2	U		0.25	2.2	2.1	U		0.23	2.1
Benzo(a)anthracene	11			0.23	1.7	2.2	U		0.3	2.2	2.1	U		0.28	2.1
Benzo(a)pyrene	9.7			0.19	1.7	2.2	U		0.25	2.2	2.1	U		0.23	2.1
Benzo(b)fluoranthene	21			0.33	1.7	2.2	U		0.43	2.2	2.1	U		0.4	2.1
Benzo(g,h,i)perylene	5.9		L	0.61	1.7	2.2	U	UL	0.79	2.2	2.1	U	UL	0.73	2.1
Benzo(k)fluoranthene	5.9			0.3	1.7	2.2	U		0.39	2.2	2.1	U		0.36	2.1
Chrysene	14			0.28	1.7	2.2	U		0.36	2.2	2.1	U		0.33	2.1
Dibenz(a,h)anthracene	1.7	U		0.59	1.7	2.2	U		0.76	2.2	2.1	U		0.71	2.1
Fluoranthene	18			0.3	1.7	2.2	U		0.39	2.2	2.1	U		0.36	2.1
Fluorene	1.4	J	J	0.46	1.7	2.2	U		0.59	2.2	2.1	U		0.55	2.1
Indeno(1,2,3-cd)pyrene	6.8			0.55	1.7	2.2	U		0.72	2.2	2.1	U		0.67	2.1
Naphthalene	22			0.67	1.7	2.2	U		0.86	2.2	2.1	U		0.8	2.1
Phenanthrene	28			0.27	1.7	2.2	U		0.34	2.2	2.1	U		0.32	2.1
Pyrene	22			0.39	1.7	2.2	U		0.5	2.2	2.1	U		0.47	2.1
SVOCs (ug/kg)															
1,2,4-Trichlorobenzene	170	U		7.1	170	220	U		9.1	220	200	U		8.5	200
1,2-Dichlorobenzene	170	U		4.9	170	220	U		6.3	220	200	U		5.9	200
1,3-Dichlorobenzene	170	U		5.3	170	220	U		6.9	220	200	U		6.4	200
1,4-Dichlorobenzene	170	U		5.9	170	220	U		7.6	220	200	U		7.1	200
2,4,5-Trichlorophenol	170	U		6.2	170	220	U		8.1	220	200	U		7.5	200
2,4,6-Trichlorophenol	170	U		4.9	170	220	U		6.3	220	200	U		5.9	200
2,4-Dichlorophenol	170	U		4	170	220	U		5.2	220	200	U		4.9	200
2,4-Dinitrotoluene	7.2	J	J	5.8	170	220	U		7.5	220	200	U		7	200
2-Chloronaphthalene	170	U		4.4	170	220	U		5.7	220	200	U		5.3	200
2-Chlorophenol	170	U		4.1	170	220	U		5.3	220	200	U		4.9	200
2-Methylnaphthalene	170	U		6.6	170	220	U		8.5	220	200	U		7.9	200
2-Methylphenol	170	U	UL	6.9	170	220	U	UL	9	220	200	U	UL	8.4	200
2-Nitrophenol	170	U		5.7	170	220	U		7.3	220	200	U		6.8	200
4-Chloro-3-methylphenol	170	U		8.2	170	220	U		11	220	200	U		9.9	200
4-Chlorophenyl phenyl ether	170	U		5.4	170	220	U		7	220	200	U		6.5	200
4-Methylphenol	170	U	UL	6.1	170	220	U	UL	7.8	220	200	U	UL	7.3	200
Acenaphthene	170	U		4.8	170	220	U		6.2	220	200	U		5.7	200
Acenaphthylene	170	U		4.6	170	220	U		6	220	200	U		5.6	200
Benzo(a)anthracene	13	J	J	4.9	170	220	U		6.4	220	13	J	J	5.9	200
Benzo(a)pyrene	8.1	J	J	4.2	170	220	U		5.5	220	200	U		5.1	200
Benzo(b)fluoranthene	13	J	J	3.6	170	220	U		4.7	220	200	U		4.4	200
Benzo(g,h,i)perylene	10	J	J	4.8	170	220	U		6.2	220	200	U		5.8	200
Benzo(k)fluoranthene	5	J	J	4.9	170	220	U		6.3	220	200	U		5.9	200
bis(2-Chloroethoxy)methane	170	U		5.3	170	220	U		6.8	220	200	U		6.3	200
bis(2-Chloroethyl)ether	170	U		3.9	170	220	U		5	220	200	U		4.7	200
bis(2-Chloroisopropyl)ether	170	U		3.9	170	220	U		5	220	200	U		4.6	200
bis(2-Ethylhexyl)phthalate	27	J	B	12	170	18	J	B	15	220	18	J	B	14	200
Butylbenzylphthalate	170	U		6.7	170	8.8	J	B	8.7	220	200	U		8.1	200
Chrysene	8.9	J	J	4	170	220	U		5.1	220	8.8	J	J	4.8	200
Dibenzofuran	170	U		4.9	170	220	U		6.3	220	200	U		5.9	200
Diethylphthalate	170	U		5	170	220	U		6.4	220	200	U		6	200
Di-n-butylphthalate	170	U		50	170	220	U		64	220	200	U		60	200
Di-n-octylphthalate	170	U		7.7	170	220	U		9.9	220	200	U		9.2	200
Fluoranthene	16	J	J	5.6	170	220	U		7.3	220	200	U		6.8	200
Fluorene	170	U		5.6	170	220	U		7.2	220	200	U		6.7	200
Hexachlorobenzene	170	U		6.4	170	220	U		8.2	220	200	U		7.7	200
Hexachlorobutadiene	170	U		5.7	170	220	U		7.4	220	200	U		6.9	200
Hexachloroethane	170	U		4.6	170	220	U		5.9	220	200	U		5.5	200
Indeno(1,2,3-cd)pyrene	9.4	J	J	6.6	170	220	U		8.5	220	200	U		8	200
Isophorone	170	U		4.3	170	220	U		5.5	220	200	U		5.2	200
Naphthalene	170	U		6.3	170	220	U		8.1	220	200	U		7.6	200
Nitrobenzene	170	U		8.5	170	220	U		11	220	200	U		10	200
N-nitrosodiphenylamine	170	U		8.1	170	220	U		11	220	200	U		9.8	200
Phenanthrene	9.3	J	J	5.4	170	220	U		6.9	220	200	U		6.4	200
Pyrene	17	J	J	5.2	170	220	U		6.8	220	12	J	J	6.3	200

Analyte	LFSB13A 6/26/02 8.3-9 Result	Lab Q	Val Q	MDL	MRL	LFSB14A 6/26/02 5.5-7 Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)										
Toluene	6.5	U		0.42	6.5	5.3	U		0.34	5.3
PAHs (ug/kg)										
2-Methylnaphthalene	2.4		B	0.83	2.4	1	J	B	0.67	2
Acenaphthene	1.7	J	B	1.4	2.4	2	U		1.1	2
Acenaphthylene	1.5	J	J	0.32	2.4	2	U		0.26	2
Anthracene	2.4	U		0.27	2.4	2	U		0.22	2
Benzo(a)anthracene	2.4	U		0.32	2.4	2	U		0.26	2
Benzo(a)pyrene	2.4	U		0.27	2.4	2	U		0.22	2
Benzo(b)fluoranthene	2.4	U		0.47	2.4	2	U		0.38	2
Benzo(g,h,i)perylene	2.4	U	UL	0.86	2.4	2	U	UL	0.7	2
Benzo(k)fluoranthene	2.4	U		0.43	2.4	2	U		0.35	2
Chrysene	2.4	U		0.39	2.4	2	U		0.32	2
Dibenz(a,h)anthracene	2.4	U		0.83	2.4	2	U		0.68	2
Fluoranthene	2.4	U		0.42	2.4	2	U		0.34	2
Fluorene	1.2	J	J	0.65	2.4	0.86	J	J	0.53	2
Indeno(1,2,3-cd)pyrene	2.4	U		0.78	2.4	2	U		0.64	2
Naphthalene	1.5	J	B	0.95	2.4	0.9	J	B	0.77	2
Phenanthrene	2.4	U		0.37	2.4	2	U		0.3	2
Pyrene	2.4	U		0.55	2.4	2	U		0.45	2
SVOCs (ug/kg)										
1,2,4-Trichlorobenzene	240	U		10	240	200	U		8.1	200
1,2-Dichlorobenzene	240	U		6.9	240	200	U		5.6	200
1,3-Dichlorobenzene	240	U		7.5	240	200	U		6.1	200
1,4-Dichlorobenzene	240	U		8.3	240	200	U		6.7	200
2,4,5-Trichlorophenol	240	U		8.8	240	200	U		7.2	200
2,4,6-Trichlorophenol	240	U		6.9	240	200	U		5.6	200
2,4-Dichlorophenol	240	U		5.7	240	200	U		4.6	200
2,4-Dinitrotoluene	240	U		8.2	240	200	U		6.7	200
2-Chloronaphthalene	240	U		6.2	240	200	U		5	200
2-Chlorophenol	240	U		5.8	240	200	U		4.7	200
2-Methylnaphthalene	240	U		9.3	240	200	U		7.5	200
2-Methylphenol	240	U	UL	9.8	240	200	U	UL	8	200
2-Nitrophenol	240	U		8	240	200	U		6.5	200
4-Chloro-3-methylphenol	240	U		12	240	200	U		9.4	200
4-Chlorophenyl phenyl ether	240	U		7.6	240	200	U		6.2	200
4-Methylphenol	240	U	UL	8.6	240	200	U	UL	7	200
Acenaphthene	240	U		6.7	240	200	U		5.5	200
Acenaphthylene	240	U		6.5	240	200	U		5.3	200
Benzo(a)anthracene	240	U		7	240	200	U		5.7	200
Benzo(a)pyrene	240	U		6	240	200	U		4.9	200
Benzo(b)fluoranthene	240	U		5.2	240	200	U		4.2	200
Benzo(g,h,i)perylene	240	U		6.8	240	200	U		5.6	200
Benzo(k)fluoranthene	240	U		6.9	240	200	U		5.6	200
bis(2-Chloroethoxy)methane	240	U		7.4	240	200	U		6	200
bis(2-Chloroethyl)ether	240	U		5.5	240	200	U		4.4	200
bis(2-Chloroisopropyl)ether	240	U		5.4	240	200	U		4.4	200
bis(2-Ethylhexyl)phthalate	17	J	B	16	240	13	J	B	13	200
Butylbenzylphthalate	240	U		9.5	240	200	U		7.7	200
Chrysene	240	U		5.6	240	200	U		4.6	200
Dibenzofuran	240	U		6.9	240	200	U		5.6	200
Diethylphthalate	240	U		7	240	200	U		5.7	200
Di-n-butylphthalate	240	U		70	240	200	U		57	200
Di-n-octylphthalate	240	U		11	240	200	U		8.8	200
Fluoranthene	240	U		8	240	200	U		6.5	200
Fluorene	240	U		7.9	240	200	U		6.4	200
Hexachlorobenzene	240	U		9	240	200	U		7.3	200
Hexachlorobutadiene	240	U		8.1	240	200	U		6.6	200
Hexachloroethane	240	U		6.5	240	200	U		5.2	200
Indeno(1,2,3-cd)pyrene	240	U		9.3	240	200	U		7.6	200
Isophorone	240	U		6.1	240	200	U		4.9	200
Naphthalene	240	U		8.9	240	200	U		7.2	200
Nitrobenzene	240	U		12	240	200	U		9.7	200
N-nitrosodiphenylamine	240	U		12	240	200	U		9.4	200
Phenanthrene	240	U		7.6	240	200	U		6.1	200
Pyrene	240	U		7.4	240	200	U		6	200

Table 5-3
Analytes Detected in Soil - 2002 RFI

Analyte				Sample ID / Sample Date / Sample Depth	LFSS01 6/26/02 0-0.5					LFSS02 6/26/02 0-0.5					LFSS03 6/26/02 0-0.5					LFSB12A 6/26/02 0-0.5				
	i-RBC	r-RBC	Background	SSL Transfer	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Pesticides (ug/kg)																								
4,4'-DDD	12000	2700	na	11000	NT					NT					0.863			*0.143*	*0.679*	0.423	J	J	*0.144*	*0.68*
4,4'-DDE	8400	1900	na	35000	NT					NT					2.32			*0.142*	*0.679*	0.83		B	*0.143*	*0.68*
4,4'-DDT	8400	1900	na	1200	NT					NT					83.2			*2.4*	*6.79*	15.4			*0.241*	*0.68*
delta-BHC	na	na	na	na	NT					NT					0.679	U		*0.118*	*0.679*	0.495	BJ	B	*0.118*	*0.68*
Endosulfan II	610000	47000	na	20000	NT					NT					19.9			*0.242*	*0.679*	4.2			*0.243*	*0.68*
Endrin aldehyde	na	na	na	na	NT					NT					33.4			*0.343*	*0.679*	6.3			*0.344*	*0.68*
Endrin ketone	na	na	na	na	NT					NT					6.79	U		*5.47*	*6.79*	0.68	U		*0.548*	*0.68*
gamma-Chlordane	8200	1800	na	920	NT					NT					0.679	U		*0.158*	*0.679*	0.68	U		*0.158*	*0.68*
Methoxychlor	510000	39000	na	310000	NT					NT					0.679	U		*0.518*	*0.679*	0.68	U		*0.519*	*0.68*
PCBs (mg/kg)																								
PCB-1248	1.4	0.32	na	na	0.0343	U		*0.0163*	*0.0343*	0.0345	U		*0.0164*	*0.0345*	0.0339	U		*0.0161*	*0.0339*	0.0339	U		*0.0161*	*0.0339*
PCB-1254	1.4	0.16	na	1.1	0.138			*0.0101*	*0.0343*	0.0404			*0.0102*	*0.0345*	1.58			*0.01*	*0.0339*	0.129			*0.01*	*0.0339*
Explosives (mg/kg)																								
2,4-Dinitrotoluene	200	16	na	0.57	0.062	J	J	*0.0163*	*0.2*	0.2	U		*0.0163*	*0.2*	0.12	J	J	*0.0163*	*0.2*	0.2	U		*0.0163*	*0.2*
Herbicides (ug/kg)																								
Metals (mg/kg)																								
Aluminum	100000	7800	40041	na	24000			*5.7*	*20.6*	22300			*5.7*	*20.7*	19600			*5.6*	*20.3*	17400			*5.6*	*20.4*
Antimony	41	3.1	na	13	0.47	B	J	*0.17*	*0.515*	0.518	U	UL	*0.17*	*0.518*	24		J	*0.17*	*0.509*	0.43	B	J	*0.17*	*0.51*
Arsenic	1.9	0.43	15.8	0.026	7.4		J	*0.36*	*0.515*	3.02		J	*0.36*	*0.518*	**19.4**		**J**	*0.36*	*0.509*	3.12		J	*0.36*	*0.51*
Barium	7200	550	209	2100	62.5			*0.34*	*2.06*	58.9			*0.35*	*2.07*	**2630**			*0.34*	*2.03*	59.3			*0.34*	*2.04*
Beryllium	200	16	1.02	1200	**1.18**			*0.0356*	*0.515*	0.4	B	J	*0.0357*	*0.518*	1.01			*0.0351*	*0.509*	**1.25**			*0.0352*	*0.51*
Cadmium	51	3.9	0.69	27	0.177			*0.049*	*0.103*	0.072	B	J	*0.049*	*0.104*	**9.81**			*0.048*	*0.102*	0.111			*0.048*	*0.102*
Calcium	na	na	na	na	61600		J	*2.9*	*10.3*	4660		J	*2.9*	*10.4*	20300		J	*2.8*	*10.2*	21600		J	*2.8*	*10.2*
Chromium	310	23	65.3	42	59.8		J	*0.39*	*1.03*	33.1		J	*0.39*	*1.04*	**299**		**J**	*0.38*	*1.02*	31.1		J	*0.38*	*1.02*
Cobalt	2000	160	72.3	na	7.83		J	*0.83*	*5.15*	3.7	B	J	*0.84*	*5.18*	22.5		J	*0.82*	*5.09*	19.7		J	*0.83*	*5.1*
Copper	4100	310	53.5	11000	**521**		**J**	*0.64*	*2.06*	37.9		J	*0.64*	*2.07*	**1670**		**J**	*0.63*	*2.03*	**57.5**		**J**	*0.63*	*2.04*
Iron	31000	2300	50962	na	22800		J	*3.5*	*5.15*	25100		J	*3.5*	*5.18*	**61400**		**J**	*3.4*	*5.09*	22000		J	*3.4*	*5.1*
Lead	800	400	26.8	na	**50.9**			*0.031*	*0.309*	**89.3**		**J**	*3.8*	*10.4*	**3150**		**J**	*3.7*	*10.2*	**60.7**			*0.031*	*0.306*
Magnesium	na	na	na	na	41600			*2.4*	*10.3*	2280			*2.4*	*10.4*	15500			*2.4*	*10.2*	20400			*2.4*	*10.2*
Manganese	2000	160	2543	950	277		J	*0.058*	*1.03*	183		J	*0.058*	*1.04*	1250		J	*0.057*	*1.02*	333		J	*0.057*	*1.02*
Mercury	31	2.3	0.13	na	0.0555			*0.0204*	*0.0515*	**0.141**			*0.0205*	*0.0518*	**0.875**			*0.0201*	*0.0509*	0.038	B	J	*0.0202*	*0.051*
Nickel	2000	160	62.8	na	18.8		J	*0.94*	*4.12*	8.44		J	*0.95*	*4.14*	**121**		**J**	*0.93*	*4.07*	18.2		J	*0.93*	*4.08*
Potassium	na	na	na	na	4400			*34*	*309*	883			*35*	*311*	3260			*34*	*305*	2310			*34*	*306*
Silver	510	39	na	31	1.03	U		*0.51*	*1.03*	1.04	U		*0.51*	*1.04*	44.4		J	*0.5*	*1.02*	1.02	U		*0.5*	*1.02*
Sodium	na	na	na	na	58.8			*3.9*	*20.6*	61.9			*3.9*	*20.7*	996			*3.8*	*20.3*	39.5			*3.8*	*20.4*
Thallium	7.2	0.55	2.11	3.6	0.361			*0.031*	*0.309*	0.16	B	J	*0.031*	*0.311*	0.15	B	J	*0.031*	*0.305*	0.22	B	J	*0.031*	*0.306*
Vanadium	102	7.8	108	730	39.3		J	*0.6*	*5.15*	48.4		J	*0.6*	*5.18*	35		J	*0.59*	*5.09*	41.1		J	*0.59*	*5.1*
Zinc	31000	2300	202	14000	**232**		**J**	*0.37*	*2.06*	63.6		J	*0.37*	*2.07*	**5080**		**J**	*0.36*	*2.03*	115		J	*0.37*	*2.04*
Misc.																								
Total Organic Carbon (mg/kg)	na	na	na	na	NT					NT					NT					14500			*172*	*1020*
pH	na	na	na	na	NT					NT					NT					7.57		J	*+/-0.1*	*+/-0.1*

Analyte	LFSB12B 6/26/02 2-4					LFSB12C 6/26/02 4-5.4					LFSB13A 6/26/02 8.3-9					LFSB14A 6/26/02 5.5-7				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Pesticides (ug/kg)																				
4,4'-DDD	NT					NT					NT					NT				
4,4'-DDE	NT					NT					NT					NT				
4,4'-DDT	NT					NT					NT					NT				
delta-BHC	NT					NT					NT					NT				
Endosulfan II	NT					NT					NT					NT				
Endrin aldehyde	NT					NT					NT					NT				
Endrin ketone	NT					NT					NT					NT				
gamma-Chlordane	NT					NT					NT					NT				
Methoxychlor	NT					NT					NT					NT				
PCBs (mg/kg)																				
PCB-1248	0.0439	U		*0.0208*	*0.0439*	0.0409	U		*0.0194*	*0.0409*	0.048	U		*0.0228*	*0.048*	1.42			*0.0185*	*0.039*
PCB-1254	0.0439	U		*0.013*	*0.0439*	0.0409	U		*0.0121*	*0.0409*	0.048	U		*0.0142*	*0.048*	0.039	U		*0.0115*	*0.039*
Explosives (mg/kg)																				
2,4-Dinitrotoluene	0.2	U		*0.0163*	*0.2*	0.2	U		*0.0163*	*0.2*	0.2	U		*0.0163*	*0.2*	0.2	U		*0.0163*	*0.2*
Herbicides (ug/kg)																				
Metals (mg/kg)																				
Aluminum	31600			*7.3*	*26.4*	37700			*6.8*	*24.5*	20300			*8*	*28.8*	22500			*6.5*	*23.4*
Antimony	0.22	B	B	*0.22*	*0.659*	0.613	U	UL	*0.21*	*0.613*	0.27	B	B	*0.24*	*0.72*	0.585	U	UL	*0.2*	*0.585*
Arsenic	3.49		J	*0.46*	*0.659*	1.39		J	*0.43*	*0.613*	2.82		J	*0.5*	*0.72*	2.79		J	*0.41*	*0.585*
Barium	74.4			*0.44*	*2.64*	102			*0.41*	*2.45*	59			*0.48*	*2.88*	51.6			*0.39*	*2.34*
Beryllium	**1.96**			*0.0455*	*0.659*	**2.09**			*0.0423*	*0.613*	**2.02**			*0.0497*	*0.72*	**1.49**			*0.0404*	*0.585*
Cadmium	0.132	U		*0.063*	*0.132*	0.123	U		*0.058*	*0.123*	0.08	B	B	*0.068*	*0.144*	0.117	U		*0.056*	*0.117*
Calcium	11200		J	*3.7*	*13.2*	23300		J	*3.4*	*12.3*	7460		J	*4*	*14.4*	8220		J	*3.3*	*11.7*
Chromium	43.2		J	*0.49*	*1.32*	41.5		J	*0.46*	*1.23*	26.6		J	*0.54*	*1.44*	35.1		J	*0.44*	*1.17*
Cobalt	9.65		J	*1.1*	*6.59*	9.2		J	*0.99*	*6.13*	7.65		J	*1.2*	*7.2*	12.5		J	*0.95*	*5.85*
Copper	29.5		J	*0.81*	*2.64*	23.7		J	*0.76*	*2.45*	26.4		J	*0.89*	*2.88*	21.1		J	*0.72*	*2.34*
Iron	35700		J	*4.4*	*6.59*	39800		J	*4.1*	*6.13*	33100		J	*4.8*	*7.2*	29200		J	*3.9*	*5.85*
Lead	12.3			*0.04*	*0.395*	14.4			*0.037*	*0.368*	14.6			*0.044*	*0.432*	25.1			*0.035*	*0.351*
Magnesium	45500			*3.1*	*13.2*	51400			*2.9*	*12.3*	7940			*3.4*	*14.4*	15200			*2.8*	*11.7*
Manganese	214		J	*0.074*	*1.32*	496		J	*0.069*	*1.23*	373		J	*0.081*	*1.44*	263		J	*0.066*	*1.17*
Mercury	0.031	B	J	*0.0261*	*0.0659*	0.035	B	J	*0.0243*	*0.0613*	0.121			*0.0285*	*0.072*	0.036	B	J	*0.0232*	*0.0585*
Nickel	30.5		J	*1.2*	*5.27*	27.9		J	*1.1*	*4.91*	28.9		J	*1.3*	*5.76*	26.1		J	*1.1*	*4.68*
Potassium	8670			*44*	*395*	4200			*41*	*368*	2020			*48*	*432*	1770			*39*	*351*
Silver	1.32	U		*0.65*	*1.32*	1.23	U		*0.6*	*1.23*	1.44	U		*0.71*	*1.44*	1.17	U		*0.58*	*1.17*
Sodium	75.7			*4.9*	*26.4*	129			*4.6*	*24.5*	24	B	B	*5.4*	*28.8*	39.7			*4.4*	*23.4*
Thallium	0.29	B	J	*0.04*	*0.395*	0.25	B	J	*0.037*	*0.368*	0.27	B	J	*0.043*	*0.432*	0.21	B	J	*0.035*	*0.351*
Vanadium	62.1		J	*0.76*	*6.59*	66		J	*0.71*	*6.13*	47.8		J	*0.83*	*7.2*	47.5		J	*0.68*	*5.85*
Zinc	56.4		J	*0.47*	*2.64*	50.7		J	*0.44*	*2.45*	75.1		J	*0.52*	*2.88*	40		J	*0.42*	*2.34*
Misc.																				
Total Organic Carbon (mg/kg)	NT					3740			*207*	*1230*	NT					NT				
pH	NT					7.56		J	*+/-0.1*	*+/-0.1*	NT					NT				

Table 5-3
Analytes Detected in Soil - 2002 RFI

Analyte				Sample ID Sample Date Sample Depth	LFSB14B 6/26/02 7-8.8					LFSB15A 6/26/02 0-0.5				
	i-RBC	r-RBC	Background	SSL Transfe	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)														
Toluene	20000000	1600000	na	8800	6.5	U		0.42	6.5	12	U		0.78	12
PAHs (ug/kg)														
2-Methylnaphthalene	410000	31000	na	4400	2.2	U		0.74	2.2	8.9			0.69	2
Acenaphthene	6100000	470000	na	100000	2.2	U		1.2	2.2	2		B	1.1	2
Acenaphthylene	3100000	230000	na	680000	2.2	U		0.29	2.2	1.2	J	J	0.27	2
Anthracene	31000000	2300000	na	470000	2.2	U		0.24	2.2	3.4			0.22	2
Benzo(a)anthracene	3900	870	na	1500	2.2	U		0.29	2.2	14			0.27	2
Benzo(a)pyrene	390	87	na	370	2.2	U		0.25	2.2	15			0.23	2
Benzo(b)fluoranthene	3900	870	na	4500	2.2	U		0.42	2.2	27			0.39	2
Benzo(g,h,i)perylene	3100000	230000	na	680000	2.2	U	UL	0.78	2.2	7.7		L	0.72	2
Benzo(k)fluoranthene	39000	8700	na	45000	2.2	U		0.38	2.2	9.1			0.35	2
Chrysene	390000	87000	na	150000	2.2	U		0.35	2.2	17			0.32	2
Dibenz(a,h)anthracene	390	87	na	1400	2.2	U		0.75	2.2	2.7		J	0.69	2
Fluoranthene	4100000	310000	na	6300000	2.2	U		0.38	2.2	25			0.35	2
Fluorene	4100000	310000	na	140000	2.2	U		0.58	2.2	2.6			0.54	2
Indeno(1,2,3-cd)pyrene	3900	870	na	13000	2.2	U		0.71	2.2	9.5			0.65	2
Naphthalene	2000000	160000	na	150	2.2	U		0.85	2.2	7.4			0.79	2
Phenanthrene	3100000	230000	na	680000	2.2	U		0.34	2.2	23			0.31	2
Pyrene	3100000	230000	na	680000	2.2	U		0.5	2.2	23			0.46	2
SVOCs (ug/kg)														
1,2,4-Trichlorobenzene	1000000	78000	na	280	220	U		9	220	200	U		8.3	200
1,2-Dichlorobenzene	9200000	700000	na	4600	220	U		6.2	220	200	U		5.7	200
1,3-Dichlorobenzene	310000	23000	na	290	220	U		6.8	220	200	U		6.3	200
1,4-Dichlorobenzene	120000	27000	na	7.1	220	U		7.5	220	200	U		6.9	200
2,4,5-Trichlorophenol	10000000	780000	na	na	220	U		7.9	220	200	U		7.3	200
2,4,6-Trichlorophenol	260000	58000	na	na	220	U		6.2	220	200	U		5.7	200
2,4-Dichlorophenol	310000	23000	na	1200	220	U		5.1	220	200	U		4.8	200
2,4-Dinitrotoluene	200000	16000	na	570	220	U		7.4	220	16	J	J	6.8	200
2-Chloronaphthalene	8200000	630000	na	32000	220	U		5.6	220	200	U		5.1	200
2-Chlorophenol	510000	39000	na	na	220	U		5.2	220	200	U		4.8	200
2-Methylnaphthalene	410000	31000	na	4400	220	U		8.4	220	14	J	J	7.7	200
2-Methylphenol	5100000	390000	na	na	220	U	UL	8.8	220	200	U	UL	8.2	200
2-Nitrophenol	na	na	na	na	220	U		7.2	220	200	U		6.7	200
4-Chloro-3-methylphenol	na	na	na	na	220	U		10	220	200	U		9.6	200
4-Chlorophenyl phenyl ether	na	na	na	na	220	U		6.8	220	200	U		6.3	200
4-Methylphenol	510000	39000	na	na	220	U	UL	7.7	220	200	U	UL	7.1	200
Acenaphthene	6100000	470000	na	100000	220	U		6.1	220	200	U		5.6	200
Acenaphthylene	3100000	230000	na	680000	220	U		5.9	220	200	U		5.4	200
Benzo(a)anthracene	3900	870	na	1500	220	U		6.3	220	20	J	J	5.8	200
Benzo(a)pyrene	390	87	na	370	220	U		5.4	220	18	J	J	5	200
Benzo(b)fluoranthene	3900	870	na	4500	220	U		4.6	220	30	J	J	4.3	200
Benzo(g,h,i)perylene	3100000	230000	na	680000	220	U		6.1	220	13	J	J	5.7	200
Benzo(k)fluoranthene	39000	8700	na	45000	220	U		6.2	220	8.7	J	J	5.7	200
bis(2-Chloroethoxy)methane	na	na	na	na	220	U		6.7	220	200	U		6.2	200
bis(2-Chloroethyl)ether	2600	580	na	0.044	220	U		4.9	220	200	U		4.5	200
bis(2-Chloroisopropyl)ether	41000	9100	na	1.7	220	U		4.9	220	200	U		4.5	200
bis(2-Ethylhexyl)phthalate	200000	46000	na	2900000	35	J	B	15	220	68	J	B	14	200
Butylbenzylphthalate	1500000	340000	na	81000	14	J	B	8.5	220	200	U		7.9	200
Chrysene	390000	87000	na	150000	220	U		5	220	23	J	J	4.7	200
Dibenzofuran	200000	16000	na	3800	220	U		6.2	220	200	U		5.8	200
Diethylphthalate	82000000	6300000	na	450000	220	U		6.3	220	9.1	J	B	5.8	200
Di-n-butylphthalate	10000000	780000	na	5000000	220	U		63	220	200	U		58	200
Di-n-octylphthalate	4100000	310000	na	4.9E+09	220	U		9.8	220	200	U		9	200
Fluoranthene	4100000	310000	na	6300000	220	U		7.2	220	30	J	J	6.6	200
Fluorene	4100000	310000	na	140000	220	U		7.1	220	200	U		6.6	200
Hexachlorobenzene	1800	400	na	52	220	U		8.1	220	20	J	J	7.5	200
Hexachlorobutadiene	20000	1600	na	1800	220	U		7.3	220	200	U		6.7	200
Hexachloroethane	102000	7800	na	360	220	U		5.8	220	200	U		5.4	200
Indeno(1,2,3-cd)pyrene	3900	870	na	13000	220	U		8.4	220	11	J	J	7.8	200
Isophorone	3000000	670000	na	410	220	U		5.4	220	200	U		5	200
Naphthalene	2000000	160000	na	150	220	U		8	220	14	J	J	7.4	200
Nitrobenzene	51000	3900	na	23	220	U		11	220	200	U		9.9	200
N-nitrosodiphenylamine	580000	130000	na	760	220	U		10	220	200	U		9.6	200
Phenanthrene	3100000	230000	na	680000	220	U		6.8	220	28	J	J	6.3	200
Pyrene	3100000	230000	na	680000	220	U		6.7	220	23	J	J	6.2	200

Analyte	LFSB15B 6/26/02 2-4					LFSB15C 6/26/02 4-6					LFSB16A 6/26/02 0-0.5				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)															
Toluene	5.7	U		0.37	5.7	6.4	U		0.41	6.4	NT				
PAHs (ug/kg)															
2-Methylnaphthalene	2.1	U		0.72	2.1	1.8	J	B	0.73	2.2	NT				
Acenaphthene	2.1	U		1.2	2.1	1.3	J	B	1.2	2.2	NT				
Acenaphthylene	2.1	U		0.28	2.1	0.98	J	J	0.29	2.2	NT				
Anthracene	2.1	U		0.23	2.1	0.93	J	J	0.24	2.2	NT				
Benzo(a)anthracene	2.1	U		0.28	2.1	2.2	U		0.29	2.2	NT				
Benzo(a)pyrene	2.1	U		0.24	2.1	2.2	U		0.24	2.2	NT				
Benzo(b)fluoranthene	2.1	U		0.41	2.1	2.2	U		0.41	2.2	NT				
Benzo(g,h,i)perylene	2.1	U	UL	0.75	2.1	2.2	U	UL	0.76	2.2	NT				
Benzo(k)fluoranthene	2.1	U		0.37	2.1	2.2	U		0.38	2.2	NT				
Chrysene	2.1	U		0.34	2.1	2.2	U		0.35	2.2	NT				
Dibenz(a,h)anthracene	2.1	U		0.73	2.1	2.2	U		0.74	2.2	NT				
Fluoranthene	2.1	U		0.37	2.1	2.2	U		0.37	2.2	NT				
Fluorene	2.1	U		0.57	2.1	1.3	J	J	0.57	2.2	NT				
Indeno(1,2,3-cd)pyrene	2.1	U		0.69	2.1	2.2	U		0.69	2.2	NT				
Naphthalene	2.1	U		0.83	2.1	1.2	J	B	0.84	2.2	NT				
Phenanthrene	2.1	U		0.33	2.1	1.1	J	J	0.33	2.2	NT				
Pyrene	2.1	U		0.48	2.1	2.2	U		0.49	2.2	NT				
SVOCs (ug/kg)															
1,2,4-Trichlorobenzene	210	U		8.8	210	210	U		8.8	210	200	U		8.4	200
1,2-Dichlorobenzene	210	U		6	210	210	U		6.1	210	200	U		5.8	200
1,3-Dichlorobenzene	210	U		6.6	210	210	U		6.7	210	200	U		6.4	200
1,4-Dichlorobenzene	210	U		7.3	210	210	U		7.3	210	200	U		7	200
2,4,5-Trichlorophenol	210	U		7.7	210	210	U		7.8	210	200	U		7.4	200
2,4,6-Trichlorophenol	210	U		6.1	210	210	U		6.1	210	200	U		5.8	200
2,4-Dichlorophenol	210	U		5	210	210	U		5.1	210	200	U		4.8	200
2,4-Dinitrotoluene	210	U		7.2	210	210	U		7.2	210	200	U		6.9	200
2-Chloronaphthalene	210	U		5.4	210	210	U		5.5	210	200	U		5.2	200
2-Chlorophenol	210	U		5.1	210	210	U		5.1	210	200	U		4.9	200
2-Methylnaphthalene	210	U		8.1	210	210	U		8.2	210	200	U		7.8	200
2-Methylphenol	210	U	UL	8.6	210	210	U	UL	8.7	210	200	U	UL	8.3	200
2-Nitrophenol	210	U		7	210	210	U		7.1	210	200	U		6.8	200
4-Chloro-3-methylphenol	210	U		10	210	210	U		10	210	200	U		9.8	200
4-Chlorophenyl phenyl ether	210	U		6.7	210	210	U		6.7	210	200	U		6.4	200
4-Methylphenol	210	U	UL	7.5	210	210	U	UL	7.6	210	200	U	UL	7.2	200
Acenaphthene	210	U		5.9	210	210	U		5.9	210	200	U		5.7	200
Acenaphthylene	210	U		5.7	210	210	U		5.8	210	200	U		5.5	200
Benzo(a)anthracene	210	U		6.1	210	210	U		6.2	210	7.9	J	J	5.9	200
Benzo(a)pyrene	210	U		5.2	210	210	U		5.3	210	200	U		5.1	200
Benzo(b)fluoranthene	210	U		4.5	210	210	U		4.6	210	200	U		4.3	200
Benzo(g,h,i)perylene	210	U		6	210	210	U		6	210	200	U		5.8	200
Benzo(k)fluoranthene	210	U		6	210	210	U		6.1	210	200	U		5.8	200
bis(2-Chloroethoxy)methane	210	U		6.5	210	210	U		6.6	210	200	U		6.3	200
bis(2-Chloroethyl)ether	210	U		4.8	210	210	U		4.8	210	200	U		4.6	200
bis(2-Chloroisopropyl)ether	210	U		4.8	210	210	U		4.8	210	200	U		4.6	200
bis(2-Ethylhexyl)phthalate	23	J	B	14	210	210	U		14	210	15	J	B	14	200
Butylbenzylphthalate	210	U		8.3	210	210	U		8.4	210	200	U		8	200
Chrysene	210	U		4.9	210	210	U		5	210	200	U		4.7	200
Dibenzofuran	210	U		6.1	210	210	U		6.1	210	200	U		5.8	200
Diethylphthalate	210	U		6.2	210	210	U		6.2	210	200	U		5.9	200
Di-n-butylphthalate	210	U		61	210	210	U		62	210	200	U		59	200
Di-n-octylphthalate	210	U		9.5	210	210	U		9.6	210	200	U		9.1	200
Fluoranthene	210	U		7	210	210	U		7	210	200	U		6.7	200
Fluorene	210	U		6.9	210	210	U		7	210	200	U		6.7	200
Hexachlorobenzene	210	U		7.9	210	210	U		8	210	200	U		7.6	200
Hexachlorobutadiene	210	U		7.1	210	210	U		7.2	210	200	U		6.8	200
Hexachloroethane	210	U		5.6	210	210	U		5.7	210	200	U		5.4	200
Indeno(1,2,3-cd)pyrene	210	U		8.2	210	210	U		8.3	210	200	U		7.9	200
Isophorone	210	U		5.3	210	210	U		5.4	210	200	U		5.1	200
Naphthalene	210	U		7.8	210	210	U		7.8	210	200	U		7.5	200
Nitrobenzene	210	U		10	210	210	U		11	210	200	U		10	200
N-nitrosodiphenylamine	210	U		10	210	210	U		10	210	200	U		9.7	200
Phenanthrene	210	U		6.6	210	210	U		6.7	210	200	U		6.4	200
Pyrene	210	U		6.5	210	210	U		6.6	210	200	U		6.3	200

Analyte	LFSB16B 6/26/02 1-3					LFSB16C 6/26/02 3-5					LFSB17A 6/26/02 0-0.5					LFSB17B 6/26/02 1-3				
	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
VOCs (ug/kg)																				
Toluene	NT					NT					NT					NT				
PAHs (ug/kg)																				
2-Methylnaphthalene	NT					NT					NT					NT				
Acenaphthene	NT					NT					NT					NT				
Acenaphthylene	NT					NT					NT					NT				
Anthracene	NT					NT					NT					NT				
Benzo(a)anthracene	NT					NT					NT					NT				
Benzo(a)pyrene	NT					NT					NT					NT				
Benzo(b)fluoranthene	NT					NT					NT					NT				
Benzo(g,h,i)perylene	NT					NT					NT					NT				
Benzo(k)fluoranthene	NT					NT					NT					NT				
Chrysene	NT					NT					NT					NT				
Dibenz(a,h)anthracene	NT					NT					NT					NT				
Fluoranthene	NT					NT					NT					NT				
Fluorene	NT					NT					NT					NT				
Indeno(1,2,3-cd)pyrene	NT					NT					NT					NT				
Naphthalene	NT					NT					NT					NT				
Phenanthrene	NT					NT					NT					NT				
Pyrene	NT					NT					NT					NT				
SVOCs (ug/kg)																				
1,2,4-Trichlorobenzene	31	J	J	8.8	210	220	U		9.2	220	12	J	J	7.6	180	200	U		8.4	200
1,2-Dichlorobenzene	30	J	J	6.1	210	220	U		6.3	220	180	U		5.2	180	200	U		5.8	200
1,3-Dichlorobenzene	32	J	J	6.6	210	220	U		6.9	220	12	J	J	5.7	180	200	U		6.3	200
1,4-Dichlorobenzene	34	J	J	7.3	210	220	U		7.6	220	13	J	J	6.3	180	200	U		7	200
2,4,5-Trichlorophenol	12	J	J	7.7	210	220	U		8.1	220	180	U		6.7	180	200	U		7.4	200
2,4,6-Trichlorophenol	18	J	J	6.1	210	220	U		6.4	220	180	U		5.2	180	200	U		5.8	200
2,4-Dichlorophenol	22	J	J	5	210	220	U		5.3	220	180	U		4.3	180	200	U		4.8	200
2,4-Dinitrotoluene	210	U		7.2	210	220	U		7.5	220	180	U		6.2	180	200	U		6.9	200
2-Chloronaphthalene	20	J	J	5.4	210	220	U		5.7	220	8	J	J	4.7	180	200	U		5.2	200
2-Chlorophenol	25	J	J	5.1	210	220	U		5.3	220	8.2	J	J	4.4	180	200	U		4.9	200
2-Methylnaphthalene	23	J	J	8.2	210	220	U		8.5	220	12	J	J	7	180	200	U		7.8	200
2-Methylphenol	21	J	B	8.6	210	220	U	UL	9	220	180	U	UL	7.4	180	200	U	UL	8.2	200
2-Nitrophenol	26	J	J	7	210	220	U		7.4	220	11	J	J	6.1	180	200	U		6.7	200
4-Chloro-3-methylphenol	14	J	J	10	210	220	U		11	220	180	U		8.8	180	200	U		9.7	200
4-Chlorophenyl phenyl ether	12	J	J	6.7	210	220	U		7	220	180	U		5.8	180	200	U		6.4	200
4-Methylphenol	19	J	B	7.5	210	220	U	UL	7.9	220	180	U	UL	6.5	180	200	U	UL	7.2	200
Acenaphthene	13	J	J	5.9	210	220	U		6.2	220	180	U		5.1	180	200	U		5.7	200
Acenaphthylene	13	J	J	5.7	210	220	U		6	220	180	U		4.9	180	200	U		5.5	200
Benzo(a)anthracene	210	U		6.1	210	220	U		6.4	220	17	J	J	5.3	180	10	J	J	5.9	200
Benzo(a)pyrene	210	U		5.3	210	220	U		5.5	220	22	J	J	4.5	180	200	U		5	200
Benzo(b)fluoranthene	210	U		4.5	210	220	U		4.7	220	25	J	J	3.9	180	200	U		4.3	200
Benzo(g,h,i)perylene	210	U		6	210	220	U		6.3	220	16	J	J	5.2	180	200	U		5.7	200
Benzo(k)fluoranthene	210	U		6.1	210	220	U		6.3	220	7.1	J	J	5.2	180	200	U		5.8	200
bis(2-Chloroethoxy)methane	13	J	J	6.5	210	220	U		6.8	220	180	U		5.6	180	200	U		6.2	200
bis(2-Chloroethyl)ether	19	J	J	4.8	210	220	U		5	220	180	U		4.1	180	200	U		4.6	200
bis(2-Chloroisopropyl)ether	21	J	J	4.8	210	220	U		5	220	8.8	J	J	4.1	180	200	U		4.6	200
bis(2-Ethylhexyl)phthalate	210	U		14	210	220	U		15	220	36	J	B	12	180	34	J	B	14	200
Butylbenzylphthalate	210	U		8.3	210	220	U		8.7	220	180	U		7.2	180	17	J	B	8	200
Chrysene	210	U		4.9	210	220	U		5.2	220	21	J	J	4.2	180	200	U		4.7	200
Dibenzofuran	14	J	J	6.1	210	220	U		6.4	220	180	U		5.2	180	200	U		5.8	200
Diethylphthalate	210	U		6.2	210	220	U		6.5	220	180	U		5.3	180	200	U		5.9	200
Di-n-butylphthalate	210	U		62	210	220	U		65	220	180	U		53	180	200	U		59	200
Di-n-octylphthalate	210	U		9.5	210	220	U		10	220	20	J	J	8.2	180	200	U		9.1	200
Fluoranthene	210	U		7	210	220	U		7.3	220	21	J	J	6	180	200	U		6.7	200
Fluorene	9	J	J	7	210	220	U		7.3	220	180	U		6	180	200	U		6.7	200
Hexachlorobenzene	210	U		7.9	210	220	U		8.3	220	180	U		6.8	180	200	U		7.6	200
Hexachlorobutadiene	30	J	J	7.1	210	220	U		7.5	220	10	J	J	6.1	180	200	U		6.8	200
Hexachloroethane	13	J	J	5.7	210	220	U		5.9	220	180	U		4.9	180	200	U		5.4	200
Indeno(1,2,3-cd)pyrene	210	U		8.2	210	220	U		8.6	220	15	J	J	7.1	180	200	U		7.8	200
Isophorone	10	J	J	5.3	210	220	U		5.6	220	7.4	J	J	4.6	180	200	U		5.1	200
Naphthalene	24	J	J	7.8	210	220	U		8.2	220	12	J	J	6.7	180	200	U		7.5	200
Nitrobenzene	35	J	J	10	210	220	U		11	220	180	U		9	180	200	U		10	200
N-nitrosodiphenylamine	210	U		10	210	220	U		11	220	180	U		8.7	180	200	U		9.7	200
Phenanthrene	210	U		6.6	210	220	U		7	220	14	J	J	5.7	180	200	U		6.4	200
Pyrene	210	U		6.5	210	220	U		6.8	220	32	J	J	5.6	180	200	U		6.2	200

Analyte	i-RBC	r-RBC	Background	SSL Transfer	LFSB14B 6/26/02 7-8.8 Result	Lab Q	Val Q	MDL	MRL	LFSB15A 6/26/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL
Pesticides (ug/kg)														
4,4'-DDD	12000	2700	na	11000	NT					5.93			0.169	0.799
4,4'-DDE	8400	1900	na	35000	NT					49.3			1.68	7.99
4,4'-DDT	8400	1900	na	1200	NT					45.6			2.83	7.99
delta-BHC	na	na	na	na	NT					0.799	U		0.139	0.799
Endosulfan II	610000	47000	na	20000	NT					1.23			0.285	0.799
Endrin aldehyde	na	na	na	na	NT					1.87			0.404	0.799
Endrin ketone	na	na	na	na	NT					4.46			0.644	0.799
gamma-Chlordane	8200	1800	na	920	NT					2.81			0.186	0.799
Methoxychlor	510000	39000	na	310000	NT					0.728	J	J	0.61	0.799
PCBs (mg/kg)														
PCB-1248	1.4	0.32	na	na	0.0432	U		0.0205	0.0432	0.0399	U		0.0189	0.0399
PCB-1254	1.4	0.16	na	1.1	0.0432	U		0.0127	0.0432	0.335			0.0118	0.0399
Explosives (mg/kg)														
2,4-Dinitrotoluene	200	16	na	0.57	0.2	U		0.0163	0.2	0.4	U		0.0326	0.4
Herbicides (ug/kg)														
Metals (mg/kg)														
Aluminum	100000	7800	40041	na	38300			7.2	25.9	**47800**			6.6	24
Antimony	41	3.1	na	13	0.649	U	UL	0.22	0.649	47.6		J	0.2	0.599
Arsenic	1.9	0.43	15.8	0.026	1.52		J	0.45	0.649	**26.2**		**J**	0.42	0.599
Barium	7200	550	209	2100	72.7			0.43	2.59	**2300**			0.4	2.4
Beryllium	200	16	1.02	1200	**2.36**			0.0447	0.649	0.726			0.0413	0.599
Cadmium	51	3.9	0.69	27	0.13	U		0.062	0.13	**19.8**			0.057	0.12
Calcium	na	na	na	na	11800		J	3.6	13	18000		J	3.3	12
Chromium	310	23	65.3	42	44.1		J	0.49	1.3	**281**		**J**	0.45	1.2
Cobalt	2000	160	72.3	na	8.63		J	1.1	6.49	47		J	0.97	5.99
Copper	4100	310	53.5	11000	32.6		J	0.8	2.59	**2890**		**J**	0.74	2.4
Iron	31000	2300	50962	na	42500		J	4.4	6.49	**99900**		**J**	4	5.99
Lead	800	400	26.8	na	11.9			0.039	0.389	**1650**		**J**	4.4	12
Magnesium	na	na	na	na	33700			3.1	13	7510			2.8	12
Manganese	2000	160	2543	950	298		J	0.073	1.3	2230		J	0.067	1.2
Mercury	31	2.3	0.13	na	**0.135**			0.0257	0.0649	**2.11**			0.0237	0.0599
Nickel	2000	160	62.8	na	36.4		J	1.2	5.19	**404**		**J**	1.1	4.79
Potassium	na	na	na	na	4540			43	389	2870			40	359
Silver	510	39	na	31	1.3	U		0.64	1.3	18.9		J	0.59	1.2
Sodium	na	na	na	na	77.4			4.8	25.9	2460			4.5	24
Thallium	7.2	0.55	2.11	3.6	0.26	B	J	0.039	0.389	0.099	B	J	0.036	0.359
Vanadium	102	7.8	108	730	69.5		J	0.75	6.49	31		J	0.69	5.99
Zinc	31000	2300	202	14000	55		J	0.46	2.59	**5600**		**J**	0.43	2.4
Misc.														
Total Organic Carbon (mg/kg)	na	na	na	na	NT					NT				
pH	na	na	na	na	NT					NT				

Analyte	LFSB15B 6/26/02 2-4 Result	Lab Q	Val Q	MDL	MRL	LFSB15C 6/26/02 4-6 Result	Lab Q	Val Q	MDL	MRL	LFSB16A 6/26/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL
Pesticides (ug/kg)															
4,4'-DDD	NT					NT					NT				
4,4'-DDE	NT					NT					NT				
4,4'-DDT	NT					NT					NT				
delta-BHC	NT					NT					NT				
Endosulfan II	NT					NT					NT				
Endrin aldehyde	NT					NT					NT				
Endrin ketone	NT					NT					NT				
gamma-Chlordane	NT					NT					NT				
Methoxychlor	NT					NT					NT				
PCBs (mg/kg)															
PCB-1248	0.042	U		0.0199	0.042	0.0424	U		0.0201	0.0424	NT				
PCB-1254	0.042	U		0.0124	0.042	0.0424	U		0.0125	0.0424	NT				
Explosives (mg/kg)															
2,4-Dinitrotoluene	0.2	U		0.0163	0.2	0.2	U		0.0163	0.2	NT				
Herbicides (ug/kg)															
Metals (mg/kg)															
Aluminum	18500			7	25.2	29300			7	25.5	26600			6.7	24.3
Antimony	0.631	U	UL	0.21	0.631	0.29	B	B	0.21	0.637	0.38	B	B	0.2	0.608
Arsenic	2.09		J	0.44	0.631	1.59		J	0.45	0.637	1.96		J	0.42	0.608
Barium	46			0.42	2.52	71			0.43	2.55	73.8			0.41	2.43
Beryllium	**1.34**			0.0435	0.631	**1.84**			0.0439	0.637	0.946			0.0419	0.608
Cadmium	0.126	U		0.06	0.126	0.127	U		0.061	0.127	0.122	U		0.058	0.122
Calcium	488		J	3.5	12.6	1910		J	3.6	12.7	2050		J	3.4	12.2
Chromium	30.9		J	0.47	1.26	45.9		J	0.48	1.27	28.4		J	0.45	1.22
Cobalt	9.81		J	1	6.31	10.8		J	1	6.37	20.5		J	0.98	6.08
Copper	18.9		J	0.78	2.52	36.7		J	0.79	2.55	23.6		J	0.75	2.43
Iron	24600		J	4.2	6.31	30700		J	4.3	6.37	36200		J	4.1	6.08
Lead	13.2			0.038	0.378	26.6			0.039	0.382	23.8			0.037	0.365
Magnesium	12300			3	12.6	40900			3	12.7	5030			2.9	12.2
Manganese	285		J	0.071	1.26	358		J	0.071	1.27	574		J	0.068	1.22
Mercury	0.039	B	J	0.025	0.0631	0.05	B	J	0.0252	0.0637	0.047	B	J	0.0241	0.0608
Nickel	23.3		J	1.2	5.04	36.4		J	1.2	5.1	15.6		J	1.1	4.86
Potassium	2810			42	378	7210			43	382	2440			41	365
Silver	1.26	U		0.62	1.26	0.95	B	J	0.63	1.27	1.22	U		0.6	1.22
Sodium	27		B	4.7	25.2	131			4.8	25.5	44.2			4.5	24.3
Thallium	0.22	B	J	0.038	0.378	0.23	B	J	0.038	0.382	0.15	B	J	0.037	0.365
Vanadium	43.7		J	0.73	6.31	52.9		J	0.74	6.37	53.6		J	0.7	6.08
Zinc	39.7		J	0.45	2.52	80.7		J	0.46	2.55	52.2		J	0.44	2.43
Misc.															
Total Organic Carbon (mg/kg)	NT					NT					NT				
pH	NT					NT					NT				

Analyte	LFSB16B 6/26/02 1-3 Result	Lab Q	Val Q	MDL	MRL	LFSB16C 6/26/02 3-5 Result	Lab Q	Val Q	MDL	MRL	LFSB17A 6/26/02 0-0.5 Result	Lab Q	Val Q	MDL	MRL
Pesticides (ug/kg)															
4,4'-DDD	NT					NT					NT				
4,4'-DDE	NT					NT					NT				
4,4'-DDT	NT					NT					NT				
delta-BHC	NT					NT					NT				
Endosulfan II	NT					NT					NT				
Endrin aldehyde	NT					NT					NT				
Endrin ketone	NT					NT					NT				
gamma-Chlordane	NT					NT					NT				
Methoxychlor	NT					NT					NT				
PCBs (mg/kg)															
PCB-1248	NT					NT					NT				
PCB-1254	NT					NT					NT				
Explosives (mg/kg)															
2,4-Dinitrotoluene	NT					NT					NT				
Herbicides (ug/kg)															
Metals (mg/kg)															
Aluminum	25800			7	25.3	**47900**			7.3	26.5	13800			6	21.8
Antimony	0.633	U	UL	0.21	0.633	0.662	U	UL	0.22	0.662	1.73		J	0.18	0.545
Arsenic	5.45		J	0.44	0.633	4.27		J	0.46	0.662	2.22		J	0.38	0.545
Barium	69.3			0.42	2.53	104			0.44	2.65	52.5			0.36	2.18
Beryllium	**1.72**			0.0437	0.633	**3**			0.0457	0.662	0.588			0.0376	0.545
Cadmium	0.127	U		0.06	0.127	0.132	U		0.063	0.132	0.11	B	J	0.052	0.109
Calcium	1280		J	3.5	12.7	1830		J	3.7	13.2	12100		J	3	10.9
Chromium	32.5		J	0.47	1.27	58.5		J	0.5	1.32	24.3		J	0.41	1.09
Cobalt	12.5		J	1	6.33	9.26		J	1.1	6.62	6.88		J	0.88	5.45
Copper	23.6		J	0.78	2.53	35.2		J	0.82	2.65	39.3		J	0.67	2.18
Iron	30800		J	4.3	6.33	49100		J	4.5	6.62	15900		J	3.7	5.45
Lead	22.1			0.038	0.38	16.5			0.04	0.397	**1670**		**J**	4	10.9
Magnesium	11000			3	12.7	20300			3.1	13.2	13200			2.6	10.9
Manganese	418		J	0.071	1.27	270		J	0.074	1.32	230		J	0.061	1.09
Mercury	0.0982			0.0251	0.0633	**0.15**			0.0262	0.0662	0.037	B	J	0.0216	0.0545
Nickel	28.6		J	1.2	5.06	47.4		J	1.2	5.3	11.6		J	1	4.36
Potassium	2520			42	380	5190			44	397	1960			36	327
Silver	1.27	U		0.62	1.27	1.32	U		0.65	1.32	1.09	U		0.54	1.09
Sodium	29.2		B	4.7	25.3	47.1			4.9	26.5	52.9			4.1	21.8
Thallium	0.26	B	J	0.038	0.38	0.34	B	J	0.04	0.397	0.12	B	J	0.033	0.327
Vanadium	50		J	0.73	6.33	71.7		J	0.77	6.62	28.5		J	0.63	5.45
Zinc	50.6		J	0.45	2.53	64.2		J	0.47	2.65	87.4		J	0.39	2.18
Misc.															
Total Organic Carbon (mg/kg)	NT					NT					NT				
pH	NT					NT					NT				

Analyte	LFSB17B 6/26/02 1-3 Result	Lab Q	Val Q	MDL	MRL
Pesticides (ug/kg)					
4,4'-DDD	NT				
4,4'-DDE	NT				
4,4'-DDT	NT				
delta-BHC	NT				
Endosulfan II	NT				
Endrin aldehyde	NT				
Endrin ketone	NT				
gamma-Chlordane	NT				
Methoxychlor	NT				
PCBs (mg/kg)					
PCB-1248	NT				
PCB-1254	NT				
Explosives (mg/kg)					
2,4-Dinitrotoluene	NT				
Herbicides (ug/kg)					
Metals (mg/kg)					
Aluminum	20900			6.7	24.2
Antimony	0.605	U	UL	0.2	0.605
Arsenic	1.79		J	0.42	0.605
Barium	25.3			0.4	2.42
Beryllium	**1.06**			0.0418	0.605
Cadmium	0.121	U		0.058	0.121
Calcium	55700		J	3.4	12.1
Chromium	35.5		J	0.45	1.21
Cobalt	9.24		J	0.98	6.05
Copper	10.8		J	0.75	2.42
Iron	19600		J	4.1	6.05
Lead	18.3			0.037	0.363
Magnesium	60400			2.9	12.1
Manganese	137		J	0.068	1.21
Mercury	0.0605	U		0.024	0.0605
Nickel	20.4		J	1.1	4.84
Potassium	7870			40	363
Silver	1.21	U		0.6	1.21
Sodium	104			4.5	24.2
Thallium	0.19	B	J	0.036	0.363
Vanadium	41		J	0.7	6.05
Zinc	26		J	0.43	2.42
Misc.					
Total Organic Carbon (mg/kg)	NT				
pH	NT				

Table 5-4
Dioxins/Furans Detected in Soil - 2002 RFI

Analyte				Sample ID / Sample Date / Sample Depth	LFSS01 6/26/02 0-0.5					LFSS02 6/26/02 0-0.5					LFSS03 6/26/02 0-0.5					LFSB12A 6/26/02 0-0.5					LFSB12B 6/26/02 2-4					LFSB12C 6/26/02 4-5.4					LFSB13A 6/26/02 8.3-9				
	i-RBC	r-RBC	Background	SSL Transfer	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Dioxins/Furans (ng/kg)																																							
2,3,7,8-TCDF	na	na	na	na	1.615		J	*0.19*	*0.154*	0.437		J	*0.19*	*0.163*	25.96		J	*0.19*	*0.246*	1.211		J	*0.19*	*0.543*	0.094	U		*0.19*	*0.094*	0.213	U		*0.19*	*0.213*	0.193	U		*0.19*	*0.193*
2,3,7,8-TCDD	19	4.3	na	8.6	1.366	X	J	*0.13*	*0.072*	0.368	X	J	*0.13*	*0.076*	12.07	X	J	*0.13*	*0.024*	0.165	U		*0.13*	*0.165*	0.254	U		*0.13*	*0.254*	0.272	U		*0.13*	*0.272*	0.27	U		*0.13*	*0.27*
1,2,3,7,8-PECDD	na	na	na	na	2.777		J	*0.19*	*0.204*	0.622		J	*0.19*	*0.145*	8.679		J	*0.19*	*0.696*	1.055	X	J	*0.19*	*0.203*	0.208	U		*0.19*	*0.208*	0.225	U		*0.19*	*0.225*	0.173	U		*0.19*	*0.173*
1,2,3,4,7,8-HXCDD	na	na	na	na	7.05		J	*0.53*	*0.175*	1.49		J	*0.53*	*0.12*	15.64		J	*0.53*	*0.561*	1.993			*0.53*	*0.294*	0.291	U		*0.53*	*0.291*	0.319	U		*0.53*	*0.319*	0.278	U		*0.53*	*0.278*
1,2,3,6,7,8-HXCDD	na	na	na	na	9.289		J	*0.57*	*0.137*	1.975		J	*0.57*	*0.096*	22.35		J	*0.57*	*0.439*	2.956			*0.57*	*0.231*	0.228	U		*0.57*	*0.228*	0.25	U		*0.57*	*0.25*	0.218	U		*0.57*	*0.218*
1,2,3,7,8,9-HXCDD	460	100	na	na	15.01		J	*0.68*	*0.133*	2.972		J	*0.68*	*0.099*	36.04		J	*0.68*	*0.425*	4.969			*0.68*	*0.223*	0.221	U		*0.68*	*0.221*	0.242	U		*0.68*	*0.242*	0.211	U		*0.68*	*0.211*
1,2,3,4,6,7,8-HPCDD	na	na	na	na	153		J	*0.63*	*0.096*	46.97		J	*0.63*	*0.112*	220.5		J	*0.63*	*0.355*	62.85			*0.63*	*0.422*	5.233			*0.63*	*0.238*	2.494	X	J	*0.63*	*0.277*	0.221	U		*0.63*	*0.221*
OCDD	na	na	na	na	873.4		J	*6.86*	*0.134*	2464	B	J	*6.86*	*0.087*	1313		J	*6.86*	*0.21*	1311			*6.86*	*0.258*	35.21			*6.86*	*0.334*	30.78			*6.86*	*0.307*	50.02			*6.86*	*0.216*
1,2,3,7,8-PECDF	na	na	na	na	1.013		J	*0.28*	*0.211*	0.32		J	*0.28*	*0.067*	18.52		J	*0.28*	*0.57*	0.719	X	J	*0.28*	*0.161*	0.262	U		*0.28*	*0.262*	0.161	U		*0.28*	*0.161*	0.13	U		*0.28*	*0.13*
2,3,4,7,8-PECDF	na	na	na	na	2.803		J	*0.56*	*0.22*	0.788		J	*0.56*	*0.074*	46.47		J	*0.56*	*0.597*	1.22			*0.56*	*0.169*	0.274	U		*0.56*	*0.274*	0.169	U		*0.56*	*0.169*	0.136	U		*0.56*	*0.136*
1,2,3,4,7,8-HXCDF	na	na	na	na	7.171		J	*0.34*	*0.131*	2.282		J	*0.34*	*0.059*	176.4		J	*0.34*	*0.29*	6.468			*0.34*	*0.257*	0.121	U		*0.34*	*0.121*	0.191	U		*0.34*	*0.191*	0.148	U		*0.34*	*0.148*
1,2,3,6,7,8-HXCDF	na	na	na	na	2.008		J	*0.49*	*0.127*	1.055		J	*0.49*	*0.058*	49.9	I	J	*0.49*	*0.282*	1.593	I	J	*0.49*	*0.25*	0.118	U		*0.49*	*0.118*	0.186	U		*0.49*	*0.186*	0.144	U		*0.49*	*0.144*
2,3,4,6,7,8-HXCDF	na	na	na	na	2.87		J	*0.47*	*0.149*	1.283		J	*0.47*	*0.072*	7.765		J	*0.47*	*0.33*	2.244			*0.47*	*0.292*	0.138	U		*0.47*	*0.138*	0.217	U		*0.47*	*0.217*	0.168	U		*0.47*	*0.168*
1,2,3,7,8,9-HXCDF	na	na	na	na	0.15	U	UJ	*0.25*	*0.15*	0.077	U	UJ	*0.25*	*0.077*	3.205		J	*0.25*	*0.332*	0.294	U		*0.25*	*0.294*	0.139	U		*0.25*	*0.139*	0.219	U		*0.25*	*0.219*	0.169	U		*0.25*	*0.169*
1,2,3,4,6,7,8-HPCDF	na	na	na	na	26.17		J	*0.33*	*0.104*	11.87		J	*0.33*	*0.062*	323.7		J	*0.33*	*0.149*	17.19			*0.33*	*0.194*	0.924			*0.33*	*0.119*	0.498	X	J	*0.33*	*0.149*	0.119	U		*0.33*	*0.119*
1,2,3,4,7,8,9-HPCDF	na	na	na	na	2.095		J	*0.5*	*0.134*	0.685		J	*0.5*	*0.084*	22.47		J	*0.5*	*0.193*	1.167			*0.5*	*0.25*	0.153	U		*0.5*	*0.153*	0.192	U		*0.5*	*0.192*	0.153	U		*0.5*	*0.153*
OCDF	na	na	na	na	49.59		J	*0.79*	*0.163*	17.93		J	*0.79*	*0.07*	181.7		J	*0.79*	*0.231*	29.75			*0.79*	*0.354*	3.081			*0.79*	*0.532*	0.394	U		*0.79*	*0.394*	0.274	U		*0.79*	*0.274*
TOTAL TCDD	na	na	na	na	1.463		J		*0.072*	0.076	U	UJ		*0.076*	4.198		J		*0.024*	1.913				*0.165*	0.254	U			*0.254*	0.272	U			*0.272*	0.27	U			*0.27*
TOTAL PECDD	na	na	na	na	14.59		J		*0.204*	0.622		J		*0.145*	19.81		J		*0.696*	0.393				*0.203*	0.208	U			*0.208*	0.225	U			*0.225*	0.173	U			*0.173*
TOTAL HXCDD	na	na	na	na	115.8		J		*0.133*	18.71		J		*0.096*	263.4		J		*0.425*	29.92				*0.223*	0.221	U			*0.221*	0.242	U			*0.242*	0.211	U			*0.211*
TOTAL HPCDD	na	na	na	na	312		J		*0.096*	94.32		J		*0.112*	415.3		J		*0.355*	141.7				*0.422*	5.233				*0.238*	2.044				*0.277*	1.138				*0.221*
TOTAL TCDF	na	na	na	na	27.09		J		*0.194*	6.861		J		*0.073*	314		J		*0.203*	15.68				*0.242*	0.094	U			*0.094*	0.213	U			*0.213*	0.193	U			*0.193*
TOTAL PECDF	na	na	na	na	22.15		J		*0.211*	3.947		J		*0.067*	305		J		*0.57*	11.33				*0.161*	0.262	U			*0.262*	0.161	U			*0.161*	0.13	U			*0.13*
TOTAL HXCDF	na	na	na	na	33.69		J		*0.127*	14.08		J		*0.058*	597.3		J		*0.282*	24.93				*0.25*	0.118	U			*0.118*	0.186	U			*0.186*	0.144	U			*0.144*
TOTAL HPCDF	na	na	na	na	61.85		J		*0.104*	24.98		J		*0.062*	444.8		J		*0.149*	20.39				*0.194*	0.924				*0.119*	0.149	U			*0.149*	0.119	U			*0.119*
TCDD TE	19	4.3	na	8.6	12.02					3.401					84.45					4.985					0.8140					0.8082					0.6804				
TCDD RME	19	4.3	na	8.6	12.01					3.397					84.45					4.888					0.4397					0.4206					0.3427				

Analyte				Sample ID / Sample Date / Sample Depth	LFSB14A 6/26/02 5.5-7					LFSB14B 6/26/02 7-8.8					LFSB15A 6/26/02 0-0.5					LFSB15B 6/26/02 2-4					LFSB15C 6/26/02 4-6					LFSB16A 6/26/02 0-0.5					LFSB17A 6/26/02 0-0.5				
	i-RBC	r-RBC	Background	SSL Transfer	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Dioxins/Furans (ng/kg)																																							
2,3,7,8-TCDF	na	na	na	na	0.172	U		*0.19*	*0.172*	0.076	U		*0.19*	*0.076*	39.08		J	*0.19*	*0.509*	0.294	U		*0.19*	*0.294*	0.233	U	UJ	*0.19*	*0.233*	0.229	U	UJ	*0.19*	*0.229*	1.315		J	*0.19*	*0.355*
2,3,7,8-TCDD	19	4.3	na	8.6	0.166	U		*0.13*	*0.166*	0.23	U		*0.13*	*0.23*	5.232			*0.13*	*0.144*	0.369	U		*0.13*	*0.369*	0.291	U		*0.13*	*0.291*	0.166	U		*0.13*	*0.166*	0.041	U	UJ	*0.13*	*0.041*
1,2,3,7,8-PECDD	na	na	na	na	0.162	U		*0.19*	*0.162*	0.176	U		*0.19*	*0.176*	33.8			*0.19*	*0.223*	0.255	U		*0.19*	*0.255*	0.236	U		*0.19*	*0.236*	0.255	U		*0.19*	*0.255*	0.997		J	*0.19*	*0.211*
1,2,3,4,7,8-HXCDD	na	na	na	na	0.171	U		*0.53*	*0.171*	0.178	U		*0.53*	*0.178*	76.1			*0.53*	*0.333*	0.306	U		*0.53*	*0.306*	0.24	U		*0.53*	*0.24*	0.211	U		*0.53*	*0.211*	1.733		J	*0.53*	*0.196*
1,2,3,6,7,8-HXCDD	na	na	na	na	0.134	U		*0.57*	*0.134*	0.14	U		*0.57*	*0.14*	160.5			*0.57*	*0.261*	0.239	U		*0.57*	*0.239*	0.188	U		*0.57*	*0.188*	0.801			*0.57*	*0.165*	3.003		J	*0.57*	*0.154*
1,2,3,7,8,9-HXCDD	460	100	na	na	0.13	U		*0.68*	*0.13*	0.135	U		*0.68*	*0.135*	190.5			*0.68*	*0.253*	0.232	U		*0.68*	*0.232*	0.182	U		*0.68*	*0.182*	1.159	X	J	*0.68*	*0.16*	5.006		J	*0.68*	*0.149*
1,2,3,4,6,7,8-HPCDD	na	na	na	na	3.527			*0.63*	*0.161*	1.476			*0.63*	*0.147*	2967			*0.63*	*0.347*	3.588			*0.63*	*0.235*	3.429			*0.63*	*0.135*	22.77			*0.63*	*0.288*	63.5		J	*0.63*	*0.152*
OCDD	na	na	na	na	90.87			*6.86*	*0.147*	63.86		J	*6.86*	*0.162*	7298		J	*6.86*	*0.31*	730.4			*6.86*	*0.237*	57.36		J	*6.86*	*0.227*	1468			*6.86*	*0.219*	1420		J	*6.86*	*0.146*
1,2,3,7,8-PECDF	na	na	na	na	0.123	U		*0.28*	*0.123*	0.133	U		*0.28*	*0.133*	49.17			*0.28*	*0.485*	0.244	U		*0.28*	*0.244*	0.142	U		*0.28*	*0.142*	0.181	U		*0.28*	*0.181*	1.033		J	*0.28*	*0.16*
2,3,4,7,8-PECDF	na	na	na	na	0.128	U		*0.56*	*0.128*	0.139	U		*0.56*	*0.139*	124.9			*0.56*	*0.507*	0.255	U		*0.56*	*0.255*	0.148	U		*0.56*	*0.148*	0.189	U		*0.56*	*0.189*	1.599	X	J	*0.56*	*0.168*
1,2,3,4,7,8-HXCDF	na	na	na	na	0.095	U		*0.34*	*0.095*	0.103	U		*0.34*	*0.103*	756.9			*0.34*	*0.46*	0.122	U		*0.34*	*0.122*	1.981			*0.34*	*0.109*	1.2	X	J	*0.34*	*0.144*	5.912		J	*0.34*	*0.12*
1,2,3,6,7,8-HXCDF	na	na	na	na	0.093	U		*0.49*	*0.093*	0.1	U		*0.49*	*0.1*	168.1	I	J	*0.49*	*0.447*	0.119	U		*0.49*	*0.119*	0.683			*0.49*	*0.106*	0.141	U		*0.49*	*0.141*	1.749		J	*0.49*	*0.117*
2,3,4,6,7,8-HXCDF	na	na	na	na	0.109	U		*0.47*	*0.109*	0.117	U		*0.47*	*0.117*	287.5			*0.47*	*0.523*	0.139	U		*0.47*	*0.139*	0.977			*0.47*	*0.124*	0.165	U		*0.47*	*0.165*	2.404		J	*0.47*	*0.137*
1,2,3,7,8,9-HXCDF	na	na	na	na	0.109	U		*0.25*	*0.109*	0.118	U		*0.25*	*0.118*	11.22			*0.25*	*0.527*	0.14	U		*0.25*	*0.14*	0.125	U		*0.25*	*0.125*	0.166	U		*0.25*	*0.166*	0.138	U	UJ	*0.25*	*0.138*
1,2,3,4,6,7,8-HPCDF	na	na	na	na	1.217			*0.33*	*0.099*	0.265	X	J	*0.33*	*0.076*	1660			*0.33*	*0.129*	0.653			*0.33*	*0.085*	4.843			*0.33*	*0.1*	5.907			*0.33*	*0.139*	16.55		J	*0.33*	*0.095*
1,2,3,4,7,8,9-HPCDF	na	na	na	na	0.128	U		*0.5*	*0.128*	0.098	U		*0.5*	*0.098*	147.1			*0.5*	*0.166*	0.109	U		*0.5*	*0.109*	0.517			*0.5*	*0.129*	0.563	X	J	*0.5*	*0.18*	1.115		J	*0.5*	*0.123*
OCDF	na	na	na	na	11.47			*0.79*	*0.257*	0.96		J	*0.79*	*0.174*	1263		J	*0.79*	*0.19*	0.279	U		*0.79*	*0.279*	3.15		J	*0.79*	*0.216*	16.22			*0.79*	*0.262*	26.97		J	*0.79*	*0.206*
TOTAL TCDD	na	na	na	na	0.166	U			*0.166*	0.23	U			*0.23*	216.9				*0.144*	0.369	U			*0.369*	0.291	U			*0.291*	0.166	U			*0.166*	0.382		J		*0.041*
TOTAL PECDD	na	na	na	na	0.162	U			*0.162*	0.176	U			*0.176*	396.3				*0.223*	0.255	U			*0.255*	0.236	U			*0.236*	0.255	U			*0.255*	2.253		J		*0.211*
TOTAL HXCDD	na	na	na	na	0.13	U			*0.13*	0.135	U			*0.135*	1741				*0.253*	0.232	U			*0.232*	1.452				*0.182*	3.85				*0.16*	27.49		J		*0.149*
TOTAL HPCDD	na	na	na	na	6.197				*0.161*	2.839				*0.147*	6654				*0.347*	6.77				*0.235*	3.429				*0.135*	43.92				*0.288*	127.5		J		*0.152*
TOTAL TCDF	na	na	na	na	0.172	U			*0.172*	0.076	U			*0.076*	1048				*0.483*	0.294	U			*0.294*	2.463				*0.22*	0.239	U			*0.239*	23.59		J		*0.182*
TOTAL PECDF	na	na	na	na	0.123	U			*0.123*	0.133	U			*0.133*	1123				*0.485*	0.244	U			*0.244*	2.137				*0.142*	0.938				*0.181*	13.82		J		*0.16*
TOTAL HXCDF	na	na	na	na	0.396				*0.093*	0.1	U			*0.1*	2202				*0.447*	0.119	U			*0.119*	5.745				*0.106*	2.19				*0.141*	22.38		J		*0.117*
TOTAL HPCDF	na	na	na	na	4.908				*0.099*	0.076	U			*0.076*	2015				*0.129*	0.653				*0.085*	5.36				*0.1*	14.94				*0.139*	32.06		J		*0.095*
TCDD TE	19	4.3	na	8.6	0.5584					0.6037					321.5					1.039					1.163					1.373					4.971				
TCDD RME	19	4.3	na	8.6	0.3080					0.3138					321.5					0.5774					0.8105					1.065					4.944				

slightly above the health protective criterion for lead. For the residential scenario, site concentrations of lead in total soil were above the health protective criterion for lead. These results indicate that for current scenarios, health risks are limited, but are more elevated for future scenarios, especially residential scenarios. Industrial scenarios are more appropriate as long as SWMU 17A is active.

A SLERA was also conducted at the FLFA to identify risks to ecological receptors. The Tier 2 food chain assessment suggests potential adverse impacts to terrestrial wildlife, especially shrews, robins, and voles for modeled contact with the hazard drivers (primarily organic compounds: 2,3,7,8-TCDD-TE and 4,4-DDT, and inorganic constituents: chromium, copper, and barium) in surface soil. The direct contact assessment Tier 2 results suggest a potential reduction in wildlife food supply due to copper, mercury, zinc, lead, chromium, barium, and nickel in surface soil. Analysis of the site and background data indicates that one of the Tier 2 inorganic chemical of potential ecological concern drivers, cobalt, is statistically related to naturally occurring surface soil concentrations. Risks would be somewhat mitigated by the small size of the site (0.36 acres) and the fact that the FLFA is within the footprint of an active burn area, making this area less attractive to ecological receptors.

5.4 CONCEPTUAL SITE MODEL

Potentially affected media at the FLFA include surface and subsurface soil; groundwater; surface water and sediment. The FLFA is located in a steeply sloping depression formed by a sinkhole. Based on the occurrence of lead slag, lead was most likely off-loaded at the rim of the sinkhole and transported to the furnace located at the bottom of the depression. Precipitation is expected to flow down the hill sides of the depression towards the FLFA and infiltrate into the ground. Site workers and terrestrial biota are considered receptors. **Table 5-5** presents the exposure pathways for each human receptor. Ecological and human exposure pathways are shown on **Figure 5-8** (current) and **Figure 5-9** (future). The exposures pathways associated with each media type are described in more detail in the following paragraphs.

Surface soil was impacted by operations at the lead furnace. In 1998, this pathway was mitigated by the removal of the furnace structure and lead-containing soil immediately around the structure. Confirmatory sampling indicated that there was at least one remaining area of soil with an elevated lead concentration. The presence of lead in soil beyond the limits of the FLFA indicate that site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with impacted soil, and the inhalation of ash or dust.

Subsurface soil was also potentially impacted by the lead smelting operations. The 1998 removal of the furnace structure and lead-containing soil around it mitigated this pathway by removing the main source of lead. The concentration of leachable lead was initially 500,000 µg/L. After the removal of the soil and furnace, the leachable lead concentration was 500 µg/L, a thousand fold decrease in concentration. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Table 5-5
Selection of Exposure Pathways - FLFA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	FLFA	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at FLFA and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to surface soil at FLFA on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to surface soil at FLFA on a daily basis.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	FLFA	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at FLFA.
				Industrial Worker	Adult	Inhalation	On-site	None	There are no workers currently exposed to airborne volatiles or particulates from surface soil at FLFA on a daily basis.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	FLFA	None	None	None	On-site	None	Current excavation or construction activities are not occurring at FLFA.
	Groundwater	Groundwater	FLFA	None	None	None	On-site	None	Groundwater is not currently being used at FLFA. Therefore, there is currently no direct exposure to groundwater.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
Future	Surface Soil	Surface Soil	FLFA	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at FLFA and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact surface soil at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact surface soil at FLFA and be exposed to COPCs via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

Table 5-5
Selection of Exposure Pathways - FLFA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Surface Soil	Air	FLFA	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at FLFA.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from surface soil at FLFA.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	FLFA	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact soil at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact soil at FLFA and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact soil at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact soil at FLFA and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact soil at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact soil at FLFA and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
					Child	Ingestion	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	FLFA	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from soils at FLFA.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from soils at FLFA.
				Excavation Worker	Adult	Inhalation	On-site	Quant	Excavation workers could be exposed to airborne volatiles or particulate matter released from soils at FLFA.

Table 5-5
Selection of Exposure Pathways - FLFA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Total Soil (Surface and Subsurface)	Air	FLFA	Resident	Adult	Inhalation	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
					Child	Inhalation	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
				Trespasser	Adolescent	Inhalation	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Sediment	Sediment	FLFA - Spring (Assumes the spring will increase in size)	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact sediment at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact sediment at FLFA and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact sediment at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact sediment at FLFA and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact sediment at FLFA and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact sediment at FLFA and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	Adult residents could contact sediment at FLFA and be exposed to COPCs via incidental ingestion during wading or swimming.
						Dermal	On-site	Quant	Adult residents could contact sediment at FLFA and be exposed to COPCs via dermal absorption during wading or swimming.
					Child	Ingestion	On-site	Quant	Child residents could contact sediment at FLFA and be exposed to COPCs via incidental ingestion during wading or swimming.
						Dermal	On-site	Quant	Child residents could contact sediment at FLFA and be exposed to COPCs via dermal absorption during wading or swimming.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Surface Water	Surface Water	FLFA - Spring (Assumes the spring will increase in size)	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers could contact surface water at FLFA while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Maintenance workers could contact surface water at FLFA and be exposed to COPCs via dermal absorption while wading.
				Industrial Worker	Adult	Ingestion	On-site	None	Industrial workers could contact surface water at FLFA while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Industrial workers could contact surface water at FLFA and be exposed to COPCs via dermal absorption while wading.

Table 5-5
Selection of Exposure Pathways - FLFA

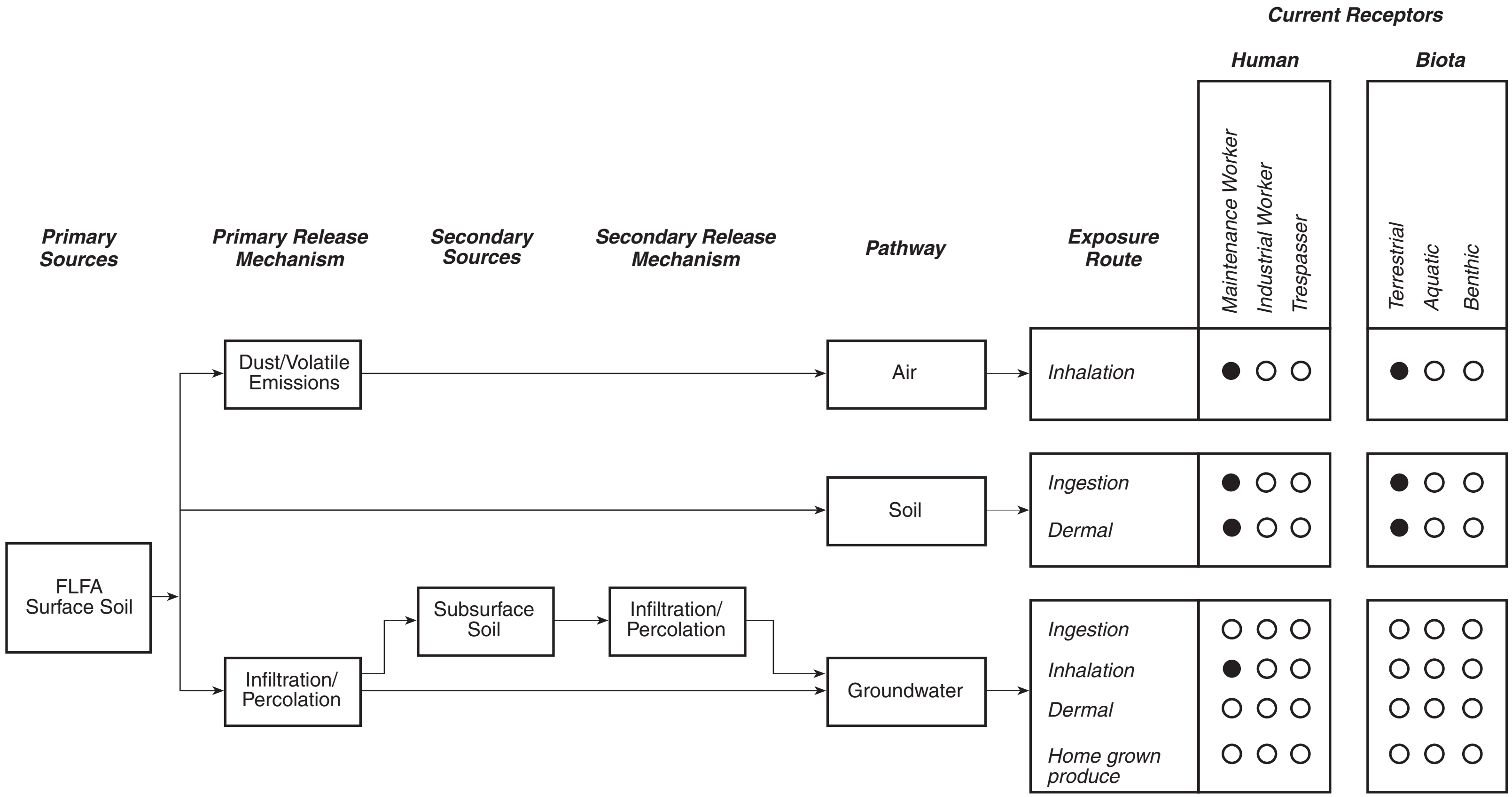
Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Surface Water	Surface Water	FLFA - Spring (Assumes the spring will increase in size)	Excavation Worker	Adult	Ingestion	On-site	None	Excavation workers could contact surface water at FLFA while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Excavation workers could contact surface water at FLFA and be exposed to COPCs via dermal absorption while wading.
				Resident	Adult	Ingestion	On-site	Quant	Residents could contact surface water at FLFA while wading or swimming. Surface water ingestion while wading is considered unlikely.
						Dermal	On-site	Quant	Adult residents could contact surface water at FLFA and be exposed to COPCs via dermal absorption while wading or swimming.
					Child	Ingestion	On-site	Quant	Residents could contact surface water at FLFA while wading or swimming. Surface water ingestion while wading is considered unlikely. Surface water ingestion while swimming is evaluated.
						Dermal	On-site	Quant	Child residents could contact surface water at FLFA and be exposed to COPCs via dermal absorption while wading or swimming.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Groundwater	Groundwater	FLFA	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers would not contact groundwater at FLFA.
						Dermal	On-site	None	Maintenance workers would not contact groundwater at FLFA.
				Industrial Worker	Adult	Ingestion	On-site	Quant	If FLFA were to be further developed for industrial purposes and groundwater wells were installed at the site, site workers could be exposed to COPCs in groundwater via ingestion.
						Dermal	On-site	None	Although site worker dermal exposures to groundwater could occur, the exposed body surface of a worker (i.e., hands and arms) would be small and exposures would be infrequent.
				Excavation Worker	Adult	Ingestion	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at FLFA.
						Dermal	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at FLFA.
				Resident	Adult	Ingestion	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If FLFA were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.

Table 5-5
Selection of Exposure Pathways - FLFA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Groundwater	FLFA	Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
		Homegrown fruits and vegetables	FLFA	Resident	Adult	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into a construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	On-site	Quant	If groundwater wells were installed for residential purposes, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	On-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
					Child	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Groundwater	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	Off-site	None	The residential scenario would be protective of the limited exposure that would be experienced by a trespasser.
						Dermal	Off-site	None	The residential scenario would be protective of the limited exposure that would be experienced by a trespasser.
		Homegrown fruits and vegetables	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.

Table 5-5
Selection of Exposure Pathways - FLFA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, volatiles could be released from groundwater into ambient air. Off-site maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into an off-site construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from FLFA groundwater were to migrate to off-site wells in the future, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	Off-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
					Child	Inhalation	Off-site	Quant	If COPCs from FLFA groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	Off-site	None	The maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.



● Indicates pathway/receptor combinations to be evaluated

○ Indicates pathway/receptor combinations incomplete or no source

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Figure 5-8. Current Land Use Conceptual Site Model for FLFA Radford Army Ammunition Plant, Virginia

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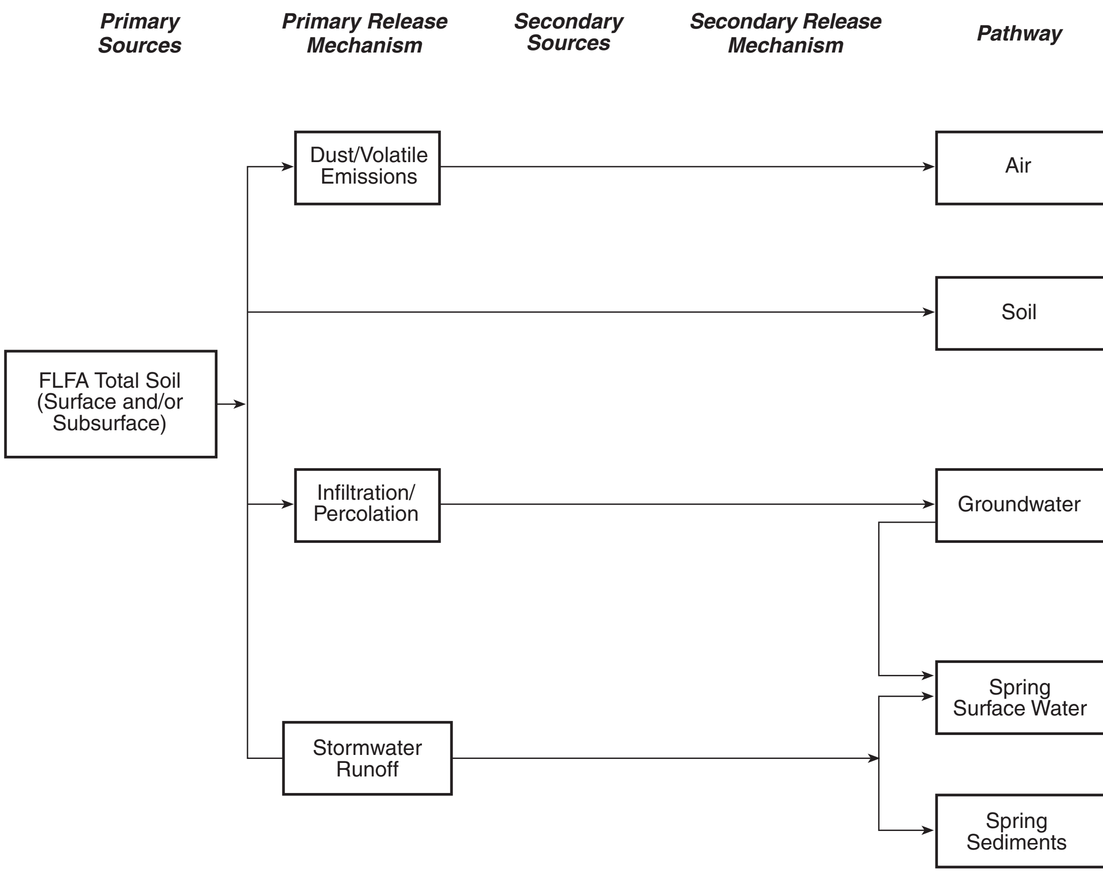
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w



Future Receptors

Pathway	Exposure Route	Human: Maintenance Worker	Human: Industrial Worker	Human: Excavation Worker	Human: Adult Resident	Human: Child Resident	Human: Trespasser	Biota: Terrestrial	Biota: Aquatic	Biota: Benthic
Air	*Inhalation*	●	●	●	●	●	○	●	○	○
Soil	*Ingestion*	●	●	●	●	●	○	●	○	○
Soil	*Dermal*	●	●	●	●	●	○	●	○	○
Groundwater	*Ingestion*	○	●	○	●	●	○	○	○	○
Groundwater	*Inhalation*	●	●	●	●	●	○	○	○	○
Groundwater	*Dermal*	○	○	○	●	●	○	○	○	○
Groundwater	*Home grown produce*	○	○	○	●	●	○	○	○	○
Spring Surface Water	*Ingestion*	○	○	○	●	●	○	●	●	○
Spring Surface Water	*Dermal*	●	●	●	●	●	○	●	●	○
Spring Sediments	*Ingestion*	●	●	●	●	●	○	●	●	○
Spring Sediments	*Dermal*	●	●	●	●	●	○	●	●	○

● Indicates pathway/receptor combinations to be evaluated

○ Indicates pathway/receptor combinations incomplete or no source

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Figure 5-9. Future Land Use Conceptual Site Model for FLFA Radford Army Ammunition Plant, Virginia

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	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w

Groundwater is potentially impacted form downward migration of constituents form site soil. A dye-trace study showed a link between the sinkhole and a spring on the New River. Surface water and sediment in the spring are potentially impacted through groundwater discharge in this area.

5.5 DATA GAP ANALYSIS

This section identifies data gaps in the current understanding of the site and is the basis for the investigation approach described in the next section.

Several previous investigations have been conducted at the FLFA and the majority of the source area has been removed. Small areas of elevated lead remained after the removal of the furnace and soil in 1998 and the 2002 investigation identified two other areas of elevated lead. Complete characterization of the site soil for lead, PCBs and dioxin/furans is a data gap that will be addressed through an on-site X-ray fluorescence (XRF) survey combined with fixed-laboratory confirmation sampling for TAL metals, TCL PCBs and dioxins/furans.

Previous investigations have not incorporated a groundwater component. Groundwater is a data gap for TCL VOCs, SVOCs, PAHs, pest/PCBs, explosives, herbicides, TAL metals, dioxins/furans, and perchlorate.

Although there is no surface water or sediment on site, the spring (SPG3) where the 1994 dye trace showed discharge from the FLFA/SWMU 17A area has not been sampled and is a potential data gap.

5.6 INVESTIGATION APPROACH

In order to complete the characterization of the FLFA, additional sampling is required to fully delineate the extent of lead, PCBs, and dioxins/furans in soil and investigate the groundwater in the area. A summary of the proposed samples and analyses is presented in **Table 5-6** and are shown on **Figure 5-6**.

<u>Soil:</u> An XRF survey will be used to complete the delineation of lead in soil. XRF analysis provides a field analytical method for analysis of lead in soil. XRF is capable of detecting lead in soil down to 20 mg/kg. By obtaining real-time data for lead concentrations, new sample locations can be guided by results from previous samples. XRF sampling will be conducted in accordance with SOP 30.13, located in **Appendix A**. A 220 ft by120 ft grid will be superimposed over the site with grid line intersections at 5-foot intervals. Initially, samples will be collected from 12 locations around the perimeter of elevated lead defined by previous samples. Approximately 12 samples can be collected and analyzed by XRF in a day. Samples will be collected, stepping outward along grid lines, until sample concentrations are below the residential screening level of 400 mg/kg. It is assumed that approximately 60 XRF samples (LFXR01-LFXR60) will be collected at the FLFA; however, sampling will continue until the extent of lead is bound or the limits of the site, as defined by RFAAP and USACE, have been reached. Soil outside the FLFA boundary is be addressed as part of a separate, future effort related to SWMU 17A.

Once the limits of lead above the residential clean-up criteria have been defined with the XRF, confirmation samples will be collected at the perimeter of the delineated area and analyzed at a fixed-base laboratory. It is anticipated that ten samples (LFSS05-LFSS14) will be sufficient to confirm the XRF results. The confirmation samples will be analyzed for PCBs and dioxins/furans in addition to TAL metals, since these parameters were also elevated in site soil.

Table 5-6
Proposed Sampling and Analysis Plan
Former Lead Furnace Area
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
Former Lead Furnace Area (FLFA)				
Surface Soil	LFXR01-60	0-0.5 ft bgs	Within defined FLFA Area	XRF Lead. A sufficient number of samples will be collected and screened to define the extent of lead in soil.
	LFSS04-14	0-0.5 ft bgs	At boundiaries of lead containing soil defined by XRF	TAL metals, TCL PCBs, dioxins/furans (assume 10 samples)
	LFSS15-21	0-0.5 ft bgs	Random grid samples within area defined by XRF	TAL metals, TCL PCBs, dioxins/furans (6 samples)
Groundwater	LFMW01	water table	in sinkhole near original furnace location.	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	17PZ01	water table	exisiting upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	17MW2	water table	exisiting upgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
	17MW3	water table	existing cross/downgradient well	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
Surface Water	LFSW01	NA	at spring discharge on New River	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate
Sediment	LFSD01	NA	at spring discharge on New River	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, perchlorate

In addition to the confirmation samples, six samples (LFSS15-LFSS21) from within the boundary of the lead-containing soil will be analyzed for PCBs and dioxins/furans to assess the soil for these constituents. These samples will be collected from randomly picked grid cells in accordance with systematic grid sampling strategy as defined in SOP 30.7 of the MWP (URS, 2003a).

Groundwater: In order to characterize the groundwater at the FLFA, a monitoring well (LFMW01) will be installed in the sinkhole by the original furnace location.

Drilling will be performed with HSA to allow split spoon sampling. If water is encountered in the overburden, the well will be installed through the augers. If additional drilling into the bedrock is required, drilling will switch to Air rotary drilling and will continue until water is encountered. The well will be constructed of two inch Schedule 40 PVC with 0.01 inch slot size screen. Ten feet of screened material will be used unless the rate of water production is low, in which case 15 to 20 ft of screen may be used. Number 1 sand will be used as a filter pack. The wells will be developed using a high capacity submersible pump, and will be periodically surged during development. Water quality parameters will be measured and recorded during development. Drilling and monitoring well installation will be performed in accordance with Section 5.2 and SOPs 20.1, 20.2 and 20.11 of the MWP (URS, 2003a).

Groundwater sampling from the existing wells and the newly installed well will be performed using low-flow sampling techniques and a submersible pump. Water quality parameters will be monitored until stabilized (3 consecutive readings within 10%), the flow cell will be removed, the flow rate will be reduced to 100 ml/min and then sampling will be performed. Groundwater samples will be obtained from the newly installed well and existing wells 17PZ1, 17MW2, and 17MW3. Samples from these wells will be analyzed for TCL VOCs, SVOCs, PAHs, pest/PCBs, explosives, herbicides, TAL metals, dioxins/furans, and perchlorate.

A surface water/sediment sample will be collected from the spring on the New River where a dye-trace study (Engineering Science, 1994) indicated discharge from the FLFA/SWMU 17A sinkhole. These samples will also be analyzed for TCL VOCs, SVOCs, PAHs, pest/PCBs, explosives, herbicides, TAL metals, dioxins/furans, and perchlorate.

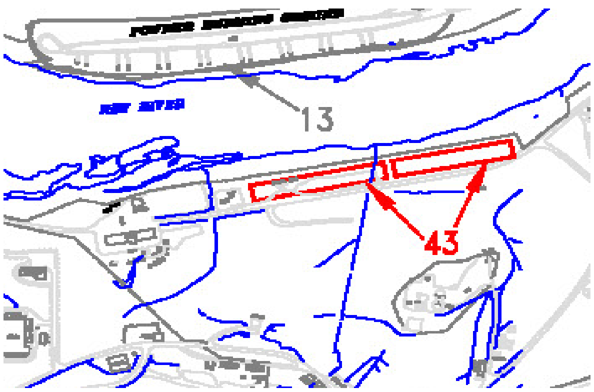
Any available groundwater data from new or existing wells at SWMU 40/71 will be incorporated into the groundwater analysis for the FLFA as well since these sites are in the expected downgradient direction from the FLFA.

6.0 SWMU 43 – SANITARY LANDFILL NO. 2

6.1 SITE DESCRIPTION AND HISTORY

6.1.1 Site Description

SWMU 43 is a closed unlined sanitary landfill consisting of two adjacent two-acre cells located immediately adjacent to the New River in the northeast section of the MMA (**Figure 6-1**).



SWMU 43 is a flat level area at an approximate elevation of 1,700 ft msl. A drainage ditch located in the center of the SWMU divides the area into east and west sections. Based on aerial photography, the landfill apparently extends east-west approximately 600 ft on either side of the drainage ditch. The north-south boundaries are the riverbank and paved roadway, respectively.

The western section is mostly grassy but has a small concrete pad and a gravel parking area, which are currently used to store office and equipment trailers. Former descriptions of the site noted a pile of soil located adjacent to the roadway at the western end of the site that is no longer present. The eastern section is covered entirely with grass. Elongated depressions, which corresponded to the disposal trenches, were filled in and the site was regarded in accordance with the 1992 VI recommendation for the site.

6.1.2 Site History

The former trench-fill operation reportedly received at least 300 tons of paper and refuse over its active life. Borings along the fence to the north encountered sanitary landfill material consisting of paper, rubber, and plastic debris down to 18 ft bgs.

It was reported by RFAAP personnel that this landfill was operated from about 1967 through the early 1970s. A previous report (USATHAMA, 1976) described a sanitary landfill in the same location as having operated from 1958 to 1969.

6.2 SITE GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

A comprehensive discussion of the regional physiography, soil, geology, and groundwater at RFAAP is included in the RFAAP MWP (URS, 2003a) and therefore is not discussed in this report.

6.2.1 Site Soil

6.2.2 Site Geology

The geology of the SWMU was investigated during the VI (Dames and Moore, 1992) through the drilling of two soil and rock borings south of the SWMU and four soil and rock borings north of the SWMU. Boring logs are presented in **Appendix B**. Subsurface conditions consist of fine- to coarse-grained alluvial deposits, which progressively thicken away from the New River. Alluvial deposits encountered in the vicinity consist mainly of fine-grained micaeous brown, sandy silts and silty sand with some interbedded silty clays.

LEGEND

SWMU 41 and 43, and Area O and P Boundaries

Other SWMU Boundary

Installation Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 500 1,000 2,000 Feet

U.S. Army Corps of Engineers

Shaw® Shaw Environmental, Inc.

FIGURE 6-1
SWMU 41 and 43, and Areas O and P
Site Location Map
Radford Army Ammunition Plant,
Radford, VA

GIS File: RFAAP_011_Fig6-1_Workplan_O_P_41_43_SiteMap.mxd

Date: 6/1/07

Eighteen feet of sanitary landfill material was encountered during the drilling of two downgradient borings drilled along the fence bordering the SWMU. Under the landfill material, a relatively thin layer of undisturbed fine grain silt to silty sand over weathered limestone rock was encountered. Where sediments were thicker in the upgradient borings, a basal layer of either river jack (silty gravel) or silty clay was present above weathered limestone bedrock.

Bedrock encountered in the vicinity of SWMU 43 generally consisted of highly argillaceous gray limestone and gray conglomeratic and brecciated limestone. Typically, limestone in this area was weathered to highly weathered, and fractured with vuggy and pitted zones and occasional clay seams.

During rock coring, large quantities of water were lost in fractured and weathered zones within the bedrock. The observed depth to limestone rock ranged from 23 to 30 ft in southern well bores and 17 to 23 ft in northern well bores.

6.2.3 Site Hydrogeology

Groundwater flows northward toward the New River at a hydraulic gradient of approximately 0.5 to 1 percent. An unconfined groundwater table was encountered from 18 to 23 ft bgs within the overburden soils in the upgradient well. Groundwater was encountered within the limestone bedrock at wells installed within the landfill and in downgradient wells.

Several groundwater seeps were observed discharging from the base of the embankment north of SWMU 43 along the New River. The seeps were detected at an elevation of approximately 1,681 ft msl.

6.2.4 Surface Water Hydrology

SWMU 43 is located adjacent to the New River at an elevation of approximately 1,700 ft msl. Surface water runoff from the SWMU is expected to flow towards a drainage ditch located in the center of the SWMU and is assumed to flow northward to the New River. Trench depressions also collect surface water that has the potential for infiltrating into the landfill.

6.3 PREVIOUS INVESTIGATIONS

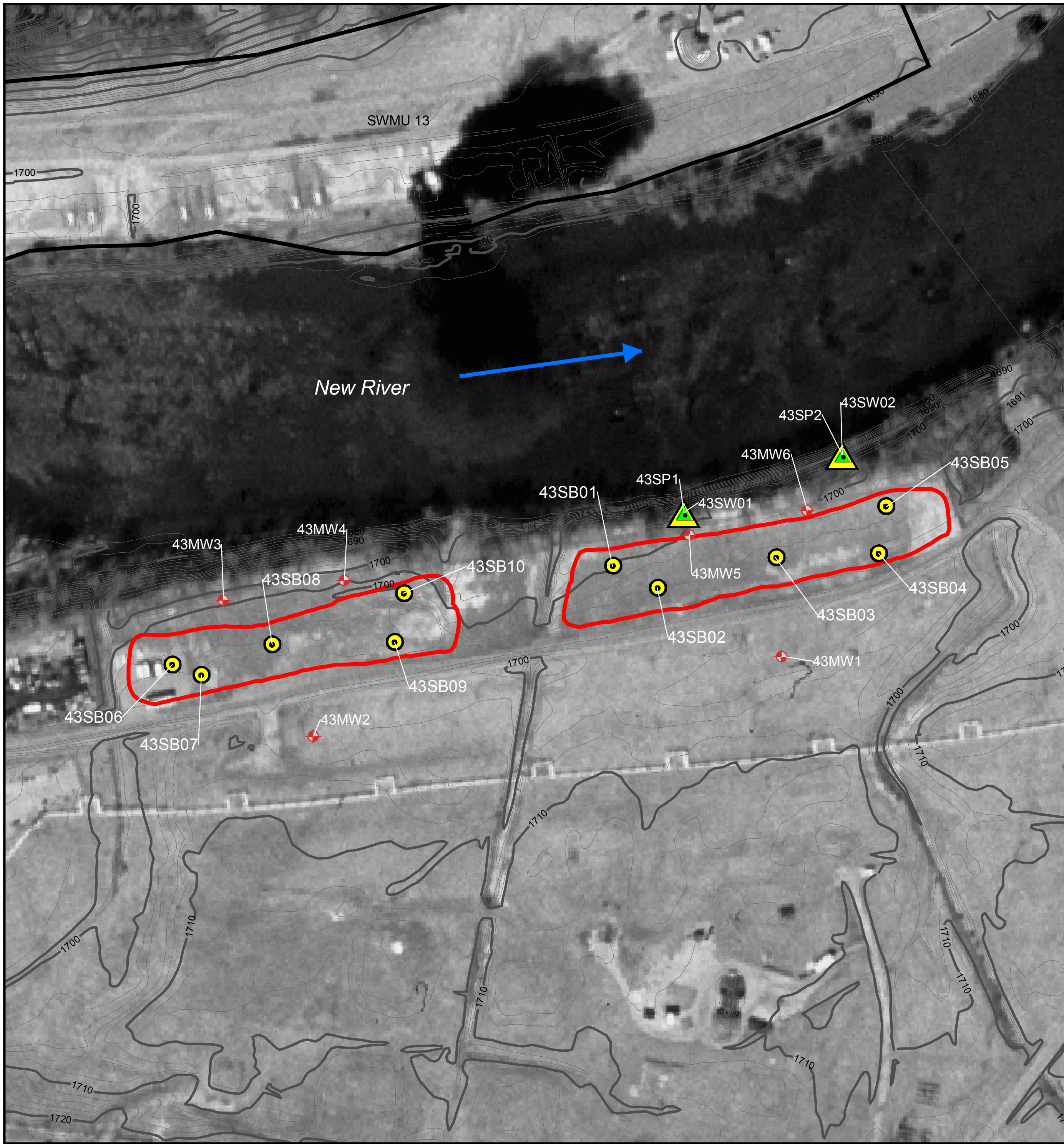
There has been one previous investigation at SWMU 43. The investigation and sample results are summarized below.

6.3.1 VI, Dames and Moore, 1992

SWMU 43 was identified in the RFA (USEPA, 1987) as having a potential for releasing contaminants into the environment and was included in the RCRA Permit for Corrective Action and Incineration Operation (USEPA, 1989) as warranting investigation. Subsequently, a VI was conducted by Dames and Moore in 1992 to evaluate whether toxic or hazardous contaminants are present and are migrating, or have the potential to migrate beyond the boundaries of the identified SWMU. The VI program at SWMU 43 involved the installation and sampling of monitoring wells and the sampling of groundwater seeps in the vicinity of the unit.

6.3.1.1 Groundwater

One well was installed upgradient of each section of the landfill (43MW1 and 43MW2), and two wells were installed downgradient of each section (43MW3, 43MW4, 43MW5, and 43MW6) (**Figure 6-2**). The maximum depth of these six wells is 42 ft.



LEGEND

- Monitoring Well Location
- Previous Investigation Seep Sample Location
- Proposed Soil Sample Location
- Proposed Surface Water Sample Location
- 10 ft Contour Line
- SWMU 43 Boundaries
- Other SWMU Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 125 250 500 Feet

U.S. Army Corps of Engineers

Shaw® Shaw Environmental, Inc.

FIGURE 6-2

SWMU 43 Sample Locations

Radford Army Ammunition Plant,
Radford, VA

Date: 1/24/07 GIS File: RFAAP_007_Fig6-2_Workplan_SWMU43_SampleLocations.mxd

During installation of the monitoring wells, water levels were documented. In the two upgradient wells, the water table was encountered within the overburden soils from 18 to 23 ft bgs. In the two eastern downgradient wells (43MW5 and 43MW6), the water table was encountered at the overburden/bedrock interface, around 20 ft bgs. In the two western downgradient wells (43MW3 and 43MW4), it was encountered within the limestone bedrock. After groundwater levels stabilized, the hydraulic gradient confirmed that the general direction of groundwater flow is north toward the New River. Stabilized measurements also showed that groundwater elevations were 2 to 3 ft higher downgradient of the eastern unit. Groundwater elevations were 1682.41 and 1682.98 ft msl at 43MW3 and 43MW4, and 1685.17 and 1684.85 ft msl at 43MW5 and 43MW6. This is probably related to increased surface water recharge in the eastern unit. Visible trench depressions observed on the surface of the unit were very soft and contained standing water. This water slowly infiltrates the soil and recharges the aquifer, producing a higher water table under the eastern unit.

Groundwater samples were collected from the six wells and analyzed for metals, VOCs, SVOCs, TOC, TOX, and pH. Results of the chemical analyses indicated the presence of metals and VOCs in groundwater at SWMU 43 (**Table 6-1**). Three metals (arsenic, iron, and manganese) exceeded both tw-RBCs and MCLs in the downgradient wells. Two VOCs (1,2-dichloroethane and benzene) exceeded tw-RBCs in downgradient wells 43MW3 and 43MW6. Groundwater concentrations were below screening levels in both upgradient wells. TOC, TOX, and pH were generally similar in upgradient and downgradient samples.

6.3.1.2 Surface Water

Two surface water samples were collected from the groundwater seeps and were analyzed for metals, VOCs, SVOCs, TOC, and TOX. Results of the chemical analyses indicated the presence of 10 metals and one VOC in the surface water samples (**Table 6-2**). Four metals (arsenic, iron, manganese, and vanadium) were detected at concentrations above tw-RBCs and four metals (aluminum, arsenic, iron, and manganese) exceeded MCLs. No SVOCs were detected.

6.4 CONCEPTUAL SITE MODEL

Potentially affected media at SWMU 43 include surface and subsurface soil, groundwater, surface water, and sediment. SWMU 43 is located in a relatively gently sloping area on the south bank of the New River. Surface water runoff is expected to flow towards the New River to the north or towards the drainage ditch that bisects the site. The drainage ditch also flows north. Site workers, hypothetical future residents, and terrestrial biota are considered receptors. **Table 6-3** presents the exposure pathways for each human receptor. Ecological and human exposure pathways are shown on **Figure 6-3** (current) and **Figure 6-4** (future). The exposures pathways associated with each media type are described in more detail in the following paragraphs.

Surface soil is potentially impacted by landfill operations. Site workers, hypothetical future residents and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with impacted soil, and the inhalation of dust.

Subsurface soil is also potentially impacted by the landfill operations. Previous investigation borehole data encountered 18 ft of landfill debris. Leachable constituents from the landfill would negatively impact the subsurface soil. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal

Table 6-1
SWMU 43
1992 VI Detected Results for Groundwater

SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	Screening Level		43MW1 RDWB*1 29-OCT-91 13-28	43MW2 RDWB*2 29-OCT-91 19.5-34.5	43MW3 RDWB*3 30-OCT-91 22.5-37.5	43MW4 RDWB*4 30-OCT-91 13.5-28.5	43MW5 RDWB*5 31-OCT-91 32.3-42.3	43MW6 RDWB*6 01-NOV-91 28-38
	MCL	tw-RBC						
Metals (ug/L)								
Arsenic	10	0.045	nd	nd	5.5	4.2	3.1	14
Barium	2000	730	55.6	86.9	45.7	152	44.2	165
Calcium	na	na	55900	47200	139000	85800	113000	111000
Iron	300	1100	nd	nd	659	6630	84.5	14500
Magnesium	na	na	23800	20500	58400	30900	42300	47900
Manganese	50	73	4.8	nd	41.7	974	41	208
Potassium	na	na	779	1020	1300	827	1060	1410
Sodium	na	na	10400	5980	23000	10200	11100	27900
VOCs (ug/L)								
1,2-Dichloroethane	5	0.12	nd	nd	0.58	nd	nd	1.4
Benzene	5	0.34	nd	nd	0.5	nd	nd	nd
Carbon disulfide	na	100	nd	nd	6	nd	nd	2.3
Wet Chemistry (ug/L)								
TOC	na	na	2820	5330	4620	14300	7620	6690
TOX	na	na	141	14.8	65.7	52.5	66.5	59.8

Table 6-2
SWMU 43
1992 VI Detected Results for Surface Water

SITE ID FIELD ID SAMPLING DATE DEPTH (ft)	Screening Level		43SP1 RDWB*7 31-OCT-91 0-0	43SP2 RDWB*10 31-OCT-91 0-0
	MCL	tw-RBC		
Metals (ug/L)				
Aluminum	50	na	403	nd
Arsenic	10	0.045	15.2	3.9
Barium	2000	730	194	84
Calcium	na	na	92000	72300
Iron	300	1100	32300	1730
Magnesium	na	na	41100	28300
Manganese	50	73	1300	98.1
Potassium	na	na	856	1510
Sodium	na	na	20800	9170
Vanadium	na	7	13.2	nd
VOCs (ug/L)				
Carbon disulfide	na	100	3.3	nd
Wet Chemistry (ug/L)				
TOC	na	na	12200	6140

Table 6-3
Selection of Exposure Pathways - SWMU 43

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	SWMU 43	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at SWMU 43 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to surface soil at SWMU 43 on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to surface soil at SWMU 43 on a daily basis.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMU 43	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 43.
				Industrial Worker	Adult	Inhalation	On-site	None	There are no workers currently exposed to airborne volatiles or particulates from surface soil at SWMU 43 on a daily basis.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMU 43	None	None	None	On-site	None	Current excavation or construction activities are not occurring at SWMU 43.
	Groundwater	Groundwater	SWMU 43	None	None	None	On-site	None	Groundwater is not currently being used at SWMU 43. Therefore, there is currently no direct exposure to groundwater.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
Future	Surface Soil	Surface Soil	SWMU 43	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at SWMU 43 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact surface soil at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact surface soil at SWMU 43 and be exposed to COPCs via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

Table 6-3
Selection of Exposure Pathways - SWMU 43

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Surface Soil	Air	SWMU 43	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 43.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 43.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMU 43	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact soil at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact soil at SWMU 43 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact soil at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact soil at SWMU 43 and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact soil at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact soil at SWMU 43 and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
					Child	Ingestion	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMU 43	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 43.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 43.
				Excavation Worker	Adult	Inhalation	On-site	Quant	Excavation workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 43.

Table 6-3
Selection of Exposure Pathways - SWMU 43

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Total Soil (Surface and Subsurface)	Air	SWMU 43	Resident	Adult	Inhalation	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
					Child	Inhalation	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
				Trespasser	Adolescent	Inhalation	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Sediment	Sediment from Spring/Seep (assumes area will increase in size)	SWMU 43	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact sediment at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact sediment at SWMU 43 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact sediment at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact sediment at SWMU 43 and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact sediment at SWMU 43 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact sediment at SWMU 43 and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	Adult residents could contact sediment at SWMU 43 and be exposed to COPCs via incidental ingestion during wading or swimming.
						Dermal	On-site	Quant	Adult residents could contact sediment at SWMU 43 and be exposed to COPCs via dermal absorption during wading or swimming.
					Child	Ingestion	On-site	Quant	Child residents could contact sediment at SWMU 43 and be exposed to COPCs via incidental ingestion during wading or swimming.
						Dermal	On-site	Quant	Child residents could contact sediment at SWMU 43 and be exposed to COPCs via dermal absorption during wading or swimming.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Surface Water	Surface Water from Spring/Seep (assumes area will increase in size)	SWMU 43	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers could contact surface water at SWMU 43 while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Maintenance workers could contact surface water at SWMU 43 and be exposed to COPCs via dermal absorption while wading.
				Industrial Worker	Adult	Ingestion	On-site	None	Industrial workers could contact surface water at SWMU 43 while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Industrial workers could contact surface water at SWMU 43 and be exposed to COPCs via dermal absorption while wading.

Table 6-3
Selection of Exposure Pathways - SWMU 43

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Surface Water	Surface Water from Spring/Seep (assumes area will increase in size)	SWMU 43	Excavation Worker	Adult	Ingestion	On-site	None	Excavation workers could contact surface water at SWMU 43 while wading. However, surface water ingestion is unlikely.
						Dermal	On-site	Quant	Excavation workers could contact surface water at SWMU 43 and be exposed to COPCs via dermal absorption while wading.
				Resident	Adult	Ingestion	On-site	Quant	Residents could contact surface water at SWMU 43 while wading or swimming. Surface water ingestion while wading is considered unlikely.
						Dermal	On-site	Quant	Adult residents could contact surface water at SWMU 43 and be exposed to COPCs via dermal absorption while wading or swimming.
					Child	Ingestion	On-site	Quant	Residents could contact surface water at SWMU 43 while wading or swimming. Surface water ingestion while wading is considered unlikely. Surface water ingestion while swimming is evaluated.
						Dermal	On-site	Quant	Child residents could contact surface water at SWMU 43 and be exposed to COPCs via dermal absorption while wading or swimming.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Groundwater	Groundwater	SWMU 43	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers would not contact groundwater at SWMU 43.
						Dermal	On-site	None	Maintenance workers would not contact groundwater at SWMU 43.
				Industrial Worker	Adult	Ingestion	On-site	Quant	If SWMU 43 were to be further developed for industrial purposes and groundwater wells were installed at the site, site workers could be exposed to COPCs in groundwater via ingestion.
						Dermal	On-site	None	Although site worker dermal exposures to groundwater could occur, the exposed body surface area of a worker (i.e., hands and arms) would be small and exposures would be infrequent.
				Excavation Worker	Adult	Ingestion	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at SWMU 43.
						Dermal	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at SWMU 43.
				Resident	Adult	Ingestion	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 43 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.

Table 6-3
Selection of Exposure Pathways - SWMU 43

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Groundwater	SWMU 43	Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
		Homegrown fruits and vegetables	SWMU 43	Resident	Adult	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into a construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	On-site	Quant	If groundwater wells were installed for residential purposes, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	On-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
					Child	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would
		Groundwater	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Homegrown fruits and vegetables	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.

Table 6-3
Selection of Exposure Pathways - SWMU 43

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, volatiles could be released from groundwater into ambient air. Off-site maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into an off-site construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate to off-site wells in the future, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	Off-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
					Child	Inhalation	Off-site	Quant	If COPCs from SWMU 43 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	Off-site	None	The maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

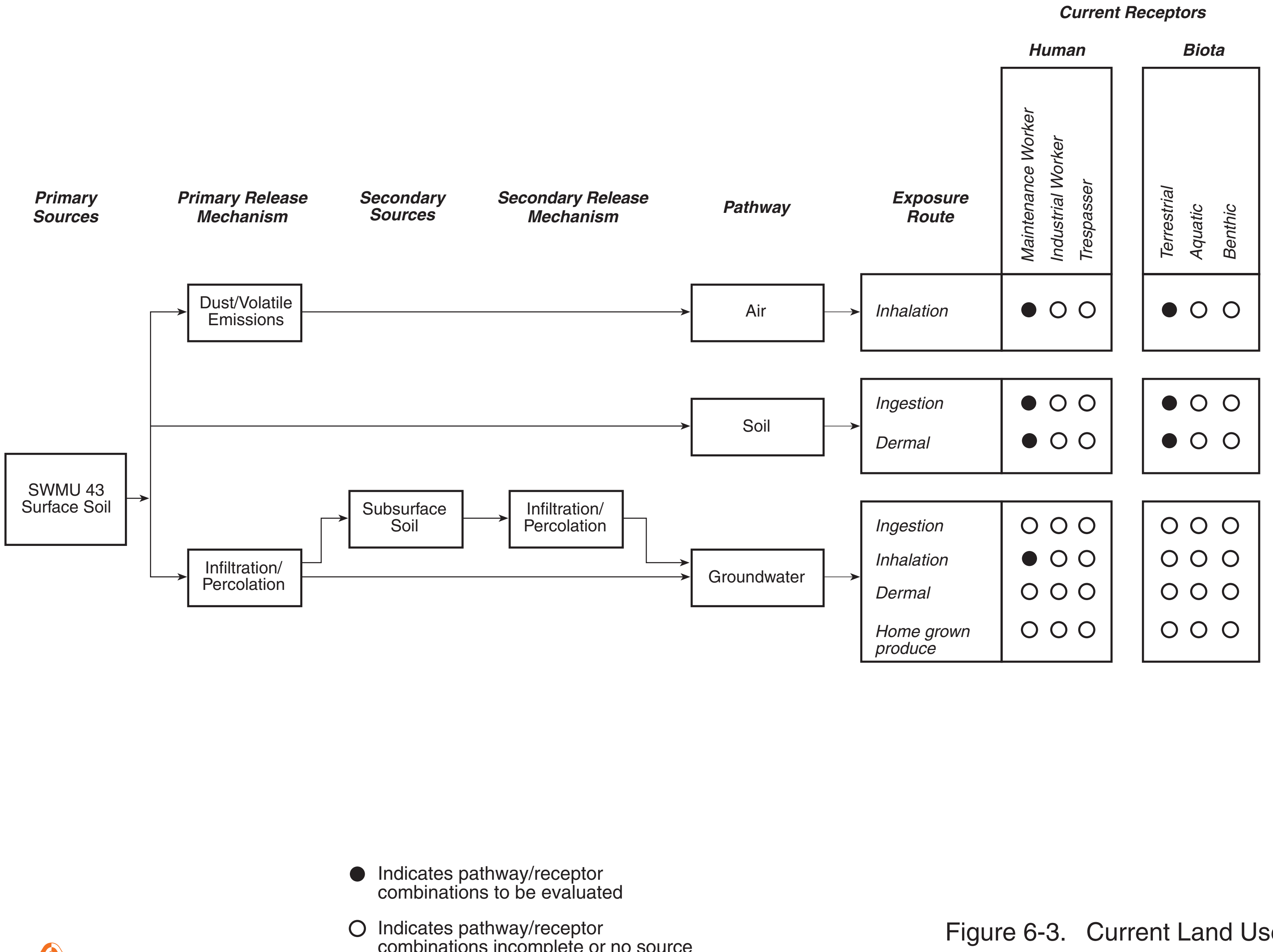


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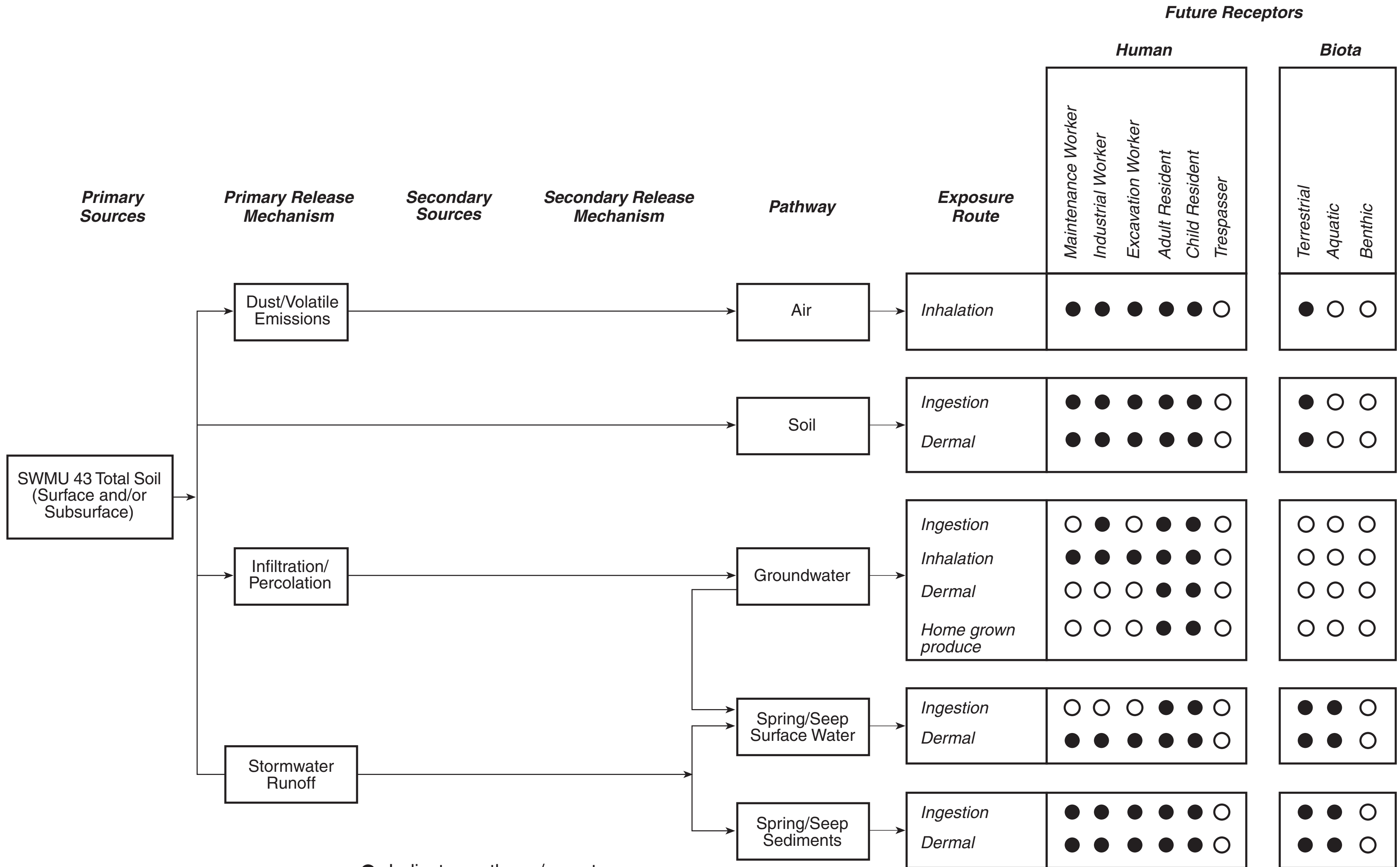
Figure 6-3. Current Land Use
Conceptual Site Model for SWMU 43
Radford Army Ammunition Plant, Virginia

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w



● Indicates pathway/receptor combinations to be evaluated

○ Indicates pathway/receptor combinations incomplete or no source

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Figure 6-4. Future Land Use
Conceptual Site Model for SWMU 43
Radford Army Ammunition Plant, Virginia

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w

absorption may also affect site workers during construction activities that expose the subsurface soil.

Groundwater is also potentially impacted by the landfill operations. Groundwater was encountered at approximately 20 ft bgs at the site and leachable constituents that have potentially impacted subsurface soil would also have impacted groundwater. Future development of groundwater resources in the area could potentially impact site workers and future residents through ingestion, inhalation of vapors or dermal absorption.

Surface water/sediment in the ditch that bisects the site and in the adjacent New River is potentially impacted by runoff from the landfill or discharge of site groundwater. Site workers, hypothetical future residents and ecological receptors could be impacted through incidental ingestion, inhalation of sediment dust during dry periods, inhalation of volatiles from surface water or absorption through direct contact with impacted sediment or surface water.

6.5 DATA GAP ANALYSIS

This section identifies data gaps in the current understanding of the site and is the basis for the investigation approach described in the next section.

The complete extent of the landfill has not been defined at this site. This is a data gap that will be addressed with a geophysical survey. The previous investigation focused on whether constituents were migrating from the landfill into groundwater and ultimately the New River. The VI did not address characterization of the landfill material or the soil in and under the landfill. The absence of soil samples is a data gap for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, and TAL metals.

Although groundwater and surface water were investigated during the VI, the existing data is 12 years old. Current chemical data that can be compared to soil data is a data gap and the groundwater monitoring wells and seeps will be re-sampled to obtain current data for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals and perchlorate.

6.6 INVESTIGATION APPROACH

Additional investigative activities will be performed to augment the existing data and fill data gaps. Soil samples will be collected to characterize landfill material and the vertical extent of the landfill. Groundwater and surface water samples collected during previous investigations suggest potential impacts to these media from metals and VOCs. Groundwater samples collected during the VI identified three metals (arsenic, iron, and manganese) and two VOCs (1,2-dichloroethane and benzene) at concentrations exceeding screening levels in downgradient monitoring wells. Results from New River seep samples collected during the VI indicated that five metals (aluminum, arsenic, iron, manganese, and vanadium) were detected at levels exceeding MCLs and tw-RBCs.

A data gap analysis for the SWMU indicated that there are data needs related to chemical groups that have not been investigated at this site. The chemical parameters needed include PAHs, explosives, TCL pesticides/PCBs, herbicides, dioxins/furans, and perchlorate.

Proposed samples and analyses are summarized in **Table 6-4**. Proposed sample locations are presented on **Figure 6–2**. Specific site investigation elements include:

Table 6-4
Proposed Sampling and Analysis Plan
SWMU 43
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
SWMU 43				
Surface Soil	43SB01A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB02A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB03A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB04A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB05A	0-0.5 ft bgs	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB06A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB07A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB08A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB09A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB010A	0-0.5 ft bgs	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
Subsurface Soil	43SB01B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB01C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB02B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB02C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB03B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB03C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB04B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB04C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB05B	in waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB05C	below waste	in east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB06B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB06C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB07B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB07C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB08B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB08C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	43SB09B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB09C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB10B	in waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
	43SB10C	below waste	in west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals
Groundwater	43MW1	21	exsiting well - upgradient, east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW2	27	exsiting well - upgradient, west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW3	30	exsiting well - downgradient, west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW4	21	exsiting well - downgradient, west cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW5	37	exsiting well - downgradient, east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43MW6	33	exsiting well - downgradient, east cell	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
Surface Water	43SW01	NA	At seep on New River (collocated with 43SP1)	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	43SW02	NA	At seep on New River (collocated with 43SP2)	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate

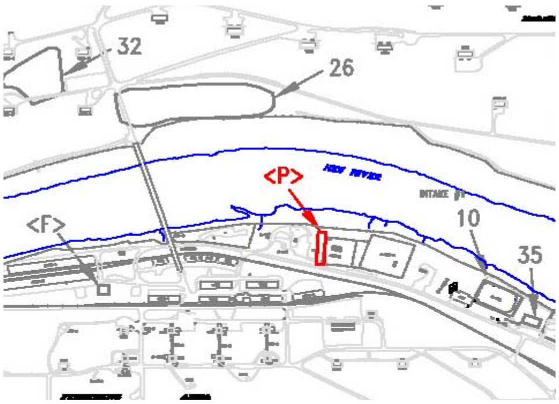
- Geophysics: A geophysical survey to define landfill boundaries will be conducted prior to the collection of soil samples so that boring locations can be adjusted to investigate anomalies identified in the geophysical survey. An EM survey will be conducted in accordance with Section 5.5 and SOP 20.7 of the MWP (URS, 2003a).
- Surface Water Sampling: Two surface water samples will be collected from the seeps where previous samples 43SP1 and 43SP2 were collected. These samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, and perchlorate. These samples are intended to characterize groundwater that is leaving the site and entering the New River. If additional seeps are located near the western cell, samples will also be collected at these locations (up to three).
- Soil Sampling: Five soil borings with three samples per boring ("A" - surface soil [0-0.5 ft bgs]; "B" - in waste sample [depth will be determined in the field]; and "C" - below waste sample [depth will be determined in the field]) in each cell so that there are five samples from each distinct layer (surface soil, waste, below waste) at each cell for statistical comparisons. 43SB01 – 43SB05 will be collected from the east landfill cell and 43SB06 – 43SB10 will be collected from the west landfill cell. 43SB06 is located near the concrete pad and former soil pile at the west end of the site. These samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, and TAL metals. Samples collected from borings 43SB03 and 43SB08 will also be analyzed for dioxins/furans to characterize each landfill cell for these constituents.
- Groundwater Sampling: Groundwater samples will be collected from the six existing wells (43MW1 – 43MW6) to assess potential contaminant migration. These samples will also be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals and perchlorate.

7.0 AREA P – BATTERY STORAGE AREA

7.1 SITE DESCRIPTION AND HISTORY

7.1.1 Site Description

The Spent Battery Storage Area, Area P (**Figure 7-1**), is a 50 ft by 200 ft long fenced gravel area located adjacent to the New River. The site is generally level, sloping gently towards the north to the river, which is 200 ft from the storage area. No site-specific subsurface or hydrogeologic studies have been conducted at this site; however, groundwater is expected to flow north to the river.



7.1.2 Site History

Area P is in the center of a scrap metal yard that was formerly used for storage of shredded scrap metal, decommissioned tanks, powder cans, and batteries prior to off-post shipment. The sole previous investigation (Dames and Moore, 1992) at the site was intended to assess whether the site was impacted by the spillage of spent battery acid.

7.2 SITE GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

A comprehensive discussion of the regional physiography, soil, geology, and groundwater at RFAAP is included in the RFAAP MWP (URS, 2003a) and therefore is not discussed in this report.

7.2.1 Site Soil

The surface of the site is a gravel pad. Soil at the site is mapped as Unison-Urban Land Complex (SCS, 1985) and has been reworked through activities at RFAAP. It is described as having moderate permeability, low organic content and medium acidity. In unworked areas, the soils have a 15-inch thick top soil of dark brown loam, and a 43-inch subsoil of yellowish-red sticky clay, which is underlain by red sandy clay to a depth of 58 inches.

7.2.2 Site Geology

There have been no subsurface investigations at the site. The site is located on a river terrace deposit and the subsurface soil is expected to consist of a mixture of sands, silts, and clays with occasional gravel “riverjack” stringers where former channels existed.

7.2.3 Site Hydrogeology

There are no monitoring wells installed at the site and no site-specific groundwater investigations have been conducted. The site is located on a river terrace deposit of unconsolidated sediments. Groundwater is expected to flow north through the unconsolidated sediments and discharge to the New River.

7.2.4 Surface Water Hydrology

Area P is a generally flat area that slopes gently towards the north in the direction of the New River. The elevation at the site ranges from approximately 1,710 ft msl at the south edge of the

LEGEND

SWMU 41 and 43, and Area O and P Boundaries

Other SWMU Boundary

Installation Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:
0 500 1,000 2,000 Feet

U.S. Army Corps of Engineers

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FIGURE 7-1
SWMU 41 and 43, and Areas O and P
Site Location Map
Radford Army Ammunition Plant,
Radford, VA

Date: 6/1/07 GIS File: RFAAP_012_Fig7-1_Workplan_O_P_41_43_SiteMap.mxd site to approximately 1,700 ft msl at the northwest corner of the site. Surface water runoff is expected to follow topography towards the New River. According to RFAAP utility maps, there are no storm drains or other engineered drainage systems at the site.

7.3 PREVIOUS INVESTIGATIONS

There has been one previous investigation at Area P. Results are summarized below.

7.3.1 VI, Dames and Moore, 1992

In 1992, soils at Area P were evaluated to determine if they had been impacted from the possible spillage of spent battery acid. At each of five locations, one surface (0-0.5 ft bgs) and one subsurface soil sample (4-5 ft bgs) was collected and analyzed for TAL metals and pH. Arsenic, beryllium, and cobalt were detected at concentrations greater than screening criteria at the time of the investigation. However, a current review of the metals results indicates that these concentrations are below the RFAAP Facility-Wide Background inorganic screening levels (IT, 2002a).

Compared to current RBCs, antimony and copper each exceeded the R-RBC in sample PSB2A (0-0.5 ft bgs). The remaining metals were below screening criteria. Results from the samples are presented in **Table 7-1**. Sample locations are presented on **Figure 7-2**. pH results indicated that soil samples varied from neutral to slightly basic.

7.4 CONCEPTUAL SITE MODEL

Potentially affected media at Area P include surface and subsurface soil and groundwater. Area P is located in a relatively gently sloping area on the south bank of the New River. Surface water runoff is expected to flow towards the New River to the north. Site workers, hypothetical future residents, and terrestrial biota are considered receptors. **Table 7-2** presents the exposure pathways for each human receptor ecological and human exposure pathways are shown on **Figure 7-3** (current) and **Figure 7-4** (future). The exposures pathways associated with each media type are described in more detail in the following paragraphs.

Surface soil is potentially impacted by past operations. Site workers, hypothetical future residents and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with impacted soil, and the inhalation of dust.

Subsurface soil is also potentially impacted by past site operations. Leachable constituents would migrate down through the soil column and negatively impact the subsurface soil. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Groundwater is also potentially impacted by past site operations. Groundwater is expected to be shallow at the site due to its proximity to the New River and leachable constituents that have potentially impacted subsurface soil would also have impacted groundwater. Future development of groundwater resources in the area could potentially impact site workers and future residents through ingestion, inhalation of vapors or dermal absorption.

7.5 DATA GAP ANALYSIS

This section identifies data gaps in the current understanding of the site and is the basis for the investigation approach described in the next section.

Groundwater has not been investigated at the site. Although previous investigation soil data does not indicate that constituents are migrating downward, the absence of previous groundwater sampling makes this a data gap for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides explosives, TAL metals, and perchlorate.

Soil samples (surface and subsurface) from the previous investigation at the site were analyzed for TAL metals and pH because these constituents were the most likely to be elevated due to the past history of battery storage at the site. A data gap exists for other analyte classes (TCL VOCs, SVOCs, pesticides/PCBs, herbicides, and explosives) in both surface and subsurface soil.

7.6 INVESTIGATION APPROACH

In order to complete the characterization of Area P, additional samples need to be collected to fill data gaps. A summary of the proposed samples is presented in **Table 7-3** and sample locations are presented on **Figure 7-2**. The samples are briefly described in the following subsections.

Soil: The collection of five surface soil (APSB6A – APSB10A) and five subsurface soil samples (APSB6B – APSB10B). Surface soil samples will be collected from 0-0.5 ft bgs and subsurface soil samples will be collected from 4-6 ft bgs. Samples will be collected using a direct push rig, and will be collected in accordance with Section 5.2 and SOP 30.1 of the MWP (URS, 2003a). These samples are intended to fill data gaps and will be analyzed for the following previously untested analyte classes: TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides and explosives.

Groundwater: Groundwater at the site has not been analyzed. Based on the site history and previous sampling at the site, it is expected that groundwater has not been impacted by site activities. Five direct push groundwater samples will be collected to demonstrate that groundwater is not impacted. These samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, and perchlorate to characterize Area P groundwater. Direct push groundwater sampling will follow Section 5.2 and SOP 20.12 of the MWP (URS, 2003a).

Table 7-1
1992 VI Detected Results for Soil - Area P

SITE ID	i-RBC	r-RBC	Background	PSB1	PSB1	PSB2	PSB2	PSB2	PSB3	PSB3	PSB4	PSB4	PSB5	PSB5
FIELD ID				RVFS*76	RVFS*77	RVFS*78	RVFS*79	RVFS*105	RVFS*80	RVFS*81	RVFS*82	RVFS*83	RVFS*84	RVFS*85
SAMPLING DATE				05-MAR-92	05-MAR-92	05-MAR-92	05-MAR-92	05-MAR-92	05-MAR-92	05-MAR-92	05-MAR-92	05-MAR-92	05-MAR-92	05-MAR-92
DEPTH (ft)				0-0.5	4-5	0-0.5	4-5	4-5	0-0.5	4-5	0-0.5	4-5	0-0.5	4-5
Metals (mg/kg)														
Aluminum	na	na	40041	12500	16600	3620	15800	15300	11000	18200	10400	6350	13200	5580
Antimony	41	3.1	na	nd	nd	10.5	nd	nd	nd	nd	nd	nd	nd	nd
Arsenic	1.9	0.43	15.8	3.4	1.5	2.0	1.2	1.5	1.7	1.3	0.9	0.7	2.44	0.6
Barium	20000	1600	209	138	113	73.1	126	104	132	187	**257**	176	189	145
Beryllium	200	16	1.02	0.6	nd	nd	0.7	0.7	0.8	0.9	nd	nd	0.69	nd
Calcium	na	na	na	3350	1330	160000	2740	1540	2080	2300	1510	815	5000	1120
Chromium	310	23	65.3	59.6	28.3	7.6	25.6	27.1	22.2	33.5	22.7	12.7	27.7	12.6
Cobalt	na	na	72.3	12.6	13.5	2.6	11.6	12.2	10.5	11.8	10.1	5.8	11.4	5.7
Copper	4100	310	53.5	**71.3**	15.1	**347**	**125**	**65.3**	15.7	34.9	25.1	6.6	76.2	10.3
Iron	31000	2300	50962	24900	27500	6880	24400	25700	19600	24700	17200	11600	23400	10400
Lead	800	400	26.8	37.6	nd	**105**	21.9	23.5	**29.1**	**49.2**	**43.7**	nd	**150**	nd
Magnesium	na	na	na	4110	4860	83000	4720	4100	3210	4770	3260	2000	5670	1940
Manganese	2000	160	2543	608	493	130	447	457	625	430	582	253	497	308
Nickel	2000	160	62.8	33.4	18.4	9.0	16.8	17.8	13.0	20.3	15.9	9.1	17.2	8.9
Potassium	na	na	na	1400	1920	932	1880	1810	1260	1890	1220	996	1740	626
Silver	510	39	na	nd	0.68	1.8	0.7	0.8	nd	nd	nd	nd	0.7	nd
Sodium	na	na	na	206	185	281	200	163	179	198	261	218	222	188
Vanadium	102	7.8	108	40.2	49.8	12.1	46.4	49.6	31.3	44.0	27.5	17.2	41.4	15.2
Zinc	31000	2300	202	155	73.6	115	89.1	81.4	128	84.9	121	51.3	159	53.4
Wet Chemistry														
pH	na	na	na	8	6.9	8.7	7.6	7.6	7.8	6.9	7.5	7.3	8	7.6

LEGEND

- Previous Investigation Soil Sample Location
- Proposed Soil Sample Location
- Proposed Geoprobe Groundwater Sample Location
- 10 ft Contour Line
- Area P Boundary

Notes:
1) Aerial photo, dated 25 May 2000, was obtained from the Army Topographic Engineering Center.

N

Scale:

0 75 150 300 Feet

U.S. Army Corps of Engineers

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FIGURE 7-2

Area P Sample Locations

Radford Army Ammunition Plant,
Radford, VA

Date: 6/1/07 GIS File: RFAAP_005_Fig7-2_Workplan_SWMU41_SampleLocations.mxd

Table 7-2
Selection of Exposure Pathways - Area P

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	Area P	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at Area P and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at Area P and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	None	There are no workers currently exposed to surface soil at Area P on a daily basis.
						Dermal	On-site	None	There are no workers currently exposed to surface soil at Area P on a daily basis.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	Area P	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at Area P.
				Industrial Worker	Adult	Inhalation	On-site	None	There are no workers currently exposed to airborne volatiles or particulates from surface soil at Area P on a daily basis.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	Area P	None	None	None	On-site	None	Current excavation or construction activities are not occurring at Area P.
	Groundwater	Groundwater	Area P	None	None	None	On-site	None	Groundwater is not currently being used at Area P. Therefore, there is currently no direct exposure to groundwater.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
Future	Surface Soil	Surface Soil	Area P	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at Area P and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at Area P and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact surface soil at Area P and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact surface soil at Area P and be exposed to COPCs via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

Table 7-2
Selection of Exposure Pathways - Area P

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Surface Soil	Air	Area P	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at Area P.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from surface soil at Area P.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	Area P	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact soil at Area P and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact soil at Area P and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact soil at Area P and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact soil at Area P and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact soil at Area P and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact soil at Area P and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
					Child	Ingestion	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	Area P	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from soils at Area P.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from soils at Area P.
				Excavation Worker	Adult	Inhalation	On-site	Quant	Excavation workers could be exposed to airborne volatiles or particulate matter released from soils at Area P.

Table 7-2
Selection of Exposure Pathways - Area P

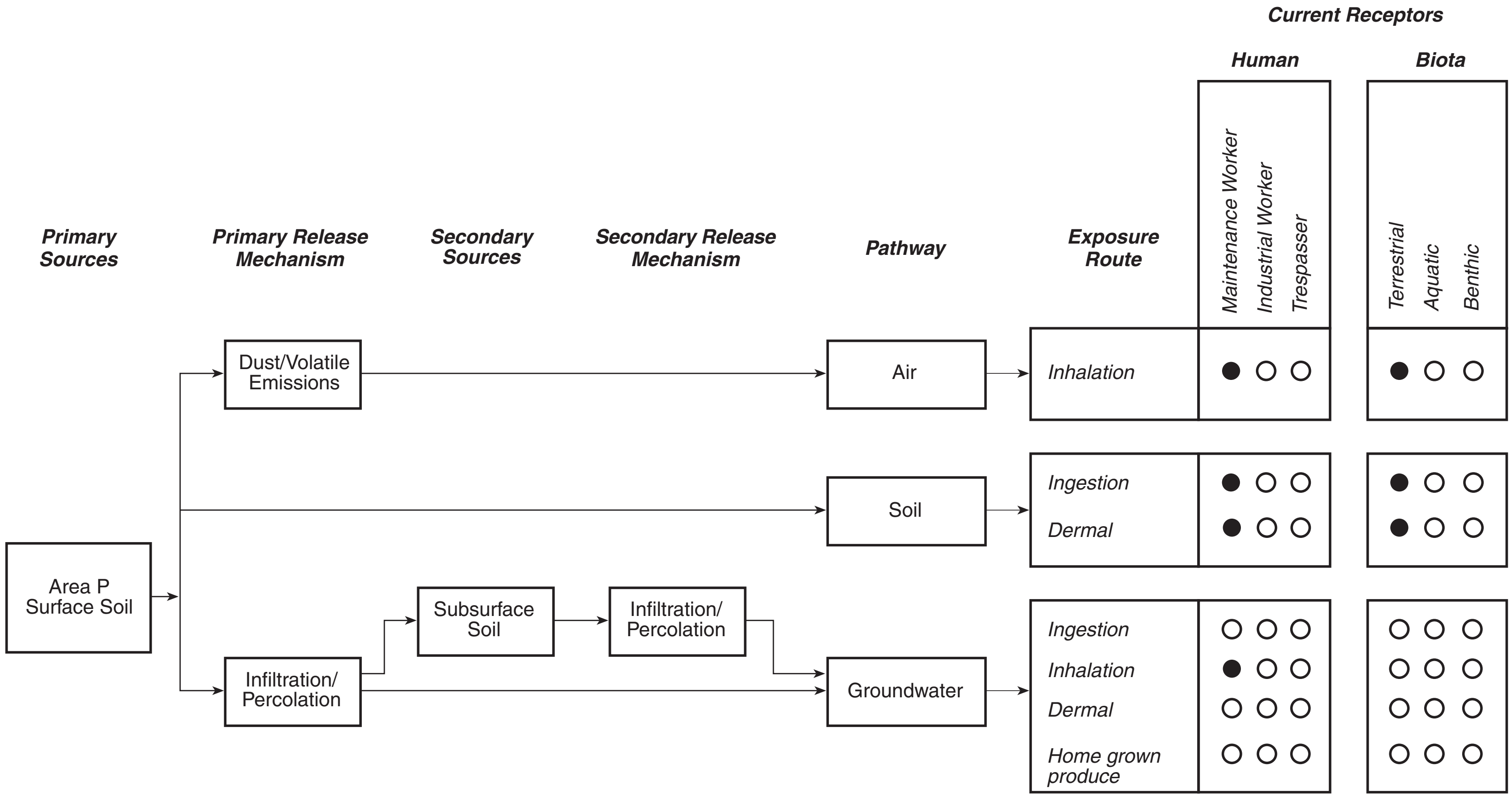
Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Total Soil (Surface and Subsurface)	Air	Area P	Resident	Adult	Inhalation	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
					Child	Inhalation	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
				Trespasser	Adolescent	Inhalation	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Groundwater	Groundwater	Area P	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers would not contact groundwater at Area P.
						Dermal	On-site	None	Maintenance workers would not contact groundwater at Area P.
				Industrial Worker	Adult	Ingestion	On-site	Quant	If Area P were to be further developed for industrial purposes and groundwater wells were installed at the site, site workers could be exposed to COPCs in groundwater via ingestion.
						Dermal	On-site	None	Although site worker dermal exposures to groundwater could occur, the exposed body surface area of a worker (i.e., hands and arms) would be small and exposures would be infrequent.
				Excavation Worker	Adult	Ingestion	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at Area P.
						Dermal	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at Area P.
				Resident	Adult	Ingestion	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If Area P were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
		Homegrown fruits and vegetables	Area P	Resident	Adult	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.

Table 7-2
Selection of Exposure Pathways - Area P

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into a construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	On-site	Quant	If groundwater wells were installed for residential purposes, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	On-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
					Child	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Groundwater	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	Off-site	None	The residential scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Homegrown fruits and vegetables	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, volatiles could be released from groundwater into ambient air. Off-site maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site buildings via vapor intrusion.
			Trench Vapors	Excavation Worker	Adult	Inhalation	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into an off-site construction or utility trench via vapor intrusion.

Table 7-2
Selection of Exposure Pathways - Area P

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Volatiles at Showerhead	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from Area P groundwater were to migrate to off-site wells in the future, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	Off-site	None	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
					Child	Inhalation	Off-site	Quant	If COPCs from Area P groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
			Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	Off-site	None	The maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.



● Indicates pathway/receptor combinations to be evaluated

○ Indicates pathway/receptor combinations incomplete or no source

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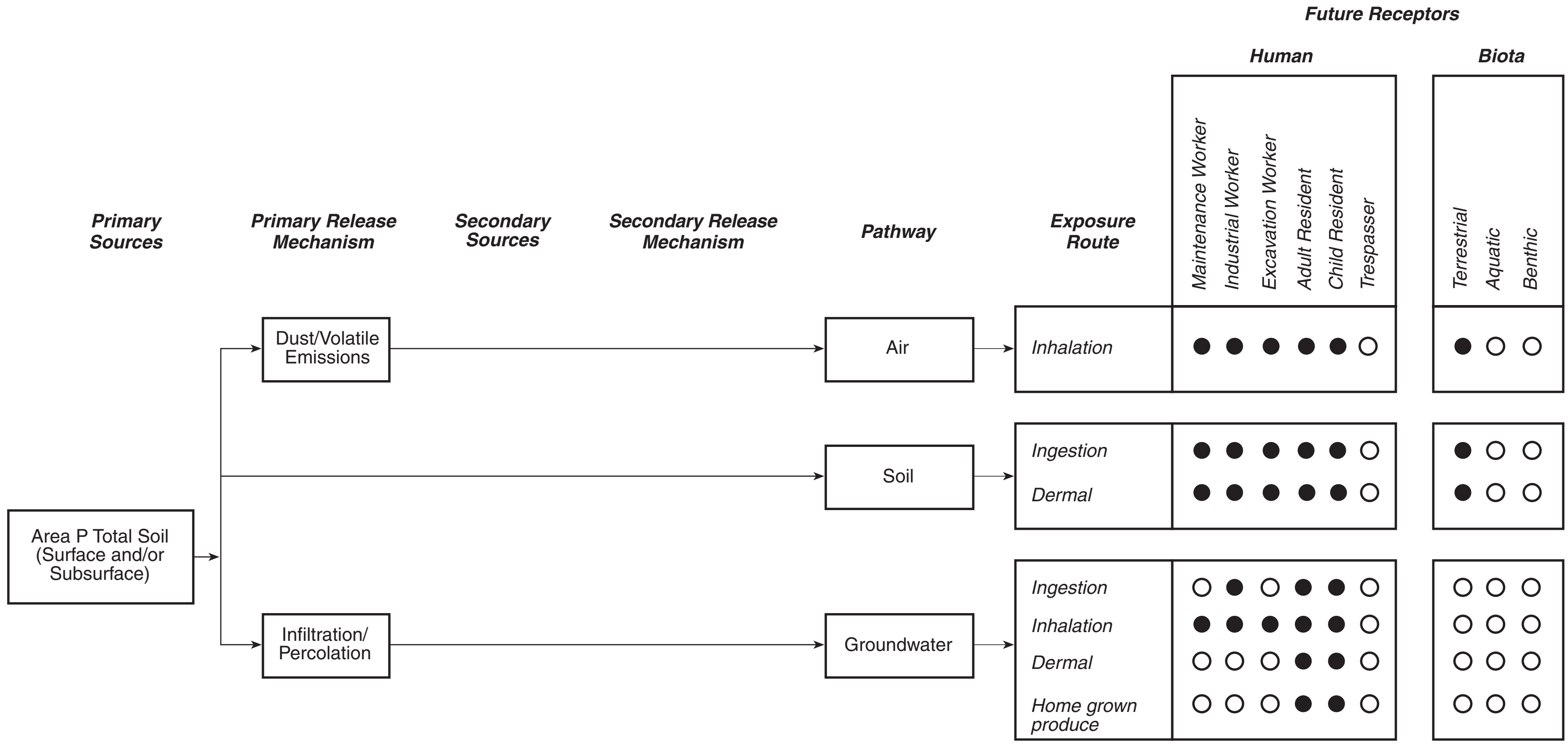
Figure 7-3. Current Land Use Conceptual Site Model for Area P Radford Army Ammunition Plant, Virginia

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w



● Indicates pathway/receptor combinations to be evaluated

○ Indicates pathway/receptor combinations incomplete or no source

Shaw™ Shaw Environmental, Inc.

Figure 7-4. Future Land Use Conceptual Site Model for Area P Radford Army Ammunition Plant, Virginia

DRAWING BY	JIS, III	CHECKED BY	CH	2/20/07	DRAWING NO.
	1/24/07	APPROVED BY	CH	2/20/07	S-123461-1/07-w

Table 7-3
Proposed Sampling and Analysis Plan
Area P
Radford AAP, Radford, VA

Media	Sampling ID	Depth	Location	Analytes
Area P				
Surface Soil	APSB06A	0-0.5 ft bgs	upgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB07A	0-0.5 ft bgs	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB08A	0-0.5 ft bgs	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB09A	0-0.5 ft bgs	downgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB10A	0-0.5 ft bgs	downgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
Subsurface Soil	APSB06B	4-6 ft bgs	upgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB07B	4-6 ft bgs	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB08B	4-6 ft bgs	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB09B	4-6 ft bgs	downgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
	APSB10B	4-6 ft bgs	downgradient end of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives
Groundwater	APGW01	water table	upgradient of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	APGW02	water table	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	APGW03	water table	central area within former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	APGW04	water table	downgradient of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate
	APGW05	water table	downgradient of former battery storage area	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, explosives, TAL metals, perchlorate

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APPENDIX A

XRF Standard Operating Procedure

STANDARD OPERATING PROCEDURE 30.13
SCREENING FOR METALS VIA X-RAY FLUORESCENCE (XRF) SPECTROMETRY

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide general guidance for the analysis of samples using X-Ray Fluorescence (XRF) methods. XRF can be used to screen for a variety of metals (**Attachment 1**) in environmental sample matrices that include soil, air filters, solid surfaces, materials including dried filter papers, and to screen for lead-based paint. The XRF technique has been accepted by the U.S. Environmental Protection Agency (EPA) for screening of samples during investigative and remediation actions and is published in USEPA SW-846 as Method 6200.

This procedure is applicable to efforts where metals are to be assessed using XRF methods. It is intended to act primarily as a guideline for the use and applicable Quality Control (QC) requirements of this technique. This procedure is not intended to replace the applicable manufacturer's information/procedures or those in SW-846, and it also does not present expanded detail on sample preparation. XRF is a surface analysis technique and as such, higher confidence data is achieved when solid samples, especially soil samples, are homogenized and reduced to consistent particle-size mixtures by drying, grinding, and sieving.

2.0 MATERIALS

- NITON Model XL-703 XRF system;
- Applicable source (Cd-109, Am-241);
- Filter holder assembly;
- System blank;
- Energy blank;
- System reference material (SRM);
- Sample cup; and,
- Field logbook and log sheets.

3.0 PRECAUTIONS

- XRF instruments contain radioactive source(s), and the electron beam is hazardous. Do not remove shielding or disassemble instruments beyond the user maintenance dictated in the instrument manual.
- Never place a hand or other body part in the path of the detector, and always operate it either with its shield closed or with the sensor window held tight against a surface; do not look directly at the beam.
- Some systems utilize cryogenic cooling systems, and appropriate precautions should be taken during operation.
- These instruments are regulated radioactive sources and require licensing and specific radioactive licensee procedures for use. In several states, some units, especially those containing Cd109 sources, are considered controlled sources and subject to state radioactive regulations including specific training for persons using the instrument, posting of radioactive safety procedures, isolation of work areas, and issuance of state radioactive licenses and permits. The Commonwealth of Virginia allows

the use of Niton Corporation's Radioactive Materials License. The Virginia State Department of Health must be informed (804-786-5932) that a "generally licensed source" is being used. Personnel using this type of instrument for the first time must attend the manufacturer's Safety Training course or be trained by a certified representative. Manufacturers will not send instruments containing radioactive sources to a project site without a competent person as required by their Specific License and General License with an Agreement State where analysis will be performed. The Commonwealth of Virginia requires the instrument to be shipped to the site directly. For additional information or assistance in dealing with licensing and/or shipment issues, contact the manufacturer, or leasing agent.

4.0 PROCEDURE

4.1 GENERAL INFORMATION

Method sensitivity is a function of the count time. Consult the manufacturer's manual to establish a count time that provides the needed sensitivity while allowing for sample throughput efficiency. Typical count times are 60 to 180 seconds.

Soil samples will be analyzed by using *ex situ* methods. *Ex situ* analysis involves thorough drying, grinding, mixing, and sieving of the sample, placing it into a sample cup for introduction to the instrument, and collecting data. Soil samples are analyzed by placing the sample cup into the manufacturer's holder and read by the instrument. The average of two readings should be calculated for each result.

XRF instruments are essentially semi-quantitative screening instruments and in most instances provide non-definitive screening data that must be confirmed by definitive methods. In well defined remedial actions governed by detailed approved plans, XRF has been used as a confirmatory tool. Use of the method for confirmatory purposes requires site-specific calibration over multiple points, regular QC checks, adjustments of the site-specific curve/Definitive method relationship via split sample analysis, and defined confidence windows for grey-area data.

4.2 GENERAL OPERATION

4.2.1 **Record** data onto a log sheet using the XRF Calibration Log (**Attachment 2**) and XRF Sample Collection Log (**Attachment 3**).

4.2.2 Allow the instrument to warm-up for 15 to 30 minutes before use.

4.2.3 **Perform** manufacturer-specified background (scatter) and internal self-calibration checks using the supplied materials. The XRF Calibration Log should be **completed daily** to record the date, time, sample no., leakage current (Pa), and resolution (eV). If the resolution reads above 900 eV or the leakage current is above 160 milliamps, the detector is not performing adequately. If the system fails the background check, **clean** the window and repeat. Do not use an instrument that fails either the background check or internal calibration criteria. **Contact** the manufacturer if the instrument does not pass calibration.

4.2.4 Prior to analyzing samples, **analyze** each of the required QC samples to include SRM and blanks and **compare** to the project criteria. Do not proceed to project samples until QC meets criteria. QC samples in sample cups should be **tilted** to **remix** the contents before analysis.

4.2.5 For *ex situ* samples, **place** approximately 5-10 grams of soil on a drying pan or tin and **place** in 103ºC oven for 2-4 hours.

4.2.6 Using a 60 mesh sieve, **sift** out any coarse material. **Mix and grind** the sample using a mortar and pestle until a fine consistency is reached.

4.2.7 **Fill** each sample cup with the soil matrix. **Analyze** in duplicate and **average** the results. Higher confidence data from soils in sample cups is achieved if each cup is analyzed in duplicate.

4.2.8 **Tilt** the cup to **remix** the material between each analysis. **Report** the result as the average of the two values, provided they differ by less than 20%. If they differ by more than 20%, sample preparation methods should be reviewed.

4.2.9 **Analyze** a calibration check standard (SRM) and instrument blank after every ten sample analyses, following an extended down period, and at the end of the analysis day/shift.

4.3 QUALITY CONTROL

QC requirements include analysis of blanks (instrument, method), calibration checks (SRMs or known value samples), and replicate samples. Blanks should be less than the instrument detection limits in **Attachment 1**. Instrument blank is clean sand or lithium carbonate. The SRM and continuing calibration should be ±20% D of certified value.

Confirmatory use requires more extensive QC efforts. A site-specific calibration should be performed by split analyzing prepared samples in duplicate by XRF and off-site definitive methods. The results are used to develop a site-specific XRF/Definitive method correlation and calibration curve. Daily QC should include the analysis of blanks, at least three of the site-specific calibration standards bracketing the expected concentration ranges, replicates, and a check sample or SRM. The correlation should be verified and if necessary adjusted on a defined sample analysis or time frequency.

5.0 REFERENCES

Field Portable X-ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment, Method 6200, Revision 0, 1998, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, Third Edition, January.

Instrument Manual for Spectrace Model 9000 XRF, TN Technologies.

Instrument Manual for Niton 700 Series Systems, Niton Inc.

Attachment 1
List of XRF Analytes and Instrument Detection Limits[a]

Element	Typical Reporting Limits for Each Radioactive Source (mg/kg)	
	Cd-109	Am-241
Sulfur		
Chlorine		
Potassium		
Calcium		
Titanium		
Chromium	260	
Manganese	205	
Iron	110	
Cobalt	100	
Nickel	65	
Copper	45	
Zinc	35	
Mercury	30	
Arsenic	25	
Selenium	15	
Lead	15	
Rubidium	5	
Strontium	4	
Zirconium	3	
Molybdenum	4	
Cadmium		50
Tin		85
Antimony		45
Barium		30
Silver		9

[a] Typically achievable in a clean, silica sand matrix. Actual sample detection limits will be higher due to the sample matrix interferences.

Attachment 2
XRF Calibration Log

XRF Model Number:		**XRF Serial Number:**		
Date	**Time**	**Sample No.**	**Instrument Self-Calibration**	
			Leakage Current (Pa)	**Resolution (eV)**

Notes: If the Resolution reads above 900 eV, contact Niton Corporation.
If leakage current is above 160 milliamps, the detector is not performing adequately.

Attachment 3
XRF Sample Collection Log

Client:		XRF Model:		XRF Serial Number:					
Site:		Samplers:		Parameters/Readings (ppm)					
Date	Time	Sample No.	Media	Arsenic	Chromium	Copper	Iron	Lead	Remarks

APPENDIX B

Monitoring Well Boring Logs and Construction Diagrams

PARSONS ENGINEERING-SCIENCE, INC.
DRILLING RECORD

CONTRACTOR: CT & E

GEOLOGIST: BACHOVCHIN/GLENNIE

DRILLING METHOD: HSA/AIR ROTARY

DTW FROM TOC: 122 FT (FROM SURFACE)

DATE/TIME: 12/19/94 1200

PROJECT NAME: RAAP

CLIENT: US AEC

PROJECT NO.: 722843

BORING NO: 48MW1

LOCATION: SWMU 48
NW OF LOWER DISPOSAL AREA

WEATHER: DAMP, 45° F

DATE/TIME START: 12/17/94 1545

DATE/TIME FINISH: 12/19/94 1255

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
1								SILT, SOME CLAY, SOME SAND, ORANGE-BROWN
6–7	1	100	11,9 7,14	3.4	SS	SS 5'-7'	ML	
9								SILT AND SAND, GRAVEL, ORANGE-BROWN, SLIGHT ODOR
11–12	2	100	3,3 4,6	3.5	HS	SS 10'-12'	GM/SM	
12								SILT AND CLAY, ORANGE-BROWN TO YELLOW-BROWN
18								SILT BECOMING MORE COMPETENT, MORE RED, WEATHERED, LAYERED
21–22	3*	95	11,8 7,10	4.0	HS	SS 20'-22'	ML	
26–27	4	95	8,7 8,10	1.1	HS	SS 25'-27'		
31–32	5	80	13,9 10,11	0.0	HS	SS 30'-32'		
36–37	6	75	9,12 9,9	4.0	HS	SS 35'-37'		
41–42	7	95	7,9 10,9	0.0	HS	SS 40'-42'		

LITHOLOGIC COLUMN

WELL COMPLETION: TOC 1819.95' 2.2' STICK UP; GROUT TO SURFACE

DEPTH (FT): 1–45

HSA = HOLLOW STEM AUGER
CAL = CALIBRATION
USCS = UNIFIED SOIL CLASS. SYS.
SS = SPLIT SPOON
A = AUGER CUTTINGS
* = LAB SAMPLE
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
▽ = WATER LEVEL

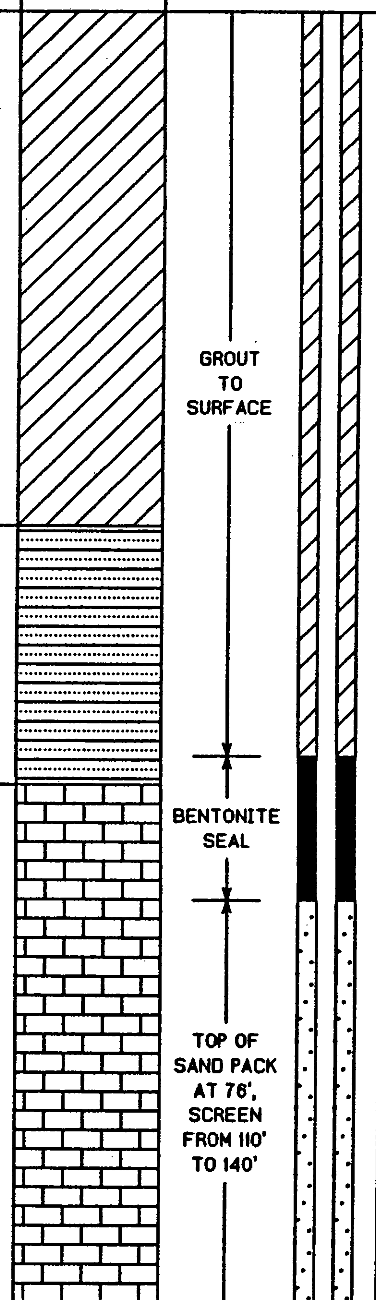
COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

CONTRACTOR: CT & E	BORING NO: 48MW1
GEOLOGIST: BACHOVCHIN/GLENNIE	LOCATION: SWMU 48
DRILLING METHOD: HSA/AIR ROTARY	WEATHER: DAMP, 45° F
DTW FROM TOC: 122 FT (FROM SURFACE)	DATE/TIME START: 12/17/94 1545
DATE/TIME: 12/19/94 1200	DATE/TIME FINISH: 12/19/94 1255

PARSONS ENGINEERING-SCIENCE, INC.
DRILLING RECORD

PROJECT NAME: RAAP
CLIENT: US AEC
PROJECT NO.: 722843

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
46	8	100	9,70	2.8	HS	SS		CLAY AND SILT, TRACE SAND, BROWN, SLIGHTLY DAMP AT 52 FEET, WEATHERED
47			17,16			45'-47'		
51	9	75	9,9	6.0	HS	SS	CL	
52			9,9			50'-52'		
53	10*	75	16,8	6.0	HS	SS		
54			9,8			52'-54'		
60								SWITCHED TO AIR ROTARY DRILLING AT 60 FEET
61	11	60	10,10	4.5	HS	SS		
62			10,10			60'-62'		
64								SILTSTONE, GREEN-BROWN, WEATHERED, VERY DAMP AT 66 FEET
66	12	100	12,28	3.9	HS	SS	SLSN	
67			31,75			65'-67'		
71								DISTINCT CHANGE AT 72 FEET
73								LIMESTONE, DARK BROWN CUTTINGS, ARGILLACEOUS
80							LMSN	



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▽ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

CONTRACTOR: CT & E

GEOLOGIST: BACHOVCHIN/GLENNIE

DRILLING METHOD: HSA/AIR ROTARY

DTW FROM TOC: 122 FT (FROM SURFACE)

DATE/TIME: 12/19/94 1200

PARSONS ENGINEERING-SCIENCE, INC. DRILLING RECORD

PROJECT NAME: RAAP

CLIENT: US AEC

PROJECT NO.: 722843

BORING NO: 48MW1

LOCATION: SWMU 48

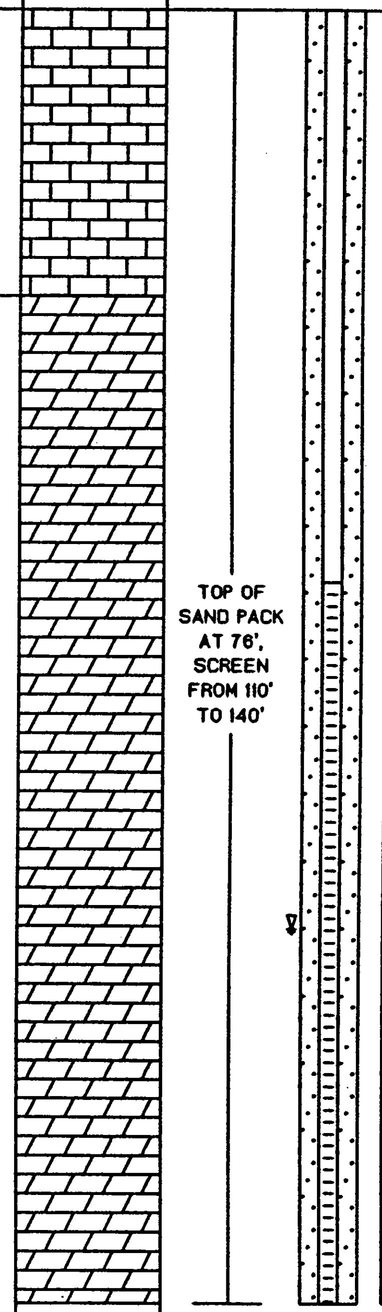
WEATHER: DAMP, 45° F

DATE/TIME START: 12/17/94 1545

DATE/TIME FINISH: 12/19/94 1255

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
91–100							LMSN	LIMESTONE, DARK BROWN CUTTINGS, ARGILLACEOUS STOPPED OVERNIGHT AT 94 FEET, NO WATER IN HOLE 12-19-94 DRILLING RATE IS APPROXIMATELY 1 FOOT/1.5 MINUTES
100–135							DLMT	DOLOMITE, GRAY, WEATHERED, SOFT DRILLING RATE IS APPROXIMATELY 1 FOOT/2.5 MINUTES

LITHOLOGIC COLUMN / WELL COMPLETION



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BH = BORE HOLE
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HS = HEADSPACE
▽ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

CONTRACTOR: CT & E

GEOLOGIST: BACHOVCHIN/GLENNIE

DRILLING METHOD: HSA/AIR ROTARY

DTW FROM TOC: 122 FT (FROM SURFACE)

DATE/TIME: 12/19/94 1200

PARSONS ENGINEERING-SCIENCE, INC. DRILLING RECORD

PROJECT NAME: RAAP

CLIENT: US AEC

PROJECT NO.: 722843

BORING NO: 48MW1

LOCATION: SWMU 48

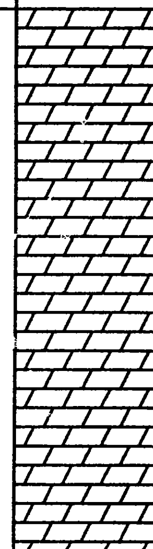
WEATHER: DAMP, 45° F

DATE/TIME START: 12/17/94 1545

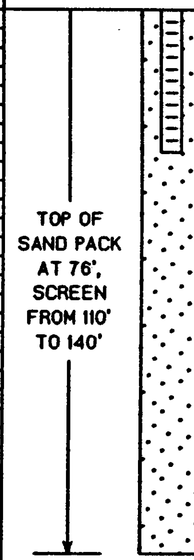
DATE/TIME FINISH: 12/19/94 1255

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS	DEPTH (FT)
136								DOLOMITE, GRAY, WEATHERED, SOFT	136
137									137
138									138
139									139
140									140
141									141
142									142
143									143
144									144
145							DLMT		145
146									146
147									147
148								BECOMES HARDER AT 148 FEET, NO WATER TO END OF BORING, THEN WATER TO 122 FEET AFTER 1.5 HOURS	148
149									149
150									150
151									151
152									152
153									153
154								END OF BORING AT 154 FEET	154
155									155
156									156
157									157
158									158
159									159
160									160
161									161
162									162
163									163
164									164
165									165
166									166
167									167
168									168
169									169
170									170
171									171
172									172
173									173
174									174
175									175
176									176
177									177
178									178
179									179
180									180

LITHOLOGIC COLUMN



WELL COMPLETION



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A = AUGER CUTTINGS
* = LAB SAMPLE
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
▽ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

PARSONS ENGINEERING-SCIENCE, INC.
DRILLING RECORD

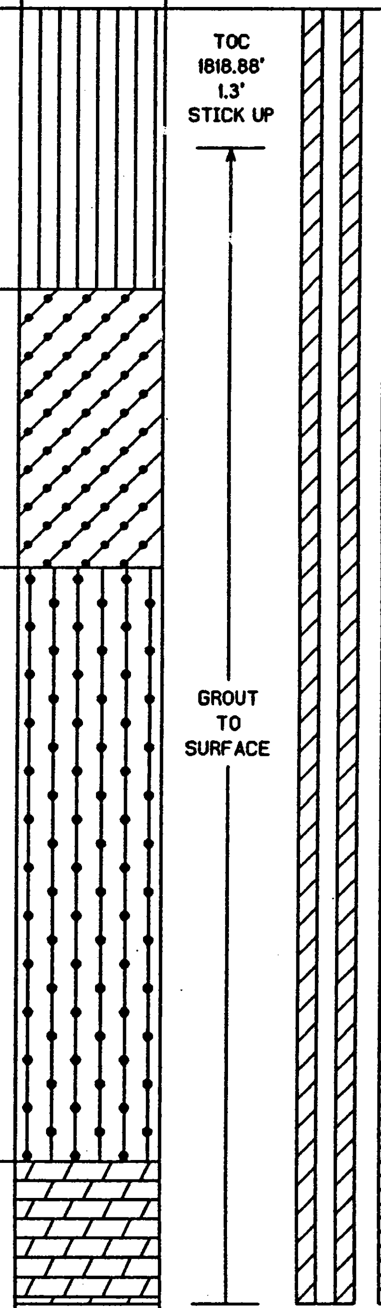
CONTRACTOR: CT & E
GEOLOGIST: BACHOVCHIN/GLENNIE
DRILLING METHOD: HSA/AIR ROTARY
DTW FROM TOC: 126 FT (FROM SURFACE)
DATE/TIME: 1/07/95 0830

PROJECT NAME: RAAP
CLIENT: US AEC
PROJECT NO.: 722843

BORING NO: 48MW2
LOCATION: SWMU 48
SW OF LOWER DISPOSAL AREA
WEATHER: CLEAR, 25° F
DATE/TIME START: 12/19/94 1630
DATE/TIME FINISH: 1/07/95 1200

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
1								SILT, SOME SAND AND CLAY, RED-BROWN
6	1	60	8,12 15,16	0.0	HS	SS 5'-7'	ML	
11	2	75	7,5 5,4	0.0	HS	SS 10'-12'	SM	SILT AND SAND, BROWN
17								VERY HARD DRILLING AT 17 FEET (GRAVEL)
21	3	5	100/ 2.5	0.0	HS	SS 20'-22'	GM/ML	SILT AND CLAY, SOME SAND, LIGHT BROWN, GRAVEL
31	4	30	10,8 5,4	0.0	HS	SS 30'-32'		
41	5*	90	18,25 25,28			SS 40'-42'	DLMT	DOLOMITE, WEATHERED, LIGHT GRAY, ARGILLACEOUS, INTERBEDDED SILTSTONE
45	6*	5	100/1			SS 44'-46'		SWITCHED TO AIR HAMMER AT 44 FT

LITHOLOGIC COLUMN / WELL COMPLETION



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A = AUGER CUTTINGS
* = LAB SAMPLE
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
▽ = WATER LEVEL

COMMENTS:
2 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

PARSONS ENGINEERING-SCIENCE, INC.
DRILLING RECORD

CONTRACTOR: CT & E

GEOLOGIST: BACHOVCHIN/GLENNIE

DRILLING METHOD: HSA/AIR ROTARY

DTW FROM TOC: 126 FT (FROM SURFACE)

DATE/TIME: 1/07/95 0830

PROJECT NAME: RAAP

CLIENT: US AEC

PROJECT NO.: 722843

BORING NO: 48MW2

LOCATION: SWMU 48

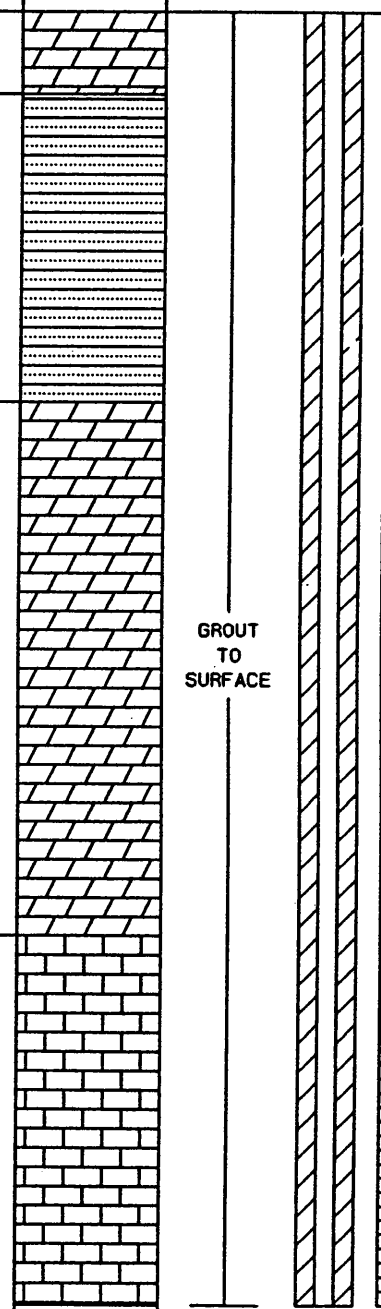
WEATHER: CLEAR, 25° F

DATE/TIME START: 12/19/94 1630

DATE/TIME FINISH: 1/07/95 1200

DEPTH (FT)	SAMPLE ID	RECOVERY *	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
47–49								DOLOMITE, WEATHERED, LIGHT GRAY
49–60							SLSN	SILTSTONE, LIGHT BROWN, WEATHERED, INTERBEDDED GRAY DOLOMITE DRILLING RATE (1 FOOT/3 MINUTES)
60–79							DLMT	DOLOMITE, WEATHERED, LIGHT GRAY, ARGILLACEOUS DRILLING RATE (1 FOOT/2.3 MINUTES) NOTE: SOFT FORMATION NOT RETURNING CUTTINGS UP HOLE. MUST SET TEMPORARY CASING. HOLE IS STOPPED AT 80 FEET OVER HOLIDAY, RESUME DRILLING ON 1-5-95.
79–92							LMSN	LIMESTONE, WEATHERED, GRAY-BROWN

LITHOLOGIC COLUMN / WELL COMPLETION



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A = AUGER CUTTINGS
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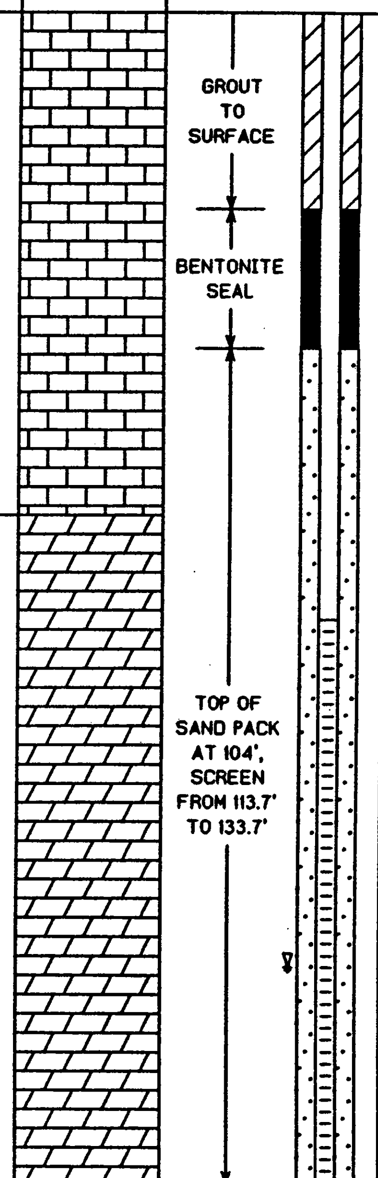
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
∇ = WATER LEVEL

COMMENTS:
2 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

CONTRACTOR: CT & E	# PARSONS ENGINEERING-SCIENCE, INC. DRILLING RECORD	BORING NO: 48MW2
GEOLOGIST: BACHOVCHIN/GLENNIE		LOCATION: SWMU 48
DRILLING METHOD: HSA/AIR ROTARY		WEATHER: CLEAR, 25° F
DTW FROM TOC: 126 FT (FROM SURFACE)	PROJECT NAME: RAAP	DATE/TIME START: 12/19/94 1630
DATE/TIME: 1/07/95 0830	CLIENT: US AEC	
	PROJECT NO.: 722843	DATE/TIME FINISH: 1/07/95 1200

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS	LITHOLOGIC COLUMN	WELL COMPLETION	DEPTH (FT)
93–110							LMSN	LIMESTONE, WEATHERED, GRAY-BROWN DRILLING RATE (1 FOOT/1.7 MINUTES)			93–110
110–133.7							DLMT	DOLOMITE, LIGHT GRAY, WEATHERED, ALTERNATING HARD AND SOFT, GRAY AND BROWN, LAYERS DRILLING RATE (1 FOOT/3.3 MINUTES)			110–134
134–138								END OF BORING AT 133.7 FEET			134–138



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HS = HEADSPACE
▽ = WATER LEVEL

COMMENTS:
2 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

PARSONS ENGINEERING-SCIENCE, INC. DRILLING RECORD

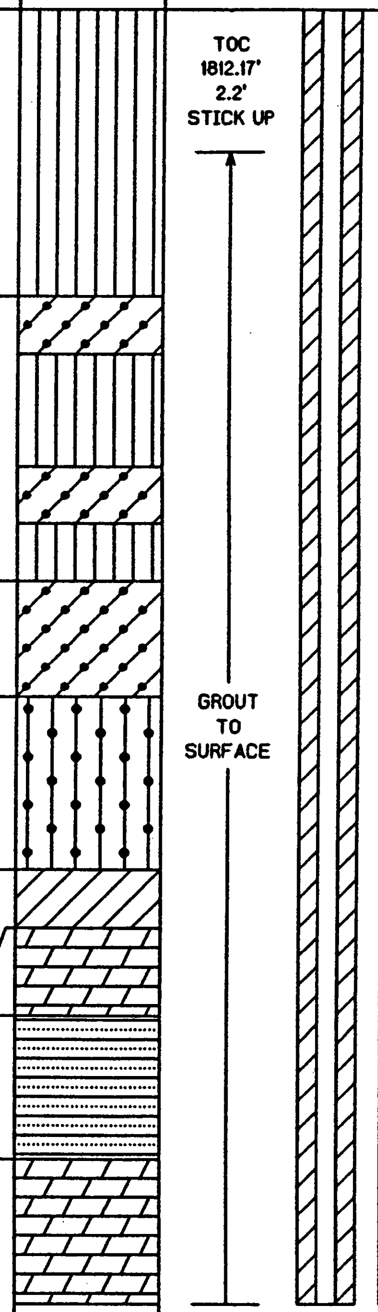
CONTRACTOR: CT & E
GEOLOGIST: BACHOVCHIN/GLENNIE
DRILLING METHOD: HSA/AIR ROTARY
DTW FROM TOC: 119 FT (FROM SURFACE)
DATE/TIME: 1/08/95 1430

PROJECT NAME: RAAP
CLIENT: US AEC
PROJECT NO.: 722843

BORING NO: 48MW3
LOCATION: SWMU 48
SE OF LOWER DISPOSAL AREA
WEATHER: WET, COLD, 40° F
DATE/TIME START: 1/07/95 1237
DATE/TIME FINISH: 1/08/95 1430

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
0–10							ML	SILT AND CLAY, LITTLE SAND, ORANGE-BROWN
10–20	1	95	2,5 8,6	2.0	HS	SS	ML/SM	SILT, LITTLE SAND AND CLAY, ORANGE-BROWN
20–24	2*	95	2,6 6,5	3.5	SS	SS	SM	SILT AND SAND, LITTLE CLAY, ORANGE
24–30							GM	GRAVEL, SILTY
30–32	3*	90	8,26 50/2"	1.1	HS	SS	CL	CLAY AND SILT, YELLOW-BROWN, SWITCHED TO AIR HAMMER AT 32 FEET
32–35							DLMT	DOLOMITE, WEATHERED, LIGHT GRAY
35–40							SLSN	SILTSTONE, BROWN, INTERBEDDED WITH GRAY DOLOSTONE
40–45							DLMT	DOLOMITE, WEATHERED, GRAY, ARGILLACEOUS

LITHOLOGIC COLUMN / WELL COMPLETION



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SS = SPLIT SPOON
A = AUGER CUTTINGS
* = LAB SAMPLE
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
∇ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

CONTRACTOR: CT & E

GEOLOGIST: BACHOVCHIN/GLENNIE

DRILLING METHOD: HSA/AIR ROTARY

DTW FROM TOC: 119 FT (FROM SURFACE)

DATE/TIME: 1/08/95 1430

PARSONS ENGINEERING-SCIENCE, INC.
DRILLING RECORD

PROJECT NAME: RAAP

CLIENT: US AEC

PROJECT NO.: 722843

BORING NO: 48MW3

LOCATION: SWMU 48

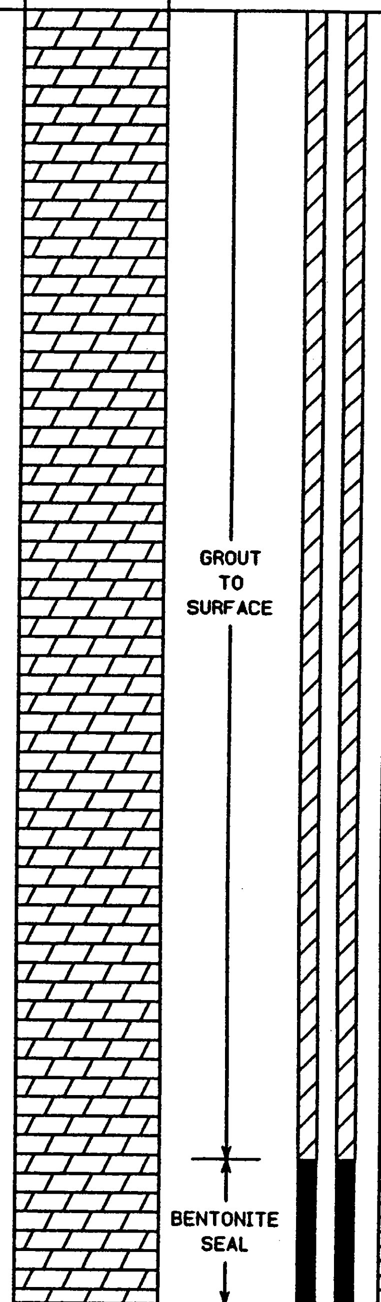
WEATHER: WET, COLD, 40° F

DATE/TIME START: 1/07/95 1237

DATE/TIME FINISH: 1/08/95 1430

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS	WELL COMPLETION	DEPTH (FT)
46								DOLOMITE, WEATHERED, GRAY,		46
47								ARGILLACEOUS		47
48								DRILLING RATE FROM 40-60 FEET		48
49								(1 FOOT/1.8 MINUTES)		49
50										50
51										51
52										52
53										53
54							DLMT			54
55										55
56										56
57										57
58										58
59										59
60										60
61								LESS CLAY, LESS WEATHERING		61
62										62
63										63
64								DRILLING RATE FROM 60-90 FEET	GROUT	64
65								(1 FOOT/6.3 MINUTES)	TO	65
66									SURFACE	66
67										67
68										68
69										69
70										70
71										71
72										72
73										73
74										74
75										75
76										76
77										77
78										78
79										79
80										80
81								DOLOMITE, LIGHT GRAY		81
82										82
83										83
84										84
85										85
86										86
87									BENTONITE	87
88									SEAL	88
89										89
90										90

LITHOLOGIC COLUMN / WELL COMPLETION



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SS = SPLIT SPOON
A = AUGER CUTTINGS
* = LAB SAMPLE
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
∇ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

PARSONS ENGINEERING-SCIENCE, INC. DRILLING RECORD

CONTRACTOR: CT & E

GEOLOGIST: BACHOVCHIN/GLENNIE

DRILLING METHOD: HSA/AIR ROTARY

DTW FROM TOC: 119 FT (FROM SURFACE)

DATE/TIME: 1/08/95 1430

PROJECT NAME: RAAP

CLIENT: US AEC

PROJECT NO.: 722843

BORING NO: 48MW3

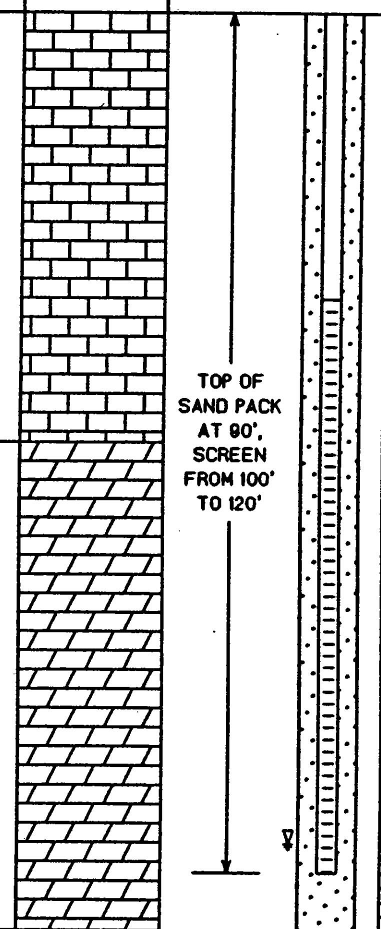
LOCATION: SWMU 48

WEATHER: WET, COLD, 40° F

DATE/TIME START: 1/07/95 1237

DATE/TIME FINISH: 1/08/95 1430

DEPTH (FT)	SAMPLE ID	RECOVERY *	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
91								LIMESTONE, LIGHT GRAY,
92								DRILLING RATE (1 FOOT/4 MINUTES)
94							LMSN	
106								DOLOMITE, LIGHT GRAY, POSSIBLE WET ZONE AT 112 FEET
111							DLMT	
112								DRILLING RATE (1 FOOT/3.5 MINUTES)
122								END OF BORING AT 122 FEET



HSA = HOLLOW STEM AUGER
CAL = CALIBRATION
USCS = UNIFIED SOIL CLASS. SYS.
SS = SPLIT SPOON
A = AUGER CUTTINGS
* = LAB SAMPLE
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
▽ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

CONTRACTOR: CT & E

GEOLOGIST: BACHOVCHIN/GLENNIE

DRILLING METHOD: HSA/AIR ROTARY

DTW FROM TOC: 78.19 FT

DATE/TIME: 7/22/95 1200

PARSONS ENGINEERING-SCIENCE, INC.
DRILLING RECORD

PROJECT NAME: RAAP

CLIENT: US AEC

PROJECT NO.: 722843

BORING NO: 48MW4

LOCATION: SWMU 48 CENTER OF UPPER DISPOSAL AREA

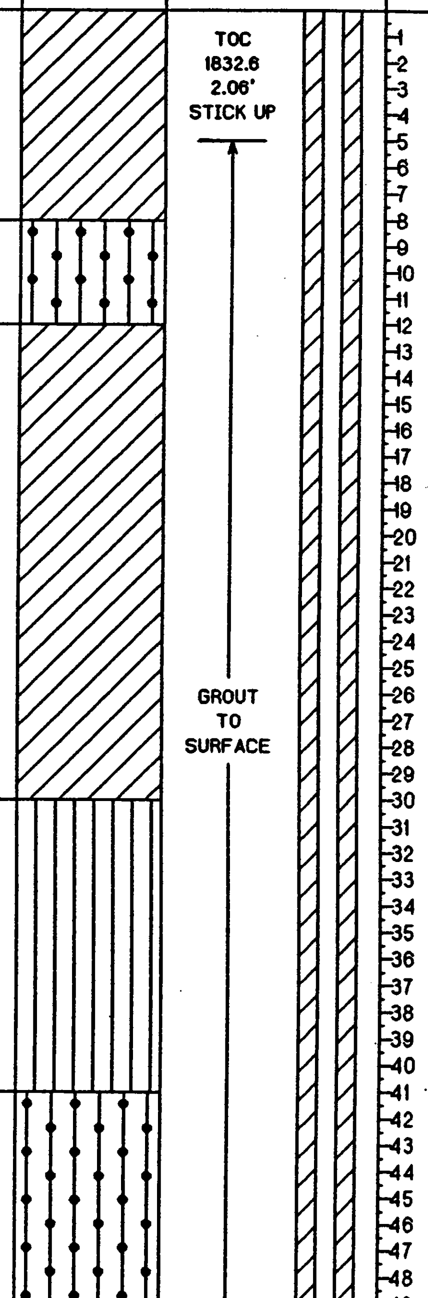
WEATHER: RAIN, 85' F

DATE/TIME START: 7/18/95 1100

DATE/TIME FINISH: 7/20/95 1830

DEPTH (FT)	SAMPLE ID	RECOVERY %	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
0–8				0.1 (at 4)	BH		CL	CLAY AND SILT, LITTLE SAND, RED-BROWN
8–12				0.0 (at 10)	BH		GM	SILT AND GRAVEL, LITTLE SAND, ORANGE-BROWN
12–30				0.0 (at 18); 0.0 (at 27)	BH		CL	CLAY AND SILT, LITTLE SAND, RED-BROWN, MOIST
30–41				0.0 (at 33)	BH		ML	SILT AND CLAY, ORANGE-BROWN, MOIST ZONE AT 40-41 FEET
41–49				0.0 (at 45)	BH		GM	SAND AND GRAVEL, SOME SILT, BROWN, MOIST, GRAVEL LAYER AT 49 FEET

LITHOLOGIC COLUMN / WELL COMPLETION



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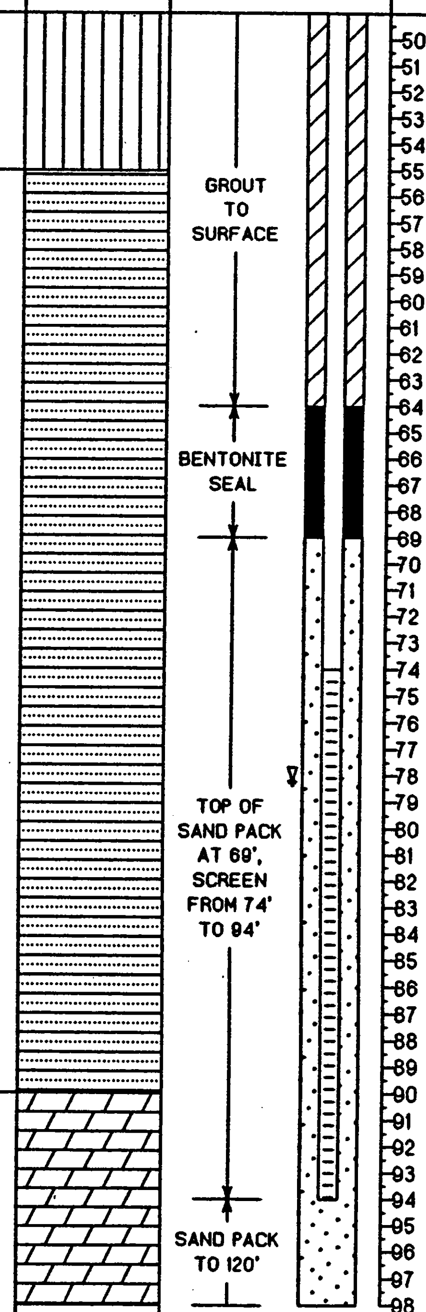
SS = SPLIT SPOON
A = AUGER CUTTINGS
* = LAB SAMPLE
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
▽ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

CONTRACTOR: CT & E	# PARSONS ENGINEERING-SCIENCE, INC. DRILLING RECORD	BORING NO: 48MW4
GEOLOGIST: BACHOVCHIN/GLENNIE		LOCATION: SWMU 48
DRILLING METHOD: HSA/AIR ROTARY		WEATHER: RAIN, 85° F
DTW FROM TOC: 78.19 FT	PROJECT NAME: RAAP	DATE/TIME START: 7/18/95 1100
DATE/TIME: 7/22/95 1200	CLIENT: US AEC	DATE/TIME FINISH: 7/20/95 1830
	PROJECT NO.: 722843	

DEPTH (FT)	SAMPLE ID	RECOVERY *	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
50–55				0.0 (52)	BH		ML	SILT, BROWN, BECOMING MORE COMPETENT, SWITCHED TO AIR ROTARY DRILLING AT 55 FEET
55–90				0.0 (60)	BH		SLSN	SILTSTONE, WEATHERED, ALTERNATING RED AND GREEN LAYERS, INTERBEDDED DOLOMITE (SLIGHT HCL FIZZ)
				0.0 (71)	BH			
				0.0 (84)	BH			
90–98				0.0 (94)	BH		DLMT	DOLOMITE, GREEN-GRAY, AND INTERBEDDED DARK GRAY SILTSTONE, SOFT ZONE AT 100-108 FEET (WATER?)

LITHOLOGIC COLUMN / WELL COMPLETION / DEPTH (FT)



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A = AUGER CUTTINGS
* = LAB SAMPLE

BH = BORE HOLE
GS = GRAB SAMPLE

HS = HEADSPACE
∇ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

CONTRACTOR: CT & E

GEOLOGIST: BACHOVCHIN/GLENNIE

DRILLING METHOD: HSA/AIR ROTARY

DTW FROM TOC: 78.19 FT

DATE/TIME: 7/22/95 1200

PARSONS ENGINEERING-SCIENCE, INC. DRILLING RECORD

PROJECT NAME: RAAP

CLIENT: US AEC

PROJECT NO.: 722843

BORING NO: 48MW4

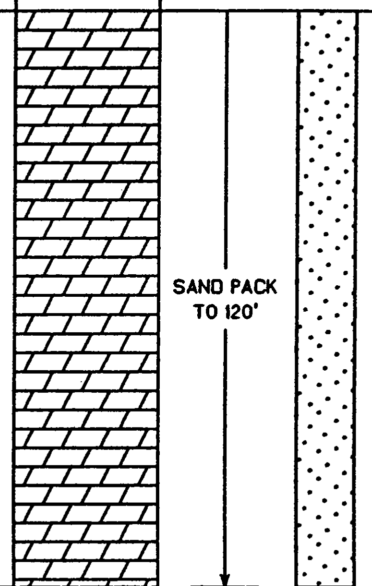
LOCATION: SWMU 48

WEATHER: RAIN, 85° F

DATE/TIME START: 7/18/95 1100

DATE/TIME FINISH: 7/20/95 1830

DEPTH (FT)	SAMPLE ID	RECOVERY *	BLOW COUNT	PID (ppm)	READING AT	SAMPLE TYPE	USCS	LITHOLOGY/REMARKS
99–120				0.0 (at 108)	BH		DLMT	DOLOMITE, GREEN-GRAY, AND INTERBEDDED DARK GRAY SILTSTONE, SOFT ZONE AT 100-108 FEET (WATER?)
120								END OF BORING AT 120 FEET



Depth scale (FT): 99–147

HSA = HOLLOW STEM AUGER
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A = AUGER CUTTINGS
* = LAB SAMPLE
BH = BORE HOLE
GS = GRAB SAMPLE
HS = HEADSPACE
▽ = WATER LEVEL

COMMENTS:
4 INCH ID PVC, SCH 40
0.01 INCH SLOT SCREEN

BORING 41MW1

Surface Elevation: 0
Location: Radford AAP, Virginia
Start: 08:15 on 10-8-91
Finish: 10:45 on 10-10-91

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %
0						
	SPT	1	19		10	
5						
	SPT	2	10		5	
10						
	SPT	3	63		79	
15						
20	NX			1	100	85
25	NX			2	98	100
30	NX			3	100	27
35	NX			4	100	50
	NX			5	82	96
40						

Sample Interval

Symbols	Description
CL	REDDISH BROWN (5YR 4/4) SILTY CLAY, STIFF, LITTLE YELLOW AND OLIVE MOTTLING, DRY GRADING DARK BROWN (7.5YR 3/3) BECOMING SLIGHTLY PLASTIC, TRACE MEDIUM SAND, SLIGHTLY MOIST SLIGHTLY GRAVELLY GRADING SOFTER GRAVEL SEAM 11.0–12.0 FEET BLACK SILT, SOFT, AND LIGHT BROWN SILT WITH REDDISH YELLOW MOTTLING OVERLAYING BEDROCK AT 13.0 FEET
LS/DLST	LIMESTONE/DOLOSTONE, LIGHT GRAY TO BLUISH BLACK, HARD, WELL CEMENTED, MODERATELY TO HIGHLY FRACTURED, WITH CALCITE INFILLING RUST COLORED STAINING FOUND AT MOST FRACTURES GRADES TO LIGHT GRAY (N/7), HARD ZONE OF MORE FRACTURES, THICKER CALCITE VEINS, SOME SAND AND CLAY FILLED PARTINGS BECOMES DARK GRAY TO BLUISH BLACK, WITH ABUNDANT CALCITE FILLED CRACKS. RUST COLORED STAINING, LESS FREQUENT TRACE PYRITE AT 24.0 FEET LESS FRACTURED, CALCITE VEINS BECOME PITTED AND VUGGY GRAYISH BROWN (2.5Y 5/2) HIGHLY WEATHERED AND FRACTURED ZONE FROM 32.0 TO 35.0 FEET SOME FRACTURES STAINED STRONG BROWN (7.5YR 5/6) GRAY (N/5) CONTINUED GRAY, HARD, WITH HEALED CRACKS AND FRACTURES

PLATE
LOG OF BORING

Dames & Moore

FILE

BORING 41MW1 (Cont'd)

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval	Symbols	Description
40								LS/DLST	GRADES TO 10YR 4/3 DARK BROWN WITH VARYING SHADES OF GRAY, WITH ABUNDANT CALCITE CRYSTALS, SLIGHT PITTING
									BECOMING LESS FRACTURED, WITH FRACTURES OCCURRING ALONG CALCITE VEINS, WHERE MINERAL STAINING IS EVIDENT (YELLOWISH BROWN AND BLACK)
45	NX			6	80	90			
50	NX			7	90	93			
									SAME LIMESTONE/DOLOSTONE WITH FEW FRACTURES AND YELLOWISH RED STAINING AT FRACTURES
55	NX			8	100	57			
									SOME LIGHT OLIVE SHADING
60	NX			9	100	98			
									BECOMES PITTED, CALCITE MORE OBUNDANT, THIN SEAMS OF MORE WEATHERED LIMESTONE INTERBEDDED WITH THE HARDER DOLOSTONE/ LIMESTONE
									PITTING ENDS 62.9 FEET WHERE BECOMES HARDER
65	NX			10	100	83			
									BECOMING DARKER, FEW FRACTURES
70	NX			11	100	88			
									GRADING DARKER TO DARK BLUISH GRAY (5B 4/1), WITH FEW FRACTURES AND CALCITE-HOLED CRACKS HEALED CRACKS SHOW SLIGHT SIGNS OF WEATHERING
75	NX			12	96	100			
80	NX			13	100	90			

PLATE
LOG OF BORING

Dames & Moore

FILE

BORING 41MW1 (Cont'd)

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval	Symbols	Description
80									WITH SLIGHT ORANGE-YELLOW STAINING
									BORING TERMINATED AT A DEPTH OF 81.5 FEET
85									

PLATE
LOG OF BORING

Dames & Moore

FILE

BORING 41MW2

Surface Elevation: **1,795.4** Feet, MSL
Location: Radford AAP, Virginia
Start: 10:25 on 9-4-91
Finish: 15:30 on 9-6-91

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval
0	SPT	1	13		60		
5	SPT	2	17		30		
10	SPT	3	11		45		
15	SPT	4	11		65		
20	SPT	5	49		90		
25	SPT	6	42		0		
30	SPT	7			35		
35							
40							

Symbols	Description
CL	BROWN (7.5YR 5/4) SILTY SANDY CLAY WITH PEA GRAVEL, SLIGHTLY PLASTIC, SLIGHTLY MOIST, MEDIUM STIFF PLASTICITY INCREASING, SAND CONTENT DECREASING OCCASIONAL GRAVEL ZONES CLAY BECOMING MOIST OCCASIONAL SILTY ZONES GRAVEL DECREASING
CL	STRONG BROWN (7.5YR 4/6) HIGHLY PLASTIC CLAY, SMALL BLACK SPECKS, TRACE SAND, NO GRAVELS, VERY STIFF OCCASIONAL GRAVELS OR COBBLES
LS/DLST	YELLOWISH BROWN (5YR 4/4) SILTY CLAY, WITH SOME REDDISH BROWN MOTTLING, OVERLYING BEDROCK BLUE-GRAY LIMESTONE/DOLOSTONE, DRY, HARD

PLATE
LOG OF BORING

Dames & Moore

BORING 41MW2 (Cont'd)

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval	Symbols	Description
40									
	AH	1						LS/DLST	BLUE GRAY LIMESTONE/DOLOSTONE, HARD
45									
50									
55	AH	2							BLUE-GRAY LIMESTONE/DOLOSTONE, HARD
60									
	AH	3							BLUE-GRAY LIMESTONE/DOLOSTONE, HARD, DRY
65									
70									
	AH	4							BLUE-GRAY LIMESTONE/DOLOSTONE, HARD, DRY
75									
80									

PLATE
LOG OF BORING

Dames & Moore

BORING 41MW2 (Cont'd)

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval	Symbols	Description
80									
	AH	5							BLUE-GRAY LIMESTONE/DOLOSTONE, HARD, DRY
85									
90									
									BECOMING SOFTER GRAY, CLAYEY LIMESTONE/DOLOSTONE
95	AH	6							
100								LS/DLST	
	AH	7							GRAY, CLAYEY, SOFT LIMESTONE/DOLOSTONE
105									
110									
									ROCK GETTING SOFTER, CUTTINGS SLIGHTLY MOIST
115	AH	8							
120									

PLATE
LOG OF BORING

Dames & Moor

BORING 41MW2 (Cont'd)

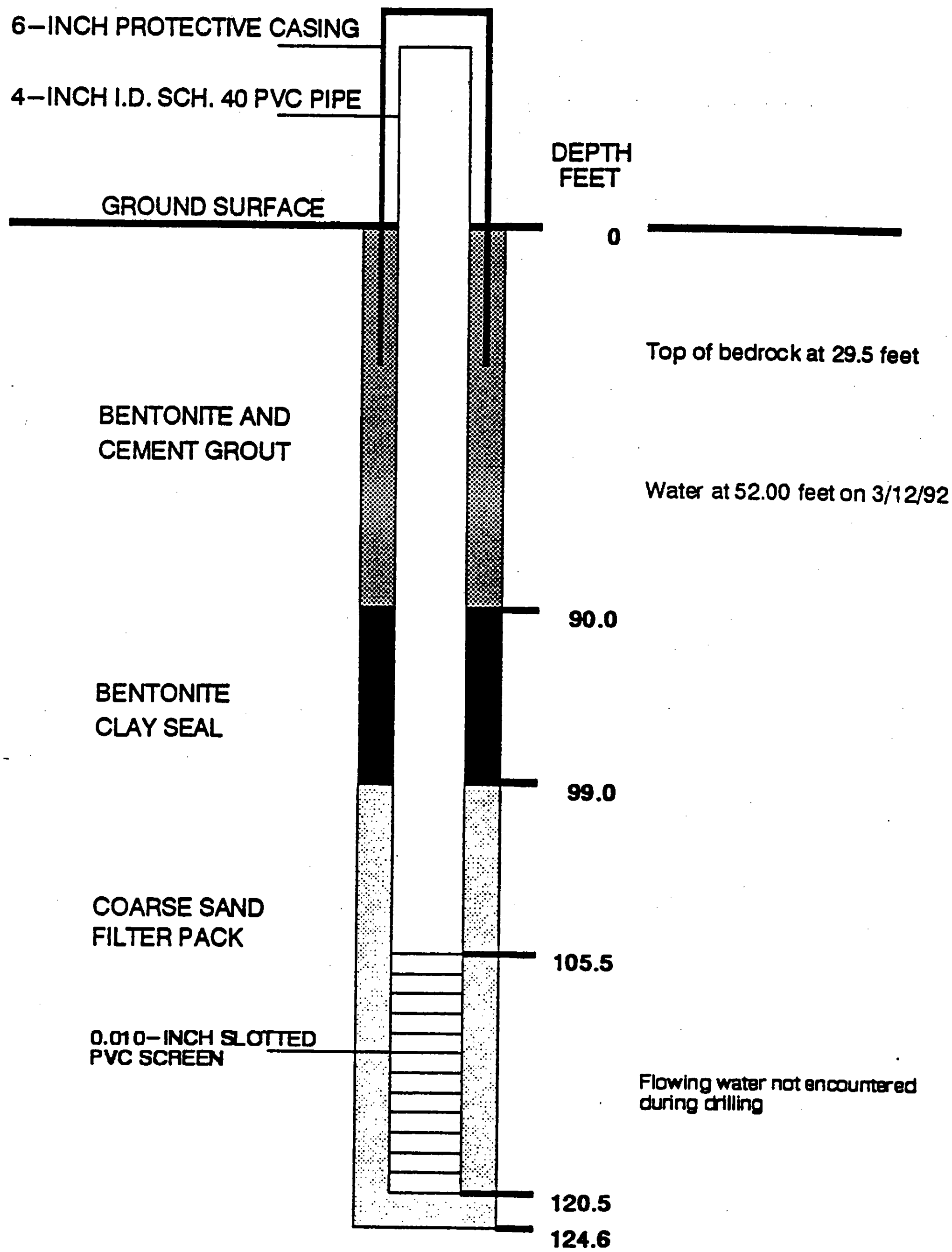
Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval	Symbols	Description
120									
	AH	9						LS/DLST	CUTTINGS MOIST, SOFT, LIGHT GRAY CLAYEY LIMESTONE/DOLOSTONE
125									BORING TERMINATED AT A DEPTH OF 125.0 FEET

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR VERIFICATION INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 41MW2
Installation Date: 9/6/91
Surface Elevation: 1795.4 Feet
Top of PVC Elevation: 1797.45 Feet



NOT TO SCALE

BORING 41MW3

Surface Elevation: **1,757.3** Feet, MSL
Location: Radford AAP, Virginia
Start: 07:30 on 10-17-91
Finish: 14:00 on 10-17-91

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Symbols	Description
0	SPT	1	35		65		ML	STRONG BROWN (7.5YR 4/6) CLAYEY SILT WITH SOME GRAVELS, WITH REDDISH BROWN AND VERY PALE BROWN MOTTLING
							CL	DARK YELLOWISH BROWN (10YR 4/4) SANDY CLAY, HIGHLY PLASTIC WITH OCCASIONAL GRAVELLY ZONES
5	SPT	2	22		65			
								BECOMES STRONG BROWN (7.5YR 5/6)
10	SPT	3	18		95			MORE GRAVELS
								VERY GRAVELLY 14-19 FEET, WITH CLAY
15	SPT	4	103		45			
							ML	PALE OLIVE (5YR 6/3) AND OLIVE YELLOW (2.5Y 6/6) SILT, HARD, DRY, FRIABLE, SLIGHTLY GRAVELLY, WITH SOME BLACK STAINING
20	SPT	5	82		80			OCCASIONAL THIN SILTSTONE SEAMS (OLIVE GRAY)
								GRADES TO LIGHT YELLOWISH BROWN (2.5Y 6/4) WITH OLIVE AND GRAY MOTTLING
25	SPT	6	35		80		CL	STRONG BROWN (7.5YR 5/6) CLAY, SOFT, MOIST, STICKY, HIGHLY PLASTIC
30	SPT	7	50/0		100		SH	DARK GREENISH GRAY (5BG 4/1) SHALE, WITH ABUNDANT CALCITE VEINS, NO APPARENT BEDDING, YELLOW STAINING AT FRACTURES
35	NX			1	95	66		BECOMES HIGHLY WEATHERED YELLOWISH BROWN WITH INCREASED CLAY
								OCCASIONAL LAYERS OF SILTSTONE AND PITTED LIMESTONE
40								

PLATE
LOG OF BORING

Dames & Moore

BORING 41MW3 (Cont'd)

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Symbols
40							
	NX			2	88	45	SH
45							
	NX			3	100	78	DLST
50							
55							
60							
65							

Description

LESS WEATHERED DARK GREENISH GRAY SHALE WITH CALCITE VEINS

WITH HIGHLY WEATHERED AND CLAYEY ZONES

BECOMES PITTED AND SLIGHTLY VUGGY CLAYEY DOLOSTONE, GRAY (N/5) WITH THIN LIMESTONE SEAMS, HIGHLY WEATHERED, SANDY

BLUISH GRAY, HIGHLY CRACKED AND RECEMENTED WITH SOME REDDISH BROWN STAINING

CONTINUED HIGHLY WEATHERED

WET

BROWN (10YR 5/3) DOLOSTONE, WET, MUDDY

SOFT, MUDDY

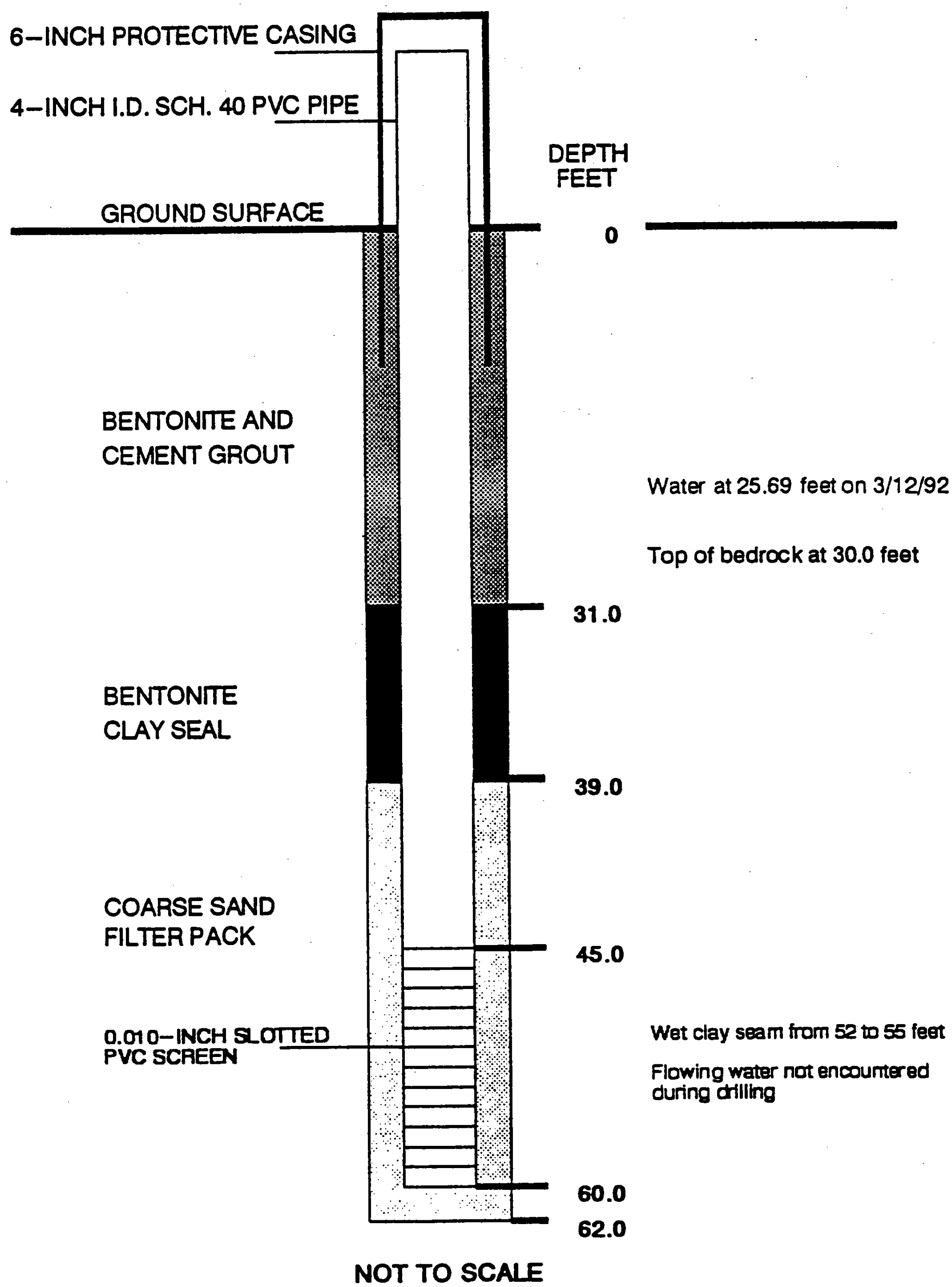
BOREHOLE TERMINATED AT A DEPTH OF 62.0 FEET

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR VERIFICATION INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 41MW3
Installation Date: 10/17/91
Surface Elevation: 1757.3 Feet
Top of PVC Elevation: 1759.35 Feet



BORING OMW1

Surface Elevation: 1777.6 Feet, MSL
Location: Radford AAP, Virginia
Start: 8:30 on 11-11-91
Finish: 11:30 on 11-11-91

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %
0	SPT	1	26		75	
5	SPT	2	19		50	
10	SPT	3	14		100	
15	SPT	4	5		100	
20	SPT	5	7		100	
25	SPT	6	4		100	
30	SPT	7			100	
35	SPT	8	100/5		100	
40						

Symbols	Description
SC	STRONG BROWN (7.5YR 4/6) SILTY CLAYEY SAND, SLIGHTLY MOIST, NO ODOR GRAVELLY
ML	BROWNISH YELLOW (10YR 6/8) GRAVELLY CLAYEY SILT, TRACE SAND, MEDIUM STIFF, NO ODOR WITH YELLOWISH RED AND BLACK MOTTLING PRODUCT ODOR AT 15.0 FEET
ML	OLIVE BROWN (2.5Y 4/4) OLIVE BROWN SLIGHTLY SANDY SLIGHTLY CLAYEY SILT, SOFT, SLIGHTLY MOIST, WITH RED, BLUISH GRAY, AND YELLOWISH BROWN MOTTLING STRONGER FUEL ODOR AT 19.0 FEET
CL/CH	LIGHT YELLOWISH BROWN (2.5Y 6/4) CLAY, SOFT, HIGHLY PLASTIC WITH SOME GRAY (N/5) MOTTLING, VERY MOIST TO WET WATER AT 25.0 FEET
ML	YELLOWISH BROWN (10YR 5/8) SILT, VERY SOFT, CLAYEY ENCOUNTERED BEDROCK AT 35.5 FEET

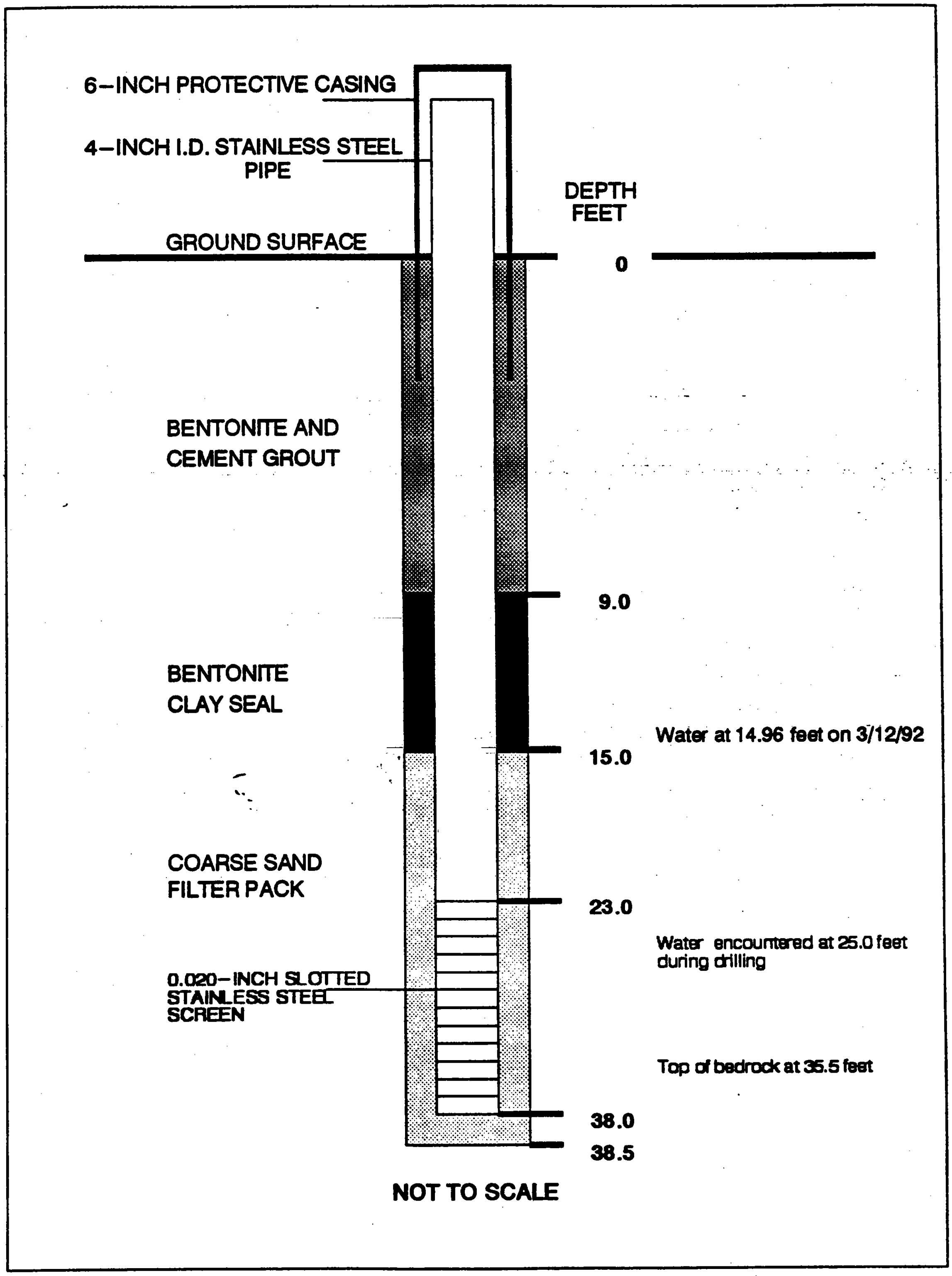
BOREHOLE TERMINATED AT A DEPTH OF 38.0 FEET

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR RCRA FACILITY INVESTIGATION
RADFORD AAP, VIRGINIA

Location: OMW1
Installation Date: 11/11/91
Surface Elevation: 1777.6 Feet
Top of SS Elevation: 1780.04 Feet



BORING	OMW2
SURFACE ELEVATION:	1776.1 FEET, MSL
LOCATION:	RADFORD AAP, VIRGINIA
START:	16:50 ON 6/4/93
FINISH:	11:40 ON 6/5/93

DEPTH (FEET)	SAMPLING METHOD	SAMPLE NO.	BLOW COUNT/FOOT	% RECOVERY
0	CUT			
5	SPT	1	17	100
10	SPT	2	12	100
15	SPT	3	9	100
20	SPT	4	5	100
25	SPT	5	4	100
30				

SYMBOLS	DESCRIPTION
–	STRONG BROWN SANDY SILT SLIGHTLY CLAYEY, SLIGHTLY MOIST, NO ODOR
CL	REDDISH YELLOW (7.5 YR 6/8) SLIGHTLY STIFF SILTY CLAY, TRACE SAND, HIGHLY PLASTIC, SLIGHTLY STICKY, MOIST, NO ODOR GRADING YELLOWISH BROWN (10 YR 5/8) W/ PALE BROWN (10 YR 6/3) MOTTLING
CL/ML	YELLOWISH BROWN (10 YR 5/8) SOFT TO MEDIUM STIFF VERY CLAYEY SL. SANDY SILT, STICKY, VERY MOIST TO WET, NO STAINING OR ODORS. TRACE YELLOW MOTTLING. TRACE MUDSTONE FRAGMENTS PROBABLE WATER TABLE DEPTH AT 17 FEET SAND INCREASING W/ DEPTH
CL	STRONG BROWN (7.5 YR 5/8) SANDY SILTY CLAY, VERY SOFT, TRACE FINE GRAVELS, NO ODORS OR STAINS GRADING YELLOWISH RED (5 YR 5/6) W/ INCREASING SAND, COARSE
ML	BROWN (10 YR 5/3) BROWN SANDY SILT ROCK AT 28 FEET

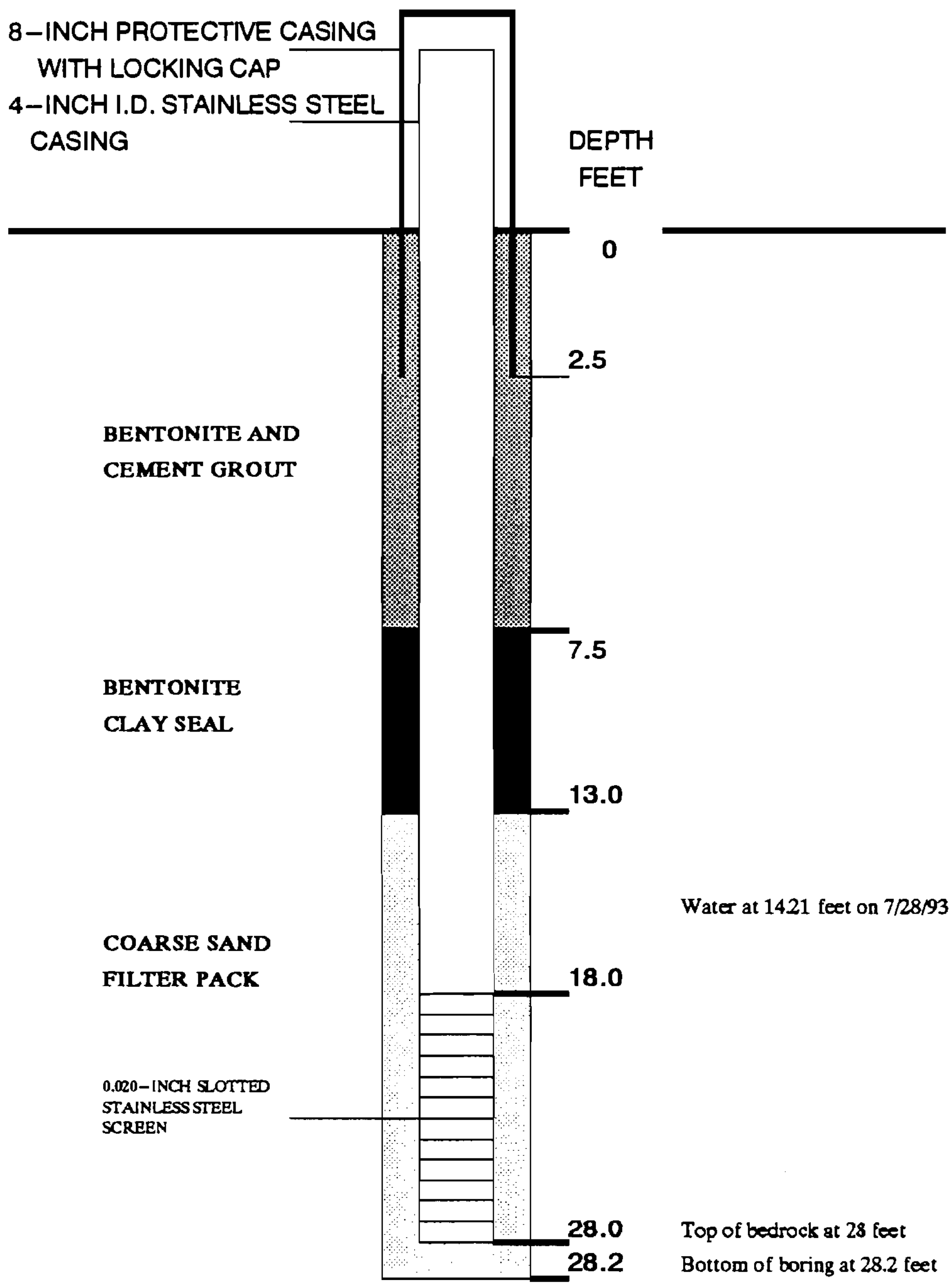
BOREHOLE TERMINATED AT A DEPTH OF 28 FEET

LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM FOR VERIFICATION INVESTIGATION RADFORD AAP, VIRGINIA

Location: OMW2
Installation Date: 6/5/93
Surface Elevation: 1776.1 Feet
Top of St. Elevation: 1778.60 Feet



NOT TO SCALE

Betz·Converse·Murdoch·Inc. BCM

Drilling Log

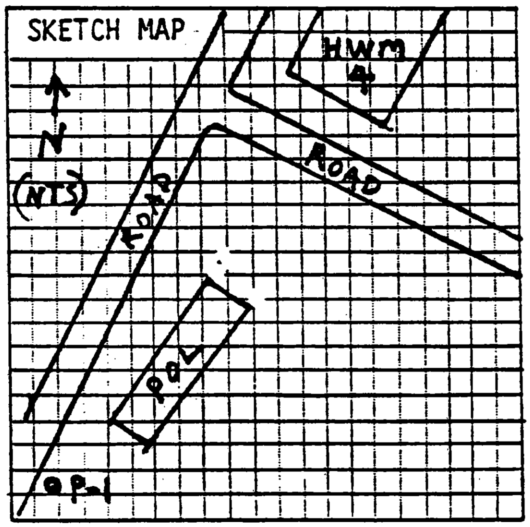
Well Number P-1

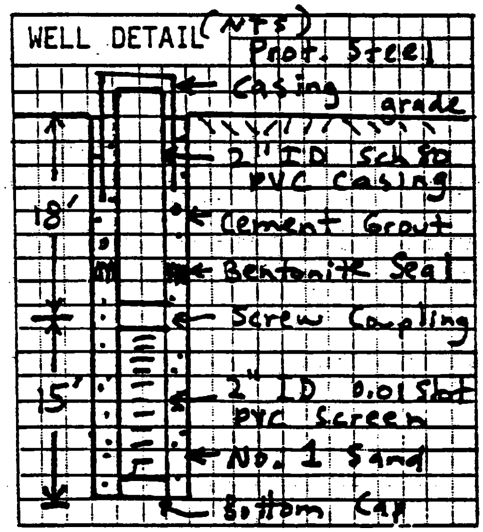
Client Corps of Engineers/Radford AAP Project No. 00-0008-01
Well Location upslope from tank farm - POL area
Driller/Company Dean/Cunningham
Drilling Method NX core Hole Diameter Nominal 4" Date(s) Drilled 2/4 - 7/83
Sample Type split spoon/core Sample Interval spoon 5'* No. Samples Retained 6
Surface Elevation 1777.02' Casing Top Elevation 1779.77' Total Well Depth 33
Casing Material and Size 2" ID PVC ** Cased Interval(s) 0-18 (+2' stickup)
Grouting Type a sand/cement Grouted Interval 0 - 17
Screening Material and Size 2" ID PVC; 0.010" slots ** Screened Interval(s) 18 - 33
Packing Material and Size No. 1 sand Packed Interval 17 - 33
Depth to Static Water 12.58' *** Date 2/24/83 Approx Well Yield 3 - 4 gpm
Development Method air Development Time 1.5 hours
Logged by: Peter R. Jacobson

Comments

* continuous core sampling
** threaded couples

*** Measured from top of PVC casing





Depth Scale	Sample	Spoon Blows	Description of Materials
0 - 1.5	spoon	5-12-6	medium to dark brown, dry, silty clay; very thin sand lenses
5 - 6.5	spoon	5-12-15	orange brown sandy clay, black/brown specks; some fine gravel
10 - 11.5	spoon	3-7-9	mottled grey-green and orange-brown sandy clay; occasional pebbles
13			coarse gravel
15 - 16.5	spoon	1-1-3	moist orange-brown to yellow-brown clay; thin silt and sand stringers
20 - 21.5	spoon	1-1-1	soft, moist, mottled orange-brown/yellow-brown sandy clay
25 - 26.5	spoon	1-10-7	weathered blue-grey sandy dolomite; clay seams; grades to top of rock at 26'; noticeable water above rock
26 - 33	core		grey conglomeratic dolomite, angular to subangular clasts; clasts coarse sand to cobble gravel; clay seam from 31.5 to 32.5
end of hole @ 33'			

Betz·Converse·Murdoch·Inc. BCM

Drilling Log

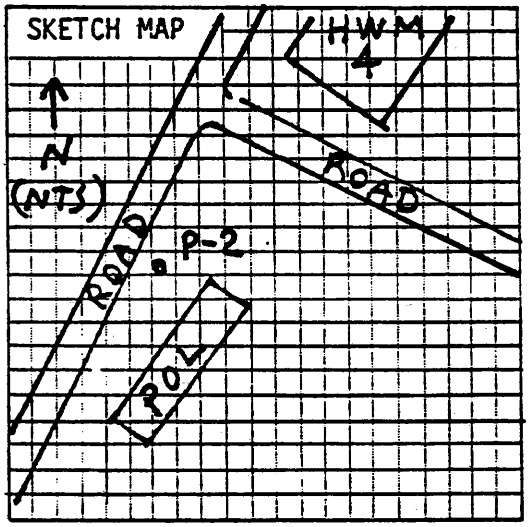
Well Number P-2

Client Corps of Engineers/Radford AAP — Project No. 00-0008-01
Well Location west of northernmost tank - POL area
Driller/Company Dean/Cunningham
Drilling Method NX core — Hole Diameter nominal 4" — Date(s) Drilled 2/3 - 4/83
Sample Type split spoon/core — Sample Interval spoons 5'* — No. Samples Retained 3
Surface Elevation 1756.20' — Casing Top Elevation 1758.61' — Total Well Depth 21
Casing Material and Size 2" ID PVC ** — Cased Interval(s) 0-1 (+2' stickup)
Grouting Type sand cement; bentonite seal — Grouted Interval 0-1 (0.5' bentonite
Screening Material and Size 2" ID; 0.010 slots — Screened Interval(s) 1 - 21
Packing Material and Size No. 1 sand — Packed Interval 1 - 21
Depth to Static Water 4.21' *** — Date 2/24/83 — Approx Well Yield 4 - 5 gpm
Development Method air — Development Time 4 hours
Logged by: Peter R. Jacobson

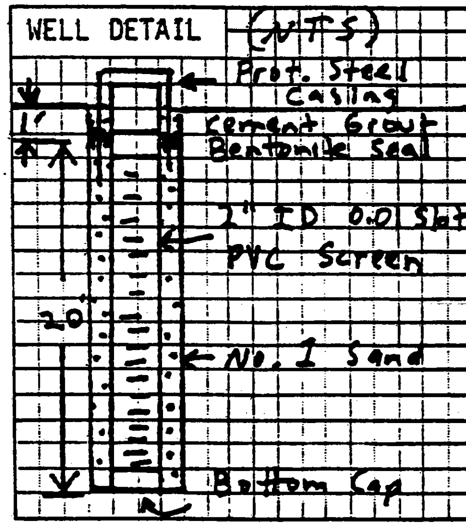
Comments

* continuous core sampling
** all joints threaded
*** measured from top of PVC casing

SKETCH MAP



WELL DETAIL



Depth Scale	Sample	Spoon Blows	Description of Materials
0 - 1.5	spoon	2-4-3	damp silty clay, minor sand, occasional pebbles; medium brown occasional orange/brown streaks; friable in zones
5 - 6.5	spoon	3-4-9	damp medium brown to orange brown silty clay with thin coarse sandy zones, minor pebbles
10 - 11.5	spoon	50/3"	wet clayey sand, yellow brown,gravel at 11'
13 - 14	core		top of rock at 13'; vuggy, grey, thinly laminated dolomite
14 - 15	core		orange brown/greenish grey dolomite, thin veins of quartz; irregular fracturing, small vugs
15 - 16	core		crumbly grey dolomite; small vugs; slightly brecciated
16 - 21	core		grey/white/buff thinly laminated dolomite; small quartz veins
end of hole @ 21'			

Betz·Converse·Murdoch·Inc. BCM

Drilling Log

Well Number P-3

Client Corps of Engineers/Radford AAP
Project No. 00-0008-01
Well Location POL site
Driller/Company Dean/Cunningham
Drilling Method NX core
Hole Diameter 4" nominal
Date(s) Drilled 2/2 - 3/83
Sample Type split spoon/core
Sample Interval 5' spoon *
No. Samples Retained 4 spoon *
Surface Elevation 1752.54'
Casing Top Elevation 1754.57'
Total Well Depth 25'
Casing Material and Size 2" ID PVC
Cased Interval(s) 0 - 10 **
Grouting Type sand/cement grout
Grouted Interval 0 - 8
Screening Material and Size 2" ID PVC; 0.010 slots
Screened Interval(s) 10 - 25
Packing Material and Size No. 1 sand
Packed Interval 9 - 25
Depth to Static Water 7.94' ***
Date 2/24/83
Approx Well Yield 1 - 2 gpm
Development Method air
Development Time 4 hours
Logged by: Peter R. Jacobson

Comments

* continuous core samples; all core recovered retained

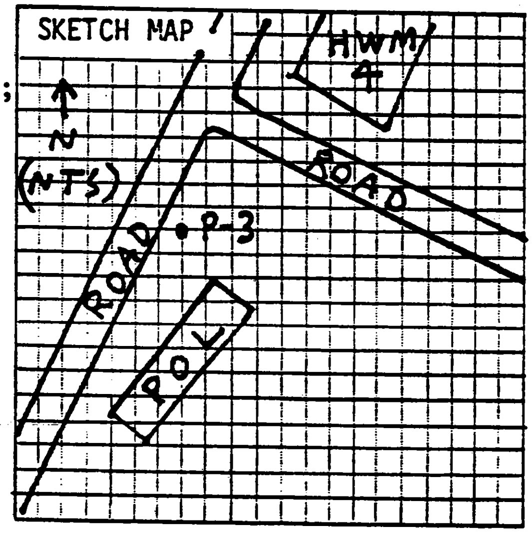
** plus 2' stickup

Note: all screen and casing joints by threaded couples

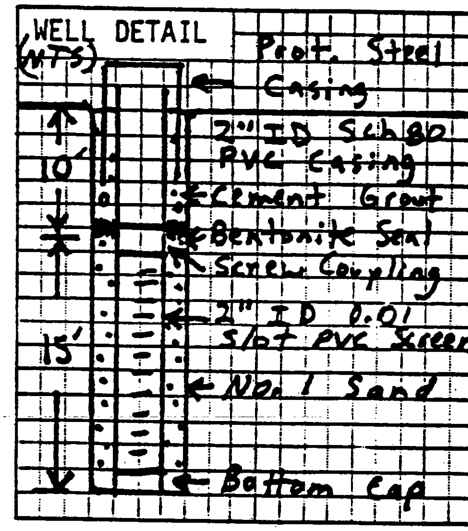
No petroleum odors noted

*** Measured from top of PVC casing

SKETCH MAP



WELL DETAIL



Depth Scale	Sample	Spoon Blows	Description of Materials
0 - 1.5	spoon	2-4-3	dark grey to brown silty clay, minor sand
5 - 6.5	spoon	18-28-38	medium brown clay, silty sandy lenses, occasional gravel; soil is damp, not saturated
6.5 - 10	core		cobble gravel, mostly white/buff sandstone
10 - 10'3.5"	spoon	5-/3.5"	brown/buff clay and silt grading to decomposed dark grey limestone
10'3.5" - 15	core		brecciated dolomite; matrix is silt and clay, clasts are sand to coarse gravel; most clasts are buff/grey dolomite subangular to rounded
15 - 20	core		same as above to 18'; at 18' sharp contact from brown matrix to grey, clasts more angular coarse
20 - 25	core		same as above becoming coarser and more angular with depth; 6" - 8" zones of vuggy dolomite separated by brecciated angular grey dolomite
end of hole at 25'			

Betz·Converse·Murdoch·Inc. BCM

Drilling Log

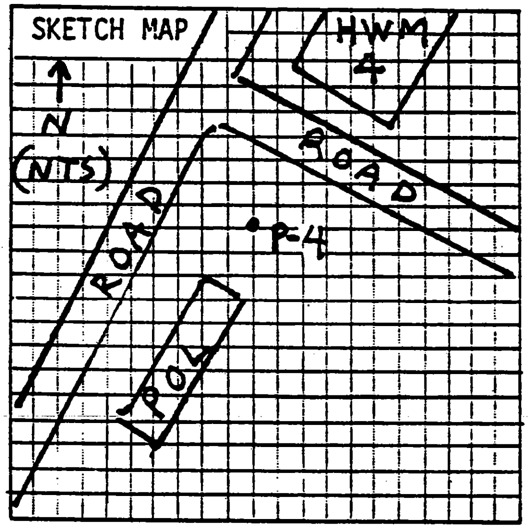
Well Number P-4

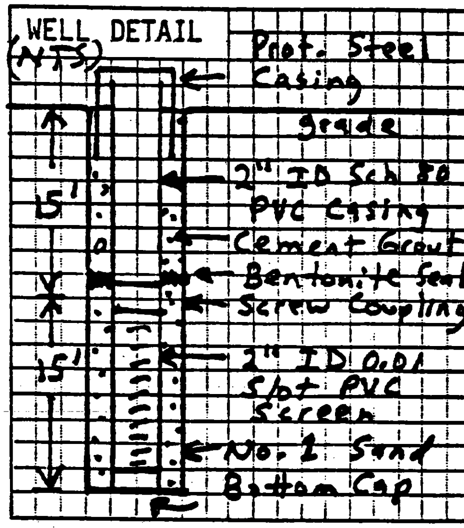
Client Corps of Engineer/Radford AAP | Project No. 00-0008-01
Well Location POL site
Driller/Company Dean/Cunningham
Drilling Method NX core | Hole Diameter nominal 4" | Date(s) Drilled 2/17/83
Sample Type split spoon/core | Sample Interval 5' spoon * | No. Samples Retained 5
Surface Elevation 1771.12' | Casing Top Elevation 1773.16' | Total Well Depth 30'
Casing Material and Size 2" ID PVC sched. 80 threaded joints | Cased Interval(s) 0-15 (+2' stickup)
Grouting Type sand/cement | Grouted Interval 0 - 14
Screening Material and Size 2" PVC 0.010" slots | Screened Interval(s) 15 - 30
Packing Material and Size No. 1 sand | Packed Interval 14 - 30
Depth to Static Water 25.75'*** | Date 2/24/83 | Approx Well Yield **
Development Method air | Development Time 1 hour
Logged by: Peter R. Jacobson

Comments
* continuous core sampling
** very poor yield during development, 0.1 gpm, but water cleared up

Note: slight ether odor detected

*** measured from top of PVC casing





Depth Scale	Sample	Spoon Blows	Description of Materials
0 - 1.5	spoon	1-1-2	moist brown silty clay
5 - 6.5	spoon	16-16-18	medium brown, fissile, hard silt and clay
10 - 11.5	spoon	1-2-4	soft moist brown clay,minor fine sand and silt
15 - 16.5	spoon	1-1-2	same as above with occasional medium to coarse sand
			lost water at 15'
20 - 21.5	spoon	31-50/1.5"	blue grey weathered bedrock - wet, pebbly, sandy, silty
			clay
22			top of solid rock
22 - 30			thinly laminated grey-buff dolomite; thin brecciated
			zones, many white quartz veins; lost water at 26'
end of hole at 30'			

Army Pollution Abatement Program Study, Installation of Monitoring Wells, Radford Army Ammunition Plant, Radford, VA, 3-9 April 1981, (USAEHA Control No. 81-26-8251-81)

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT RAAP 81-26-8251-81 DATE 6 April 81

LOCATION Background well southwest of site 4. May be contaminated from old POC spill. DRILLERS Smithson, Hoddinott, Craig, Gates (logger)

DRILL RIG Acker II w/4 in. continuous flight auger BORE HOLE MW-1

TD - 13 ft
water level initial - 10 ft
24 hr - 10' 9"

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN.	DESCRIPTION	REMARKS	
		Reddish brown gravely clay (¼ - ½ in) wet	3.75 ft of concrete grout	8 ft of 2 in ID, Schedule 40, PVC Casing
			1.5 ft of Bentonite	
5 ft			7.5 ft of sand pack	
		Brown gravely clay - POL smell - No. 2 fuel oil very strong		5 ft of slotted 2 in ID PVC screen
10 ft	▼	Gravel layer (½-1½ in) Large cobbles at 12 ft very difficult drilling		
		Refusal TD 13 ft (Riverjack)		Depth of well 13 ft
15 ft				

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 Aug 74, which will be used.

Form No 500

BORING LOG

SINCE 1881 FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERING/CHEMICAL
"ONE HUNDRED YEARS OF SERVICE"

Report No. O-62084

DATE May 1987

Client: Hercules Inc.

Project: Radford Army Ammunition Plant   Radford, Virginia

Boring No.: WCI-2 | Total Depth: 50.0 ft. | Elevation: -------- | Location: See Location Plan

Type of Boring: Hollow Stem Auger | Started: 3/18/87 | Completed: 3/18/87 | Driller: D. Fralin

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
	0.0	Stiff yellow brown clayey SILT, trace medium to fine sand (ML) manganese stains		1.5		GROUNDWATER DATA
			5 5 6	3.0		
		to				
				4.5		
		Very loose mottled to gray medium to fine to fine sandy SILT, trace clay (ML)	2 4 8	6.0		
		Increased fine gravel content at depth				
				8.5		
			2*	10.0		*12 inch spoon penetration on 1 hammer blow
				13.5		
			*1 1	15.0		*weight of hammer
		-RESIDUUM-		18.5		
			1 1 3	20.0		
				23.5		
	24.0		4*	24.4		*30/4"
				25.0		
		Medium hard to hard light gray to light brown limestone, with dolomitic and shaley intervals vuggy, fractured: occasional intervals of dolomite and shale clasts in a calcareous matrix: moderately well developed calcium crystals in vugs: possible flow structure			65.0	RQD = 22
				30.0		
					90.0	RQD = 47
				35.0		
					100.0	RQD = 55
				40.0		

*No. of blows req'd. for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

Form No. 500

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERING/CHEMICAL
"ONE HUNDRED YEARS OF SERVICE"

Report No. O-62084 DATE May 1987

Client: Hercules Inc.				
Project: Radford Army Ammunition Plant		Radford, Virginia		
Boring No.: WCI-2	Total Depth: 50.0 ft.	Elevation: --------	Location: See Location Plan	
Type of Boring: Hollow Stem Auger	Started: 3/18/87	Completed: 3/18/87	Driller: D. Fralin	

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
	40.0			40.0		GROUNDWATER DATA
		WC1-2 Continued			81.7	RQD = 42
				45.0		
					81.7	RQD = 8
	50.0			50.0		
		Boring terminated at 50.0 ft.				

*No. of blows req'd. for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

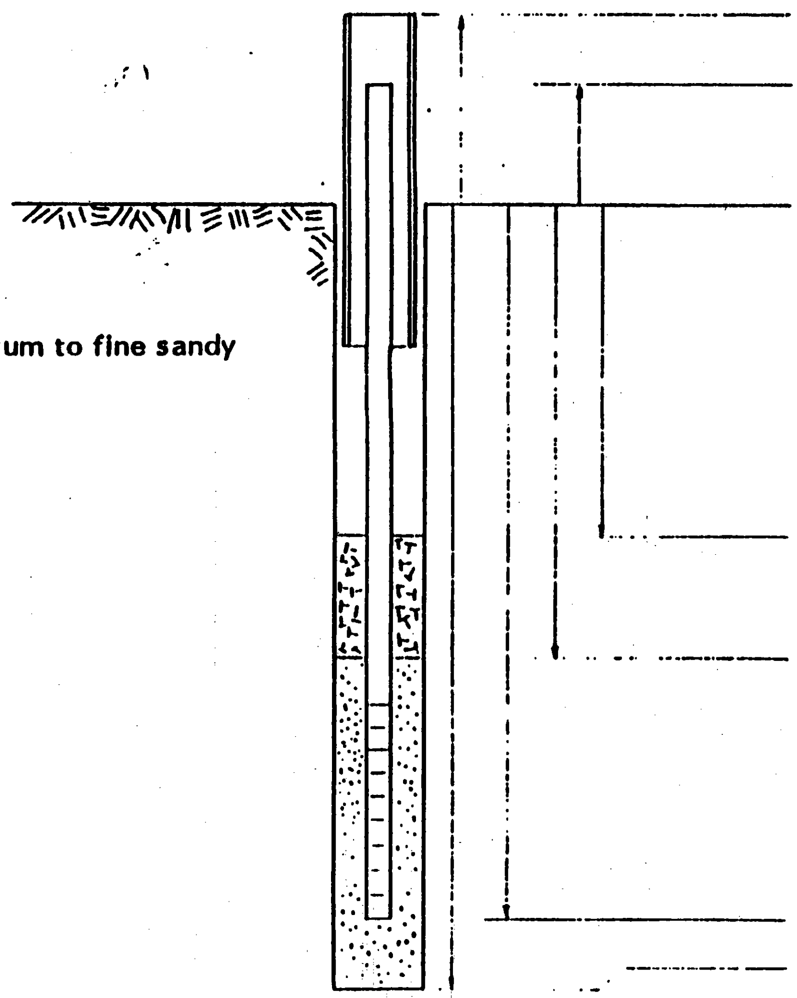
Scale 1"=5' unless otherwise noted

Project: Radford Army Ammunition Plant	Driller: Fralin	WELL No.
Location: Radford, Virginia	Inspector: Smith	WC1-2
Client: Hercules Inc.	Date Installed: 3/18/87	
Screen Description: 0.010" slot, 2.0" I.D. Teflon Screen	Sand Size: D(10)= 0.45-0.55 mm	
Riser Description: 2.0" I.D. Teflon Riser and PVC Riser	Bore/ Core Size: 6 inch/ NX	

Subsurface Conditions Summary

Yellow Brown to Gray medium to fine sandy SILT, trace clay (SM)

Auger refusal at 24.0 ft.



Casing Stickup (ft.)= 2.6 ft.
Elev. =
Riser Stickup (ft.) = 2.0 ft.
Elev. =
Ground Elev.=
Depth to Bentonite (ft.)= 16.75 ft.
Elev. =
Depth to Sand Filter(ft.)= ------
Elev. =
Depth to Well Bottom(ft.)= 45.75 ft.
Elev. =
Depth of Hole (ft.) = 48.75 ft.
Elev. =

DRILL. CONTR.: EDI
DRILLER: T. Lynch
GEOLOGIST: J. Titus
TYPE: Mobile B-80
METHOD: Air Hammer

WATER LEVEL MEASUREMENT
MEASUREMENT POINT: TOC
DATE/TIME: 10-Jun-93; 0956
DEPTH TO WATER: 79.83 ft.

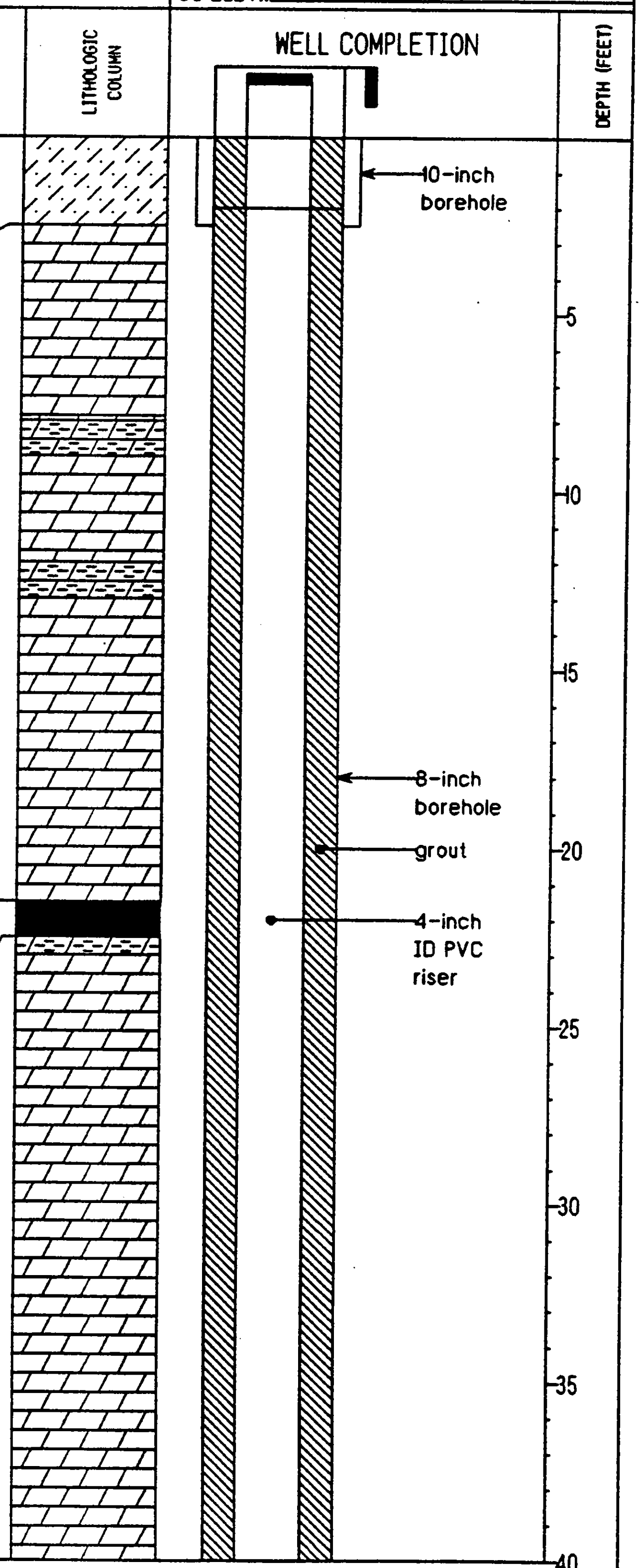
ENGINEERING-SCIENCE, INC.
DRILLING RECORD

INSTALLATION: RAAP
SITE: SWMU 17
CLIENT: USAEC
PROJECT NO.: FB517
DATE/TIME START: 19-May-93; 0745
DATE/TIME END: 20-May-93; 1505

BORING/WELL ID: 17MW2

TOTAL DEPTH (feet): 173
BOREHOLE DIAM.: 8 in.
CASING DIAM.: 4 in.
TOC ELEV.: 1906.29 ft. msl
GS ELEV.: 1903.99 ft. msl

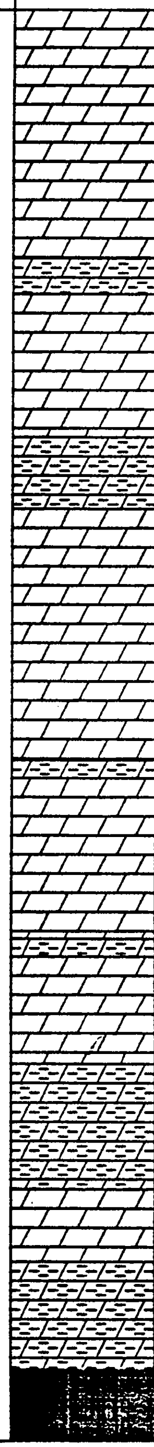
DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
			DRILLING WITH 10-INCH AIR ROTARY BIT SILT and CLAY; color: dark yellowish brown (10YR4/4)
			BEDROCK SWITCH TO 8-INCH AIR HAMMER
5			
	1ft/4min	+pwd	interbedded DOLOTONE and argillaceous DOLOSTONE
			DOLOSTONE: massive, hard color: gray (10YR5/1 to 2.5YR6/0)
10	1ft/4min		
			argillaceous DOLOSTONE: weathered, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)
15			
	1ft/5min		
20			
			VOID, filled with fine SAND and SILT color: reddish brown
	1ft/4.5min		
25			
	1ft/7min		
30			
35			
40			



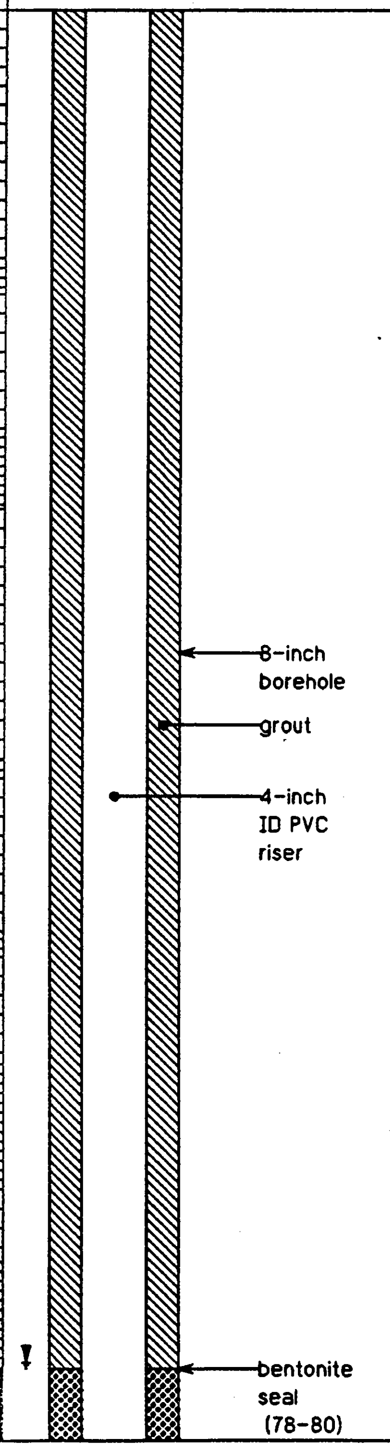
DRILL. CONTR.: EDI	**ENGINEERING-SCIENCE, INC. DRILLING RECORD**	**BORING/WELL ID: 17MW2**
DRILLER: T. Lynch	INSTALLATION: RAAP	TOTAL DEPTH (feet): 173
GEOLOGIST: J. Titus	SITE: SWMU 17	BOREHOLE DIAM.: 8 in.
TYPE: Mobile B-80	CLIENT: USAEC	CASING DIAM.: 4 in.
METHOD: Air Hammer	PROJECT NO.: FB517	TOC ELEV.: 1906.29 ft. msl
WATER LEVEL MEASUREMENT MEASUREMENT POINT: TOC	DATE/TIME START: 19-May-93; 0745	GS ELEV.: 1903.99 ft. msl
DATE/TIME: 10-Jun-93; 0956	DATE/TIME END: 20-May-93; 1505	
DEPTH TO WATER: 79.83 ft.		

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
45			
50			
55			interbedded DOLOSTONE and argillaceous DOLOSTONE DOLOSTONE massive, hard color: gray (10YR5/1 to 2.5YR6/0)
60			argillaceous DOLOSTONE weathered, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)
65		+pwd	
70			
75			
80			VOID, some clayey SILT color: reddish brown (7.5YR6/8)

LITHOLOGIC COLUMN



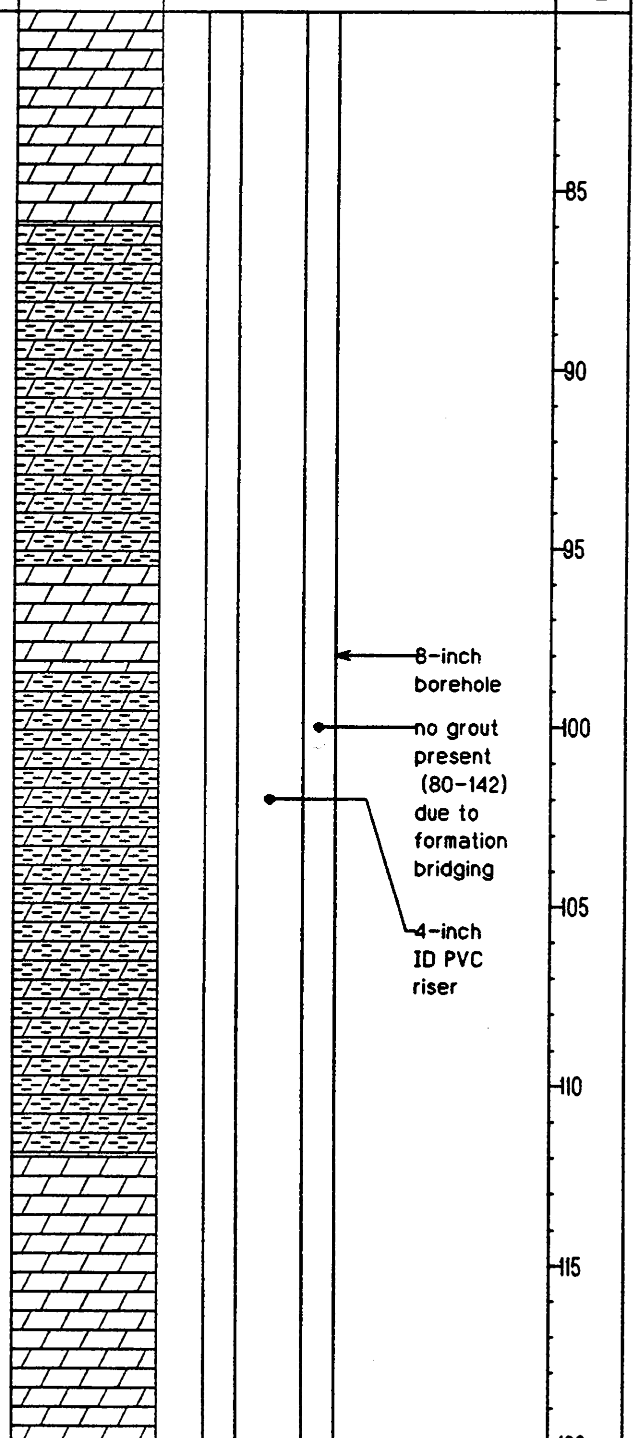
WELL COMPLETION



IRILL. CONTR.: EDI IRILLER: T. Lynch EOLOGIST: J. Titus TYPE: Mobile B-80 METHOD: Air Hammer	ENGINEERING-SCIENCE, INC. DRILLING RECORD	BORING/WELL ID: 17MW2
WATER LEVEL MEASUREMENT EASUREMENT POINT: TOC ATE/TIME: 10-Jun-93; 0956 EPTH TO WATER: 79.83 ft.	INSTALLATION: RAAP SITE: SWMU 17 CLIENT: USAEC PROJECT NO.: FB517 DATE/TIME START: 19-May-93; 0745 DATE/TIME END: 20-May-93; 1505	TOTAL DEPTH (feet): 173 BOREHOLE DIAM.: 8 in. CASING DIAM.: 4 in. TOC ELEV.: 1906.29 ft. msl GS ELEV.: 1903.99 ft. msl

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
	1ft/6min	+pwd	
85			
90			
95			interbedded DOLOSTONE and argillaceous DOLOSTONE DOLOTONE massive, hard color: gray (10YR5/1 to 2.5YR6/0) argillaceous DOLOSTONE weathered, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)
100			
	1ft/1min		
105			
110			
115			
120			

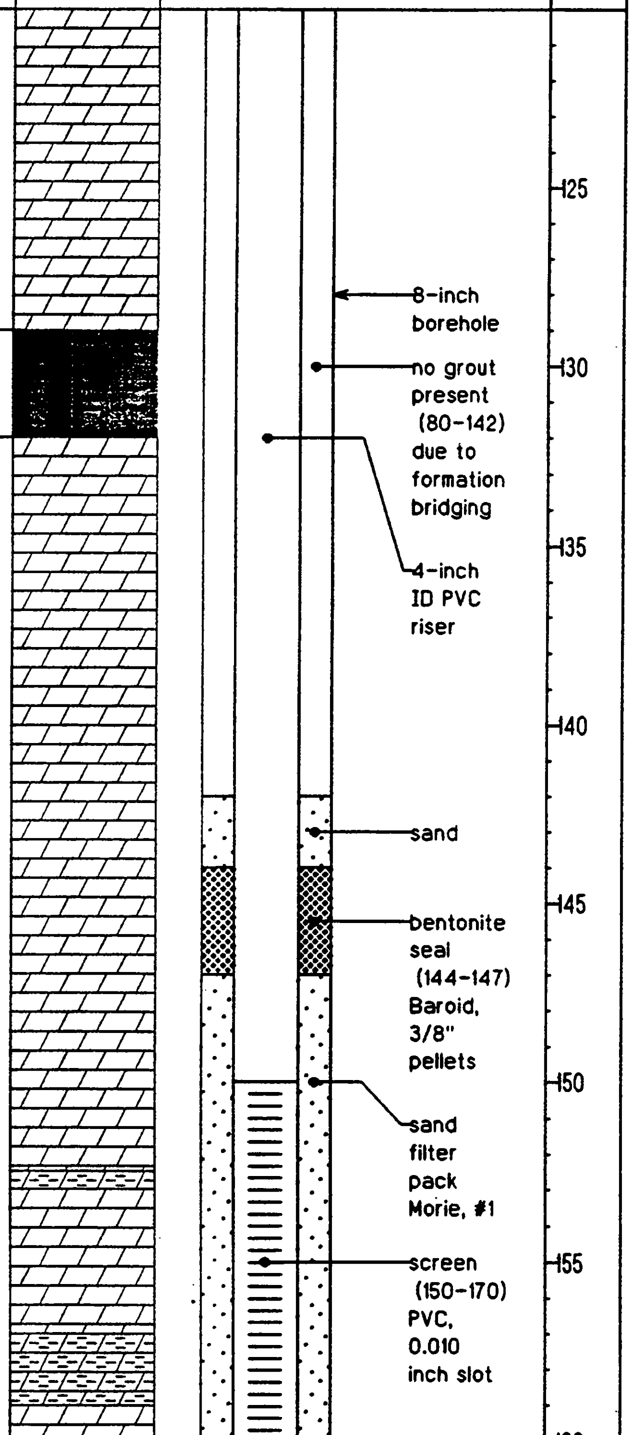
LITHOLOGIC COLUMN / WELL COMPLETION



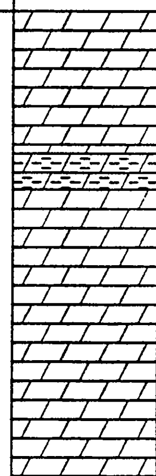
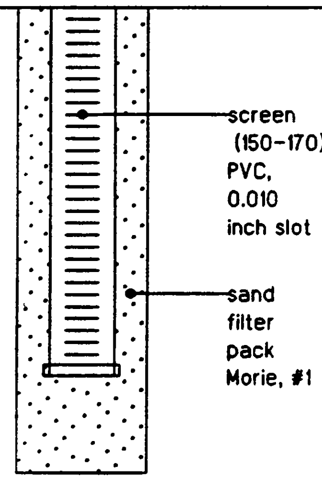
)RILL. CONTR.: EDI	**ENGINEERING-SCIENCE, INC.**	**BORING/WELL ID: 17MW2**	
)RILLER: T. Lynch	**DRILLING RECORD**		
;EOLC:IST: J. Titus	INSTALLATION: RAAP	TOTAL DEPTH (feet): 173	
TYPE: Mobile B-80	SITE: SWMU 17	BOREHOLE DIAM.: 8 in.	
METHOD: Air Hammer	CLIENT: USAEC	CASING DIAM.: 4 in.	
WATER LEVEL MEASUREMENT	PROJECT NO.: FB517	TOC ELEV.: 1906.29 ft. msl	
EASU:EMENT POINT: TOC	DATE/TIME START: 19-May-93; 0745	GS ELEV.: 1903.99 ft. msl	
ATE/TIME: 10-Jun-93; 0956	DATE/TIME END: 20-May-93; 1505		
EPTH TO WATER: 79.83 ft.			

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
125			
130			VOID, some CLAY and v. fine SAND MAJOR WATER PRODUCING ZONE
135	ıt/5.5min	+pwd	interbedded DOLOSTONE and argillaceous DOLOSTONE DOLOSTONE massive, hard color: gray (10YR5/1 to 2.5Y6/0)
140			argillaceous DOLOSTONE weatherd, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)
145			
150			
155			
160	ıft/1.3min		

LITHOLOGIC COLUMN / WELL COMPLETION



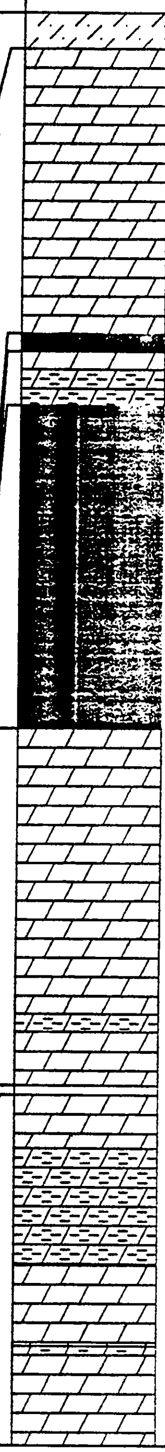
DRILL. CONTR.: EDI DRILLER: T. Lynch GEOLOGIST: J. Titus RIG TYPE: Mobile B-80 METHOD: Air Hammer	ENGINEERING-SCIENCE, INC. DRILLING RECORD	BORING/WELL ID: 17MW2
WATER LEVEL MEASUREMENT MEASUREMENT POINT: TOC DATE/TIME: 10-Jun-93; 0956 DEPTH TO WATER: 79.83 ft.	INSTALLATION: RAAP SITE: SWMU 17 CLIENT: USAEC PROJECT NO.: FB517 DATE/TIME START: 19-May-93; 0745 DATE/TIME END: 20-May-93; 1505	TOTAL DEPTH (feet): 173 BOREHOLE DIAM.: 8 in. CASING DIAM.: 4 in. TOC ELEV.: 1906.29 ft. msl GS ELEV.: 1903.99 ft. msl

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS	LITHOLOGIC COLUMN	WELL COMPLETION	DEPTH (FEET)
	1ft/4min		interbedded DOLOSTONE and argillaceous DOLOSTONE			
165			DOLOSTONE massive, hard color: gray (10YR5/1 to 2.5YR6/0)			165
170		+pwd	argillaceous DOLOSTONE weathered, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)			170
175						175
180						180
185						185
190						190
195						195
200						200

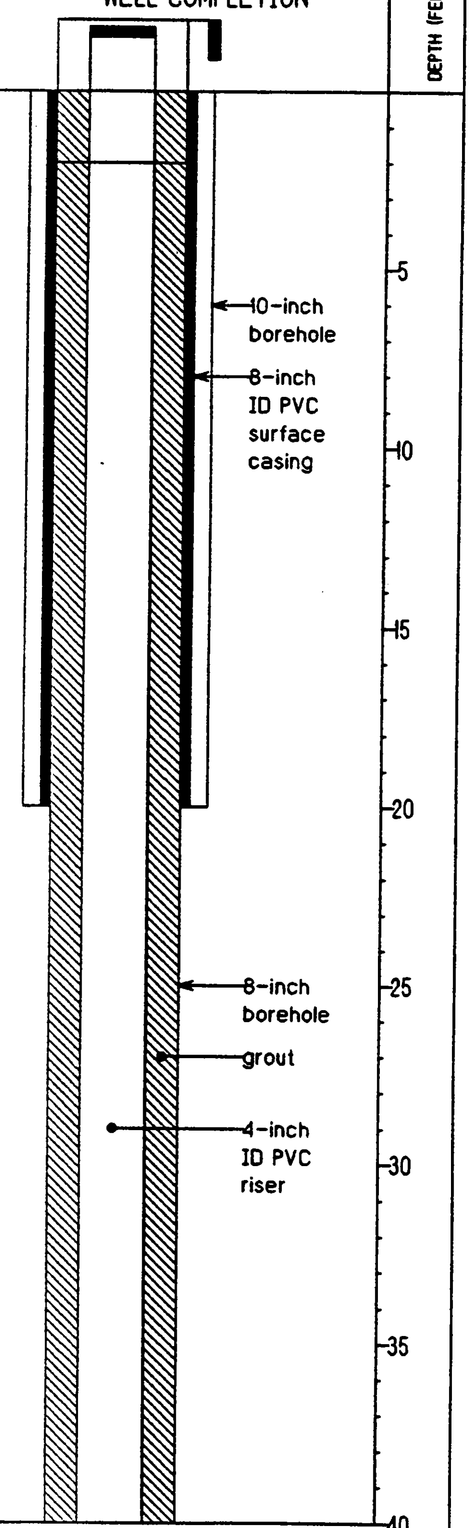
DRILL. CONTR.: EDI	**ENGINEERING-SCIENCE, INC.** **DRILLING RECORD**	**BORING/WELL ID: 17MW3**
DRILLER: T. Lynch	INSTALLATION: RAAP	TOTAL DEPTH (feet): 190
GEOLOGIST: J. Titus	SITE: SWMU 17	BOREHOLE DIAM.: 8 in.
TYPE: Mobile B-80	CLIENT: USAEC	CASING DIAM.: 4 in.
METHOD: Air Hammer	PROJECT NO.: FB517	TOC ELEV.: 1906.78 ft. msl
WATER LEVEL MEASUREMENT MEASUREMENT POINT: TOC DATE/TIME: 10-Jun-93; 0956 DEPTH TO WATER: 147.33 ft.	DATE/TIME START: 21-May-93; 1630 DATE/TIME END: 24-May-93; 0925	GS ELEV.: 1904.27 ft. msl

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
0–2			DRILLING WITH 10-INCH AIR ROTARY BIT SILT and CLAY; color: dark yellowish brown (10YR4/4)
2			BEDROCK SWITCH TO 8-INCH AIR HAMMER
5		+pwd	interbedded DOLOSTONE and argillaceous DOLOSTONE
			DOLOSTONE: massive, hard color: gray (10YR5/1 to 2.5YR6/0)
10			argillaceous DOLOSTONE: weathered, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)
15			VOID, filled with silty CLAY
			VOID, filled with silty CLAY color: reddish brown (7.5YR6/8)
20			
	1ft/10min		
25	1ft/14min		
	1ft/4min		
30	1ft/4.5min		calcite vein
35		+pwd	
	1ft/3.8min		
40	1ft/6min		

LITHOLOGIC COLUMN



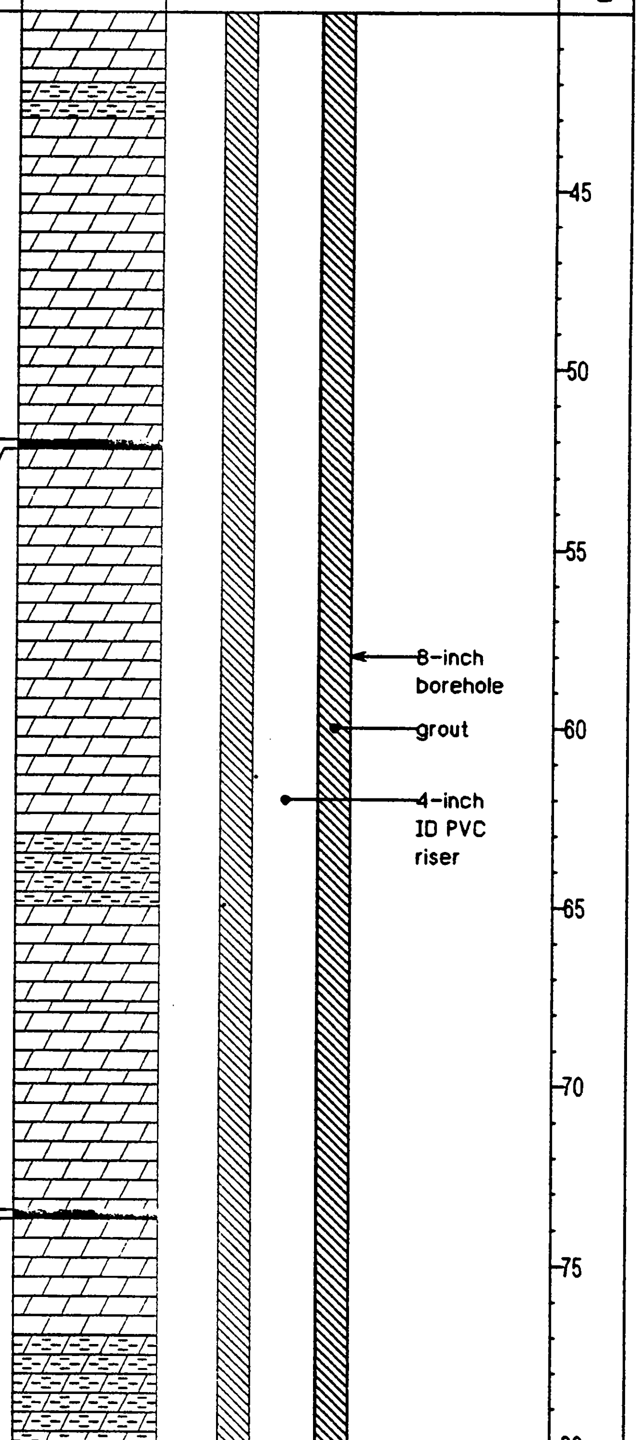
WELL COMPLETION



DRILL. CONTR.: EDI	**ENGINEERING-SCIENCE, INC.**	**BORING/WELL ID: 17MW3**
DRILLER: T. Lynch	**DRILLING RECORD**	
GEOLOGIST: J. Titus	INSTALLATION: RAAP	TOTAL DEPTH (feet): 190
TYPE: Mobile B-80	SITE: SWMU 17	BOREHOLE DIAM.: 8 in.
METHOD: Air Hammer	CLIENT: USAEC	CASING DIAM.: 4 in.
WATER LEVEL MEASUREMENT	PROJECT NO.: FB517	
MEASUREMENT POINT: TOC		TOC ELEV.: 1906.78 ft. msl
DATE/TIME: 10-Jun-93; 0956	DATE/TIME START: 21-May-93; 1630	
DEPTH TO WATER: 147.33 ft.	DATE/TIME END: 24-May-93; 0925	GS ELEV.: 1904.27 ft. msl

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
45			
50	1ft/4min		
			VOID, filled with orange brown silty CLAY moist
55	1ft/6min	+pwd	interbedded DOLOSTONE and argillaceous DOLOSTONE
			DOLOSTONE massive, hard color: gray (10YR5/1 to 2.5YR6/0)
60			argillaceous DOLOSTONE weathered, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)
65			
70	1ft/5.8	+pwd	
			VOID, filled with silty CLAY
75	1ft/5min		
80	1ft/3.5min		

LITHOLOGIC COLUMN / WELL COMPLETION



ENGINEERING-SCIENCE, INC.
DRILLING RECORD

BORING/WELL ID: 17MW3

DRILLING CONTR.: ESI
DRILLER: T. Lynch
GEOLOGIST: J. Titus
RIG TYPE: Mobile B-80
METHOD: Air Hammer

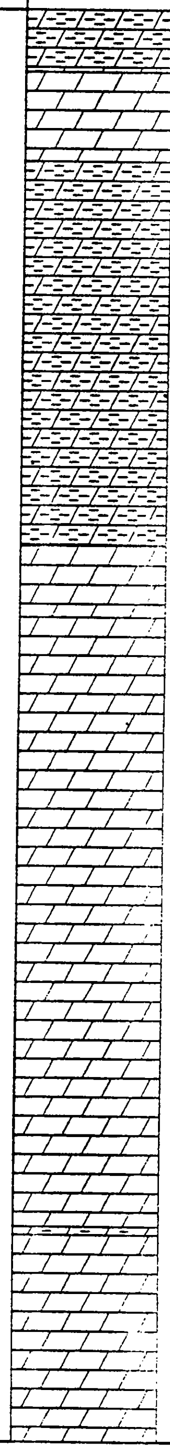
WATER LEVEL MEASUREMENT
MEASUREMENT POINT: TOC
DATE/TIME: 10-Jun-93; 0956
DEPTH TO WATER: 147.33 ft.

INSTALLATION: RAAP
SITE: SWMU 17
CLIENT: USAEC
PROJECT NO.: FB517
DATE/TIME START: 21-May-93; 1630
DATE/TIME END: 24-May-93; 0925

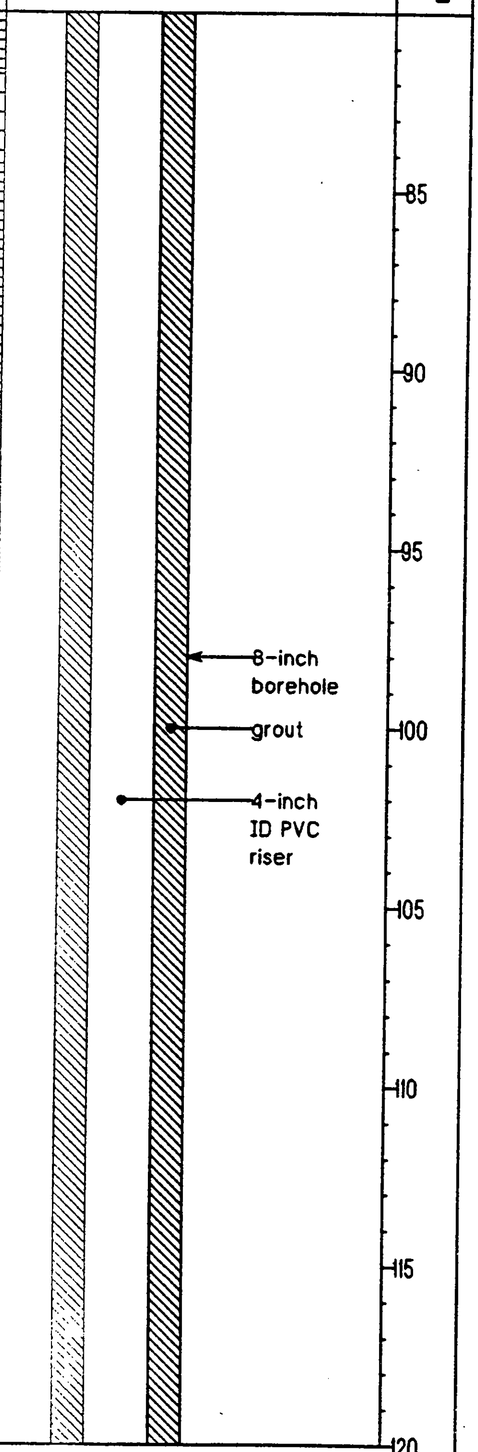
TOTAL DEPTH (feet): 190
BOREHOLE DIAM.: 8 in.
CASING DIAM.: 4 in.
TOC ELEV.: 1906.78 ft. msl
GS ELEV.: 1904.27 ft. msl

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
	1ft/4min		
	1ft/2min		
85	1ft/1min		
90			
	1ft/2.5min		
95			interbedded DOLOSTONE and argillaceous DOLOSTONE
			DOLOSTONE massive, hard color: gray (10YR5/1 to 2.5YR6/0)
100			
			argillaceous DOLOSTONE weathered, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)
	1ft/2min		
105	1ft/1min		interbedded DOLOSTONE and argillaceous DOLOSTONE
	1ft/1.8min		DOLOSTONE massive, hard color: gray (10YR5/1 to 2.5Y6/0)
110			
			argillaceous DOLOSTONE weathered, soft weathered color: light, yellowish brown (2.5Y7/6) unweathered color: gray (2.5Y6/0)
115			
120			

LITHOLOGIC COLUMN



WELL COMPLETION

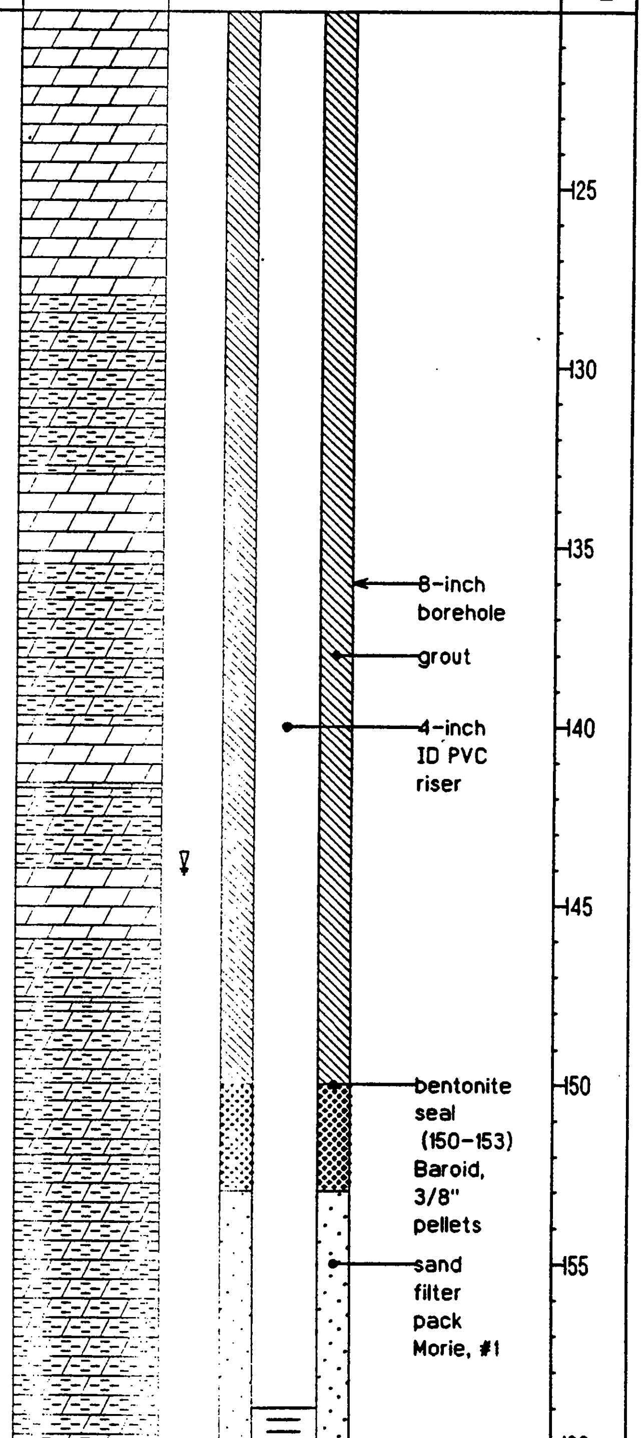


DEPTH (FEET)

DRILL. .NTR.: E.I	**ENGINEERING-SCIENCE, INC. DRILLING RECORD**	**BORING/WELL ID: 17MW3**
DRILL .: T. Lync.	INSTALLATION: RAAP	TOTAL DEPTH (feet): 190
GEOLC .ST: J. Ti.s	SITE: SWMU 17	BOREHOLE DIAM.: 8 in.
.. T. .: Mobile .-80	CLIENT: USAEC	CASING DIAM.: 4 in.
METHOD: Air Hammer	PROJECT NO.: FB517	TOC ELEV.: 1906.78 ft. msl
WATER LEVEL MEASUREMENT	DATE/TIME START: 21-May-93; 1630	GS ELEV.: 1904.27 ft. msl
MEASU. .ENT POI.: TOC	DATE/TIME END: 24-May-93; 0925	
DATE/. .E: 10-Ju.-93; 0956		
DEPTH . WATER: 147.33 ft.		

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
125			
130			
	1ft/5min		
135			
140	1ft/6.5min		
145	1ft/5min		
150			
	1ft/3.2min		
155			
160			

LITHOLOGIC COLUMN / WELL COMPLETION



DRILLING CONTR.: E...	
DRILLER: T. Lyn...	
GEOLOGIST: J. T...s	
RIG TYPE: Mobile ...-80	
METHOD: Air Hammer	

ENGINEERING-SCIENCE, INC.
DRILLING RECORD

BORING/WELL ID: 17MW3

INSTALLATION: RAAP	TOTAL DEPTH (feet): 190
SITE: SWMU 17	BOREHOLE DIAM.: 8 in.
CLIENT: USAEC	CASING DIAM.: 4 in.
PROJECT NO.: FB517	TOC ELEV.: 1906.78 ft. msl
DATE/TIME START: 21-May-93; 1630	GS ELEV.: 1904.27 ft. msl
DATE/TIME END: 24-May-93; 0925	

WATER LEVEL MEASUREMENT

MEASUREMENT POINT: TOC

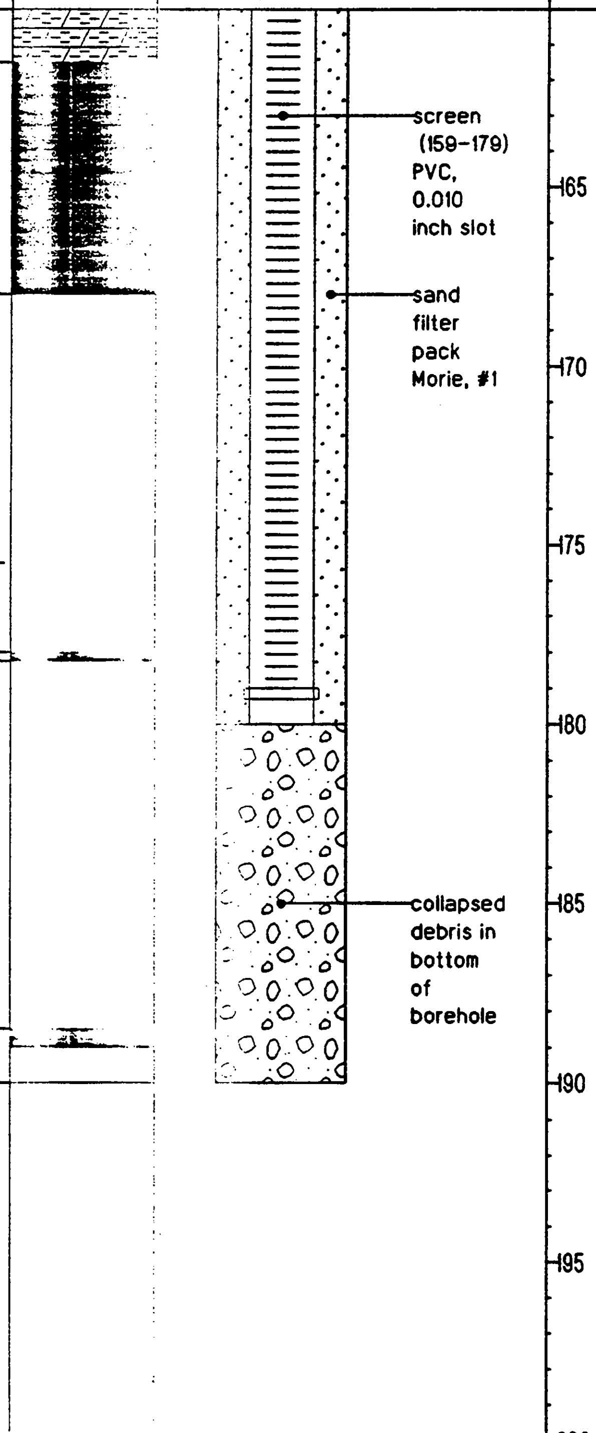
DATE/TIME: 10-Ju...-93; 0956

DEPTH TO WATER: 47.33 ft.

DEPTH (FEET)	DRILL RATE	HCl TEST	LITHOLOGY/REMARKS
	1ft/1min		extremely soft-highly weathered argillaceous DOLOSTONE cuttings are moist, becoming more wet at 167 feet
165			
	1ft/2.5min		rock becoming harder at 168 feet no return of cuttings, loss of circulation due to void (161.5-168 feet)
170			
	1ft/1.3min		
175			rock becoming harder
			VOID
180			little return on cuttings some cuttings coming out of bore hole damp to wet
	1ft/2min		
185	1ft/40sec		
	1ft/1.5min		
			VOID
190			END OF BORING AT 190 FEET
195			
200			

LITHOLOGIC COLUMN

WELL COMPLETION



BORING 17PZ1

Surface Elevation: 1904.7 Feet, MSL
Location: Radford AAP, Virginia
Start: 2:11 on 10–30–91
Finish: 1:20 on 11–1–91

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %
0	SS	1	34		30	
5	AH	2				
10	AH	3				
	AH	4				
15						
20						
	AH	5				
25						
30						
	AH	6				
35						
	NX	7		1	100	52
40						

Symbols	Description
ML	VERY PALE BROWN (10YR 7/4) FINE SANDY SILT, DRY, VERY STIFF
DS / LS / Shale	ENCOUNTER ROCK AT 3 FEET CONTINUE DRILLING USING 8-INCH AIR HAMMER LOG BOREHOLE FROM CUTTINGS GRAY (5Y 5/1) DOLOSTONE, FINE GRAINED, DRY, HARD, DUSTY CONDITIONS INTERBEDDED WITH LIGHT YELLOWISH BROWN LIMESTONE WITH PALE RED (2.5YR 6/2) AND BROWNISH YELLOW (10YR 6/6) SILTSTONE SOFT HIGHLY WEATHERED ZONE FROM 17.5 TO 20.0 FEET, WITH MUCH CLAY AND SILT, SLIGHTLY MOIST ALTERNATING BEDS OF HARD GRAY DOLOSTONE AND SOFT BROWNISH YELLOW SILTSTONE AND LIMESTONE SOFT INTERBEDDED DOLOMITE LIMESTONE AND SILTSTONE HARDER VERY DARK GRAY (2.5Y N/3) DOLOSTONE, HARD, WITH SOME CALCITE AND LIMESTONE SEAMS
DS / LS / Shale	BEGIN NX CORING VERY DARK GRAY DOLOSTONE, HARD, SLIGHT WEATHERING AT FRACTURES FREQUENT THIN LIMESTONE SEAMS EVERY 0.1 FEET

PLATE
LOG OF BORING

Dames & Moore

BORING 17PZ1 (Cont'd)

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Symbols	Description
40								WITH LAYERS OF GRAY (5Y 5/1) HIGHLY WEATHERED LIMESTONE AND PALE YELLOW (2.5Y 7/3) SANDSTONE, POORLY TO MODERATELY CEMENTED
	NX	8		2	100	52		MAINLY PALE YELLOW HIGHLY WEATHERED LIMESTONE AND DOLOSTONE, ABUNDANT FRACTURES
45								
	NX	9		3	75	0		
								STOP CORING, LOG OF BOREHOLE FROM CUTTINGS
50								VERY SOFT FROM 51–54 FEET, WITH VOIDS, NO RETURN CUTTINGS
	AH	10						HIGHLY WEATHERED, INTERBEDDED DOLOSTONE AND LIMESTONE
55								
	AH	11						WITH MORE DARK GRAY DOLOSTONE
							DS/LS/Shale	
60								CONTINUED INTERBEDDED DARK GRAY DOLOSTONE AND HIGHLY WEATHERED LIGHT GRAY AND PALE YELLOW LIMESTONE
65								
	AH	12						
70								
	AH	13						
75								
	AH	14						
								VERY SOFT HIGHLY WEATHERED FROM 77 TO 79 FEET
80								

PLATE
LOG OF BORING

Dames & Moore

\RAAP\R17PZ1b.dwg

BORING 17PZ1 (Cont'd)

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval	Symbols	Description
80									GETTING SOFTER, WITH SOME PALE RED LIMESTONE NO CUTTINGS RETURNED FROM 83 TO 96 FEET
		AH 15							
85									
90									
95									
		AH 16							LIGHT GRAY TO OLIVE YELLOW (2.5Y 6/4) LIMESTONE AND GRAY DOLOSTONE, SOFT
100		AH 17						DS / LS / Shale	
105									
		AH 18							INTERBEDDED LIMESTONE AND DOLOSTONE
110									
		AH 19							OCCASIONAL HARD SEAMS
115									
		AH 20							FEW CUTTINGS RETURNED. LIGHT GRAY AND PALE YELLOW DOLOSTONE AND LIMESTONE
120									

\RAAP\17PZ1c.dwg

PLATE
LOG OF BORING

Dames & Moore

BORING 17PZ1 (Cont'd)

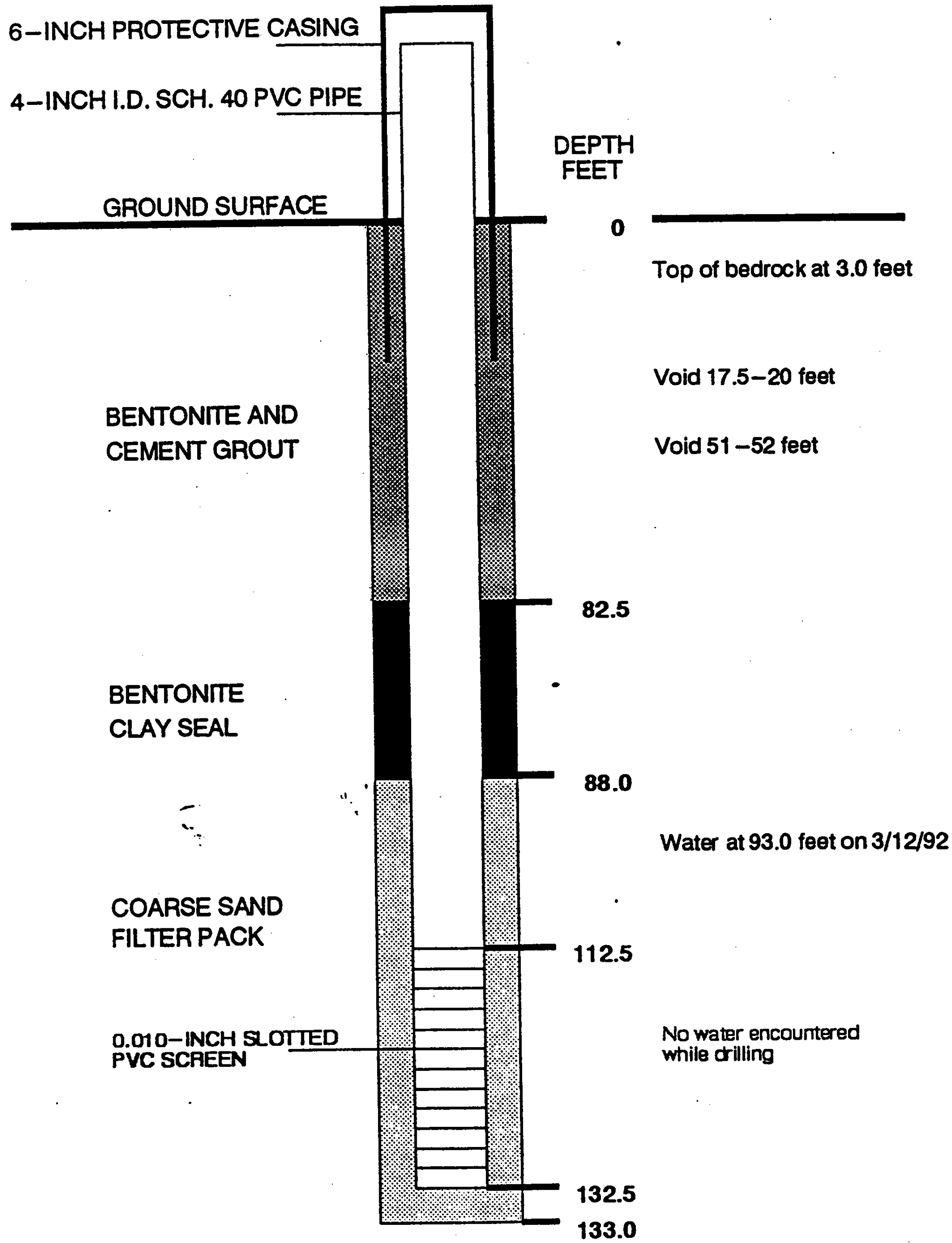
Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval	Symbols	Description
120	AH	21						DS / LS / Shale	CONTINUED INTERBEDDED, SOFT, DOLOSTONE AND LIMESTONE
125	AH	22							VERY SOFT SEAMS FROM 125 TO 128 FEET
									NO CUTTINGS RETURNED BELOW 128 FEET
130									
									BOREHOLE TERMINATED AT A DEPTH OF 133 FEET
135									

PLATE
LOG OF BORING

Dames & Moore

PIEZOMETER INSTALLATION DIAGRAM FOR RCRA FACILITY INVESTIGATION RADFORD AAP, VIRGINIA

Location: 17PZ1
Installation Date: 11/1/91
Surface Elevation: 1906.1 Feet
Top of PVC Elevation: 1907.02 Feet



NOT TO SCALE

Dames & Moore

BORING 43MW1

Surface Elevation: **1,703.9** Feet, MSL
Location: Radford AAP, Virginia
Start: 07:30 on 8-13-91
Finish: 08:50 on 8-13-91

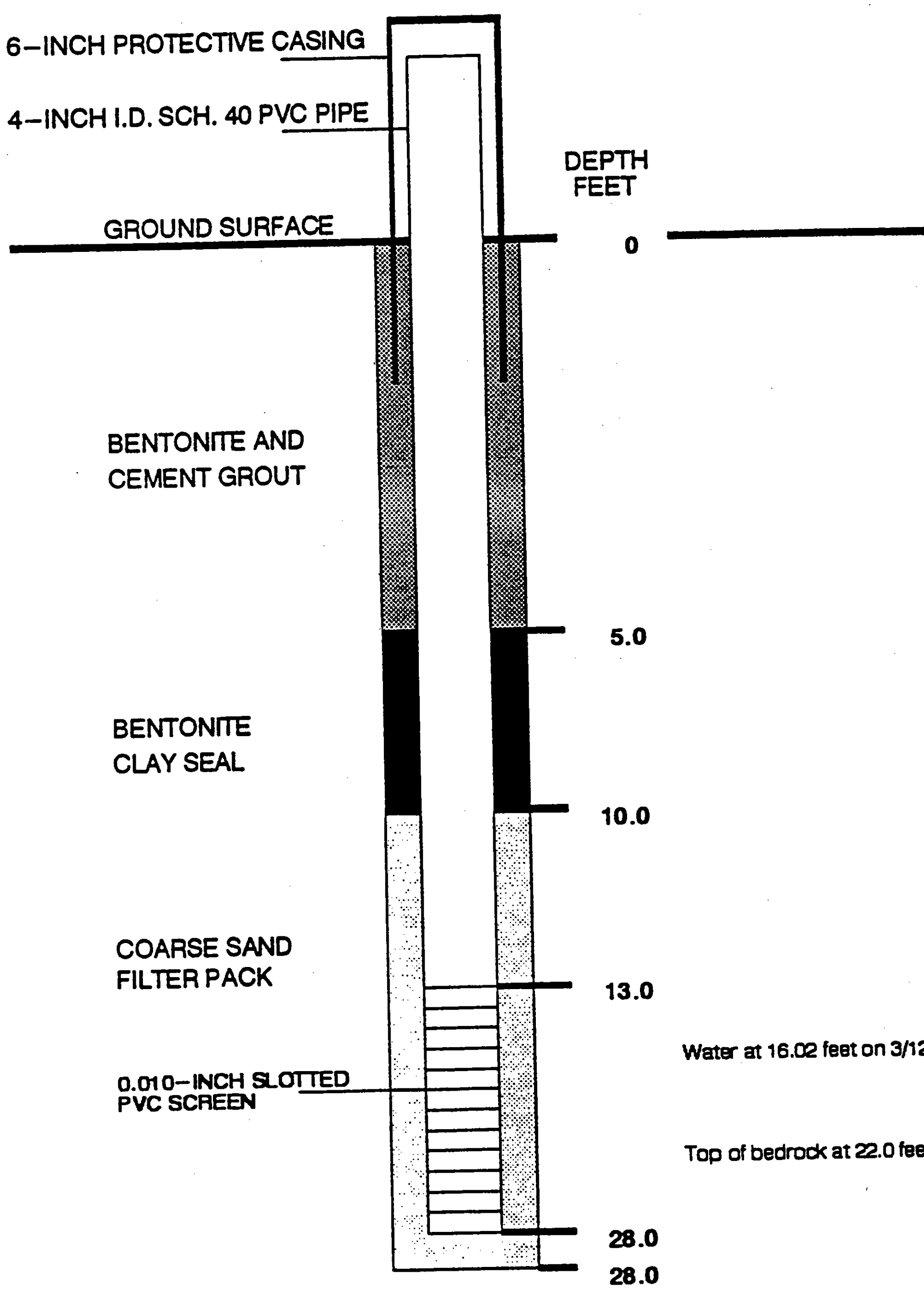
Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Symbols	Description
0	SPT	1	11		83		ML	YELLOWISH BROWN (10YR 5/4) SANDY SILT, TRACE ORANGE MOTTLING, STIFF, DRY
								GRADING MOIST
5	SPT	2	28		100			
10	SPT	3	12		100			
							SM	YELLOWISH BROWN (10YR 5/6) SILTY SAND, VERY MOIST, LOOSE, MICACEOUS, TRACE GRAY MOTTLING
15	SPT	4	10		60			
								WATER AT 18.0 FEET
							CL	LIGHT GRAY (2.5Y N/7) CLAY WITH LIMESTONE GRAVEL
20	SPT	5	50/1		75			WITH HIGHLY FRACTURED HIGHLY WEATHERED LIMESTONE PIECES
							LS	N/7 LIGHT GRAY LIMESTONE, HARD, NOT HIGHLY WEATHERED
25								HIGHLY WEATHERED ZONE
								BOREHOLE TERMINATED AT A DEPTH OF 28.0 FEET
30								

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR VERIFICATION INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 43MW1
Installation Date: 8/13/91
Surface Elevation: 1703.9 Feet
Top of PVC Elevation: 1705.87 Feet



NOT TO SCALE

Dames & Moore

BORING 43MW2

Surface Elevation: **1,705.0** Feet, MSL
Location: Radford AAP, Virginia
Start: 07:28 on 8-13-91
Finish: 14:40 on 8-13-91

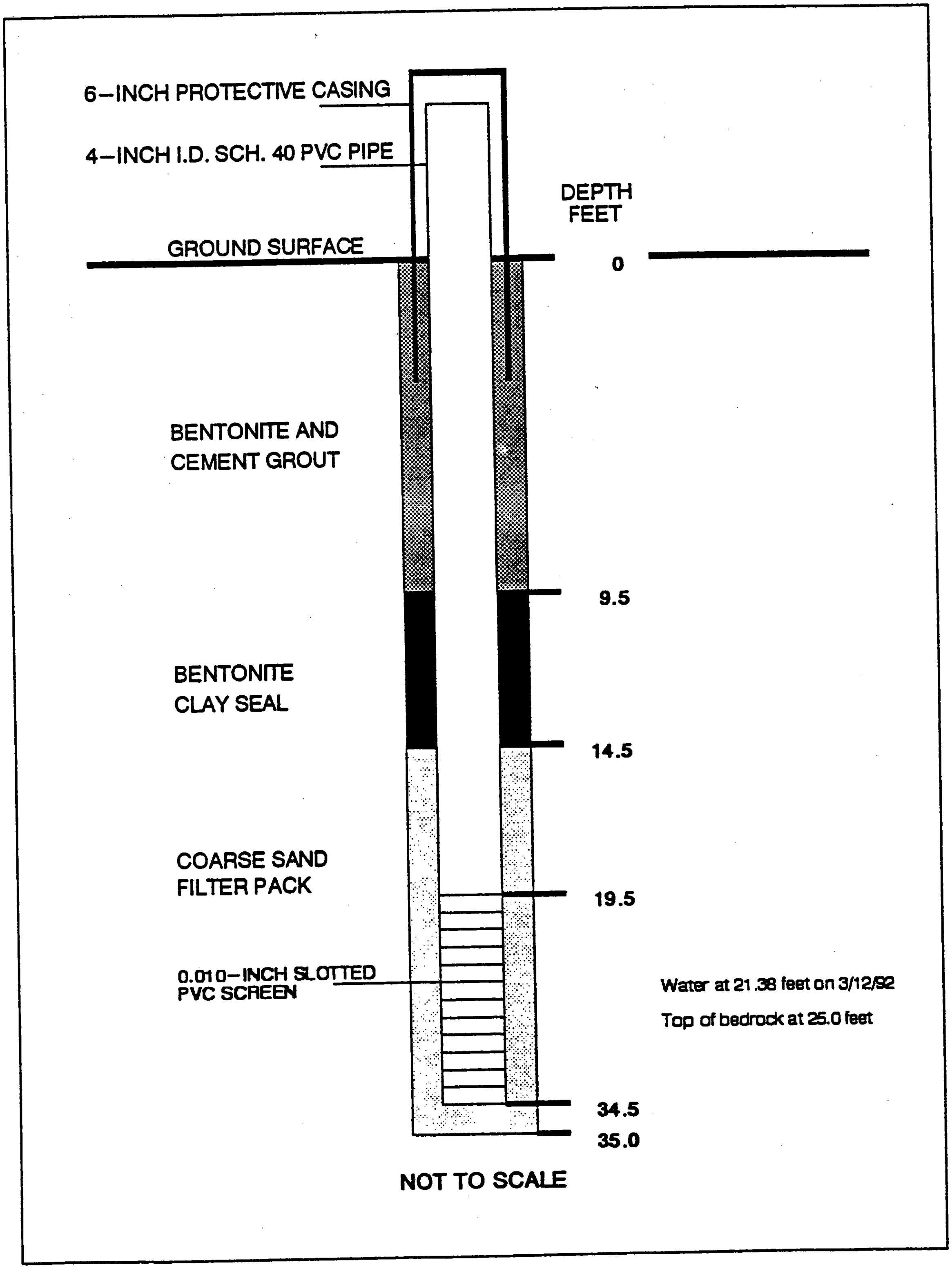
Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Symbols	Description
0	SPT	1	14		80		ML	REDDISH BROWN (5YR 4/3) SILTM SLIGHTLY MOIST, TRACE FINE SAND
							ML	DARK BROWN (7.5YR 4/4) SLIGHTLY CLAYEY SILT, MICACEOUS, COHESIVE WITH OCCASIONAL THIN GRAVELLY AREAS
5	SPT	2	20		80			
10	SPT	3	16		80			
15	SPT	4	14		75		SM	DARK BROWN (7.5YR 4/4) SILTY FINE SAND, TRACE CLAY, MICACEOUS, MOIST
								WITH GRAVELS
								MOISTURE INCREASING
20	SPT	5	4		5			VERY GRAVELLY
	SPT	6	0		0		GM	GRAYISH BROWN (10YR 5/2) SILTY CLAYEY GRAVELS, WITH LARGE COBBLES
25	SPT	7	100/5		100			
30	SPT	8	100/0		0		LS	GRAY 2.5Y N/5 WEATHERED LIMESTONE INTERBEDDED WITH SILTSTONE OR SHALE
35								BOREHOLE TERMINATED AT A DEPTH OF 35.0 FEET

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR VERIFICATION INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 43MW2
Installation Date: 8/14/91
Surface Elevation: 1705.0 Feet
Top of PVC Elevation: 1707.62 Feet



Dames & Moore

BORING 43MW3

Surface Elevation: **1,701.2** Feet, MSL
Location: Radford AAP, Virginia
Start: 08:00 on 8-19-91
Finish: 11:30 on 8-19-91

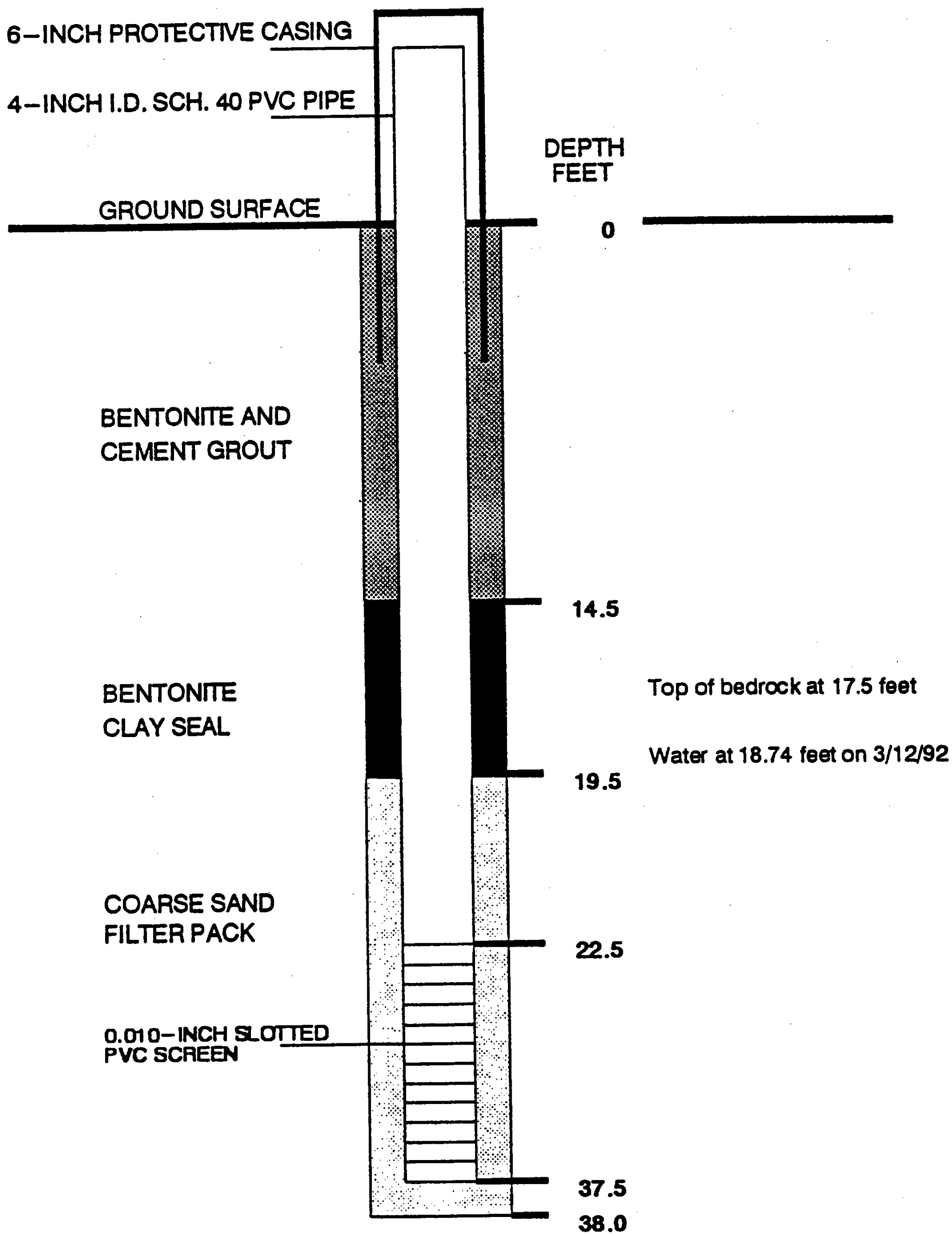
Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Symbols	Description
0	SPT	1	32		92		ML	DARK BROWN (10YR 3/3) SILTY FINE SAND, MICACEOUS, DRY, THIN BLACK ASH LAYER AT 0.5 FEET
							ML	DARK YELLOWISH BROWN (10YR 4/4) FINE SANDY SILT, MICACEOUS, TRACE DUSKY RED MOTTLING, SLIGHTLY MOIST
5	SPT	2	16		79			
								CLAY SEAM
							SP	OLIVE GRAY (5Y 4/2) FINE SAND, TRACE SILT, MICACEOUS, LOOSE, SLIGHTLY COHESIVE
10	SPT	3	13		92			
								WITH CCCASIONAL CLAYEY ZONES
15								CLAY SEAM 15.5 TO 16.5 FEET
	SPT	4	18		96			GRAY (5Y 5/1) SAND SEAM, 16.5-17.0 FEET
							LS	GRAY (2.5Y N/5) LIMESTONE, HIGHLY WEATHERED, WITH PALE YELLOW (2.5Y 8/2) SAND AND SILT
	SPT	5	100/5		0			
20								GRAY (2.5Y N/5) WEATHERED LIMESTONE, HIGHLY FRACTURED, WITH ABUNDANT THIN DEFORMED LAYERS, DIPPING TO 45 DEGREES, SEAMS STAINED BROWNISH YELLOW
	NX			1	90	42		
25								GRADING TO LIMESTONE BRECCIA
	NX			2	70	36		
30								BROWNISH GRAY LIMESTONE, DEFORMED
	NX			3	74	48		BECOMES GRAY, SOFT, LIMESTONE BRECCIA
35								WITH GREEN TINT, HIGH SHALE AND CLAY CONENT, CONTINUED HIGHLY FRACTURED
	NX			4	50	8		
40								BOREHOLE TERMINATED AT A DEPTH OF 40.0 FEET

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR VERIFICATION INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 43MW3
Installation Date: 8/19/91
Surface Elevation: 1701.2 Feet
Top of PVC Elevation: 1703.35 Feet



NOT TO SCALE

Dames & Moore

BORING 43MW4

Surface Elevation: 0
Location: Radford AAP, Virginia
Start: 07:46 ON 8-15-91
Finish: 11:07 ON 8-15-91

Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %
5	SPT	1	16		100	
10	SPT	2	15		90	
15	SPT	3	23		80	
20	SPT	4	41		20	
25	NX			1	96	

Symbols	Description
ML	DARK BROWN (7.5YR 4/3) CLAYEY SANDY SILT, MEDIUM STIFF, DRY
	GRADING STIFF, MICACEOUS
SM	BROWN (7.5YR 5/4) SILTY FINE SAND, MICACEOUS, SLIGHTLY STIFF
	WITH OCCASIONAL CLAYEY ZONES
	GRADING DARK GRAYISH BROWN (2.5YR 4/2), MEDIUM SAND
	WATER AT 18.5 FEET
	THIN 2.5YR 4/5 OLIVE BROWN FINE SANDY SILTY SEAM ABOVE WEATHERED BEDROCK
LS	GRAY (2.5Y N/5) WEATHERED LIMESTONE, SLIGHTLY PITTED, REDDISH YELLOW CLAY INFILLING AT WEATHERED FRACTURES
	HIGHLY PITTED AND VUGGY, GRADING TO OLIVE BROWN AND WEATHERED
	BECOMES VERY DARK GRAY, LESS WEATHERED, WITH CALCITE VEINS

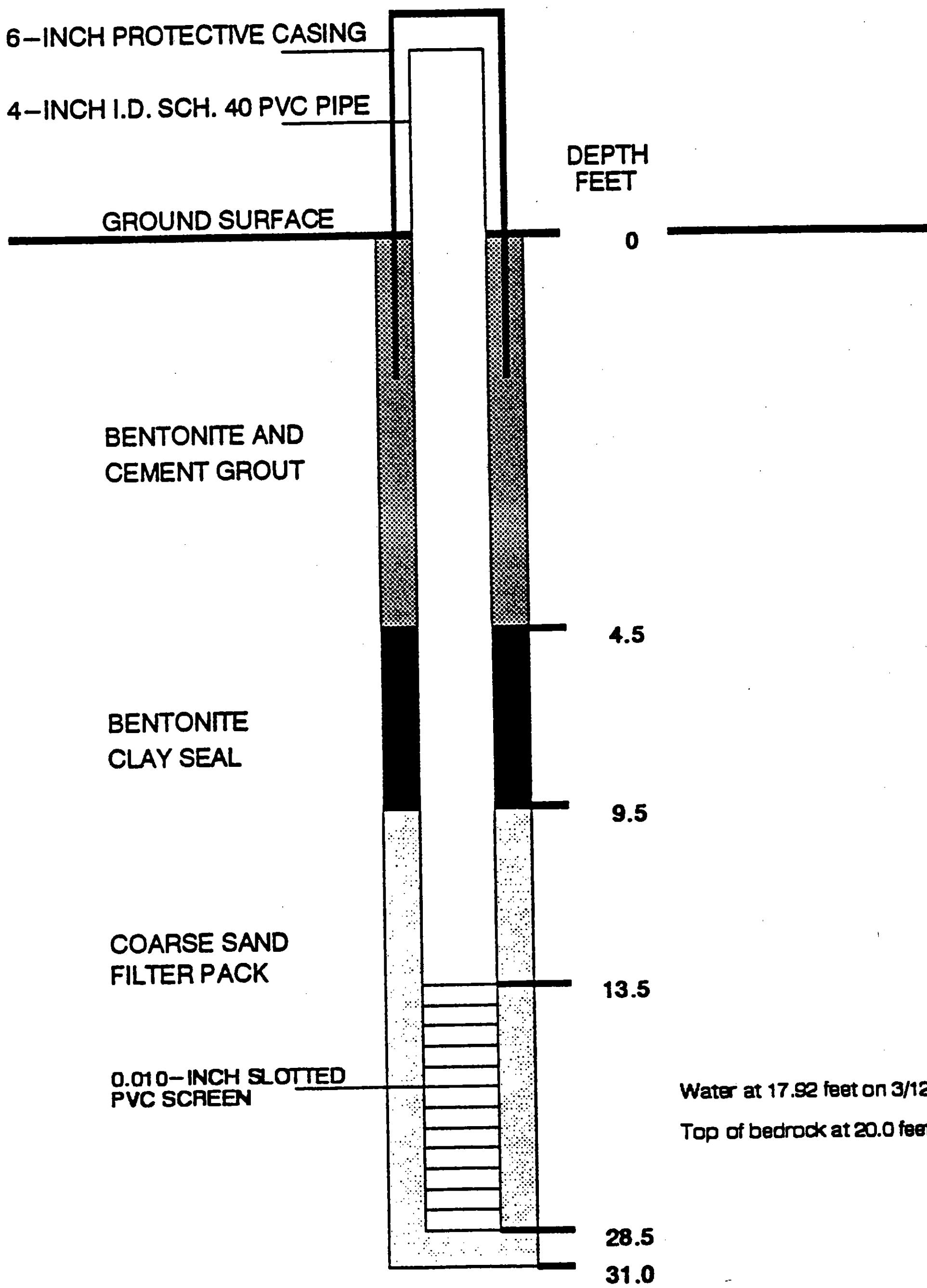
BOREHOLE TERMINATED AT A DEPTH OF 27.5 FEET

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR VERIFICATION INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 43MW4
Installation Date: 8/19/91
Surface Elevation: 1700.9 Feet
Top of PVC Elevation: 1702.78 Feet



NOT TO SCALE

Dames & Moore

BORING 43MW5

Surface Elevation: **1,700.4** Feet, MSL
Location: Radford AAP, Virginia
Start: 07:46 ON 8/15/91
Finish: 11:07 ON 8/15/91

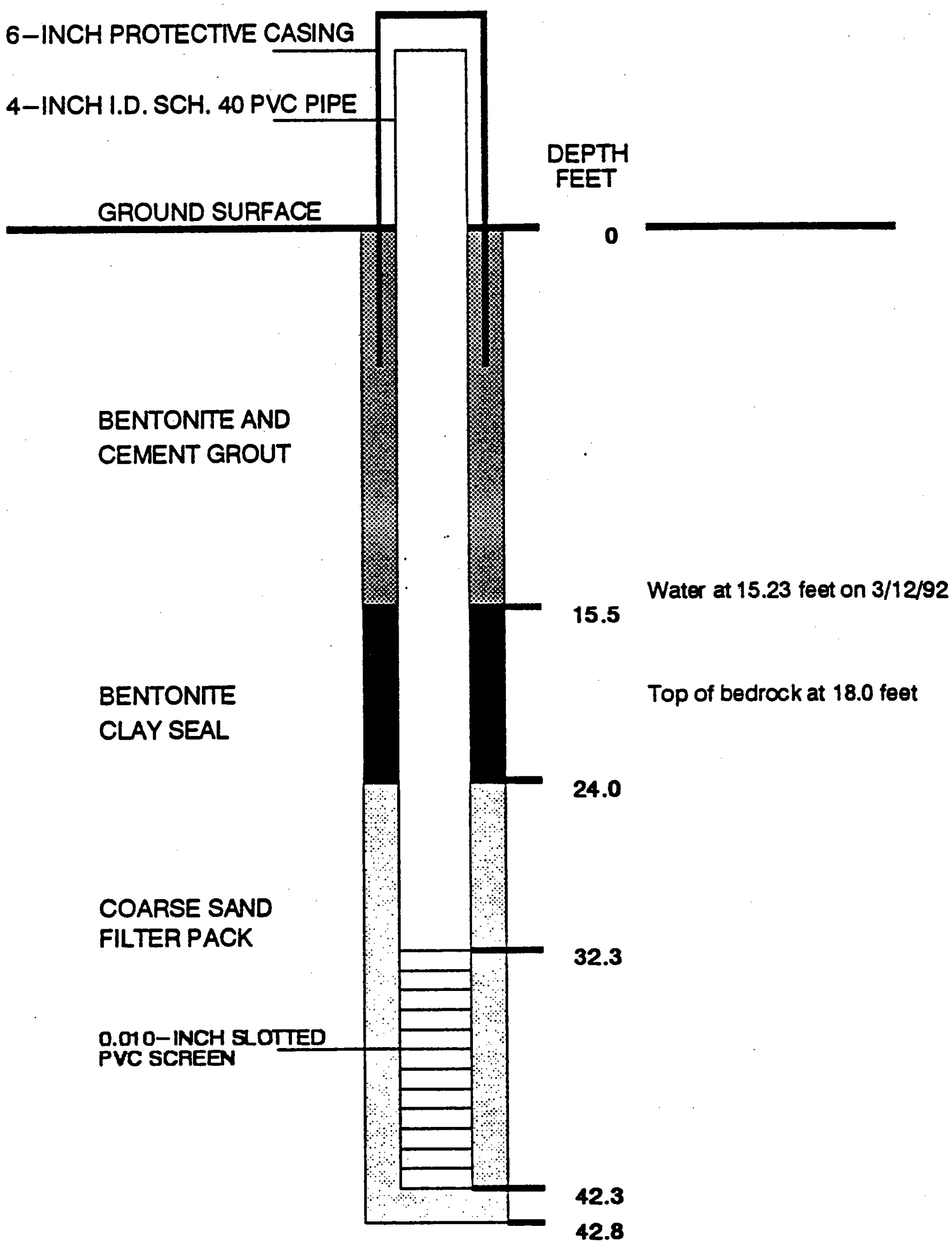
Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Sample Interval	Symbols	Description
0	NO SAMPLES COLLECTED BECAUSE DRILLED THROUGH LANDFILL							ML	BROWN(7.5YR 5/4)CLAY AND SILT, CLAY
								ML	BOWNISH YELLOW(10YR 5/6) CLAY AND SILT, WITH LANDFILL MATERIAL INCLUDING PAPER, CARDBOARD, BANDAIDS METAL, RAGS
5									
								SM	DARK OLIVE GRAY(5YR 3/2) CLAYEY FINE SAND STILL IN LANDFILL
10									
15									THIN SEAM OF DARK GRAY (2.5YR 10/4) CLAYEY, GRAVELLY SILT OVERLYING WEATHERED BEDROCK
	SPT	1			0	0		LS	DARK GRAY TO GRAY HIGHLY WEATHERED LIMESTONE CONGLOMERATE
20									NO NX CORE RECOVERY DUE TO SOFT, HIGHLY WEATHERED ROCK.
	NX			1	0	0			
25									GRAY (2.5YR N/5)LIMESTONE CONGLOMERATE, MEDIUM GRAINED,5 OF 4, POORLY CEMENTED, MUCH CLAY DUE TO IN FILLING AND WEATHERING,
	NX			2	40				
30									BLACK CLAYEY MEDIUM GRAVEL LIMESTONE CONGLOMERATE, SLIGHTLY HARDER BUT HIGHLY WEATHERED AND FRACTURED , WITH BLACK CLAY IN FILLING OF CRACKS
	NX			3	70				BECOMING HIGHLY CRACKED AND RE-CEMENTED WITH CALCITE; HIGHLY WEATHERED TO CLAYSTONE AT 34FEET.
35									CONTINUED SOFT, HIGHLY WEATHERED LIMESTONE WITH HIGH CLAY CONTENT AND ABUNDANT CALCITE.
	NX			4	76	0			
40									BORING TERMINATED AT A DEPTH OF 42.8 FEET

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR VERIFICATION INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 43MW5
Installation Date: 8/15/91
Surface Elevation: 1700.4 Feet
Top of PVC Elevation: 1702.94 Feet



NOT TO SCALE

BORING 43MW6

Surface Elevation: **1,701.2** Feet, MSL
Location: Radford AAP, Virginia
Start: 11:58 on 8-13-91
Finish: 14:00 on 8-14-91

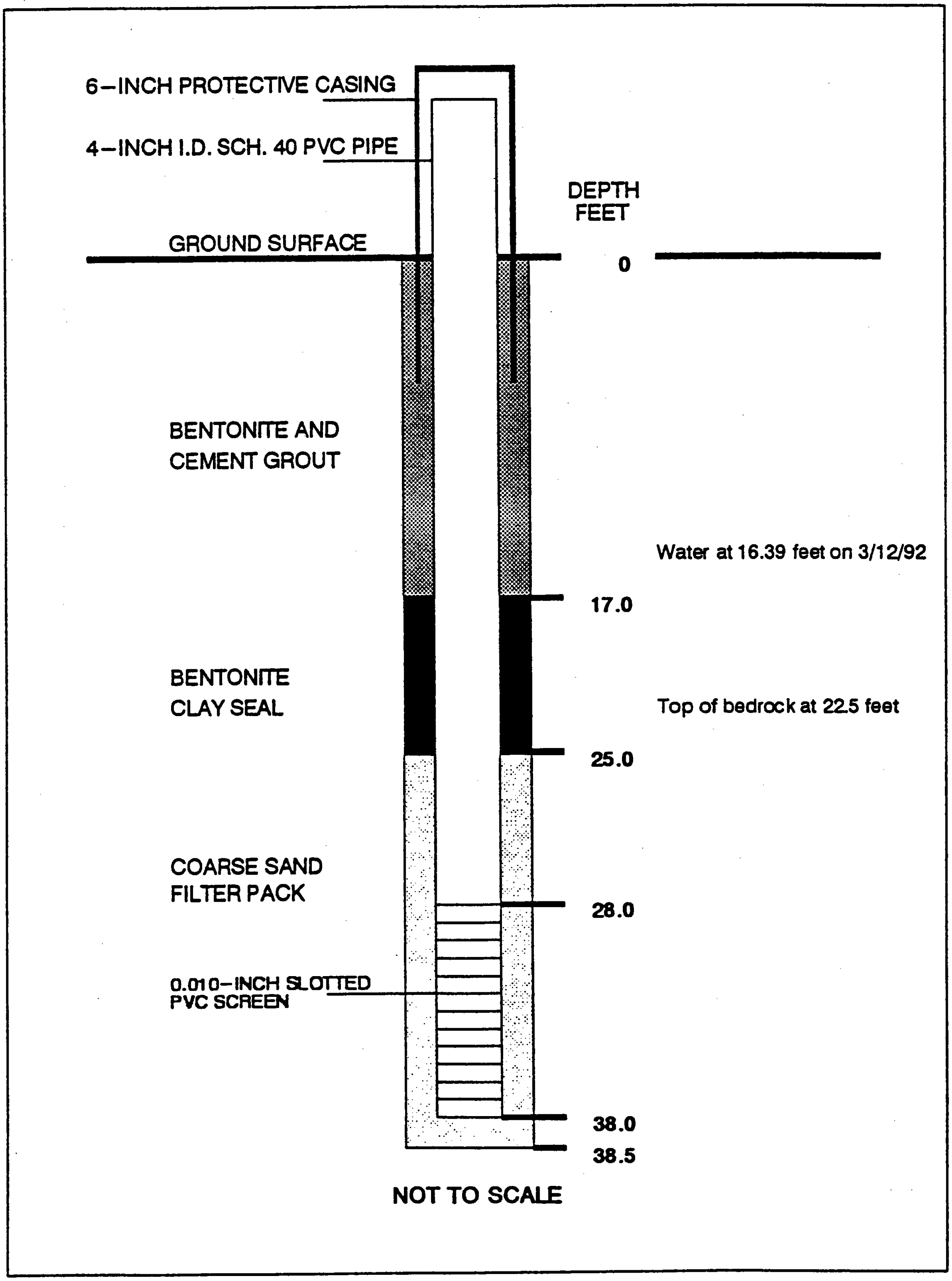
Depth (Feet)	Sampling Method	Sample No.	Blows/Foot	Core Run No.	% Recovery	RQD %	Symbols	Description
0	SPT	1	10		83		ML	BROWN (7.5YR 5/4) SANDY SILT, WITH BLACK MINERAL STAINS
							ML	ENCOUNTERED LANDFILL MATERIAL AT 1.5 FEET, SOIL MATRIX IS BLACK (2.5YR 2.5/0) SILTY SAND (FILL MATERIAL), VERY MOIST, MODERATE ODOR, LANDFILL MATERIAL INCLUDES PLASTIC, RUBBER, PAPER AND TRASH
5	SPT	2	9		54			
10	SPT	3	35		19			
15	SPT	4	37		67		SM	DARK GRAY SILTY SAND, FINE TO MEDIUM, VERY MOIST, SOME SMALL PEBBLES
								WITH THIN BROWNISH YELLOW (10YR 6/6) CLAY SEAM ABOVE WEATHERED LIMESTONE
20	SPT	5	50/1		100		LS	BROWNISH YELLOW (10YR 6/6) LIMESTONE, WEATHERED TO SMALL PEBBLES
								DARK GRAY (10YR N/4) LIMESTONE, HIGHLY FRACTURED, HARD, WITH SOME SAND AND ORANGE STAINING AT FRACTURES
25	NX			1	80	0		SOME FRACTURES ARE POORLY RECEMENTED
								PITTED AND VUGGY, WITH SOME PYRITE INFILLING
								THIN LAMINATIONS WITH CLAY PARTINGS, HIGH CLAY CONTENT, SHALY
30	NX			2	60	40		HIGHLY WEATHERED AND SOFT
								HIGHLY FRACTURED, LITTLE RECOVERY
35	NX			3	10	0		BLACK, HIGHLY WEATHERED LIMESTONE, HIGHLY FRACTURED
								BORING TERMINATED AT A DEPTH OF 38.0 FEET
40								

PLATE
LOG OF BORING

Dames & Moore

WELL INSTALLATION DIAGRAM
FOR VERIFICATION INVESTIGATION
RADFORD AAP, VIRGINIA

Location: 43MW6
Installation Date: 8/14/91
Surface Elevation: 1701.2 Feet
Top of PVC Elevation: 1703.88 Feet



Dames & Moore