Table 1
SWMU Descriptions
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

SWMU	Description	Waste Description	Available Documentation of Data	Conditions Interview Data	Results of Previous Investigations	RFI Descriptions
SWMU # 9 Solid Waste Impoundment/ Pile	• 16 acre facility used for sludge dewatering and disposal from 1966 though the late 1980s. • Facility abuts the Delaware River. • The SWMU reportedly contains over 350,000 tons of gypsum, iron oxide sludge, and alum sludge.	Hydrofluoric acid pond Residues (gypsum), red mud (Iron Oxide), and alum muds (Silica Dioxide, Aluminum Hydroxide, Calcium Sulfate, Titanium salts)	1974 metals data collected during an assessment of potential commercial uses for the stockpiled material.	No new data from interviews	• Results indicated total lead and zinc in the >1000 ppm range, total copper and arsenic in the >100 ppm range, and mercury in the >50 ppm range. • Leach test data suggested a relatively low leaching potential based on using a DI water extraction.	•Heavily vegetated but has several areas of significant erosion. •Layers of very hard, consolidated sludge. •Evidence of free phase product in boring SM09-SB01-03, strong hydrocarbon odor in native material in borings from Sectors 3, 5 & 6
SWMU # 13 Past Landfill Area I	• 10'x200'x15' excavation used to landfill drums from 1972 to 1973. • The excavation was backfilled with soil.	Various organic and inorganic acids, stripper solutions, and chlorinated solvents	None Available	The drum contents were reportedly drained into the excavation prior to placement.	Not Applicable	•Dimensions: 225'x35'x11' •Large, reinforced concrete pad constructed over drum drainage area. •Elevated PID readings
SWMU # 14 Past Landfill Area II	• 40'x40'x10' excavation used to landfill building materials potentially containing Cuprous Chloride and Cupric Chloride during 1972 and 1973. • The excavation was backfilled with soil.	Cuprous Chloride, Cupric Chloride	None Available	No new data from interviews	Not Applicable	•Dimensions approximately 140'x95'x5' •Abundant copper waste and demolition/construction debris, primarily bricks.
SWMU # 15 Past Landfill Area III	• 200'x50'x10' excavation used to landfill various waste chemicals in 1972. • The excavation was backfilled with soil. • The area is covered with construction/demolition debris (i.e. asphalt, railroad ties, concrete, etc.)	Stripper solutions, oxidizers, organic acids, and phosphorous compounds	None Available	No new data from interviews	Not Applicable	•Dimensions: 2,410'x150'x5' •Area heavily covered by construction/demolition debris. •Large concrete pad at 1.5-ft deep on Southern end of SWMU. •Elevated PID readings in Test Pit 1
SWMU # 17 Past Landfill Area V	• 6'x4'x1' excavation used to dispose of laboratory samples from 1960 to 1974. • The site is currently located under an asphalt helicopter landing pad.	Organic and inorganic acids, salts, strippers, and pesticides	None Available	No new data from interviews	Not Applicable	•Dimensions: 44'x30'x10' •AST now sits on helicopter pad •Elevated PID readings and abundant glass found in Geoprobe samples.
SWMU # 18 Past Landfill Area VI	• 12'x6'x4' excavation used to dispose of pesticide-related chemicals in 1972. • Material may be in containers. • The excavation may have been lined with plastic. • The excavation was backfilled with soil. • In 1978, the area was paved.	Acetyl Chloride, Methoxychlor and Monochlorobenzene	None Available	No new data from interviews	Not Applicable	•Dimensions: 45'x40'x5' •Evidence of a plastic liner was not found. •Glass and plastic bottles containing liquids found •Elevated PID readings
SWMU # 19 Past Landfill Area VII	• 50'x12'x10' excavation used for the disposal of sludge from DDT manufacturing during 1968 and 1969. • Backfilled with soil. • The area was paved in 1978,.	DDT, TDE	None Available	• Plant personnel indicated a process or a portion of a process tank may have been place in the excavation. • Plant personel indicated location reported previously was incorrect	Not Applicable	•Dimensions: 90'x25'x5' •Reinforced concrete pads found in Test Pits 4 and 5. •Presence of buried AST could not be confirmed •Elevated PID readings

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SWMU # 20 past Landfill Area VIII - Boron Trifluoride Pond	• 90'x90'x8' former cooling pond that was drained and backfilled in the late 1970's/early 1980's. • From 1945-75, prior to closure, leaking boron trifluoride and iodine pentafluoride cylinders were placed in the pond to control gaseous emissions.	Boron Trifluoride and Iodine Pentafluoride	None Available	• Plant personnel report that cylinders were often removed from the pond once they were emptied. • Material from SWMU 9 was brought in to fill the excavation prior to constructing the current BF3 tube trailer loading pad. • Plant personnel report that no cylinders were identified in the excavation during the project. • The sides of the cooling basin are reportedly concrete. • Plant personel indicated location reported previously was incorrect	Not Applicable	•Dimensions: approximately 60'x50'x6' •Material from SWMU 9 was brought in as fill material, has since then consolidated into a very hard, concrete-like material. Backhoe unable to break through material. •No cylinders were found during RFI excavations

Notes:
1 - Site descriptions and dimensions are based on the SWMU information sheets submitted to EPA in June 1986.
2 - Waste descriptions are based on SWMU information sheets, and interviews with current and former facility personnel

Table 2
Summary of RFI Analytical Samples
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

SWMU	Field Id	VOCS	SVOCS	PESTICIDES	METALS TOTAL	METALS DISSOLVED	HERBICIDES	PCBS	GENERAL CHEMISTRY
SWMU 9	SM09-GW01				WG	WG			
SWMU 9	SM09-GW02				WG	WG			
SWMU 9	SM09-GW03				WG	WG			
SWMU 9	SM09-Runoff-01				WS				WS
SWMU 9	SM09-Runoff-02				WS				WS
SWMU 9	SM09-Runoff-03				WS				WS
SWMU 9	SM09-SB01-01				SO				SO
SWMU 9	SM09-SB01-02				SO				SO
SWMU 9	SM09-SB01-02A				SO				SO
SWMU 9	SM09-SB01-03				SO				SO
SWMU 9	SM09-SB02-01				SO				SO
SWMU 9	SM09-SB02-02				SO				SO
SWMU 9	SM09-SB02-03				SO				SO
SWMU 9	SM09-SB03-01				SO				SO
SWMU 9	SM09-SB03-02				SO				SO
SWMU 9	SM09-SB03-03				SO				SO
SWMU 9	SM09-SB04-01				SO				SO
SWMU 9	SM09-SB04-02				SO				SO
SWMU 9	SM09-SB04-03				SO				SO
SWMU 9	SM09-SB05-01				SO				SO
SWMU 9	SM09-SB05-02				SO				SO
SWMU 9	SM09-SB05-02A				SO				SO
SWMU 9	SM09-SB06-01				SO				SO
SWMU 9	SM09-SB06-02				SO				SO
SWMU 13	SM13-GP01-01	WG	WG	WG	WG	WG	WG	WG	WG
SWMU 13	SM13-GP02-01	WG	WG	WG	WG	WG		WG	
SWMU 13	SM13-GP02-01A	WG	WG	WG	WG	WG		WG	
SWMU 13	SM13-TP05-01	SO	SO	SO	SO			SO	SO
SWMU 13	SM13-TP05-01A	SO	SO	SO				SO	SO
SWMU 13	SM13-TP07-01	SO	SO	SO	SO		SO		SO
SWMU 14	SM14-TP03-01	SO, WG	SO, WG	SO, WG	SO, WG	WG		SO, WG	SO
SWMU 14	SM14-TP06-01	SO, WG	SO, WG	SO, WG	SO, WG	WG	SO, WG		SO, WG
SWMU 14	SM14-TP06-01A				SO, WG	WG			SO
SWMU 15	SM15-GP01-01	WG	WG	WG	WG	WG		WG	
SWMU 15	SM15-GP01-01A	WG	WG	WG	WG	WG		WG	
SWMU 15	SM15-GP02-01	WG	WG	WG	WG	WG	WG		WG

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SWMU	Field Id	VOCS	SVOCS	PESTICIDES	METALS TOTAL	METALS DISSOLVED	HERBICIDES	PCBS	GENERAL CHEMISTRY
SWMU 15	SM15-GP03-01	WG			WG	WG			
SWMU 15	SM15-TP01-01	SO	SO	SO				SO	SO
SWMU 15	SM15-TP03-01	SO			SO				SO
SWMU 15	SM15-TP07-01	SO	SO		SO				SO
SWMU 17	SM17-GP01-01	SO, WG	SO, WG	SO, WG	SO, WG	WG	SO, WG	SO	SO, WG
SWMU 18	SM18-GP01-01	WG	WG	WG	WG	WG		WG	
SWMU 18	SM18-GP02-01	WG	WG	WG	WG	WG		WG	
SWMU 18	SM18-GP03-01	WG	WG	WG	WG	WG		WG	
SWMU 18	SM18-TP08-01	SO	SO	SO	SO			SO	SO
SWMU 18	SM18-TP09-01	SO	SO	SO	SO			SO	SO
SWMU 19	SM19-GP01-01	WG	WG	WG	WG		WG		WG
SWMU 19	SM19-TP03-01	SO	SO	SO	SO		SO		SO
SWMU 19	SM19-TP04-01	SO		SO					SO
SWMU 20	SM20-GP01-01				WG	WG			WG
SWMU 20	SM20-GP02-01	WG	WG	WG	WG		WG		WG
SWMU 20	SM20-TP02-01	SO	SO	SO	SO		SO		SO
SWMU 20	SM20-TP03-01				SO				SO
MW	MW-1	WG	WG	WG	WG	WG		WG	
MW	MW-1A	WG	WG	WG	WG	WG		WG	
MW	MW-2	WG	WG	WG	WG	WG		WG	
MW	MW-3	WG	WG	WG	WG	WG		WG	
MW	MW-4	WG	WG	WG	WG	WG		WG	

Notes:
WG - groundwater sample
WS - surface water sample
SO - soil sample
General Chemistry includes analysis for pH, Floride, Iodine, Total Dissolved Solids and Total Suspended Solids.
Duplicate samples are designated with an "A" suffix (i.e. SM15-GP01-01A is a duplicate of SM15-GP01-01).

Table 3
RFI Samples and Analytical Methods
RFI Report
Honeywell -Delaware Valley Works Facility, Claymont, DE

		SOIL									GROUNDWATER								SURFACE WATER			
		TCL VOCs (1)	TCL SVOCs (2)	TAL Metals (3)	Appendix IX (4)	Copper (5)	PCBs (6)	TCL Pesticides (7)	pH (8)	Boron Floride Iodine (9)	TCL VOCs (1)	TCL SVOCs (2)	Total & Dissolved TAL Metals (3)	Appendix IX (4)	Total & Dissolved Copper (5)	PCBs (6)	TCL Pesticides (7)	Boron Floride Iodine (9)	Total Metals (3)	Total Dissolved Solids (10)	Total Suspended Solids (11)	pH (8)
SWMU #9 (16 acre sludge disposal area)	Samples	--	--	16	--	--	--	--	18	--	--	--	3/3	--	--	--	--	--	3	3	3	3
	Field Duplicates (12)	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MS/MSD (13)	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Equipment Blank	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SWMU #13 (Drum Disposal Area)	Samples	1	1	1	1	--	1	1	--	--	1	1	1	1	--	1	1	--	--	--	--	--
	Field Duplicates	1	1	--	--	--	1	1	--	--	1	1	1	--	--	--	1	--	--	--	--	--
	MS/MSD	1	1	--	--	--	1	1	--	--	1	1	1	--	--	--	1	--	--	--	--	--
	Equipment Blank	1	1	--	--	--	1	1	--	--	1	1	1	--	--	--	1	--	--	--	--	--
SWMU #14 (Cuprous Chloride Disposal Area)	Samples	1	1	1	1	1	1	1	--	--	1	1	1	1	1	1	1	--	--	--	--	--
	Field Duplicates	--	--	--	--	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--
	MS/MSD	--	--	--	--	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--
	Equipment Blank	--	--	--	--	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--
SWMU #15 (Waste Chemical Disposal Area)	Samples	2	1	3	1	--	1	1	--	--	2	1	3/3	1	--	1	1	--	--	--	--	--
	Field Duplicates	--	--	--	--	--	--	--	--	--	1	--	1	--	--	1	1	--	--	--	--	--
	MS/MSD	--	--	--	--	--	--	--	--	--	1	--	1	--	--	1	1	--	--	--	--	--
	Equipment Blank	--	--	--	--	--	--	--	--	--	1	--	1	--	--	1	1	--	--	--	--	--
SWMU #17 (Laboratory Sample Disposal Area)	Samples	--	--	1	1	--	1	--	--	--	--	--	1	1	--	1	--	--	--	--	--	--
	Field Duplicates	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MS/MSD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Equipment Blank	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SWMU #18 (Miscellaneous Chemical Waste Disposal Area)	Samples	--	1	1	1	--	1	--	--	--	--	1	1	1	--	1	--	--	--	--	--	--
	Field Duplicates	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MS/MSD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Equipment Blank	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 3
RFI Samples and Analytical Methods
RFI Report
Honeywell -Delaware Valley Works Facility, Claymont, DE

		SOIL									GROUNDWATER								SURFACE WATER			
		TCL VOCs (1)	TCL SVOCs (2)	TAL Metals (3)	Appendix IX (4)	Copper (5)	PCBs (6)	TCL Pesticides (7)	pH (8)	Boron Floride Iodine (9)	TCL VOCs (1)	TCL SVOCs (2)	Total & Dissolved TAL Metals (3)	Appendix IX (4)	Total & Dissolved Copper (5)	PCBs (6)	TCL Pesticides (7)	Boron Floride Iodine (9)	Total Metals (3)	Total Dissolved Solids (10)	Total Suspended Solids (11)	pH (8)
SWMU #19 (DDT/TDE Sludge Disposal Area)	Samples	1	--	--	1	--	--	1	--	--	1	--	--	1	--	--	--	--	--	--	--	--
	Field Duplicates	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MS/MSD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Equipment Blank	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SWMU #20 (BF3 Cylinder Disposal Area)	Samples	--	--	1	1	--	--	--	--	1	--	--	1	1	--	--	--	1	--	--	--	--
	Field Duplicates	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--
	MS/MSD	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--
	Equipment Blank	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--
Site-Wide Groundwater	Samples	--	--	--	--	--	--	--	--	--	4	4	4	4	--	4	4	--	--	--	--	--
	Field Duplicates	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MS/MSD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Equipment Blank	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

(1) TCL VOCs - Target Compound List Volatile Organic Compounds by 8260B
(2) TCL SVOCs - Target Compound List Semivolatile Organic Compounds by 8270C
(3) TAL Metals - Target Analyte List of Metals by 6010B/7470
(4) Appendix IX methodologies are the same as TCL methodologies and constituents listing does not include dioxin or furan.
(5) Copper by 6010B
(6) TCL PCBs by 8082
(7) TCL Pesticides by 8081
(8) pH by 9045C for soil and 150.1 for surface water
(9) Boron by 6010B, Floride by 6010B for soils and 350.2 modified and Iodine b SM4500I-C
(10) Total Dissolved Solids by 160.1
(11) Total Suspended Solids by 160.2
(12) MS/MSD - Matrix Spike/Matrix Spike Duplicate Analysis
(13) Actual SWMUs at which Field Duplicates, MS/MSDs, and Equipment Blanks are taken may have varied, depending upon sampling schedule. Field Duplicates and Equipment Blanks will be collected at 10 % frequency. MS/MSDs will be collected at 5% frequency.

Table 4
Monitoring Well Construction Specifications
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

Well Identification		Well Construction Data						Survey Data			
								Horizontal NAD 83		Elevation (Vertical) NAVD 88 (ft MSL)	
Monitoring Well Name	Well Completion/ Permit No.	Total Depth (ft bgs)	Screen Interval (ft bgs)	Number 1 Sand Interval (ft bgs)	Bentonite Seal Interval (ft bgs)	Grout interval (ft bgs)	Casing Diameter (in)	Easting	Northing	Ground Surface	Inner Casing
MW-101	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	18.92
MW-102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	34.91
MW-103	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	30.35
MW-104	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	30.41
MW-105	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	24.40
MW-106	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.61
MW-107	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.17
MW-108	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.11
MW-109	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.95
MW-110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.71
MW-111	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.88
MW-112	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27.51
MW-113	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	18.55
MW-114	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.59
MW-115	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.19
MW-116	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	33.46
MW-117	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	29.85
B-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.13
B-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.52
B-2D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.21
B-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.74
B-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.54
B-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.32
B-5D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.80
EWL-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	31.49
EWL-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	31.84
EWL-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	32.55
EWL-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	35.94
EWL-9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	31.53
SAL-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27.45
SAL-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	18.75
SAL-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	21.10
MW-1	03094	19.0	9-19	7-20	5-7	1-5	4	652114.19	660538.66	30.36	32.81
MW-2	03094	14.5	4.5-14.5	3.5-16	2-3.5	0.5-2	4	651791.40	661203.11	34.11	36.51
MW-3	03094	16.0	6-16	4.5-16	2.5-4.5	1-2.5	4	650702.51	660535.07	30.97	30.77
MW-4	193565W	19.5	9.5-19.5	7.7-19.5	5.5-7.7	1-5.5	4	651162.16	659870.20	30.50	32.68

NOTES:
ft bgs - feet below ground surface
ft MSL - feet relative to mean sea level
NA - this information is not available at this time.

Table 5
Sitewide Soil Detection Statistical Analysis
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

Analyte Group	Analyte	Total Number of Detections	Maximum Concentration	Minimum Concentration	Average Concentration
VOCS	1,1,2,2-Tetrachloroethane	1	1600	1600	1600
VOCS	1,1,2-Trichloro-1,2,2-trifluoroethane	1	290	290	290
VOCS	1,1,2-Trichloroethane	1	280	280	280
VOCS	1,1-Dichloroethane	1	1.4	1.4	1.4
VOCS	1,2,4-Trichlorobenzene	1	330	330	330
VOCS	1,2-Dichlorobenzene	3	4000	2.3	1626.15
VOCS	1,2-Dichloroethane	2	460	20	240
VOCS	1,4-Dichlorobenzene	2	3000	780	1890
VOCS	1,4-Dioxane (p-dioxane)	1	2300	2300	2300
VOCS	2-Butanone (MEK)	2	27	24	25.5
VOCS	4-Methyl-2-pentanone (MIBK)	2	2.4	2.3	2.35
VOCS	Acetone	10	96	11	45.13
VOCS	Benzene	5	60000	1.1	12000.98
VOCS	Carbon disulfide	4	340	1.2	93.15
VOCS	Carbon tetrachloride	2	42000	13000	27500
VOCS	Chlorobenzene	6	260000	4.1	66314.6
VOCS	Chloroethane	1	1.9	1.9	1.9
VOCS	Chloroform	10	63000	1.6	10081.36
VOCS	cis-1,2-Dichloroethylene	5	4300	1.9	1112.95
VOCS	Ethylbenzene	1	1100000	1100000	1100000
VOCS	Methylene chloride	2	3.2	1.7	2.45
VOCS	o-Xylene	1	380000	380000	380000
VOCS	p,m-Xylene	1	2200000	2200000	2200000
VOCS	Tetrachloroethylene (PCE)	13	2100000	2.1	183301.7
VOCS	Toluene	8	3000	1.6	383.19
VOCS	Total 1,2-dichloroethylene	5	4600	1.9	1189.63
VOCS	Trichloroethylene (TCE)	10	470000	1.4	59591.9
VOCS	Vinyl chloride	1	120	120	120
VOCS	Xylenes (total)	1	2700000	2700000	2700000
SVOCS	1,2,4-Trichlorobenzene	3	590	76	325.33
SVOCS	1,2-Dichlorobenzene	3	500000	220	137610
SVOCS	1,3-Dichlorobenzene	1	590	590	590
SVOCS	1,3-Dinitrobenzene	2	300000	250000	275000
SVOCS	1,4-Dichlorobenzene	4	11000	18	6408
SVOCS	2,4-Dinitrotoluene	7	42000	19	6374
SVOCS	2,6-dinitrotoluene	6	13000	57	3713.38
SVOCS	2-Chlorophenol	2	110	74	92
SVOCS	2-Methylnaphthalene	3	51	21	39.33
SVOCS	2-Methylphenol (o-cresol)	2	48	35	41.5
SVOCS	2-Nitroaniline	1	540	540	540
SVOCS	2-Nitrophenol	1	8500	8500	8500
SVOCS	3-Nitroaniline	2	100	99	99.5
SVOCS	4-Methylphenol (p-cresol)	2	140	23	81.5
SVOCS	4-Nitroaniline	1	120	120	120
SVOCS	5-nitro-o-toluidine	1	2500	2500	2500
SVOCS	Acenaphthene	4	88	22	53

Table 5
Sitewide Soil Detection Statistical Analysis
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

Analyte Group	Analyte	Total Number of Detections	Maximum Concentration	Minimum Concentration	Average Concentration
SVOCS	Acetophenone	3	25	20	23
SVOCS	Anthracene	5	340	32	154.4
SVOCS	Azobenzene	1	43	43	43
SVOCS	Benzaldehyde	3	37	29	33
SVOCS	Benzo(a)anthracene	8	3300	120	1173.61
SVOCS	Benzo(a)pyrene	7	2900	78	861.83
SVOCS	Benzo(b)fluoranthene	8	3800	120	1413.33
SVOCS	Benzo(g,h,i)perylene	7	2200	74	667.17
SVOCS	Benzo(k)fluoranthene	9	4100	120	1706.22
SVOCS	Biphenyl (diphenyl)	1	200	200	200
SVOCS	bis(2-Ethylhexyl)phthalate	7	7600	20	3850.5
SVOCS	Carbazole	5	340	32	130.8
SVOCS	Chrysene	9	4200	140	1533.78
SVOCS	Di-n-butyl phthalate	1	9600	9600	9600
SVOCS	Dibenzo(a,h)anthracene	6	870	27	255.33
SVOCS	Dibenzofuran	5	120	18	51
SVOCS	Fluoranthene	9	5200	260	1490
SVOCS	Fluorene	4	87	19	63
SVOCS	Hexachlorobenzene	5	16000	330	9941.11
SVOCS	Indeno(1,2,3-c,d)pyrene	7	2300	68	678.08
SVOCS	n-Nitrosodiphenylamine	4	96	18	50.25
SVOCS	Naphthalene	3	57	28	42.33
SVOCS	Nitrobenzene	5	300	18	128.4
SVOCS	Pentachlorobenzene	1	180	180	180
SVOCS	Phenanthrene	8	3000	240	951
SVOCS	Phenol	4	12000	95	3087.5
SVOCS	Pyrene	9	5200	290	1172.5
SVOCS	Pyridine	1	10000	10000	10000
PESTICIDES	alpha-BHC	2	84000	2300	43150
PESTICIDES	beta-BHC	4	1500	110	868.33
PESTICIDES	gamma-BHC (Lindane)	1	190	190	190
PESTICIDES	p,p'-DDD	11	580000	5.7	49307.96
PESTICIDES	p,p'-DDE	8	51000	250	8660
PESTICIDES	p,p'-DDT	11	1400000	8	114139.86
PCBS	PCB-1254 (Arochlor 1254)	1	280	280	280
PCBS	PCB-1260 (Arochlor 1260)	1	220	220	220
METALS	Aluminum	26	130000	3310	29961.54
METALS	Antimony	16	230	0.61	57.1
METALS	Arsenic	21	6850	4.3	465.71
METALS	Barium	30	1060	23.3	212.62
METALS	Beryllium	29	1.3	0.11	.68
METALS	Boron	14	37	0.99	13.48
METALS	Cadmium	19	9.4	0.046	2.83
METALS	Calcium	26	268000	690	126133.08
METALS	Chromium	30	184	6.8	29.26
METALS	Cobalt	26	140	2	21.92

Table 5
Sitewide Soil Detection Statistical Analysis
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

Analyte Group	Analyte	Total Number of Detections	Maximum Concentration	Minimum Concentration	Average Concentration
METALS	Copper	30	107000	5.2	3703.78
METALS	Iron	26	184000	912	32399.81
METALS	Lead	30	5410	6.7	583.22
METALS	Magnesium	18	9200	498	3026.67
METALS	Manganese	26	1040	8.5	180.23
METALS	Mercury	27	48.2	0.03	5.01
METALS	Nickel	25	115	3	27.18
METALS	Potassium	16	2040	494	1084.71
METALS	Selenium	21	271	0.84	24.13
METALS	Silver	11	15.9	0.46	6.26
METALS	Sodium	7	1290	93.4	433.77
METALS	Thallium	10	16.1	0.48	3.37
METALS	Tin	6	2810	2.2	386.43
METALS	Vanadium	30	105	5	39.53
METALS	Zinc	30	1670	9.2	257.01
GENCHEM	Cyanide	2	1.3	1.1	1.2
GENCHEM	Fluoride	2	5.5	4.1	4.8
GENCHEM	pH	18	11.7	4.4	6.57
GENCHEM	Sulfide	2	9.5	9.4	9.45

Notes:
VOCS- Voliatile Organic Compounds
SVOCS- Semivoliatile Organic Compounds
PCBS- Polychlorinated Biphenyls
GENCHEM- General Chemistry
Units for VOCs, SVOCs, Pesticides and PCBs are ug/kg.
Units for Metals and General Chemistry- Cyanide, Fluoride and Sulfide are mg/kg.
Units for General Chemistry- pH is pH units.

Table 6
Sitewide Groundwater Detection Statistical Analysis
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

Analyte Group	Analyte	Total Number of Detections	Minimum Concentration	Maximum Concentration	Average Concentration
VOCS	1,1,2-Trichloro-1,2,2-trifluoroethane	8	0.97	60000	13062.63
VOCS	1,1-Dichloroethane	1	3	3	3
VOCS	1,2-Dichlorobenzene	5	5.1	37000	4713.64
VOCS	1,2-Dichloroethane	3	5800	28000	13300
VOCS	1,4-Dichlorobenzene	1	410	410	410
VOCS	1,4-Dioxane (p-dioxane)	4	130	34000	14825
VOCS	2-Butanone (MEK)	2	3600	34000	18800
VOCS	4-Methyl-2-pentanone (MIBK)	4	72	87000	15786
VOCS	Acetone	10	1.6	14000	3105.31
VOCS	Benzene	8	3	12000	2452.79
VOCS	Bromobenzene	3	1	670	224.03
VOCS	Bromoform	1	2800	2800	2800
VOCS	Carbon disulfide	3	2.1	86000	43048.03
VOCS	Carbon tetrachloride	2	500	1600	1050
VOCS	Chlorobenzene	6	130	11000	2576.67
VOCS	Chloroform	10	3.1	41000	17384.11
VOCS	cis-1,2-Dichloroethylene	12	1.2	110000	18287.87
VOCS	Dichlorodifluoromethane	1	160	160	160
VOCS	Ethylbenzene	6	5.6	10000	2003.63
VOCS	Methyl tert-Butyl ether (MTBE)	2	9	11	10
VOCS	Methylene chloride	9	1.8	440000	89502.7
VOCS	Naphthalene	1	4800	4800	4800
VOCS	o-Xylene	6	1.8	3500	1897.17
VOCS	p,m-Xylene	6	1.1	18000	5549.04
VOCS	P-cymene (p-isopropyltoluene)	1	1500	1500	1500
VOCS	Tetrachloroethylene (PCE)	9	1.5	23000	7622.17
VOCS	Tetrahydrofuran	4	7.1	92000	44753.8
VOCS	Toluene	3	1100	1700	1450
VOCS	Total 1,2-dichloroethylene	12	1.3	110000	16594.52
VOCS	trans-1,2-Dichloroethylene	2	2.3	2.4	2.35
VOCS	Trichloroethylene (TCE)	14	1.3	48000	11806.4
VOCS	Vinyl chloride	3	24	120	88
VOCS	Xylenes (total)	7	3	22000	6788.42
SVOCS	1,2,4-Trichlorobenzene	3	0.59	1.4	1.06
SVOCS	1,2-Dichlorobenzene	9	4.5	29000	3899.21
SVOCS	1,3-Dichlorobenzene	2	23	23	23
SVOCS	1,3-Dinitrobenzene	1	300	300	300
SVOCS	1,4-Dichlorobenzene	5	140	600	390
SVOCS	2,4-Dichlorophenol	2	6.2	6.8	6.5
SVOCS	2,4-Dimethylphenol	2	3.3	3.3	3.3
SVOCS	2,4-Dinitrophenol	1	3300	3300	3300
SVOCS	2,4-Dinitrotoluene	1	0.75	0.75	0.75
SVOCS	2-Chlorophenol	2	1.6	6.8	4.2
SVOCS	2-Methylnaphthalene	2	0.78	0.8	0.79
SVOCS	2-Methylphenol (o-cresol)	2	6.7	6.8	6.75
SVOCS	2-Nitrophenol	1	10000	10000	10000

Table 6
Sitewide Groundwater Detection Statistical Analysis
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

Analyte Group	Analyte	Total Number of Detections	Minimum Concentration	Maximum Concentration	Average Concentration
SVOCS	4-Methylphenol (p-cresol)	5	4.3	15	10.8
SVOCS	4-Nitrophenol	1	4500	4500	4500
SVOCS	Acetophenone	4	4.9	430	126.1
SVOCS	Aniline	7	0.63	800	415.86
SVOCS	BENZOIC ACID	3	35	320	168.75
SVOCS	Benzyl alcohol	1	35	35	35
SVOCS	bis(2-Ethylhexyl)phthalate	5	0.93	3	2.07
SVOCS	Di-n-butyl phthalate	2	0.52	0.65	0.59
SVOCS	Dimethyl phthalate	1	0.64	0.64	0.64
SVOCS	Hexachloroethane	1	5.3	5.3	5.3
SVOCS	n-Nitrosodiphenylamine	4	0.56	0.8	0.71
SVOCS	n-Nitrosomorpholine	2	3.9	4	3.95
SVOCS	Naphthalene	3	0.59	150	75.3
SVOCS	Nitrobenzene	3	1.1	1200	402
SVOCS	o-Toluidine	3	3.1	1900	952.1
SVOCS	Phenol	9	17	26000	7385.25
SVOCS	Pyridine	1	3600	3600	3600
PESTICIDES	Aldrin	2	0.085	0.087	0.086
PESTICIDES	Alpha endosulfan	2	0.07	0.08	0.075
PESTICIDES	alpha-BHC	14	0.075	850	61.48
PESTICIDES	Beta endosulfan	2	0.11	0.12	0.115
PESTICIDES	beta-BHC	13	0.059	9.8	2.67
PESTICIDES	delta-BHC	6	0.065	0.96	0.36
PESTICIDES	Dieldrin	3	0.2	0.33	0.27
PESTICIDES	Endrin	1	0.12	0.12	0.12
PESTICIDES	gamma-BHC (Lindane)	3	0.093	1	0.41
PESTICIDES	Heptachlor	3	0.057	0.12	0.083
PESTICIDES	Heptachlor epoxide	1	0.075	0.075	0.075
PESTICIDES	p,p'-DDD	9	0.14	2400	267.24
PESTICIDES	p,p'-DDE	2	0.16	0.18	0.17
PESTICIDES	p,p'-DDT	7	0.16	8500	1215.02
METALS-TOT	Aluminum	20	36.2	248000	16046.48
METALS-TOT	Antimony	6	5.9	2840	759.44
METALS-TOT	Arsenic	14	4.9	101000	6433.25
METALS-TOT	Barium	24	17.4	926	279.64
METALS-TOT	Beryllium	11	0.32	10.8	5.98
METALS-TOT	Boron	22	88.5	36300	1967.55
METALS-TOT	Cadmium	9	0.52	80	18.4
METALS-TOT	Calcium	20	35900	701000	171370
METALS-TOT	Chromium	22	1.4	291	33.35
METALS-TOT	Cobalt	18	3.5	173	53.93
METALS-TOT	Copper	22	2.1	6000	748.98
METALS-TOT	Iron	20	200	962000	127827
METALS-TOT	Lead	18	1.8	3100	187.63
METALS-TOT	Magnesium	20	12800	1130000	116655
METALS-TOT	Manganese	20	140	9010	3841.15

Table 6
Sitewide Groundwater Detection Statistical Analysis
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

Analyte Group	Analyte	Total Number of Detections	Minimum Concentration	Maximum Concentration	Average Concentration
METALS-TOT	Mercury	9	0.11	33.4	4.33
METALS-TOT	Nickel	19	4.7	232	66.92
METALS-TOT	Potassium	20	837	53100	17407.34
METALS-TOT	Selenium	4	7.5	108	42.03
METALS-TOT	Silver	4	1.8	6.6	3.85
METALS-TOT	Sodium	20	9070	724000	141278.5
METALS-TOT	Thallium	2	4.3	95.5	49.9
METALS-TOT	Tin	1	35.8	35.8	35.8
METALS-TOT	Vanadium	15	3.2	494	121.09
METALS-TOT	Zinc	24	4.7	7790	450.15
METALS-DIS	Aluminum	16	30.4	187000	20548.68
METALS-DIS	Antimony	7	4.8	2400	1208.75
METALS-DIS	Arsenic	12	6.2	95900	4840.76
METALS-DIS	Barium	21	15.3	196	93.17
METALS-DIS	Beryllium	3	0.58	6.6	4.17
METALS-DIS	Boron	20	85.1	41300	2956.87
METALS-DIS	Cadmium	7	0.5	45.4	23.67
METALS-DIS	Calcium	20	35400	522000	184765
METALS-DIS	Chromium	17	0.92	39.2	17.61
METALS-DIS	Cobalt	14	3.5	243	83.0
METALS-DIS	Copper	17	1.6	1200	171.87
METALS-DIS	Iron	19	42.2	1360000	105166.67
METALS-DIS	Lead	10	1.7	241	35.78
METALS-DIS	Magnesium	20	13000	1010000	121140
METALS-DIS	Manganese	20	141	11400	4310
METALS-DIS	Mercury	5	0.12	0.49	0.29
METALS-DIS	Nickel	14	2.9	300	73.6
METALS-DIS	Potassium	20	800	70000	20223.5
METALS-DIS	Selenium	5	4.2	96.3	25.49
METALS-DIS	Silver	2	2.6	3.9	3.25
METALS-DIS	Sodium	20	7760	728000	153753
METALS-DIS	Vanadium	6	3.1	53.6	33.5
METALS-DIS	Zinc	20	3.7	3640	340.48
GENCHEM	Cyanide	1	77.6	77.6	77.6
GENCHEM	Fluoride	1	0.83	0.83	0.83

Notes:
VOCS- Voliatile Organic Compounds
SVOCS- Semivoliatile Organic Compounds
METALS-TOT- Total Metals
METALS-DIS- Dissolved Metals
GENCHEM- General Chemistry
Units for VOCs, SVOCs, Pesticides, Metals-Total, Metals-Dissolved and General Chemistry- Cyanide are ug/kg.
Units for General Chemistry- Fluoride are mg/kg.

Table 7
Water Level Gauging Data
RFI Report
Honeywell - Delaware Valley Works Facility, Claymont, DE

Monitoring Well	Top of PVC Elevation	Water Level (ft)	Water Level (ft)	Water Level (ft)
	(ft msl)	5/27/2003	6/3/2003 & 6/4/2003	7/7/2003
MW-101	18.92	9.34	NA	9.35
MW-102	34.91	11.52	NA	10.91
MW-103	30.35	7.05	NA	6.57
MW-104	30.41	6.01	NA	6.32
MW-105	24.40	9.20	NA	8.08
MW-106	9.61	5.43	NA	5.31
MW-107	14.17	9.44	NA	8.71
MW-108	12.11	7.31	NA	6.95
MW-109	12.95	7.53	NA	7.07
MW-110	10.71	6.22	NA	5.35
MW-111	10.88	7.29	NA	6.83
MW-112	27.51	6.00	NA	5.11
MW-113	18.55	11.31	NA	11.00
MW-114	12.59	7.03	NA	6.98
MW-115	15.19	12.66	NA	8.75
MW-116	33.46	10.12	NA	9.31
MW-117	29.85	4.67	NA	4.82
B-1	14.13	8.69	NA	8.30
B-2	10.52	5.28	NA	4.77
B-2D	9.21	3.92	NA	3.49
B-3	11.74	6.55	NA	5.98
B-4	11.54	6.23	NA	5.71
B-5	14.32	8.88	NA	8.46
B-5D	14.80	12.46	NA	12.11
EWL-5	31.49	7.19	NA	9.85
EWL-6	31.84	7.40	NA	6.55
EWL-7	32.55	6.85	NA	6.37
EWL-8	35.94	3.06	NA	2.34
EWL-9	31.53	7.06	NA	6.84
SAL-1	27.45	8.28	NA	6.95
SAL-3	18.75	6.50	NA	6.30
SAL-4	21.10	6.40	NA	6.25
MW-1	32.81	7.94	7.78	NA
MW-2	36.51	8.24	6.82	7.23
MW-3	30.77	5.53	5.41	5.53
MW-4	32.68	8.42	8.71	8.84

Note:
All water level measurements collected from Top Of PVC, except for well SAL-4.
The elevation and water water level measurement for well SAL-4 was collected from ground surface.

APPENDIX A

BORING LOGS FOR SWMU 9

MWH
MONTGOMERY WATSON HARZA

MWH Americas, Inc.
335 Phoenixville Pike
Malvern, Pennsylvania 19355

Boring ID: SM09-GW03

Project Name:	Honeywell-Claymont SWMU 9	**Sampling Method:**	Split Spoon
Location:	Claymont, DE	**Boring Location:**	10' South of SWMU 9 Gate
Project Number:	2110876	**Total Depth (ft):**	17.0'
Date Started:	6/4/03	**Boring Diameter (in):**	4"
Date Finished:	6/4/03	**Water Level During Drilling (ft/bgs):**	12'
Drilling Company:	Talon	**Weather Conditions:**	Rain, 60s
Drilling Method:	HSA	**Logged By:**	S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0					SILT: 0.0-5.0' Dark brown, SILT, little fine to medium-grained SAND, trace fine to medium-grained gravel, some rootlets, dry.	Heavy rain, PID not working correctly
-1						
-2						
-3						
-4						
-5	15				SILT: 5.0-10.0' Light gray, SILT, dry, firm, large pieces of wood present.	
	38					
-6	10	6				
	4					
-7						
-8						
-9						
-10	5				SAND: 10.0-11.0' Light gray, fine to medium-grained SAND, some medium-grained gravel, trace silt, wet, looks like concrete.	
	7					
-11	7	8			SAND: 11.0-11.5' Light gray, fine to medium-grained SAND, little silt, wet.	

MWH
MONTGOMERY WATSON HARZA

MWH Americas, Inc.
335 Phoenixville Pike
Malvern, Pennsylvania 19355

Boring ID:SM09-GW03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
	8				BRICK: 11.5-12.0' Yellow, BRICK, wet.	
-12					SAND AND GRAVEL: 12.0-16.0' Medium brown, yellow and black, medium-grained SAND and GRAVEL, some silt, saturated, sheen present.	
-13						
-14						
-15	5					
	2	18				
-16	4				GRAVEL: 16.0-17.0' Dark red, medium-grained GRAVEL, saturated.	
	7					
-17						

MWH
MONTGOMERY WATSON HARZA

MWH Americas, Inc.
335 Phoenixville Pike
Malvern, Pennsylvania 19355

Boring ID: SM09-SB01-01

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/22/03
Date Finished: 5/22/03
State Permit Number 193568
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Eastern Side Sector 1
Total Depth (ft): 52.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Showers, 50's
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	WOH 15	16	0.0 0.0 0.0		SILT: 0.0-1.0' Beige, SILT, trace clay and fine-grained sand and gravel, moist, soft, trace rootlets.	
-1					SLUDGE: 1.0-2.0' Medium gray, consolidated SLUDGE, some fine-grained gravel, dry, very hard.	
-2					SAND: 2.0-10.0' Dark beige, medium-grained SAND, some silt, little fine-grained gravel, moist, looks like fine concrete.	
-3						
-4						
-5	3 6 6 6	12	0.0 0.0 0.0			
-6						
-7						
-8						
-9						
-10	13 30 50/5"	12	0.0 0.0 0.0		SLUDGE: 10.0-15.0' Medium gray, consolidated SLUDGE, some fine-grained gravel, dry, very hard. Saturated at 14.0'	
-11						
-12						
-13						
-14						
-15						

Boring ID:SM09-SB01-01

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-16	50/4"	1	0.0		SLUDGE: 15.0-20.0' Medium gray, consolidated SLUDGE, some fine-grained gravel, saturated lenses, very hard. Lenses of sandy silt and trace clay.	
-17						
-18						
-19						
-20			0.0		SLUDGE: 20.0-35.0' Medium gray, consolidated SLUDGE, some fine-grained gravel, saturated lenses, very hard.	
-21	50/5"	4	0.0			
-22						
-23						
-24						
-25						
-26	50/4"	2	0.0			
-27						
-28						
-29						
-30						
-31	50/5"	3	0.0			
-32						
-33						

Boring ID:SM09-SB01-01

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-35						
	10 4 6 6	16	0.0 0.0 0.0		SAND AND GRAVEL: 35.0-40.0' Beige, medium to coarse-grained SAND and fine-grained GRAVEL, interbedded with lenses of light gray silt and fine sand, little clay, moist, soft, well sorted.	
-36						
-37						
-38						
-39						
-40					SILT: 40.0-45.0' Beige, SILT, trace clay and fine-grained sand and gravel, moist, soft.	
-41	50/4"	4	0.0			
-42						
-43						
-44						
-45					SAND: 45.0-51.0' Dark red to black, medium to coarse-grained SAND, some fine-grained gravel, little silt and fine-grained sand, wet.	
	12 9 15 9	7	0.0 0.0			
-46						
-47						
-48						
-49						
-50						
	3 7 10 10	16	0.6 0.0		SILTY CLAY: 51.0-52.0' Cream, SILTY CLAY, trace fine-grained sand, moist, soft.	
-51						
-52						

MWH
MONTGOMERY WATSON HARZA

MWH Americas, Inc.
335 Phoenixville Pike
Malvern, Pennsylvania 19355

Boring ID: SM09-SB01-02

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/22/03
Date Finished: 5/23/03
State Permit Number 193568
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: West of Entrance to Upper Level
Total Depth (ft): 57'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Showers, 50's
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	1 1 1 1	15	0.0 0.0 0.0		SILT: 0.0-5.0' Beige, SILT, trace clay, damp, firm, trace rootlets.	
-1						
-2						
-3						
-4						
-5	8 8 8 20	16	0.0 0.0 0.0		SAND AND GRAVEL: 5.0-10.0' Light gray, fine to medium-grained SAND and fine-grained GRAVEL, some lenses of consolidated sludge, moist, hard.	
-6						
-7						
-8						
-9						
-10	50/4"	3	0.0		SAND: 10.0-40.0' Dark gray, fine to medium-grained SAND, little silt, trace consolidated sludge lenses, dry, hard.	
-11						
-12						
-13						
-14						
-15	10 50	7	0.0			
-16						

Boring ID:SM09-SB01-02

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-17	50/4"		0.0		SAND: 10.0-40.0' Dark gray, fine to medium-grained SAND, little silt, trace consolidated sludge lenses, dry, hard.	
-18						
-19						
-20						
-21	2	6	0.0			
-22	50/3"		0.0			
-23						
-24						
-25						
-26	50/3"	1.5	0.0			
-27						
-28						
-29						
-30						
-31	50/2"	2	0.0			
-32						
-33						
-34						
-35						
-36	50/2"	1	0.0			
-37						

Boring ID:SM09-SB01-02

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-38					SAND: 10.0-40.0' Dark gray, fine to medium-grained SAND, little silt, trace consolidated sludge lenses, dry, hard.	
-39						
-40					SILT: 40.0-55.0' Light gray, SILT, little clay, trace fine-grained sand, moist, soft. At 40.5', medium gray silt. At 41.0', lenses of medium to coarse-grained sand. At 45.0', firm.	
-41	1 7 6 7	24	0.0			
-42						
-43						
-44						
-45						
-46	50/2"	2	0.0			
-47						
-48						
-49						
-50			0.0			
-51	25/3"	3	0.0			
-52						
-53						
-54						
-55					SILT: 55.0-57.0' Dark gray, SILT, some clay, moist, soft, trace organic material.	
-56	7 7 7 7	24	4.7 8.2 1.3 15.9			
-57						

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Boring ID: SM09-SB01-03

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/23/03
Date Finished: 5/23/03
State Permit Number 193568
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Northwest of Entrance to Upper Level
Total Depth (ft): 57'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Rain, 50's
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	3		0.0		SILT: 0.0-4.0' Beige, SILT, some clay, trace fine-grained sand, moist, soft.	
-1	2	19	0.0			
	1		0.0			
	1		0.0			
-2						
-3						
-4					SLUDGE: 4.0-15.0' Medium gray, consolidated SLUDGE, trace fine to medium-grained sand, dry, hard.	
-5						
-6	50/4"	1	0.0			
-7						
-8						
-9						
-10						
-11	50/5"	3				Heavy rain, PID not functioning.
-12						
-13						
-14						
-15						

Boring ID:SM09-SB01-03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-16	25 50/3"	6			SAND: 15.0-35.5' Medium gray, fine to medium-grained SAND, little silt and lenses of consolidated sludge, dry, hard.	
-17						
-18						
-19						
-20						
-21	50/4"	2				
-22						
-23						
-24						
-25						
-26	50/4"	2				
-27						
-28						
-29						
-30						
-31	50/4"	3				
-32						
-33						

Boring ID:SM09-SB01-03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-35						
	15					
-36	5	12			SILT: 35.5-40.0' Light gray, SILT, trace clay and fine-grained sand, lenses of medium to coarse-grained sand and fine-grained gravel, moist.	
	3					
	3					
-37						
-38						
-39						
-40						
-41	50/5"	5			SLUDGE: 40.0-45.0' Medium gray, consolidated SLUDGE, trace fine to medium-grained sand, dry, hard.	
-42						
-43						
-44						
-45						
	2				SAND AND GRAVEL: 45.0-52.0' Dark brown with red, orange and black mottles, medium to coarse-grained SAND and GRAVEL, little to some glass, saturated at 50.0', product present, strong hydrocarbon odor and sheen present.	
-46	15	16				
	25					
	25					
-47						
-48						
-49						
-50						
	2					
-51	6	18				
	6					
	5					
-52						

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Boring ID: SM09-SB02-01

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/27/03
Date Finished: 5/27/03
State Permit Number 193566
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Northwest Corner Sector 2
Total Depth (ft): 47.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Overcast, 60's
Logged By: S. Bouclier, Geologist

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	12		0.0		SILT AND SAND: 0.0-15.0' Medium gray, SILT and fine-grained SAND, little fine to medium-grained gravel and consolidated sludge, dry, hard. Abundant lenses of consolidated sludge at 10.0'.	
-1	15	17	0.0			
	40		0.0			
	26		0.0			
-2						
-3						
-4						
-5						
-6	15	5	0.0			
	50/4"		0.0			
-7						
-8						
-9						
-10						
-11	50/4"	2	0.0			
-12						
-13						
-14						
-15						

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-16	25 25 50/4"	14	0.0 0.0 0.0		SILT AND SAND: 15.0-20.0' Medium gray with purplish red to yellow mottles, SILT and fine-grained SAND, trace fine to medium-grained gravel, moist, firm. Lenses of medium-grained sand.	
-17						
-18						
-19						
-20					SILT AND SAND: 20.0-30.0' Medium gray, SILT and fine-grained SAND, little fine to medium-grained gravel and consolidated sludge, dry, hard.	
-21	35 50/3"	4	0.0 0.0			
-22						
-23						
-24						
-25						
-26	50/5"	3	0.0			
-27						
-28						
-29						
-30					SLUDGE: 30.0-35.0' Medium gray, consolidated SLUDGE, dry, very hard.	
-31	50/5"	2.5	0.0			
-32						
-33						
-34						

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Boring ID:SM09-SB02-01

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-35					SILT AND SAND: 35.0-40.5' Medium gray, SILT and fine-grained SAND, little fine to medium-grained gravel and lenses of consolidated sludge, wet, hard.	
	12	8	0.0			
-36			0.0			
	50/5"					
-37						
-38						
-39						
-40						
	14		0.0		SILT AND SAND: 40.5-41.0' Deep red with medium red to brown mottles, SILT and fine to medium-grained SAND, trace fine-grained gravel, wet, firm.	
-41	6	14				
	9		0.0		SILT: 41.0-41.5' White with black mottles, SILT, trace clay and fine-grained sand, moist.	
	14		0.0			
-42					SLAG: 41.5-45.0' Black, SLAG, some medium to coarse-grained sand and gravel, saturated, hard, large pieces of wood.	
-43						
-44						
-45					SAND: 45.0-47.0' Medium brown, fine to medium-grained SAND, trace silt, saturated, firm, poorly sorted.	
	8		0.0			
	8	16				
-46	7		0.0			
	7		0.0			
-47						

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Boring ID: SM09-SB02-02

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/27/03
Date Finished: 5/28/03
State Permit Number 193566
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Northeast side of Sector 2
Total Depth (ft): 42.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Rain, 60's
Logged By: S. Bouclier, Geologist

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	12		0.0		SILT AND SAND: 0.0-10.0' Medium gray, SILT and fine-grained SAND, little gravel and consolidated sludge, dry, hard.	
-1	8	16	0.0			
	6		0.0			
	12		0.0			
-2						
-3						
-4						
-5						
-6	15	11	0.0			
-7	50/5"		0.0			
-8						
-9						
-10					SILT AND SAND: 10.0-15.0' Medium gray, SILT and fine-grained SAND, some consolidated sludge, little gravel, dry, hard.	
-11	50/5"	3	0.0			
-12						
-13						
-14						

Boring ID:SM09-SB02-02

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-16	50/4"	2	0.0		SLUDGE: 15.0-20.0' Deep red, consolidated SLUDGE, damp, very hard.	
-17						
-18						
-19						
-20					SILT AND SAND: 20.0-30.0' Medium gray, SILT and fine-grained SAND, little gravel and consolidated sludge, moist to wet, hard.	
-21	50/5"	3	0.0			
-22						
-23						
-24						
-25						
-26	50/4"	2	0.0			
-27						
-28						
-29						
-30					SLUDGE: 30.0-40.5' Medium gray, consolidated SLUDGE, hard, saturated lenses.	
-31	50/4"	3	0.0			
-32						
-33						
-34						

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	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-35					SLUDGE: 30.0-40.5' Medium gray, consolidated SLUDGE, hard, saturated lenses.	
-36	50/3"	2	0.0			
-37						
-38						
-39						
-40						
	20		0.0			
-41	20	15	0.0		SAND: 40.5-41.0' Medium brown with light brown to dark brown mottles, medium to coarse-grained SAND, some medium-grained gravel, dry.	
	37		0.0		SAND AND GRAVEL: 41.0-41.4' Light yellow and white with black mottles, coarse-grained SAND and fine-grained GRAVEL, dry, looks like degraded brick.	
	38				SILT: 41.4-42.0' Dark red, SILT, some fine-grained sand, trace fine-grained gravel, moist, firm.	
-42						

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Boring ID: SM09-SB02-03

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/28/03
Date Finished: 5/28/03
State Permit Number 193566
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Side of road to Upper Level
Total Depth (ft): 42.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Rain, 50's
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0					SAND: 0.0-0.5' Light grayish brown, fine-grained SAND, some silt, trace medium-grained sand and fine-grained gravel, dry.	
	25	6	0.0		SILT AND SAND: 0.5-5.0' Light gray, SILT and fine-grained SAND, trace lenses of consolidated sludge, dry.	
-1	25		0.0			
	30/3"		0.0			
-2						
-3						
-4						
-5					SILT AND SAND: 5.0-25.0' Dark gray, SILT and fine-grained SAND, interbedded layers of consolidated sludge, dry, very hard. At 10.0', damp. At 15.0', wet.	
-6	50/3"	1.5	0.0			
-7						
-8						
-9						
-10						
	30	6	0.0			
-11			0.0			
	50/2"					
-12						

Boring ID:SM09-SB02-03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-13					SILT AND SAND: 12.5-25.0' Dark gray, SILT and fine-grained SAND, interbedded layers of consolidated sludge, dry, very hard. At 10.0', damp. At 15.0', wet.	
-14						
-15						
-16	50/5"	2	0.0			
-17						
-18						
-19						
-20						
-21	50/4"	3	0.0			
-22						
-23						
-24						
-25					SILT AND SAND: 25.0-40.5' Light to medium gray, SILT and fine-grained SAND, trace lenses of consolidated sludge, moist.	
			0.0			
	50					
-26		9	0.0			
			0.0			
	50/5"					
-27						

Boring ID:SM09-SB02-03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-28					SILT AND SAND: 25.0-40.5' Light to medium gray, SILT and fine-grained SAND, trace lenses of consolidated sludge, moist.	
-29						
-30						
-31	50/5"	2	0.0			
-32						
-33						
-34						
-35						
-36	50/5"	2	0.0			
-37						
-38						
-39						
-40						
-41	25 25 15 15	12	0.0 0.0 0.0		SAND AND GRAVEL: 40.5-41.5' Deep red to brownish, medium to coarse-grained SAND and GRAVEL, trace silt and fine-grained sand, wet, firm.	
-42					SAND AND GRAVEL: 41.5-42.0' Yellowish tan, coarse-grained SAND and GRAVEL, little medium-grained sand, moist, looks like degraded brick.	

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Boring ID: SM09-SB03-01

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/15/03
Date Finished: 5/15/03
State Permit Number 193566
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Western Middle Level
Total Depth (ft): 37.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Clear, 60's
Logged By: S. Bouclier, Geologist

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0						
-1	2 1 2 3	1	0.0		SILT: 0.0-5.5' Beige to tan, SILT, some fine to medium-grained sand, little subangular medium-grained gravel, dry. Moist at 5.0'.	
-2						
-3						
-4						
-5	1 1 1 50/5"	6	0.0			
-6					SLUDGE: 5.5-15.5' Light gray, consolidated SLUDGE, dry, very hard.	
-7						
-8						
-9						
-10						
-11	50/3"	2.5	0.0			
-12						
-13						
-14						
-15						
-16	26 7 2	16	0.0		SILT: 15.5-16.5' Medium gray, SILT, some fine-grained sand, saturated.	

Boring ID:SM09-SB03-01

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-17	47				SLUDGE: 16.5-35.0' Light gray, consolidated SLUDGE, interbedded layers of sandy silt, moist, very hard.	
-18						
-19						
-20						
-21	50/2"	2	0.0			
-22						
-23						
-24						
-25						
-26	50/3"	3	0.0			
-27						
-28						
-29						
-30						
-31	50/4"	4	0.0			
-32						
-33						
-34						
-35					SILT: 35.0-37.0' Dark grayish brown with little tan to gray mottling, SILT, little clay, trace fine-grained sand, damp, soft, low plasticity, trace organic material.	
-36	5 3 2 2	12	0.0			

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Boring ID: SM09-SB03-02

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/19/03
Date Finished: 5/19/03
State Permit Number 193566
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Northeastern corner Sector 3
Total Depth (ft): 32.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Clear, 75
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0			0.0		SILT AND SAND: 0.0-0.3' Medium brown, SILT and fine-grained SAND, moist, abundant rootlets.	
-1	25 25 30/3"	14	0.0 0.0 0.0		SILT: 0.3-1.8' Beige, SILT, damp, firm, trace rootlets.	
-2					SILT: 1.8-6.0' Beige with orange mottles, SILT, trace mica, moist, soft.	
-3						
-4						
-5						
-6	50/3"	14	0.0 0.0 0.0 0.0		SLUDGE: 6.0-15.5' Medium gray, consolidated SLUDGE, some mica, dry. Lenses of silt and fine-grained sand. Wet from 10.0'-10.5'.	
-7						
-8						
-9						
-10			0.0			
-11	30 50/2"	8	0.0 2.5 1.9			
-12						
-13						
-14						
-15						

Boring ID:SM09-SB03-02

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
			0.0			
-16	50/5"	13	0.0 0.0 0.0		SILT AND SAND: 15.5-20.0' Medium to dark gray, SILT and coarse-grained SAND, moist, firm.	
-17						
-18						
-19						
-20					WOOD: 20.0-22.0' Light brown, WOOD, slight odor of decaying organics.	
-21	50/4"	8				
-22					SAND AND GRAVEL: 22.0-30.0' Olive brown with dark brown mottles, medium to coarse-grained SAND and GRAVEL, trace silt, wet, abundant wood and reeds.	
-23						
-24						
-25						
-26	50 50/5"	8	6.0 12.1 13.2 8.9			
-27						
-28						
-29						
-30					CLAY AND SILT: 30.0-32.0' Dark gray with black staining CLAY and SILT, moist, soft, moderate plasticity and hydrocarbon odor.	
-31	50/5"	48	11.2 65.4 12.1 22.4			
-32						

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Boring ID: SM09-SB03-03

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/19/03
Date Finished: 5/19/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Middle Level Along Road
Total Depth (ft): 42.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Clear, 75
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	1 2 3 8	9	0.0 0.0 0.0 0.0		SILT: 0.0-2.0' Beige, SILT, trace clay and fine-grained gravel, moist, firm.	
-1						
-2					SILT: 2.0-10.0' Purplish red, SILT, some fine-grained sand, wet, firm, abundant mica flakes. Lenses of dark brown, silt and fine-grained sand at 6.5'.	
-3						
-4						
-5	9 9 8 9	14	0.0 0.0 0.0 0.0			
-6						
-7						
-8						
-9						
-10			0.0 0.0		SLUDGE: 10.0-15.0' Medium gray with purplish red mottles, consolidated SLUDGE, dry, hard. From 11.5-11.7', some silt and fine-grained sand.	
-11	50/5"	2				
-12						
-13						
-14						
-15						

Boring ID:SM09-SB03-03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-16	5 13 7 35	15	0.0 0.0 0.0 0.0		SLUDGE AND SILT: 15.0-20.0' Medium gray with yellowish mottles, consolidated SLUDGE with alternating 2" layers of red SILT, some fine-grained sand. Silt layers dry, firm. Sludge layers wet, hard.	
-17						
-18						
-19						
-20					SILT AND SAND: 20.0-25.0' Dark red, SILT and fine-grained SAND, trace clay, wet, firm. Lenses of dark gray silt.	
-21	50/5"	5	0.0			
-22						
-23						
-24						
-25					SLUDGE: 25.0-42.0' Medium gray with trace yellowish orange mottles, consolidated SLUDGE, moist, hard.	
-26	50/4"	4	0.0 0.0			
-27						
-28						
-29						
-30						
-31	30 20 35 36	15	0.0 7.9 13.2 3.4			
-32						
-33						

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Boring ID:SM09-SB03-03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-35			0.0		SLUDGE: 25.0-42.0' Medium gray with trace yellowish orange mottles, consolidated SLUDGE, moist, hard.	
-36	50/5"	5	0.0			
-37						
-38						
-39						
-40			0.0			
-41	49	7	0.0			
-42	50/3"					

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Boring ID: SM09-SB04-01

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/20/03
Date Finished: 5/20/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Middle Level Along Road
Total Depth (ft): 37.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Clear, 75
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	2				SILT: 0.0-5.0' Beige, SILT, little fine to medium-grained sand, trace fine-grained gravel, dry, soft.	
-1	2	3	0.0			
	2					
	2		0.0			
-2						
-3						
-4						
-5					SLUDGE: 5.0-25.0' Medium gray with yellowish orange mottles, consolidated SLUDGE, some silt and fine to medium-grained sand, dry, little mica flakes. Lenses of moist consolidated sludge. Wet at 15.4'.	
-6	30	6	0.0			
	50/5"		0.0			
-7						
-8						
-9						
-10						
-11	50	6	0.0			
			0.0			
	50/2"		0.0			
-12						
-13						
-14						
-15						
-16	50/4"	4	0.0			

Boring ID:SM09-SB04-01

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-17			0.0		SLUDGE: 5.0-25.0' Medium gray with yellowish orange mottles, consolidated SLUDGE, some silt and fine to medium-grained sand, dry, little mica flakes. Lenses of moist consolidated sludge. Wet at 15.4'.	
-18						
-19						
-20						
-21	50/4"	3	4.9			
-22			1.0			
-23						
-24						
-25					SILT AND SAND: 25.0-30.0' Dark gray with trace red mottles, SILT and fine to medium-grained SAND, little fine to medium-grained gravel, saturated, soft.	
-26	1 1 1 10	8	0.0 0.0			
-27						
-28						
-29						
-30					SAND AND GRAVEL: 30.0-35.5' Dark grayish brown, medium to coarse-grained SAND and fine-grained GRAVEL, trace fine-grained sand, saturated.	
-31	3 4 3 2	6	0.0 0.0			
-32						
-33						
-34						
-35						
-36	3 2 2 4	24	17 1.9 1.5		SILT: 35.5-37.0' Dark grayish brown, SILT, some clay, trace fine-grained sand, saturated, trace mica flakes and oxidation.	
-37						

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Malvern, Pennsylvania 19355

Boring ID: SM09-SB04-02

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/20/03
Date Finished: 5/20/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Southwestern side of Sector 4
Total Depth (ft): 32.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Clear, 75
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	2, 3, 4, 29	12	0.0, 0.0, 0.0		SILT: 0.0-15.0' Beige, SILT, trace clay, fine-grained sand and gravel, dry, firm, some rootlets. Some consolidated sludge at 1.5'.	
-1						
-2						
-3						
-4						
-5	1, 1, 1, 1	15	3.9, 3.7, 0.0			
-6						
-7						
-8						
-9						
-10	1, 1, 1, 1	18	0.0, 0.0, 0.0			
-11						
-12						
-13						
-14						

Boring ID:SM09-SB04-02

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-16	50/5"	5	0.0		SILT: 15.0-20.0' Purplish gray with gray to orange mottles, SILT, little fine-grained sand, trace fine-grained gravel, dry, hard.	
-17			0.0			
-18						
-19						
-20					SILT AND SAND: 20.0-25.2' Deep red with trace gray mottles, SILT and fine-grained SAND, trace lenses of consolidated sludge and lenses of oxidation, wet at 20.5'.	
-21	5 6 6 20	15	0.0 0.0 0.0			
-22						
-23						
-24						
-25						
-26	15 4 3 3	15	0.0 0.0 0.0		SAND: 25.2-26.0' Yellowish tan to bluish gray, fine to medium-grained SAND, trace fine-grained gravel, interbedded lenses of bluish silt and fine-grained sand, wet. SAND: 26.0-30.5' Purplish tan, medium to coarse-grained SAND, some fine-grained gravel, little fine-grained sand, saturated, well sorted.	
-27						
-28						
-29						
-30						
-31	6 5 1 1	18	3.1 6.4 7.2 18.5		SILT: 30.5-32.0' Light gray, SILT, little to some clay, trace fine-grained sand, moist, soft.	
-32						

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Boring ID: SM09-SB04-03

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/21/03
Date Finished: 5/21/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Southeastern side of Sector 4
Total Depth (ft): 37.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Rain, 50's
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	2		0.0		SILT: 0.0-16.0' Beige, SILT, trace clay and fine-grained sand, moist, soft. At 6.0', lenses of medium to coarse-grained sand and fine-grained gravel.	
-1	4	14	0.0			
	6		0.0			
	8		0.0			
-2						
-3						
-4						
-5						
	1		0.0			
-6	1	18	0.0			
	1		0.0			
	1		0.0			
-7						
-8						
-9						
-10						
	1		0.0			
-11	1	18	0.0			
	1		0.0			
	1		0.0			
-12						
-13						
-14						
-15						Heavy Rain, PID not functioning
	1					
-16	1	12			SAND AND GRAVEL: 16.0-20.5' Dark beige, medium-grained SAND and GRAVEL, little to some silt, moist.	
	50/3"					

Boring ID:SM09-SB04-03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-17						
-18						
-19						
-20						
-21	15 10 10 8	6			SILT AND SAND: 20.5-25.0' Deep red to purple, SILT and fine-grained SAND, trace lenses of dark gray consolidated sludge, moist, firm.	
-22						
-23						
-24						
-25					SILT AND SAND: 25.0-32.0' Medium gray, SILT and fine to medium-grained SAND, moist, moderately firm, trace consolidated sludge. At 32.0', firm.	
-26	50/5"	5				
-27						
-28						
-29						
-30						
-31	25 35 50 28	12				
-32					SILT: 32.0-37.0' Dark gray, SILT, some clay, trace fine-grained sand and mica flakes, moist, soft, trace organic material.	
-33						
-34						
-35						
-36	4 2 3 4	24				
-37						

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Boring ID: SM09-SB05-01

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 6/4/03
Date Finished: 6/4/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Lower Level, closest to DE River
Total Depth (ft): 17.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Rain, 60's
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	7				SAND: 0.0-0.5' Medium brown, medium-grained SAND, little fine-grained gravel, trace silt and fine-grained sand, damp, abundant rootlets.	
-1	15	3	0.0		SAND: 0.5-10.5' Beige, fine to medium-grained SAND, little silt and fine-grained gravel, lenses of consolidated sludge, dry, loose. Moist at 5.0'.	
	12					
	8					
-2						
-3						
-4						
-5						
	35		0.0			
-6	35	16	0.0			
	25		0.0			
	34		0.0			
-7						
-8						
-9						
-10						
	11					

Boring ID:SM09-SB05-01

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
-11	16 16 17	15			SAND: 10.5-15.0' Deep purple, medium-grained SAND, little fine-grained sand, lenses of consolidated sludge, wet.	Raining, PID not functioning correctly.
-12						
-13						
-14						
-15					SAND: 15.0-17.0' Medium to dark gray, fine to medium-grained SAND, little medium to coarse-grained gravel, saturated.	
-16	14 28 25 35	15				
-17						

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Boring ID: SM09-SB05-02

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 6/4/03
Date Finished: 6/4/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Lower Level, closest to DE River
Total Depth (ft): 12.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): 11.0'
Weather Conditions: Rain, 60's
Logged By: S. Bouclier, Geologist

Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
4		0.0		SILT: 0.0-0.5' Medium gray, SILT, some fine-grained sand and medium-grained gravel, trace fine-grained gravel, damp.	
3	16	0.0		SILT: 0.5-1.0' Orange to yellow, SILT, some fine-grained sand and medium-grained gravel, little brick, trace clay and fine-grained gravel, moist, trace to little oxidation.	
1		0.0			
1		0.0		SILT: 1.0-5.0' Light beige, SILT, little clay and fine-grained sand, damp, very soft, trace to little oxidation.	
1		0.0		SILT: 5.0-6.0' Beige to tan, SILT, little clay and fine-grained sand, damp, very soft.	
1	24	0.0			
5		0.0		GRAVEL: 6.0-7.0' Beige, fine to medium-grained GRAVEL, some silt, trace coarse-grained gravel, wet, soft.	
5		0.0			
				SILT: 7.0-11.0' Light gray, SILT, little clay and fine-grained sand, damp, very soft.	
1		0.0			
1	12	0.0			
13		0.0		SAND: 11.0-12.0' Deep brown, fine-grained SAND, little silt and medium-grained sand, saturated.	
14					

0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12

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Boring ID: SM09-SB05-03

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 6/2/03
Date Finished: 6/2/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Western Lower Level
Total Depth (ft): 12.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): 11.0'
Weather Conditions: Clear, 75
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0					SAND: 0.0-2.0' Medium brown, medium-grained SAND, some fine-grained sand, trace silt and coarse-grained sand, abundant brick, medium to coarse-grained gravel and slag, damp, some rootlets.	
-1	26	6	0.0			
	50/1"		0.0			
-2					SILT: 2.0-11.0' Beige to light brown, SILT, little coarse-grained sand and fine-grained gravel, trace clay, wet.	
-3						
-4						
-5						
-6	50/5"	5	0.0			
-7						
-8						
-9						
-10						
	1		0.0			
	1	24	14.8			
-11	1		22.4		SILT: 11.0-12.0' Black, SILT, little clay and fine-grained sand, saturated, strong hydrocarbon odor.	
	1		19.6			
-12						

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Boring ID: SM09-SB06-01

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 6/2/03
Date Finished: 6/2/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Lower Level, closest to DE River
Total Depth (ft): 12.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): 10.5'
Weather Conditions: Clear, 75
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	50		0.0		SAND: 0.0-2.0' Medium brown, medium-grained SAND, some fine-grained sand, trace silt and coarse-grained sand, abundant brick, medium to coarse-grained gravel and slag, damp, some rootlets.	
-1	8	13	0.0			
	10		0.0			
	10		0.0			
-2					SILT: 2.0-6.0' Beige to light brown, SILT, little coarse-grained sand and fine-grained gravel, trace clay, wet.	
-3						
-4						
-5						
	14		0.0			
-6	12	9	0.0			
	10		0.0		SAND AND GRAVEL: 6.0-7.0' Medium brown, medium to coarse-grained SAND and coarse-grained GRAVEL, some silt, saturated, some wood fragments.	
	20					
-7					SILT: 7.0-10.5' Beige to light brown, SILT, little coarse-grained sand and fine-grained gravel, trace clay, wet.	
-8						
-9						
-10						
	28		0.0			
-11	2	9	0.0		SILT: 10.5-12.0' Black, SILT, little clay and fine-grained sand, saturated, strong hydrocarbon odor.	
	1		15.2			
	3					
-12						

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Boring ID: SM09-SB06-02

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/29/03
Date Finished: 5/29/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Lower Level, closest to DE River
Total Depth (ft): 22.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Clear, 75
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	1		0.0		SILT: 0.0-5.0' Beige, SILT, trace clay and fine-grained sand, moist, soft, little rootlets.	
	1	17	0.0			
-1	1		0.0			
	2					
-2						
-3						
-4						
-5						
	4					
	1	NR				
-6	1					
	4					
-7					SILT: 7.0-15.0' Deep red to purple, SILT, some fine to medium-grained sand and gravel, trace coarse-grained sand, saturated.	
-8						
-9						
-10						

Boring ID:SM09-SB06-02

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
	1		0.0		SILT: 7.0-15.0' Deep red to purple, SILT, some fine to medium-grained sand and gravel, trace coarse-grained sand, saturated.	
	10	8	0.0			
-11	2		0.0			
	2					
-12						
-13						
-14						
-15					SILT: 15.0-21.0' Deep red to purple, SILT, some fine to medium-grained sand, little fine to medium-grained gravel, trace coarse-grained sand and gravel, saturated.	
	3		0.0			
	2	12	0.0			
-16	2		0.0			
	3					
-17						
-18						
-19						
-20						
	5		4.9			
	3	14	8.2			
-21	2		30.9		SILT: 21.0-22.0' Olive green, SILT, little clay, damp, soft, moderate plasticity, slight hydrocarbon odor.	
	2		45.7			
-22						

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Boring ID: SM09-SB06-03

Project Name: Honeywell-Claymont SWMU 9
Location: Claymont, DE
Project Number: 2110876
Date Started: 5/29/03
Date Finished: 5/29/03
State Permit Number 194175W
Drilling Company: Talon
Drilling Method: HSA

Sampling Method: Split Spoon
Boring Location: Lower Level, furthest from DE River
Total Depth (ft): 22.0'
Boring Diameter (in): 4"
Water Level During Drilling (ft/bgs): NA
Weather Conditions: Clear, 75
Logged By: S. Bouclier, Geologist

Depth	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
0	1		0.0		SILT: 0.0-5.0' Beige, SILT, trace clay, moist, soft, trace rootlets.	
	1	5	0.0			
-1	1					
	3					
-2						
-3						
-4						
-5					SILT: 5.0-10.0' Deep red to purple, SILT, some fine to medium-grained sand, trace coarse-grained sand and gravel, moist.	
	3		0.0			
	4	12	0.0			
-6	6		0.0			
	8					
-7						
-8						
-9						
-10						

Boring ID:SM09-SB06-03

	Blow Counts	Recovery (inches)	PID Reading	Lithology	Geologic Description	Remarks
	8		0.0		SILT: 10.0-16.0' Deep red to purple, SILT, some fine to medium-grained sand, little coarse-grained gravel, trace coarse-grained sand, wet.	
	6	12	0.0			
-11	5		0.0			
	9					
-12						
-13						
-14						
-15						
	28		0.0			
	4	12	0.0			
-16	4		5.5		SILT: 16.0-16.8' Light gray, trace medium gray mottles and oxidation, SILT, dry, firm.	
	3		18.9			
-17					SILT: 16.8-20.0' Black, SILT, trace clay and fine-grained sand, damp, trace wood fragments, moderate decaying organic odor and staining.	
-18						
-19						
-20					SILT: 20.0-22.0' Olive green, SILT, little clay, damp, soft, moderate plasticity, slight hydrocarbon odor.	
	3		0.0			
	2	20	0.0			
-21	1		0.0			
	1		0.0			
-22						

APPENDIX B

GEOPHYSICS REPORTS

SWMU 13 GEOPHYSICAL REPORT

ARM Group Inc.

Earth Resource Engineers and Consultants

April 15, 2003

Mr. Brian Carling, P.G.
Senior Geologist
Montgomery Watson Harza
335 Phoenixville Pike
Malvern, PA 19355

Re: Geophysical Survey Results
Honeywell Facility- SWMU 13
Claymont, Delaware
ARM Project 03123

Dear Mr. Carling:

ARM Group Inc. (ARM) is pleased to present to Montgomery Watson Harza (MWH) the results of a geophysical investigation performed at the Honeywell Facility located in Claymont, Delaware, by ARM on March 24 and 26, 2003. ARM's workscope relative to the subject survey was conducted in general accordance with ARM's proposal P02294, dated October 16, 2002, authorized by MWH on February 27, 2003.

The primary objective of the geophysical survey was to locate and delineate the lateral extent of a solid waste management unit (SWMU). This report relates to SWMU 13, located at the north end of the property in one of the employee parking areas. Historical information available on this SWMU indicated that plant personnel drained the contents of drums into an excavation and then disposed of the drums into the excavation. The drums reportedly contained various organic and inorganic acids, stripper solutions and chlorinated solvents. The geophysical techniques used during this investigation were electromagnetic terrain conductivity (EM-31) and ground penetrating radar (GPR). A survey grid was established in the area where the SWMU was reported to be located and was approximately 250 feet by 50 feet.

The scope of work for this investigation included standard and routinely accepted practices used in the geophysical industry. ARM conducted this survey in accordance with the latest industry standards, yet inherent technique limitations and survey limitations apply, and unforeseen site-specific conditions may impact interpretations set forth in this report.

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voice: (717) 533-8600 • fax: (717) 533-8605 • e-mail: info@armgroup.net

EM-31 Electromagnetic Induction Ground Conductivity Meter

Principles of EM-31

The EM-31 terrain conductivity is used extensively for environmental and geotechnical applications. It is commonly used in mapping certain types of shallow soil contamination (for example- conductive metals and inorganic contaminants), buried pipes, drums and pits and trenches containing buried debris. The EM-31 can also be used to assist in identifying the locations of potential sinkhole activity and for other geotechnical applications.

The EM-31 is an electromagnetic system with a transmitter coil mounted on one end and a receiver coil at the other end of a 12-foot long plastic boom. An audio-frequency alternating current is applied to the transmitter coil, causing the coil to radiate an alternating primary EM field. As described by Faraday's law of induction, the time-varying magnetic field generates eddy currents in subsurface materials. According to Lenz's law, these eddy currents have an associated secondary magnetic field with a magnitude and phase shift (relative to the primary field) that are dependent on the conductivity of the medium. The receiver coil measures the resultant effect of both primary and secondary fields. By comparing the signal at the receiver to that at the transmitter, the instrument records the components of the secondary field inphase (inphase data) and 90 degrees out of phase (quadrature/ conductivity data) with the primary field.

The EM-31 is configured so that the out-of-phase component is converted to bulk electrical conductivity in units of milli-mhos per meter (mmhos/meter). The measured conductivity is an apparent conductivity that is the resultant of the various subsurface materials that are sampled by the EM field. It is referred to as terrain conductivity. The inphase component is read in parts per thousand (ppt) of the primary EM field and is generally adjusted in the field to read zero response over background materials. The inphase component generally represents current density and is a gross measure of the presence of buried ferrous metal debris.

The EM-31 has a maximum effective exploration depth of approximately 5.5 meters (18 feet) when operating in the vertical dipole mode (horizontal coils). In this mode, the maximum instrument response results from materials at a depth of about 1.5 times the coil spacing (approximately (5.5 meters) 18 feet below the ground surface with the instrument at normal operating height of about 0.9 meters (3 feet)). In the horizontal mode (vertical coils), the EM-31 has an effective exploration depth of about 9 feet and is most sensitive to materials immediately beneath the ground surface. The EM-31 data collected during the survey was collected in the vertical dipole mode.

Field Procedures

Before the EM-31 survey was conducted, a base station was set up on the northern section of the grid. There was extensive background interference of the EM-31 data due to the presence of the dumpster, railcars, the onsite railroad tracks and the high-voltage power lines that are parallel with the property line/fence. The EM-31 was calibrated for this site; however the background EM-31 readings are high (>40 mmhos/meter). The base station was occupied with the instrument boom always in the same orientation and at normal operating height. The inphase component was set to zero, and the instrument phase was checked and adjusted as necessary. After the instrument was calibrated, a minimum of 20 readings of data was recorded in an automatic 1-second sampling mode and stored in the data logger

Before collecting field data, the data logger was programmed with the appropriate file name, line name, start station, station increment, line spacing, and operator's initials. All EM-31 and global positioning system (GPS) data were stored in digital data loggers and downloaded to a laptop computer. The EM-31 and GPS data were then merged to create files used to make contour maps of the EM-31 data with GPS coordinates in the North America Datum 1983 (NAD83) Pennsylvania South state plane grid.

The GPS is a satellite-based positioning system operated by the U.S. Department of Defense (DOD). The 24-hour operational NAVSTAR satellites orbiting the earth every 12 hours provide worldwide, all weather, 24-hour time and position information. The GPS unit used for this investigation was a Trimble Pro XRS manufactured by Trimble Navigation Limited.

GPS uses satellites in space as reference points for locations on earth. By accurately measuring distance from three satellites, the GPS receiver (rover) can triangulate its position anywhere on earth. By ranging from three satellites, an instrument can narrow its position to two points in space. To determine which point is correct, information from a fourth satellite is used. When more satellites are available, the accuracy of the GPS determination increases.

GPS was utilized to provide position data for the EM-31 survey during this investigation. EM-31 and GPS data was collected simultaneously at a rate of one reading per second, which corresponds to a sampling rate of approximately one reading every 2.5 to 3 feet.

Data Processing

The processing of EM-31 data begins with using the DAT31™ software to export the raw data into file formats the software-contouring package can read and contour. The DAT31™ software program by Geonics, Ltd., was subsequently used to generate data (.DAT) files containing the coordinates of the measurement location (x,y) along with the corresponding quadrature and inphase data (EM-31). The DAT31™ software provides an option to merge the data files and GPS positioning files during the creation of the .DAT file. The program relates GPS position to EM-31 measurement by matching time stamps that are imbedded within both data sets. Data processing involved the generation of a color-enhanced map using the Surfer© (Golden Software, Inc.) mapping and processing system.

GROUND PENETRATING RADAR

Principles of GPR

GPR is an electromagnetic instrument that transmits and records radar EM pulses. GPR systems produce cross-sectional images of subsurface features by transmitting discrete radar pulses into the subsurface and recording the signal echoes or reflections from interfaces between materials with differing dielectric properties. To conduct a GPR survey, an antenna containing a transmitter and a receiver is slowly pulled along the ground surface. The transmitter radiates short pulses of high frequency EM energy into the ground. When the wave encounters the interface between two materials having different dielectric constants (dielectric permittivity), a portion of the energy is reflected back. The contrast in dielectric permittivity between the two media can be quantified by a reflection coefficient at the media interface. The magnitude of the reflection coefficient increases as

the contrast in dielectric constant increases. The signal is transmitted to a control unit, displayed on a color monitor, and digitally recorded.

Air or air-filled voids have dielectric permittivity of 1. Soils, concrete, and other materials have higher permittivities such as: 5.5 for dry concrete; 6 for sandy soil; and 15 for wet sand. Due to the contrast in dielectric properties between air and anticipated subsurface materials, air-filled voids under the surface should be discernible in the GPR data.

The effective penetration depth of a radar system is controlled by the dielectric permittivity, the electrical conductivity (usually dictated by moisture content) of the soils, and the frequency of the antenna. In highly conductive materials (such as clay), the pulse is dissipated at very shallow depths. Two-way travel time on the GPR records can furnish estimates of depth if the dielectric constant for subsurface materials is known. If it is unknown, then an approximate depth can be obtained by using published average dielectric constants that correspond to the texture and general nature of the anticipated site soils.

Resolution of the GPR system is dependent on the frequency of the antenna used during the survey. The higher frequency antennas (900 Megahertz [MHz] or greater) can resolve small features (less than an inch in diameter) but can penetrate only to a maximum depth of 1.5 meters or less. Lower frequency antennae (300 to 500 MHz) can resolve objects deeper in the subsurface (up to 15 to 20 feet below the ground surface) and may not detect objects near surface. Two or more antennae may be used to collect the necessary depth and resolution information.

The GPR survey at SWMU 13 was conducted using a 400-MHz antenna. This antenna is considered one of the most versatile and flexible antennas manufactured. The 400-MHz antenna allows the collection of near surface and deeper data, and resolves most features.

Generally, target depths shown on GPR records are estimates based on average two-way velocities of the GPR through that media and the dielectric constants of the material the survey is targeting. Unless a known target at a known depth is available within a survey area, the depth markers on a GPR record should be considered estimations. Depth markers were not placed on the GPR records provided with this report because there was not a reliable target in the subsurface to calibrate the GPR. However, using the generalized published average constants and the range of 80 nanoseconds, the GPR wave was most likely penetrating to a depth of 10 feet at this SWMU.

Field Procedures

The GPR survey was performed on the same traverses as the EM-31 survey. Additional traverses were collected with the GPR between the rows of parked cars. The collection of GPR data is not affected by the presence of surface anomalies like cars and fences. Along the ground surface, spray paint marks were placed at 10-foot intervals to serve as distance markers on the GPR records.

The GPR was calibrated at this site by placing the antenna in an area free of subsurface anomalies to determine the optimum recording parameters for the GPR. These parameters include the range (amount of time the instrument records after transmitting an EM pulse), scan rate (number of recorded traces or scans per second), transmitter pulse rate (frequency at which the EM pulses are transmitted), instrument gains, and filter settings. These settings are automatically stored in a header file with the digital GPR data.

Data Processing

This survey was performed using a SIR2000 unit manufactured by GSSI Inc. This unit stores each of the GPR files digitally in the memory of the unit. At the conclusion of the survey, all of the GPR data files collected during the investigation were downloaded to the network computers at the ARM office. To begin the processing, each GPR file was edited to remove any stagnant points (areas where the data collector paused or had to maneuver around obstacles). These areas show up as flat lines and images, and are of no value to the overall survey.

After removal of stagnant areas, the GPR files were converted and saved as bitmap images. The bitmap files were transferred into Surfer, a commercial software package. By using Surfer, distance markers and other annotations can be added to the records.

RESULTS AND INTERPRETATION

EM-31 Survey Data

As a preface to this discussion, it should be noted that there are areas on the EM-31 terrain conductivity map indicating anomalies with negative terrain conductivity values. Theoretically, negative conductivities do not exist. However, the negative numbers actually represent extremely conductive materials or overhead interference in data collection. Since the EM-31 operates at low induction numbers, extremely conductive materials (such as ferrous metal) cause the system to lose coupling. Measured (approximated) terrain conductivity values and true conductivity values are approximately equal for the range between zero and 1,000 milli-Siemens (mS/m). When real conductivities exceed that range, the measured or approximated values become negative due to saturation and loss of coupling of the system.

Figure 1 shows the EM-31 quadrature and inphase data collected at the SWMU 13 area of the property. The quadrature (conductivity) data shows that the area has high background conductivity values. A distinct anomaly is visible at the northwest side of the survey grid and is labeled "A". The elevated quadrature data along the southwest section of the survey grid are the result of the fence interfering with the collection of EM-31 data. The inphase data, also provided on Figure 1, shows the anomaly visible in the quadrature data (Anomaly "A"), indicating that the anomaly has a metallic content to it.

In the EM-31 data, there does not appear to be any anomaly with trench-like characteristics or any anomalies that would be consistent with buried waste. However, the presence of the perimeter fence and parked cars is causing elevated EM-31 background readings in those areas. These interferences may be masking the presence of other anomalies that did not register high enough on the EM-31 to be detected over the background noise.

GPR Survey Data

The GPR traverses were performed along the same traverses as the EM-31, as well as additional traverses in order to further define the anomalies present at this SWMU. Figures 2 and 3 provide some selected GPR traverses depicting the anomaly interpreted to be the SWMU. Figure 4 provides the location of the selected GPR traverses referenced to the EM-31 survey grid.

On Figure 2, these GPR files show disturbed subsurface material from approximately 5 feet to 25 feet from the perimeter fence. This disturbance could represent the material in the trench. Historical information reported that the trench was approximately 10 feet wide and 200 feet long. On Figure 3, several GPR files have been provided that show an anomaly located between 10 and 30 feet from the fence. This anomaly appears to dip down, much like a trench or excavation. Ovals have been placed on the GPR traverses to indicate the anomalies that may represent the trench. This anomaly may represent the top of the trench after it was covered. According to the data from the GPR traverses, this anomaly extends from approximately –30 feet to approximately 10 feet short of the eastern perimeter fence of the parking lot (Figure 4) and occurs from approximately 10 feet to 30 feet from the perimeter fence.

The location of this anomaly was marked in the field with spray paint. The size of the marked area, in the field, is larger than the area referred to in the previous paragraph.

SUMMARY

In conclusion, two significant anomalies were detected in this area. One of these anomalies is clearly visible in the EM-31 data. It is circular in shape and labeled as "A". The second anomaly is visible in the GPR data but because of the close proximity of the perimeter fence causing interference, it is not visible in the EM-31 data. The anomaly located from –30 feet to the perimeter fence is the only anomaly visible in the GPR data with characteristics of a trench.

It is important to note that interferences may have masked the presence of other anomalies that did not register high enough on the EM-31 to be detected over the background noise.

ARM appreciates the opportunity to provide geophysical services to Montgomery Watson Harza. If you should have any questions please do not hesitate to contact us.

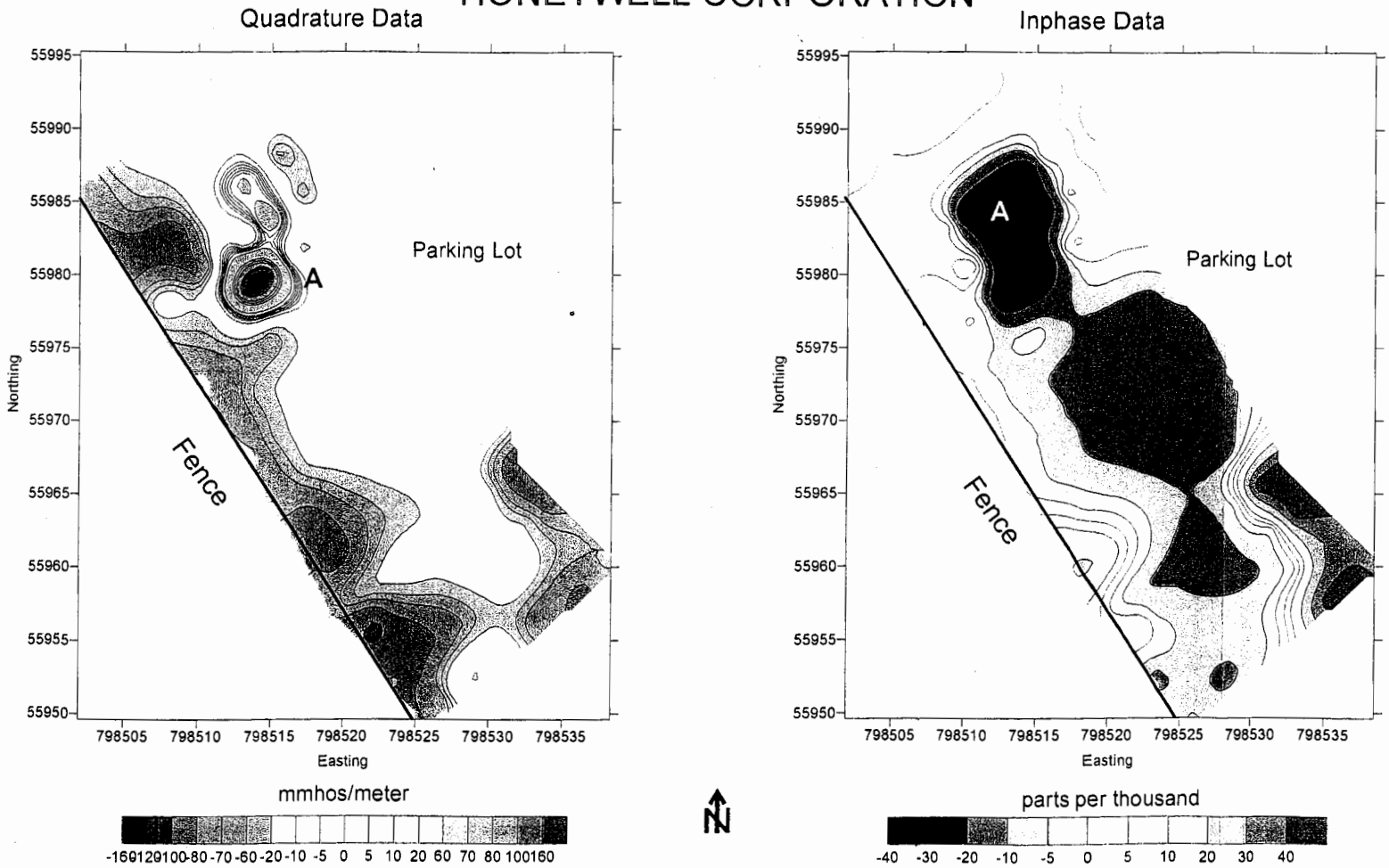
Respectfully Submitted,

Beth A. Williams

Beth A. Williams, P.G.
Senior Geophysicist

William S. Tafuto, P.E.
Vice President, Engineering

FIGURE 1
EM-31 DATA
SWMU 13
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION

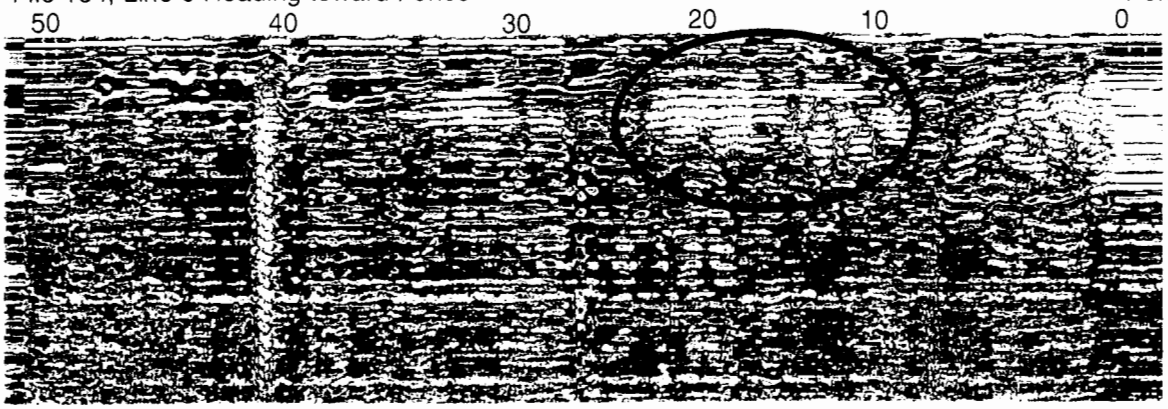


A Anomaly Location with Identifier

Coordinates are in NAD83 Pennsylvania South (meters)

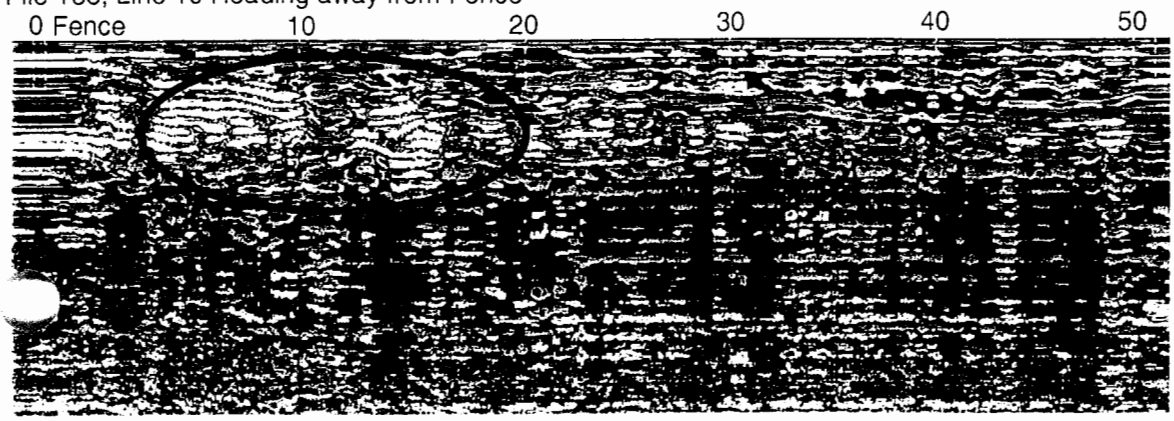
FIGURE 2
SELECTED GPR TRAVERSES
SWMU 13
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION

File 134, Line 0 Heading toward Fence

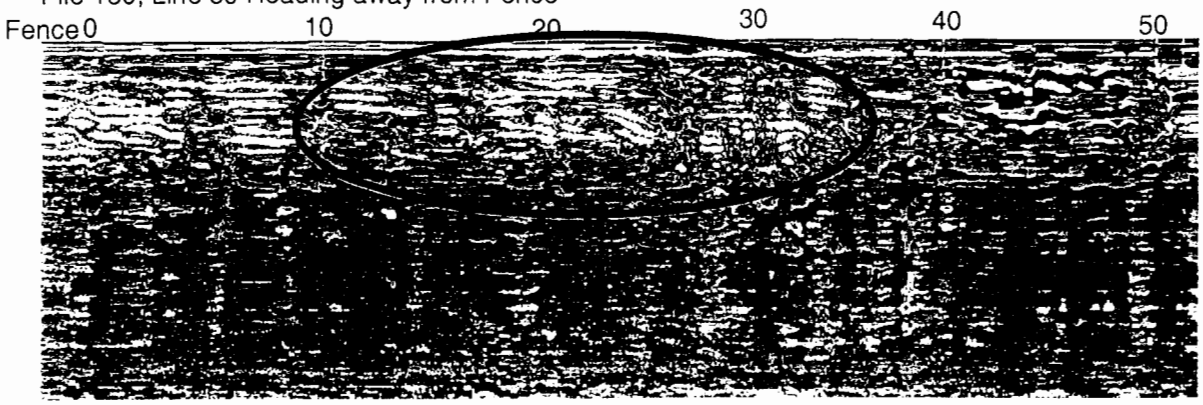


Interpreted SWMU Location

File 135, Line 10 Heading away from Fence



File 139, Line 50 Heading away from Fence



File 142, Line 80 Heading toward Fence

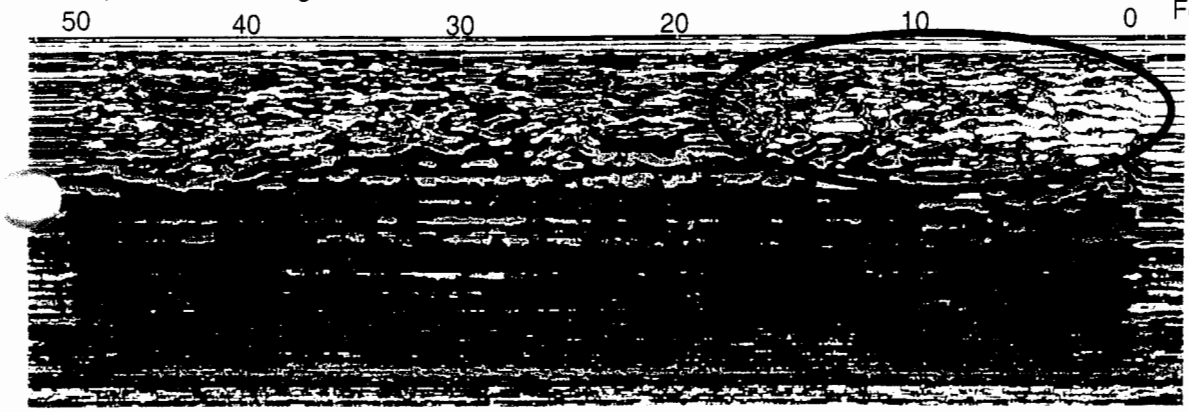
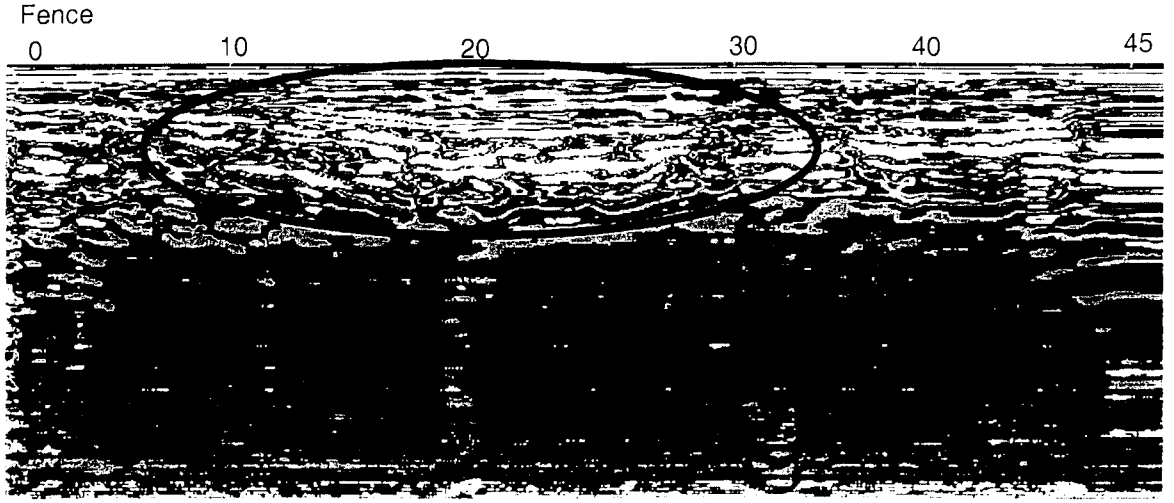
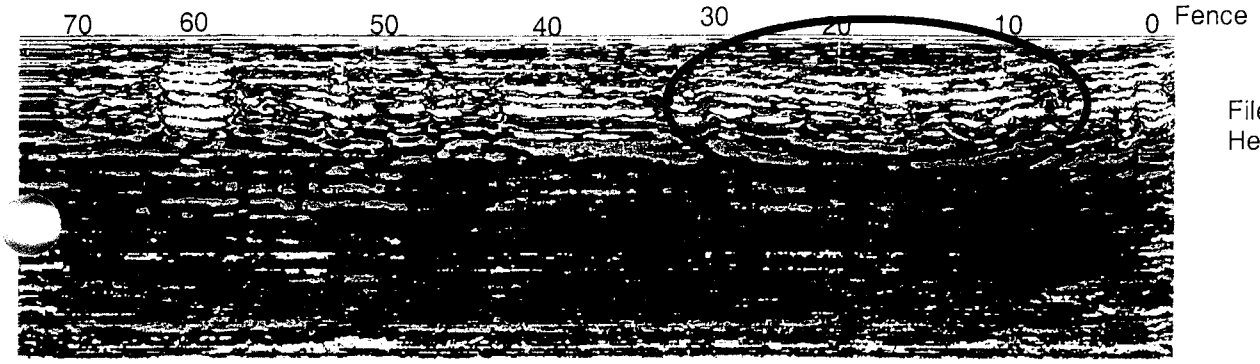


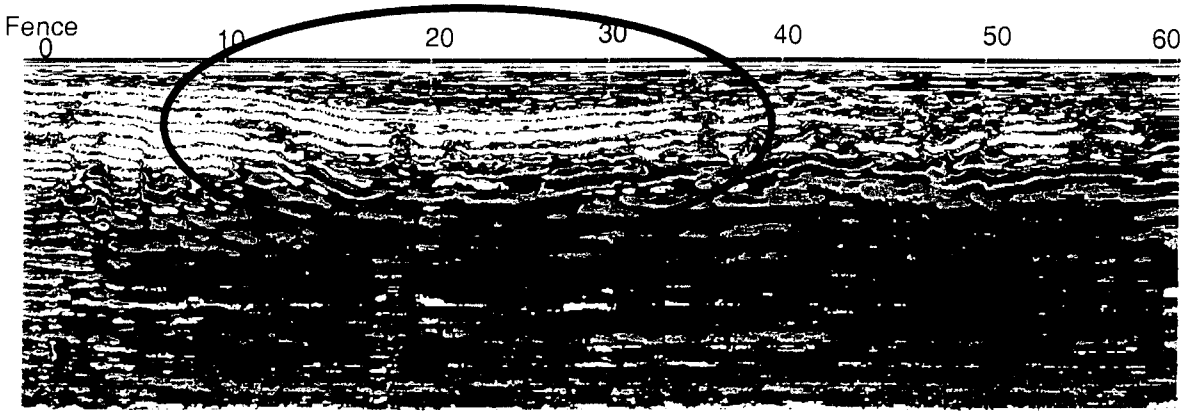
FIGURE 3
SELECTED GPR TRAVERSES
SWMU 13
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION



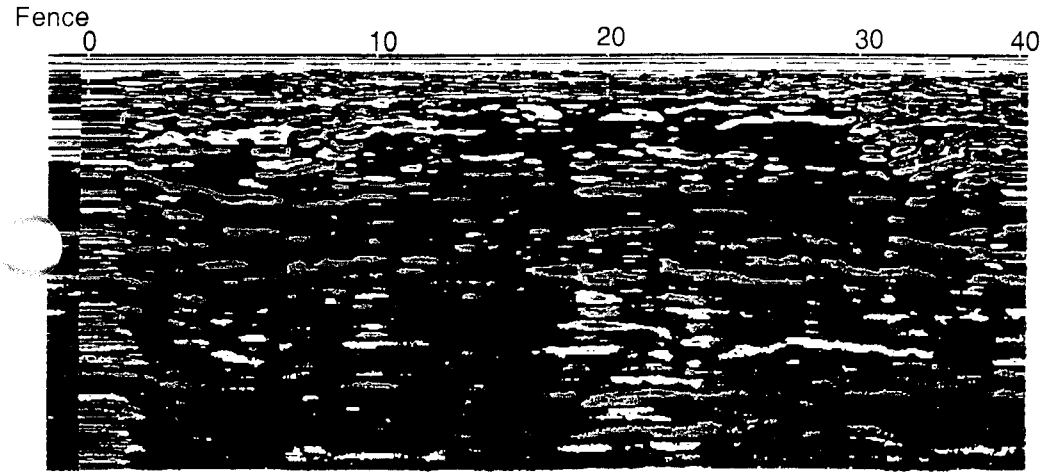
File 145, Line 110
Heading away from Fence



File 154, Line 140
Heading toward Fence



File 155, LIne 150
Heading away from Fence

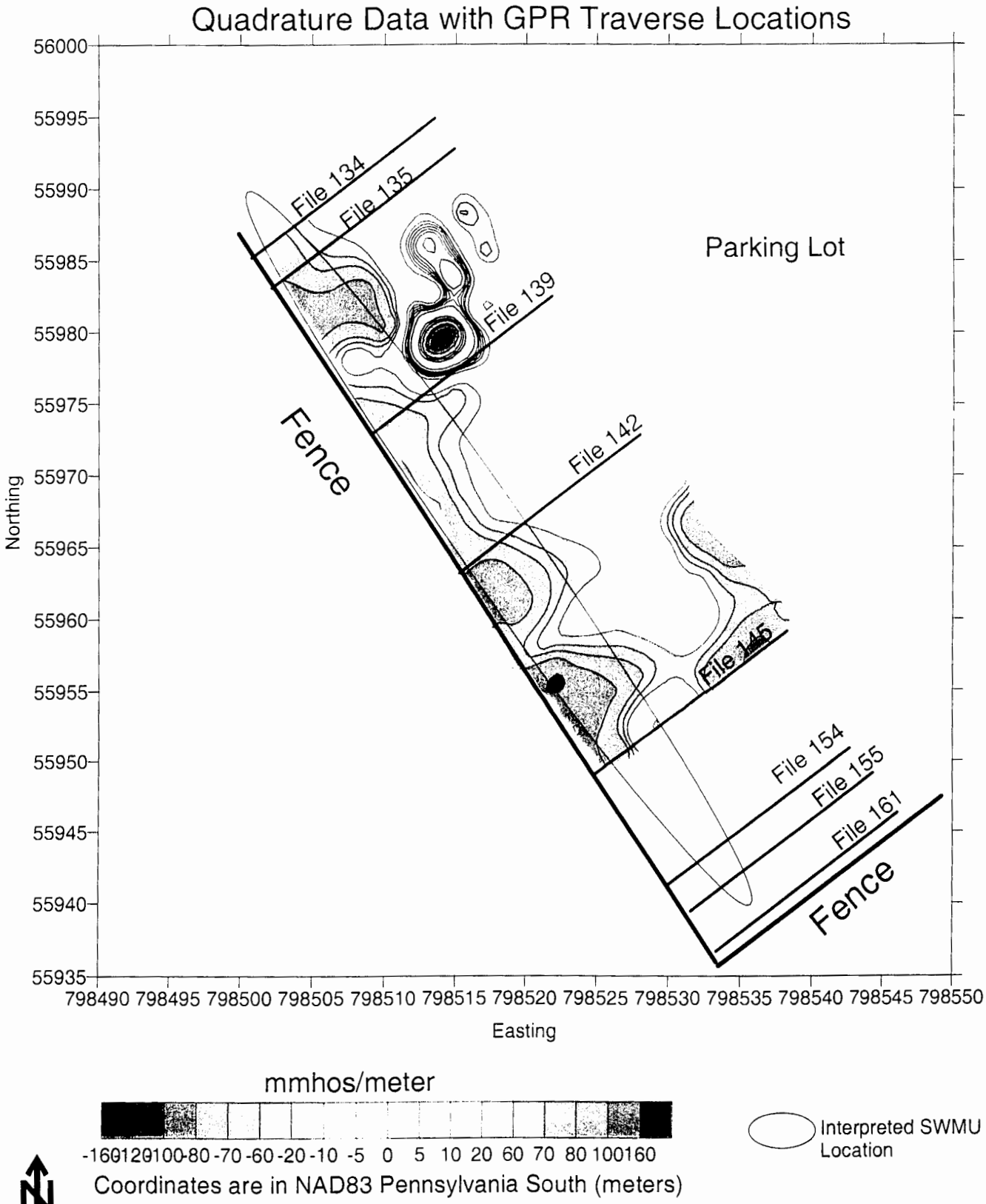


File 161, heading away from fence
last line within lot

Interpreted SWMU
Location

FIGURE 4

ANOMALY LOCATION MAP
SWMU 13
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION



SWMU 14 GEOPHYSICAL REPORT

ARM Group Inc.

Earth Resource Engineers and Consultants

April 15, 2003

Mr. Brian Carling, P.G.
Senior Geologist
Montgomery Watson Harza
335 Phoenixville Pike
Malvern, PA 19355

Re: Geophysical Survey Results
Honeywell Facility- SWMU 14
Claymont, Delaware
ARM Project 03123

Dear Mr. Carling:

ARM Group Inc. (ARM) is pleased to present to Montgomery Watson Harza (MWH) the results of a geophysical investigation performed at the Honeywell Facility located in Claymont, Delaware, by ARM on March 24 and 26, 2003. ARM's workscope relative to the subject survey was conducted in general accordance with ARM's proposal P02294, dated October 16, 2002, authorized by MWH on February 27, 2003.

The primary objective of the geophysical survey was to locate and delineate the lateral extent of a solid waste management unit (SWMU). This report relates to SWMU 14, located at the confined space training facility. Historical information available on this SWMU indicated that it was used for the disposal of cuprous chloride and cupric chloride as well as some construction debris from the demolition of a nearby building. The geophysical techniques used during this investigation were electromagnetic terrain conductivity (EM-31) and ground penetrating radar (GPR). A survey grid was established in the area where the SWMU was reported to be located and was approximately 50 feet by 120 feet.

The scope of work for this investigation included standard and routinely accepted practices used in the geophysical industry. ARM conducted this survey in accordance with the latest industry standards, yet inherent technique limitations and survey limitations apply, and unforeseen site-specific conditions may impact interpretations set forth in this report.

1129 West Governor Road • P.O. Box 797 • Hershey, PA 17033-0797
voice: (717) 533-8600 • fax: (717) 533-8605 • e-mail: info@armgroup.net

EM-31 Electromagnetic Induction Ground Conductivity Meter

Principles of EM-31

The EM-31 terrain conductivity is used extensively for environmental and geotechnical applications. It is commonly used in mapping certain types of shallow soil contamination (for example- conductive metals and inorganic contaminants), buried pipes, drums and pits and trenches containing buried debris. The EM-31 can also be used to assist in identifying the locations of potential sinkhole activity and for other geotechnical applications.

The EM-31 is an electromagnetic system with a transmitter coil mounted on one end and a receiver coil at the other end of a 12-foot long plastic boom. An audio-frequency alternating current is applied to the transmitter coil, causing the coil to radiate an alternating primary EM field. As described by Faraday's law of induction, the time-varying magnetic field generates eddy currents in subsurface materials. According to Lenz's law, these eddy currents have an associated secondary magnetic field with a magnitude and phase shift (relative to the primary field) that are dependent on the conductivity of the medium. The receiver coil measures the resultant effect of both primary and secondary fields. By comparing the signal at the receiver to that at the transmitter, the instrument records the components of the secondary field inphase (inphase data) and 90 degrees out of phase (quadrature/ conductivity data) with the primary field.

The EM-31 is configured so that the out-of-phase component is converted to bulk electrical conductivity in units of milli-mhos per meter (mmhos/meter). The measured conductivity is an apparent conductivity that is the resultant of the various subsurface materials that are sampled by the EM field. It is referred to as terrain conductivity. The inphase component is read in parts per thousand (ppt) of the primary EM field and is generally adjusted in the field to read zero response over background materials. The inphase component generally represents current density and is a gross measure of the presence of buried ferrous metal debris.

The EM-31 has a maximum effective exploration depth of approximately 5.5 meters (18 feet) when operating in the vertical dipole mode (horizontal coils). In this mode, the maximum instrument response results from materials at a depth of about 1.5 times the coil spacing (approximately (5.5 meters) 18 feet below the ground surface with the instrument at normal operating height of about 0.9 meters (3 feet)). In the horizontal mode (vertical coils), the EM-31 has an effective exploration depth of about 9 feet and is most sensitive to materials immediately beneath the ground surface. The EM-31 data collected during the survey was collected in the vertical dipole mode.

Field Procedures

Before the EM-31 survey was conducted, a base station was set up on the northern section of the grid. There was extensive background interference of the EM-31 data due to the presence of the dumpster, railcars, the onsite railroad tracks and the high-voltage power lines that are parallel with the property line/fence. The EM-31 was calibrated for this site; however the background EM-31 readings are high (>40 mmhos/meter). The base station was occupied with the instrument boom

always in the same orientation and at normal operating height. The inphase component was set to zero, and the instrument phase was checked and adjusted as necessary. After the instrument was calibrated, a minimum of 20 readings of data was recorded in an automatic 1-second sampling mode and stored in the data logger.

Before collecting field data, the data logger was programmed with the appropriate file name, line name, start station, station increment, line spacing, and operator's initials. All EM-31 and global positioning system (GPS) data were stored in digital data loggers and downloaded to a laptop computer. The EM-31 and GPS data were then merged to create files used to make contour maps of the EM-31 data with GPS coordinates in the North America Datum 1983 (NAD83) Pennsylvania South state plane grid.

The GPS is a satellite-based positioning system operated by the U.S. Department of Defense (DOD). The 24-hour operational NAVSTAR satellites orbiting the earth every 12 hours provide worldwide, all weather, 24-hour time and position information. The GPS unit used for this investigation was a Trimble Pro XRS manufactured by Trimble Navigation Limited.

GPS uses satellites in space as reference points for locations on earth. By accurately measuring distance from three satellites, the GPS receiver (rover) can triangulate its position anywhere on earth. By ranging from three satellites, an instrument can narrow its position to two points in space. To determine which point is correct, information from a fourth satellite is used. When more satellites are available, the accuracy of the GPS determination increases.

GPS was utilized to provide position data for the EM-31 survey during this investigation. EM-31 and GPS data was collected simultaneously at a rate of one reading per second, which corresponds to a sampling rate of approximately one reading every 2.5 to 3 feet.

Data Processing

The processing of EM-31 data begins with using the DAT31™ software to export the raw data into file formats the software-contouring package can read and contour. The DAT31™ software program, by Geonics, Ltd., was subsequently used to generate data (.DAT) files containing the coordinates of the measurement location (x,y) along with the corresponding quadrature and inphase data (EM-31). The DAT31™ software provides an option to merge the data files and GPS positioning files during the creation of the .DAT file. The program relates GPS position to EM-31 measurement by matching time stamps that are imbedded within both data sets. Data processing involved the generation of a color-enhanced map using the Surfer© (Golden Software, Inc.) mapping and processing system.

GROUND PENETRATING RADAR

Principles of GPR

GPR is an electromagnetic instrument that transmits and records radar EM pulses. GPR systems produce cross-sectional images of subsurface features by transmitting discrete radar pulses into the subsurface and recording the signal echoes or reflections from interfaces between materials with

differing dielectric properties. To conduct a GPR survey, an antenna containing a transmitter and a receiver is slowly pulled along the ground surface. The transmitter radiates short pulses of high frequency EM energy into the ground. When the wave encounters the interface between two materials having different dielectric constants (dielectric permittivity), a portion of the energy is reflected back. The contrast in dielectric permittivity between the two media can be quantified by a reflection coefficient at the media interface. The magnitude of the reflection coefficient increases as the contrast in dielectric constant increases. The signal is transmitted to a control unit, displayed on a color monitor, and digitally recorded.

Air or air-filled voids have dielectric permittivity of 1. Soils, concrete, and other materials have higher permittivities such as: 5.5 for dry concrete; 6 for sandy soil; and 15 for wet sand. Due to the contrast in dielectric properties between air and anticipated subsurface materials, air-filled voids under the surface should be discernible in the GPR data.

The effective penetration depth of a radar system is controlled by the dielectric permittivity, the electrical conductivity (usually dictated by moisture content) of the soils, and the frequency of the antenna. In highly conductive materials (such as clay), the pulse is dissipated at very shallow depths. Two-way travel time on the GPR records can furnish estimates of depth if the dielectric constant for subsurface materials is known. If it is unknown, then an approximate depth can be obtained by using published average dielectric constants that correspond to the texture and general nature of the anticipated site soils.

Resolution of the GPR system is dependent on the frequency of the antenna used during the survey. The higher frequency antennas (900 Megahertz [MHz] or greater) can resolve small features (less than an inch in diameter) but can penetrate only to a maximum depth of 1.5 meters or less. Lower frequency antennae (300 to 500 MHz) can resolve objects deeper in the subsurface (up to 15 to 20 feet below the ground surface) and may not detect objects near surface. Two or more antennae may be used to collect the necessary depth and resolution information.

The GPR survey at SWMU 14 was conducted using a 400-MHz antenna. This antenna is considered one of the most versatile and flexible antennas manufactured. The 400-MHz antenna allows the collection of near surface and deeper data, and resolves most features.

Generally, target depths shown on GPR records are estimates based on average two-way velocities of the GPR through that media and the dielectric constants of the material the survey is targeting. Unless a known target at a known depth is available within a survey area, the depth markers on a GPR record should be considered estimations. Depth markers were not placed on the GPR records provided with this report because there was not a reliable target in the subsurface to calibrate the GPR. However, using the generalized published average constants and the range of 80 nanoseconds, the GPR wave was most likely penetrating to a depth of 10 feet at this SWMU.

Field Procedures

The GPR survey was performed on the same traverses as the EM-31 survey. Along the ground surface, spray paint marks were placed at 10-foot intervals to serve as distance markers on the GPR records.

The GPR was calibrated at this site by placing the antenna in an area free of subsurface anomalies to determine the optimum recording parameters for the GPR. These parameters include the range (amount of time the instrument records after transmitting an EM pulse), scan rate (number of recorded traces or scans per second), transmitter pulse rate (frequency at which the EM pulses are transmitted), instrument gains, and filter settings. These settings are automatically stored in a header file with the digital GPR data.

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After removal of stagnant areas, the GPR files were converted and saved as bitmap images. The bitmap files were transferred into Surfer, a commercial software package. By using Surfer, distance markers and other annotations can be added to the records.

RESULTS AND INTERPRETATION

EM-31 Survey Data

As a preface to the discussion, it should be noted that there are areas on the EM-31 terrain conductivity map indicating anomalies with negative terrain conductivity values. Theoretically, negative conductivities do not exist. However, the negative numbers actually represent extremely conductive materials or overhead interference in data collection. Since the EM-31 operates at low induction numbers, extremely conductive materials (such as ferrous metal) cause the system to lose coupling. Measured (approximated) terrain conductivity values and true conductivity values are approximately equal for the range between zero and 1,000 milli-Siemens per meter (mS/m). When real conductivities exceed that range, the measured or approximated values become negative due to saturation and loss of coupling of the system.

Figure 1 shows the EM-31 quadrature and inphase data collected in the SWMU 14 area of the property. The quadrature (conductivity) data shows that the area has higher than normal background conductivity values. An elongated anomaly trends from northwest to southeast. This anomaly enters into the pit located at the north side of the survey grid. A circular anomaly is located at the northwest section of the survey grid and is labeled "A". The source of this anomaly is unknown; however, historical information indicates that construction debris was placed in this SWMU.

The inphase data is also provided on Figure 1. This data also shows the presence of Anomaly "A", as well as the elongated anomaly previously identified as an underground pipe.

GPR Survey Data

The ground surface at this location is very uneven due to the amount of concrete and other debris at the ground surface. The GPR traverses were performed along lines that were relatively smooth, enabling a better quality data to be collected. Figure 2 presents a few of the GPR traverses collected at this SWMU. As shown on these traverses, the subsurface appears to contain numerous anomalies and disturbed areas. This is most likely due to the presence of the construction debris. Due to the abundance of this debris, an anomaly with characteristics of buried waste could not be identified in the GPR traverses. A larger anomaly near the above ground storage tank was marked in the field and is shown on Figure 2. This anomaly was marked in the field with spray paint.

SUMMARY

In conclusion, one significant anomaly was detected in the EM-31 data, labeled as "A" on Figure 1. The GPR records indicate an abundance of subsurface anomalies, most of them small and most likely related to the construction debris placed in the subsurface in this area. The GPR data indicates the presence of an anomaly near the above ground storage tank that is denser than the random clutter observed in the other GPR records. This anomaly was marked in the field with spray paint. The sources of both of these anomalies are unknown at this time.

It is important to note that below the ground surface, the presence of the construction debris is causing random anomalies in the GPR data. This debris may have masked the presence of other anomalies.

ARM appreciates the opportunity to provide geophysical services to Montgomery Watson Harza. If you should have any questions please do not hesitate to contact us.

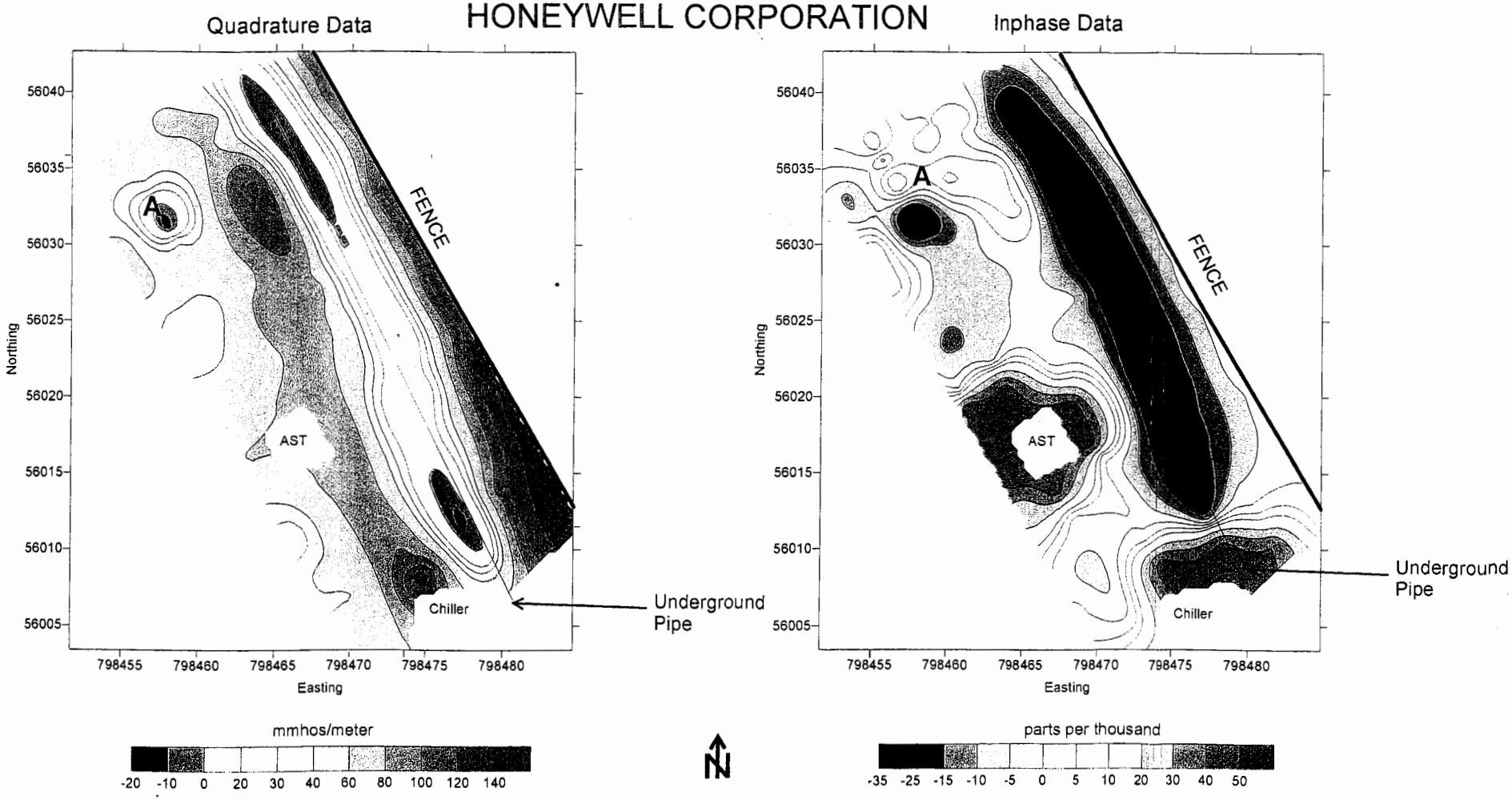
Respectfully Submitted,

Beth A. Williams

Beth A. Williams, P.G.
Senior Geophysicist

Williams S. Tafuto, P.E.
Vice President, Engineering

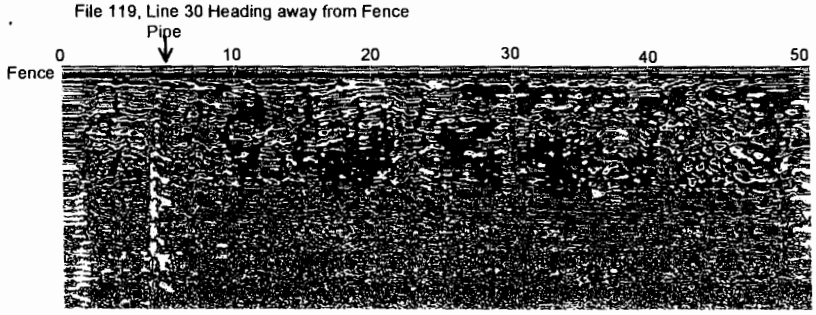
FIGURE 1
EM-31 DATA
SWMU 14
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION



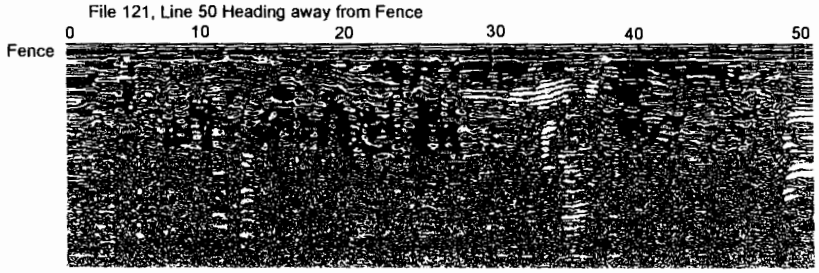
Coordinates are in NAD83 Pennsylvania South (meters)

FIGURE 2
SELECTED GPR TRAVERSES
SWMU 14
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION

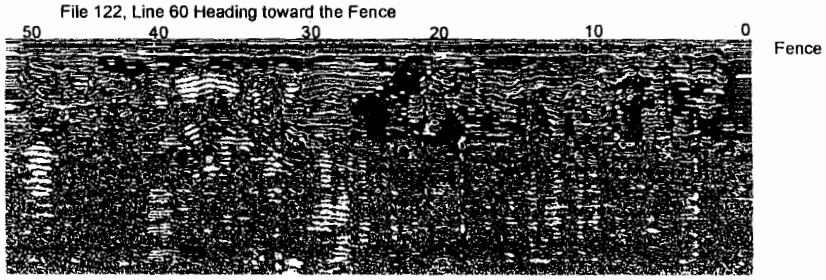
File 119, Line 30 Heading away from Fence



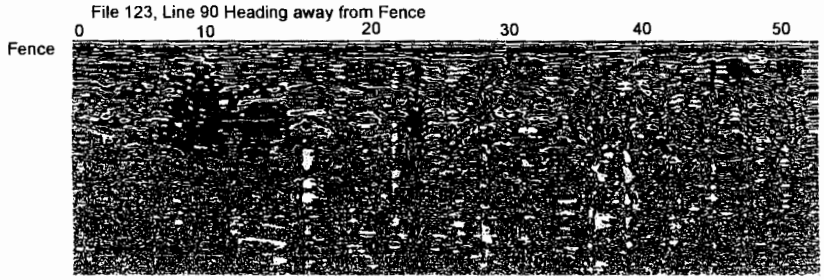
File 121, Line 50 Heading away from Fence



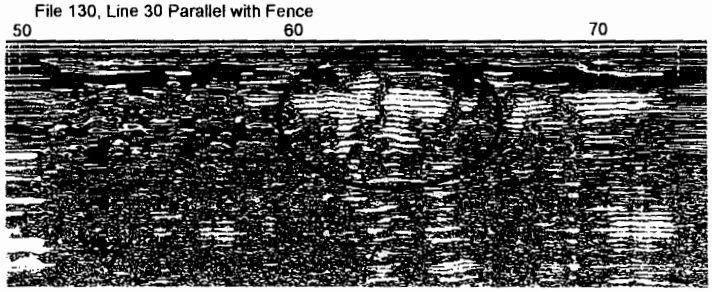
File 122, Line 60 Heading toward the Fence



File 123, Line 90 Heading away from Fence



File 130, Line 30 Parallel with Fence



SWMU 17 GEOPHYSICAL REPORT

ARM Group Inc.

Earth Resource Engineers and Consultants

April 15, 2003

Mr. Brian Carling, P.G.
Senior Geologist
Montgomery Watson Harza
335 Phoenixville Pike
Malvern, PA 19355

Re: Geophysical Survey Results
Honeywell Facility- SWMU 17
Claymont, Delaware
ARM Project 03123

Dear Mr. Carling:

ARM Group Inc. (ARM) is pleased to present to Montgomery Watson Harza (MWH) the results of the geophysical investigation performed at the Honeywell Facility located in Claymont, Delaware by ARM on March 24 and 26, 2003. ARM's Workscope relative to the subject survey was conducted in general accordance with ARM's proposal P02294, dated October 16, 2002, authorized by MWH on February 27, 2003.

The primary objective of the geophysical survey was to locate and delineate the lateral extent of a solid waste management unit (SWMU). This report relates to SWMU 17, located at the confined space training facility. Historical information available on this SWMU indicated that it was used for the disposal of waste material in a trench. The geophysical techniques used during this investigation were electromagnetic terrain conductivity (EM-31) and ground penetrating radar (GPR). A survey grid was established in the area where the SWMU was reported to be located and was approximately 90 feet by 70 feet.

The scope of work for this investigation included standard and routinely accepted practices used in the geophysical industry. ARM conducted this survey in accordance with the latest industry standards, yet inherent technique limitations and survey limitations apply, and unforeseen site-specific conditions may impact interpretations set forth in this report.

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EM-31 Electromagnetic Induction Ground Conductivity Meter

Principles of EM-31

The EM-31 terrain conductivity is used extensively for environmental and geotechnical applications. It is commonly used in mapping certain types of shallow soil contamination (for example- conductive metals and inorganic contaminants), buried pipes, drums and pits and trenches containing buried debris. The EM-31 can also be used for the locations of potential sinkhole activity and for other geotechnical applications.

The EM-31 is an electromagnetic system with a transmitter coil mounted on one end and a receiver coil at the other end of a 12-foot long plastic boom. An audio-frequency alternating current is applied to the transmitter coil, causing the coil to radiate an alternating primary EM field. As described by Faraday's law of induction, the time-varying magnetic field generates eddy currents in subsurface materials. According to Lenz's law, these eddy currents have an associated secondary magnetic field with a magnitude and phase shift (relative to the primary field) that are dependent on the conductivity of the medium. The receiver coil measures the resultant effect of both primary and secondary fields. By comparing the signal at the receiver to that at the transmitter, the instrument records the components of the secondary field inphase (inphase data) and 90 degrees out of phase (quadrature/ conductivity data) with the primary field.

The EM-31 is configured so that the out-of-phase component is converted to bulk electrical conductivity in units of milli-mhos per meter (mmhos/meter). The measured conductivity is an apparent conductivity that is the resultant of the various subsurface materials that are sampled by the EM field. It is referred to as terrain conductivity. The inphase component is read in parts per thousand (ppt) of the primary EM field and is generally adjusted in the field to read zero response over background materials. The inphase component generally represents current density and is a gross measure of the presence of buried ferrous metal debris.

The EM-31 has a maximum effective exploration depth of approximately 5.5 meters (18 feet) when operating in the vertical dipole mode (horizontal coils). In this mode, the maximum instrument response results from materials at a depth of about 1.5 times the coil spacing (approximately (5.5 meters) 18 feet below the ground surface with the instrument at normal operating height of about 0.9 meters (3 feet)). In the horizontal mode (vertical coils), the EM-31 has an effective exploration depth of about 9 feet and is most sensitive to materials immediately beneath the ground surface. The EM-31 data collected during the survey was collected in the vertical dipole mode.

Field Procedures

Before the EM-31 survey was conducted, a base station was set up on the northern section of the grid. There was extensive background interference of the EM-31 data due to the presence of the dumpster, railcars, the onsite railroad tracks and the high-voltage power lines that are parallel with the property line/fence. The EM-31 was calibrated for this site; however the background EM-31 readings are high (>40 mmhos/meter). The base station was occupied with the instrument boom

always in the same orientation and at normal operating height. The inphase component was set to zero, and the instrument phase was checked and adjusted as necessary. After the instrument was calibrated, a minimum of 20 readings of data was recorded in an automatic 1-second sampling mode and stored in the data logger.

Before collecting field data, the data logger was programmed with the appropriate file name, line name, start station, station increment, line spacing, and operator's initials. All EM-31 and global positioning system (GPS) data were stored in digital data loggers and downloaded to a laptop computer. The EM-31 and GPS data were then merged to create files used to make contour maps of the EM-31 data with GPS coordinates in the North America Datum 1983 (NAD83) Pennsylvania South state plane grid.

The GPS is a satellite-based positioning system operated by the U.S. Department of Defense (DOD). The 24-hour operational NAVSTAR satellites orbiting the earth every 12 hours provide worldwide, all weather, 24-hour time and position information. The GPS unit used for this investigation was a Trimble Pro XRS manufactured by Trimble Navigation Limited.

GPS uses satellites in space as reference points for locations on earth. By accurately measuring distance from three satellites, the GPS receiver (rover) can triangulate its position anywhere on earth. By ranging from three satellites, an instrument can narrow its position to two points in space. To determine which point is correct, information from a fourth satellite is used. When more satellites are available, the accuracy of the GPS determination increases.

GPS was utilized to provide position data for the EM-31 survey during this investigation. EM-31 and GPS data was collected simultaneously at a rate of one reading per second, which corresponds to a sampling rate of approximately one reading every 2.5 to 3 feet.

Data Processing

The processing of EM-31 data begins with using the DAT31™ software to export the raw data into file formats the software-contouring package can read and contour. The DAT31™ software program by Geonics, Ltd., was subsequently used to generate data (.DAT) files containing the coordinates of the measurement location (x,y) along with the corresponding quadrature and inphase data (EM-31). The DAT31™ software provides an option to merge the data files and GPS positioning files during the creation of the .DAT file. The program relates GPS position to EM-31 measurement by matching time stamps that are imbedded within both data sets. Data processing involved the generation of a color-enhanced map using the Surfer© (Golden Software, Inc.) mapping and processing system.

GROUND PENETRATING RADAR

Principles of GPR

GPR is an electromagnetic instrument that transmits and records radar EM pulses. GPR systems produce cross-sectional images of subsurface features by transmitting discrete radar pulses into the subsurface and recording the signal echoes or reflections from interfaces between materials with

differing dielectric properties. To conduct a GPR survey, an antenna containing a transmitter and a receiver is slowly pulled along the ground surface. The transmitter radiates short pulses of high frequency EM energy into the ground. When the wave encounters the interface between two materials having different dielectric constants (dielectric permittivity), a portion of the energy is reflected back. The contrast in dielectric permittivity between the two media can be quantified by a reflection coefficient at the media interface. The magnitude of the reflection coefficient increases as the contrast in dielectric constant increases. The signal is transmitted to a control unit, displayed on a color monitor, and digitally recorded.

Air or air-filled voids have dielectric permittivity of 1. Soils, concrete, and other materials have higher permittivities such as: 5.5 for dry concrete; 6 for sandy soil; and 15 for wet sand. Due to the contrast in dielectric properties between air and anticipated subsurface materials, air-filled voids under the surface should be discernible in the GPR data.

The effective penetration depth of a radar system is controlled by the dielectric permittivity, the electrical conductivity (usually dictated by moisture content) of the soils, and the frequency of the antenna. In highly conductive materials (such as clay), the pulse is dissipated at very shallow depths. Two-way travel time on the GPR records can furnish estimates of depth if the dielectric constant for subsurface materials is known. If it is unknown, then an approximate depth can be obtained by using published average dielectric constants that correspond to the texture and general nature of the anticipated site soils.

Resolution of the GPR system is dependent on the frequency of the antenna used during the survey. The higher frequency antennas (900 Megahertz [MHz] or greater) can resolve small features (less than an inch in diameter) but can penetrate only to a maximum depth of 1.5 meters or less. Lower frequency antennae (300 to 500 MHz) can resolve objects deeper in the subsurface (up to 15 to 20 feet below the ground surface) and may not detect objects near surface. Two or more antennae may be used to collect the necessary depth and resolution information.

The GPR survey at SWMU 18 was conducted using a 400-MHz antenna. This antenna is considered one of the most versatile and flexible antennas manufactured. The 400-MHz antenna allows the collection of near surface and deeper data, and resolves most features.

Generally, target depths shown on GPR records are estimates based on average two-way velocities of the GPR through that media and the dielectric constants of the material the survey is targeting. Unless a known target at a known depth is available within a survey area, the depth markers on a GPR record should be considered estimations. Depth markers were not placed on the GPR records provided with this report because there was not a reliable target in the subsurface to calibrate the GPR. However, using the generalized published average constants and the range of 80 nanoseconds, the GPR wave was most likely penetrating to a depth of 10 feet at this SWMU.

Field Procedures

The GPR survey was performed on the same traverses as the EM-31 survey. Along the ground surface, spray paint marks were placed at 10-foot intervals to serve as distance markers on the GPR records.

The GPR was calibrated at this site by placing the antenna in an area free of subsurface anomalies to determine the optimum recording parameters for the GPR. These parameters include the range (amount of time the instrument records after transmitting an EM pulse), scan rate (number of recorded traces or scans per second), transmitter pulse rate (frequency at which the EM pulses are transmitted), instrument gains, and filter settings. These settings are automatically stored in a header file with the digital GPR data.

Data Processing

This survey was performed using a SIR2000 unit manufactured by GSSI Inc. This unit stores each of the GPR files digitally in the memory of the unit. At the conclusion of the survey, all of the GPR data files collected during the investigation were downloaded to the network computers at the ARM office. To begin the processing, each GPR file was edited to remove any stagnant points (areas where the data collector paused or had to maneuver around obstacles). These areas show up as flat lines and images, and are of no value to the overall survey.

After removal of stagnant areas, the GPR files were converted and saved as bitmap images. The bitmap files were transferred into Surfer, a commercial software package. By using Surfer, distance markers and other annotations can be added to the records.

RESULTS AND INTERPRETATION

EM-31 Survey Data

As a preface to the discussion, it should be noted that there are areas on the EM-31 terrain conductivity map indicating anomalies with negative terrain conductivity values. Theoretically, negative conductivities do not exist. However, the negative numbers actually represent extremely conductive materials or overhead interference in data collection. Since the EM-31 operates at low induction numbers, extremely conductive materials (such as ferrous metal) cause the system to lose coupling. Measured (approximated) terrain conductivity values and true conductivity values are approximately equal for the range between zero and 1,000 milli-Siemens (mS/m). When real conductivities exceed that range, the measured or approximated values become negative due to saturation and loss of coupling of the system.

Figure 1 shows the EM-31 quadrature and inphase data collected in the SWMU 17 area of the property. The quadrature (conductivity) data shows the area has high background conductivity values. An elongated anomaly trends from northwest to southeast, plant personnel later identified this anomaly as one of the pipelines bringing water from the Delaware River to the Plant. The overhead structure of the confined space entry training facility consists of significant amount of metal. The structure has interfered with the collection of the EM-31 data.

The inphase data provided on Figure 1, also shows the presence of interference from the training facility.

GPR Survey Data

The GPR traverses were performed on the same traverses as the EM-31. Figures 2 and 3 provide some selected GPR traverses collected at the SWMU. Figure 4 provides the location of the selected GPR traverses referenced to the EM-31 survey grid.

On Figure 3, Files 103, 106, and 107, there is an anomaly with two sloping interfaces in the subsurface. This feature could represent the mounded sides of SWMU 17. However, this feature is also located directly underneath the current asphalt pad. The sloping interfaces could be related to the subbase or fill material underneath the asphalt. According to the GPR traverses, this anomaly extends from approximately 15 to 55 feet inline distance (from east to west) and from 30 to 50 feet inline distance (north to south).

The location of this anomaly was marked in the field with spray paint. The size of the area marked in the field is larger than the area referred to in the previous paragraph.

SUMMARY

In conclusion, one significant anomaly was detected in this area and is located on the northeast to east side of the survey grid. This anomaly, mound-like with two sloping sides, was observed in the GPR data. The anomaly is located approximately 15 to 55 feet inline distance (from east to west) and from 30 to 50 feet inline distance (north to south). The source of this anomaly is unknown at this time.

The background EM-31 data readings are high in this survey area. These elevated background readings are the result of the metal framework of the confined space entry training facility. It is important to note that the interference caused by the metal structure may have masked the presence of other anomalies that did not register high enough on the EM-31 to be detected over the background noise.

ARM appreciates the opportunity to provide geophysical services to Montgomery Watson Harza. If you should have any questions please do not hesitate to contact us.

Respectfully Submitted,

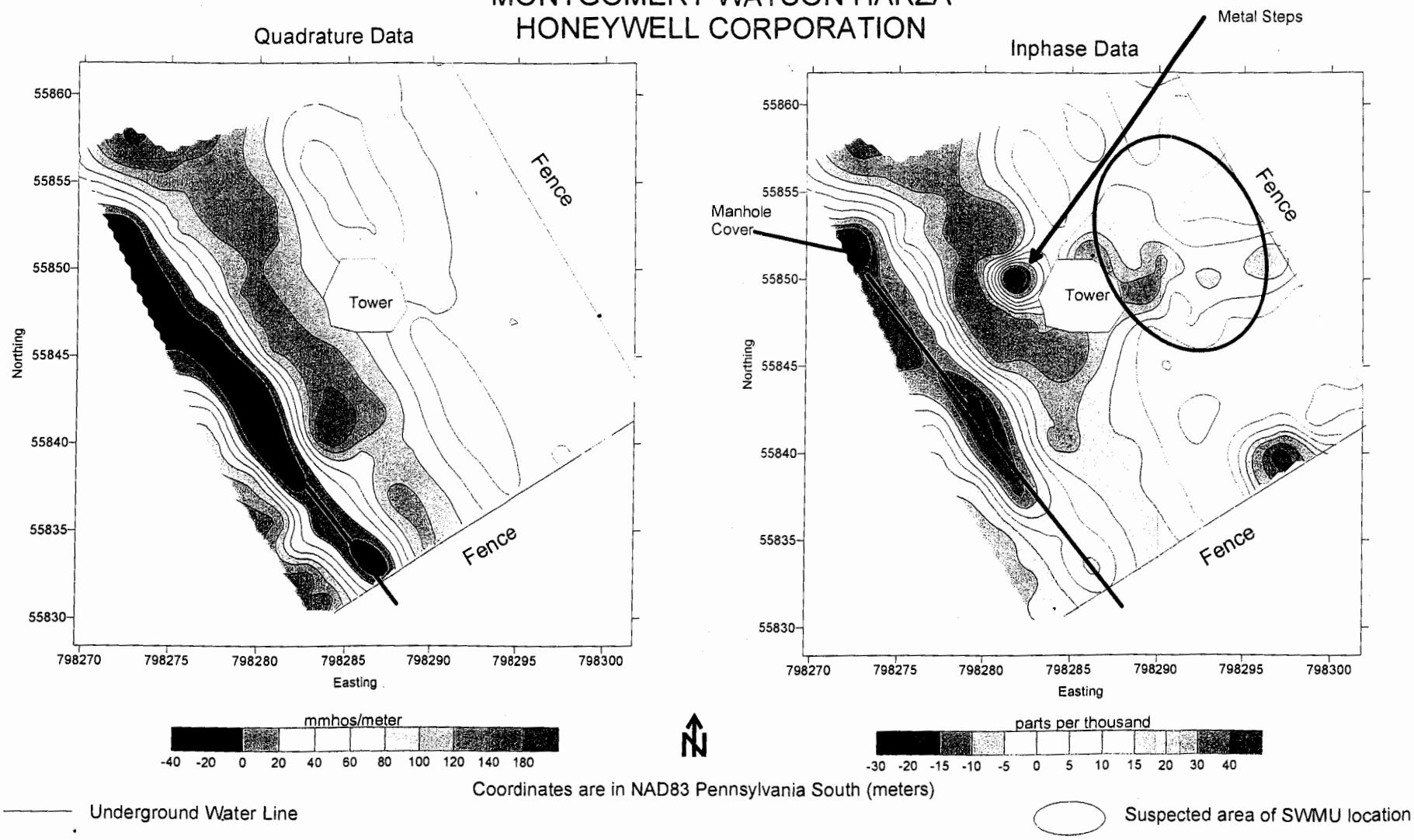
Beth A. Williams

Beth A. Williams, P.G.
Senior Geophysicist

W.S. Tafuto

William S. Tafuto, P.E.
Vice President- Engineering

FIGURE 1
EM-31 DATA
SWMU 17
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION



Coordinates are in NAD83 Pennsylvania South (meters)

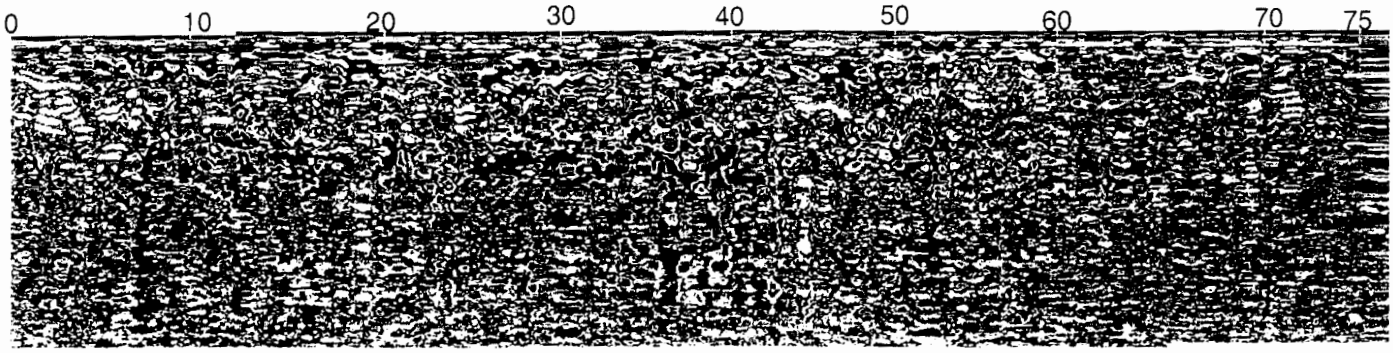
Underground Water Line

Suspected area of SWMU location

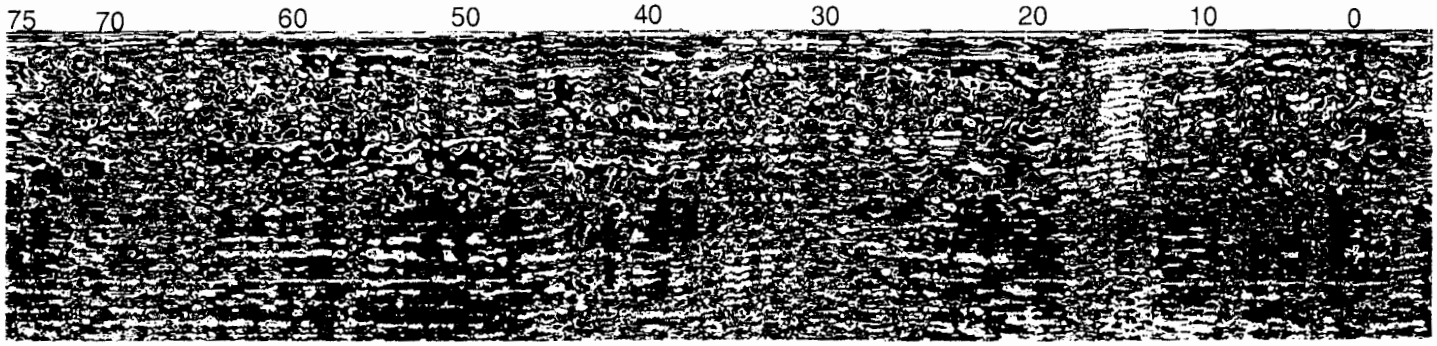
FIGURE 2

SELECTED GPR TRAVERSES
SWMU 17
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION

File 100, Line 0- Along Fence



File 101, Line 10- Parallel with Fence



File 102, Line 20, Parallel with Fence

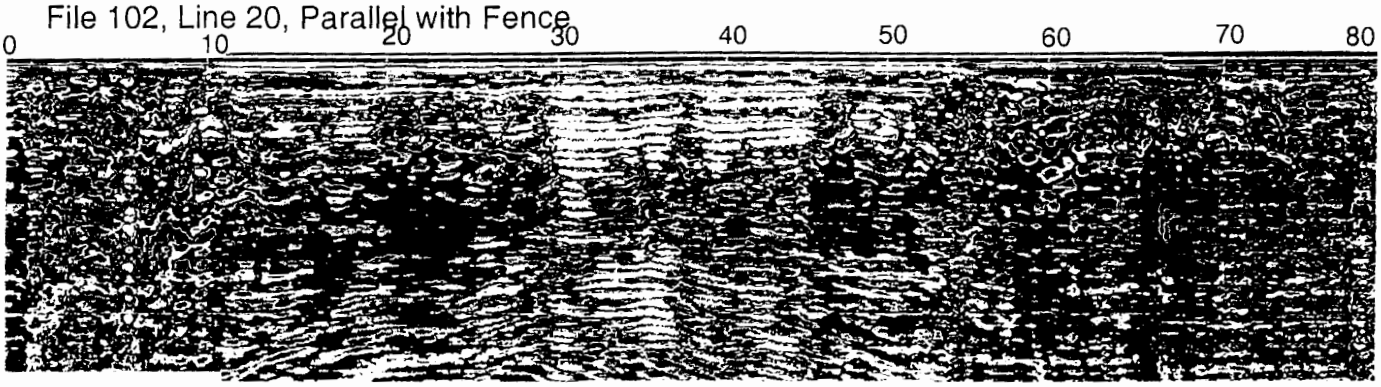
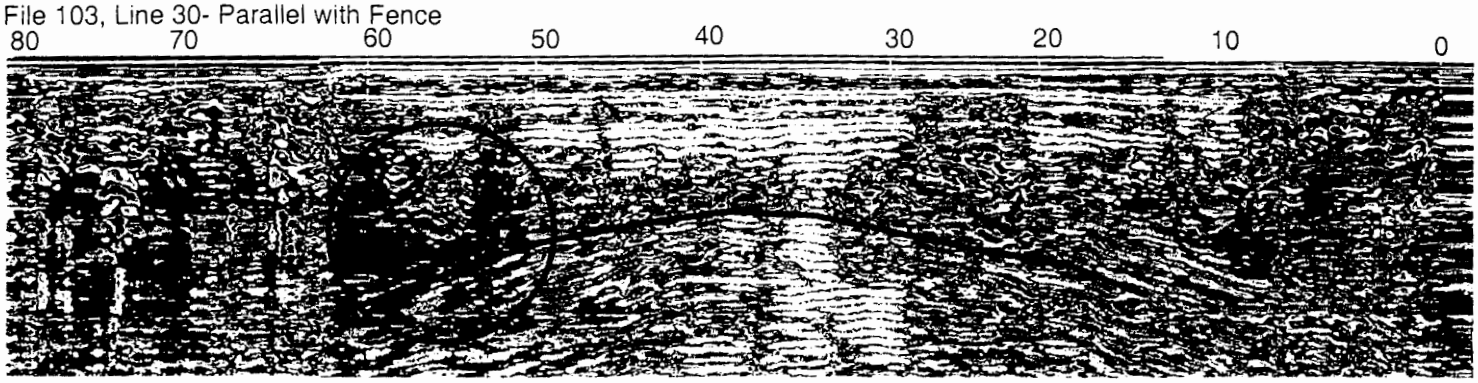


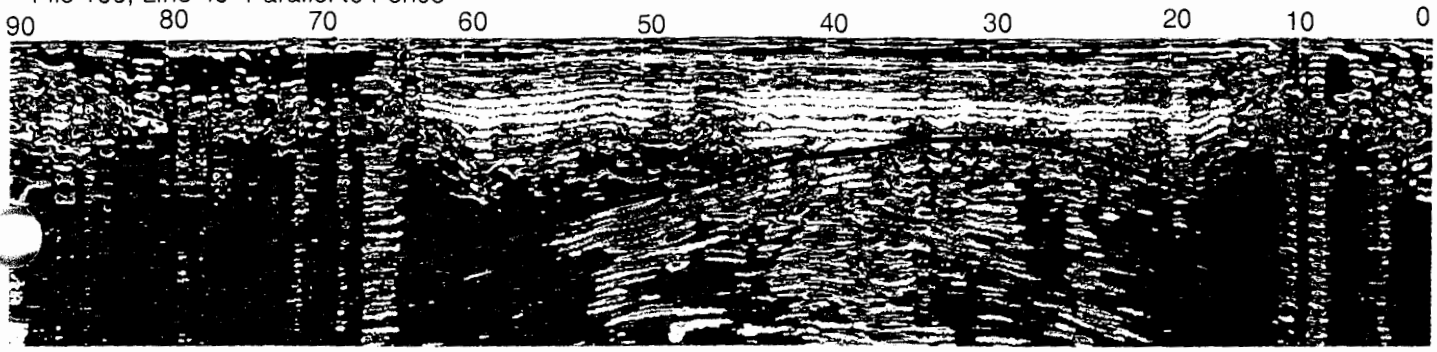
FIGURE 3

SELECTED GPR TRAVERSES
SWMU 17
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION

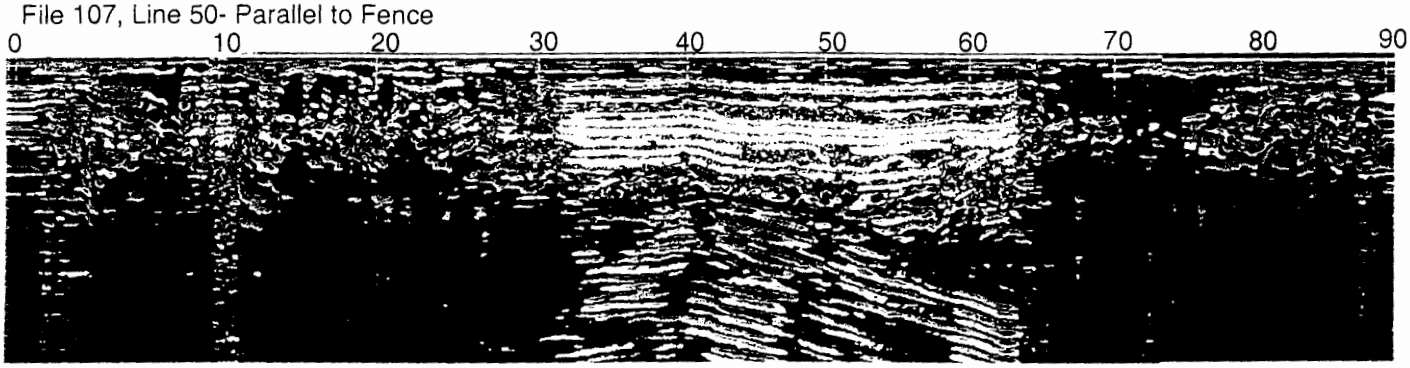
File 103, Line 30- Parallel with Fence



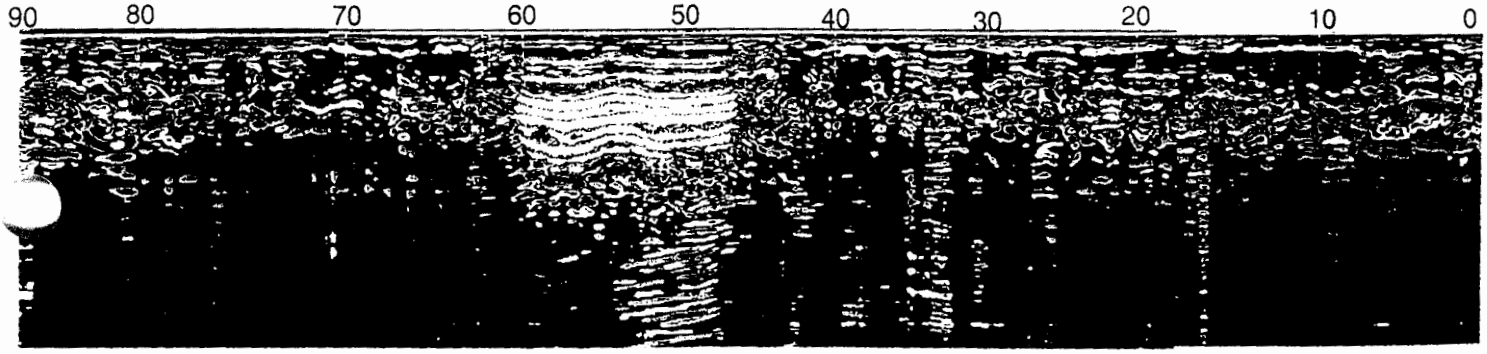
File 106, Line 40- Parallel to Fence



File 107, Line 50- Parallel to Fence



File 108, Line 60- Parallel to Fence



SWMU 18 GEOPHYSICAL REPORT

ARM Group Inc.

Earth Resource Engineers and Consultants

April 4, 2003

Mr. Brian Carling, P.G.
Senior Geologist
Montgomery Watson Harza
335 Phoenixville Pike
Malvern, PA 19355

Re: Preliminary Geophysical Survey Results
Honeywell Facility- SWMU 18
Claymont, Delaware
ARM Project 03123

Dear Mr. Carling:

ARM Group Inc. (ARM) is pleased to present to Montgomery Watson Harza (MWH) the results of the geophysical investigation performed at the Honeywell Facility located in Claymont, Delaware.

The primary objective of the geophysical survey was to locate and delineate the lateral extent of a solid waste management unit (SWMU). This preliminary report relates to SWMU 18, located at the northwestern portion of the property, adjacent to the site perimeter fence. Historical information available on this SWMU indicated that is was used for the disposal of pesticide related waste that was possible contained in glass carboys or steel drums. The geophysical techniques used during this investigation were the electromagnetic terrain conductivity meter (EM-31) and ground penetrating radar. A survey grid was established in the area where the SWMU was reported to be located and is approximately 100 feet by 70 feet.

The scope of work for this investigation included standard and/or routinely accepted practices of the geophysical industry. ARM has conducted this survey in accordance with the highest industry standards, yet inherent technique limitations, survey limitations or unforeseen site-specific conditions are part of the geophysical survey and its interpretation.

EM-31 Electromagnetic Induction Ground Conductivity Meter

Principles of EM-31

The EM-31 terrain conductivity is used extensively for environmental and geotechnical applications. It is commonly used in mapping certain types of shallow soil contamination (for

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example- conductive metals and inorganic contaminants), buried pipes, drums and pits and trenches containing buried debris. The EM-31 can be used for the location of potential sinkhole activity and other geotechnical applications.

The EM-31 is an electromagnetic system with a transmitter coil mounted on one end and a receiver coil at the other end of a 12-foot long plastic boom. An audio-frequency alternating current is applied to the transmitter coil, causing the coil to radiate an alternating primary EM field. As described by Faraday's law of induction, the time-varying magnetic field generates eddy currents in subsurface materials. According to Lenz's law these eddy currents have an associated secondary magnetic field with a magnitude and phase shift (relative to the primary field) that is dependent on the conductivity of the medium. The receiver coil measures the resultant effect of both primary and secondary fields. By comparing the signal at the receiver to that at the transmitter, the instrument records the components of the secondary field in-phase (in-phase data) and 90 degrees out of phase (quadrature/ conductivity data) with the primary field.

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The EM-31 has a maximum effective exploration depth of approximately 5.5 meters (18 feet) when operating in the vertical dipole mode (horizontal coils). In this mode, the maximum instrument response results from materials at a depth of about 1.5 the coil spacing (approximately (5.5 meters) 18 feet below the ground surface with the instrument at normal operating height of about 0.9 meters (3 feet)). In the horizontal mode (vertical coils), the EM-31 has an effective exploration depth of about nine feet and is most sensitive to materials immediately beneath the ground surface. The EM-31 data collected during this survey was collected in the vertical dipole mode.

Field Procedures

Before the EM-31 survey was conducted, a base station was set up on the northern section of the grid. There is extensive background interference of the EM-31 data due to the presence of the dumpster, railcars, the onsite railroad tracks and the high-voltage power lines that are parallel with the property line/fence. The EM-31 was calibrated for this site; however the background EM-31 readings are high (>40 mmhos/meter). The base station was occupied with the instrument boom always in the same orientation and at normal operating height, the in-phase component was set to zero, and the instrument phase was checked and adjusted as necessary. After the instrument was calibrated, a minimum of 20 readings of data was recorded in an automatic 1-second sampling mode and stored in the data logger.

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GROUND PENETRATING RADAR

Principles of GPR

GPR is an electromagnetic instrument that transmits and records radar (electromagnetic [EM]) pulses. GPR systems produce cross-sectional images of subsurface features by transmitting discrete radar pulses into the subsurface and recording the signal echoes or reflections from interfaces between materials with differing dielectric properties. To conduct a GPR survey, an antenna containing a transmitter and a receiver is slowly pulled along the ground surface. The transmitter radiates short pulses of high frequency EM energy into the ground. When the wave encounters the interface between two materials having different dielectric constants (dielectric permittivity), a portion of the energy is reflected back. The contrast in dielectric permittivity between the two media can be quantified by a reflection coefficient at the media interface. The magnitude of the reflection coefficient increases as the contrast in dielectric constant increases. The signal is transmitted to a control unit, displayed on a color monitor, and digitally recorded.

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The GPR survey at SWMU 18 was conducted using a 400-MHz antenna. This antenna is considered one of the most versatile and flexible antennas manufactured. The 400-MHz antenna will allow the collection of near surface and deeper data, and will resolve most sized features.

Generally, target depths shown on GPR records are estimates based on average two-way velocities of the GPR through that media and the dielectric constants of the material the survey is targeting. Unless a known target at a known depth is available within a survey area, the depth markers on a GPR record should be considered estimations. Depth markers were not placed on the GPR records provided with this report because there was not a reliable target in the subsurface to calibrate the GPR. However, using the generalized published average constants and the range of 80 nanoseconds, the GPR wave was most likely penetrating to a depth of 10 feet at this SWMU.

Field Procedures

The GPR survey was performed on the same traverses as the EM-31 survey. Along the ground surface, spray paint marks were placed at 10-foot intervals to serve as distance markers on the GPR records.

The GPR was calibrated for this site by placing the antenna in an area free of subsurface anomalies. The purpose of this test is to determine the optimum recording parameters for the GPR at this site. These parameters include the range (amount of time the instrument records after transmitting an EM pulse), scan rate (number of recorded traces or scans per second), transmitter pulse rate (frequency at which the EM pulses are transmitted), instrument gains, and filter settings. These settings are automatically stored in a header file with the digital GPR data.

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After removal of stagnant areas, the GPR files were converted and saved as bitmap images. The bitmap files were transferred into Surfer, a commercial software package. By using Surfer, distance markers and other annotations can be added to the records.

RESULTS AND INTERPRETATION

EM-31 Survey Data

It should be noted that there are areas on the EM-31 terrain conductivity map indicating anomalies with negative terrain conductivity values. Theoretically, negative conductivities do not exist. However, the negative numbers actually represent extremely conductive materials or overhead interference in data collection. Since the EM-31 operates at low induction numbers extremely conductive materials (such as ferrous metal) cause the system to lose coupling. Measured (approximated) terrain conductivity values and true conductivity values are approximately equal for the range between zero and 1,000 mS/m. When real conductivities exceed that range the measured or approximated values become negative due to saturation and loss of coupling of the system.

Figure 1 shows the EM-31 quadrature and inphase data collected in the SWMU 18 area of the property. The quadrature (conductivity) data shows the area has high background conductivity values; however there are two areas that may be the location of the SWMU. Plant personnel later identified one of the anomalous areas as possibly the former location of a secondary railroad track. This location was placed on Figure 1 as a dashed line. An oval has been placed around the other anomaly. The source of this anomaly is unknown at this time and is interpreted to possibly be the location of the SWMU. This anomaly is present on GPR records collected in this area.

The inphase data provided on Figure 1, also shows the presence of a third anomaly located southeast of the anomaly interpreted to be the SWMU. The source of this anomaly is unknown; it is not visible on the quadrature data.

GPR Survey Data

In this SWMU of the property, GPR traverses were performed on the same traverses as the EM-31 as well as some additional traverses in the area of the suspected SWMU location in order to better define the lateral extent of the anomaly. During the collection of the GPR traverses, an anomaly with pipe like characteristics was detected approximately 15 feet in from the perimeter fence; this anomaly has been marked as a gas line. Figures 2 and 3 provide some selected GPR traverses

depicting the anomaly interpreted to be the SWMU. Figure 4 provides the location of the selected GPR traverses referenced to the EM-31 survey grid.

On Figure 2, File 92, there appears to be a sloping interface in the subsurface. This feature could represent the side of the trench that forms SWMU 18. The ovals on Figures 2 and 3 are placed on there as a reference they are not meant to imply the exact size of the anomaly. According to the GPR traverses, this anomaly extends from approximately 70 to 110 feet inline distance (from north to south) and from 0 (baseline) to 25 feet inline distance (west to east).

The location of this anomaly was marked in the field with spray paint. The size of the marked area, in the field, is larger than the area referred to in the previous paragraph. The size was over estimated in the field because of the future excavation work that is planned for the area.

SUMMARY

In conclusion, two significant anomalies were detected in this area. One of these anomalies is believed to be the ballast material leftover from the previous set of railroad tracks. The second anomaly is located on the northwest side of the survey grid and the source of this anomaly is unknown at this time.

The background EM-31 data readings are high in this survey area. These elevated background readings are the result of the surface culture interferences such as the overhead power lines, the rail cars and tracks, and the dumpster. Below the ground surface, the presence of the ballast material from the old railroad tracks is also causing significant interference with the EM-31 data. These interferences may have masked the presence of other anomalies that did not register high enough on the EM-31 to be detected over the background noise. In addition, the anomaly interpreted to be the possible SWMU is relatively close to the ballast material; therefore the interpolated lateral extent of the SWMU is approximate.

ARM appreciates the opportunity to provide geophysical services to Montgomery Watson Harza. If you should have any questions please do not hesitate to contact us.

Respectfully Submitted,

Beth A. Williams

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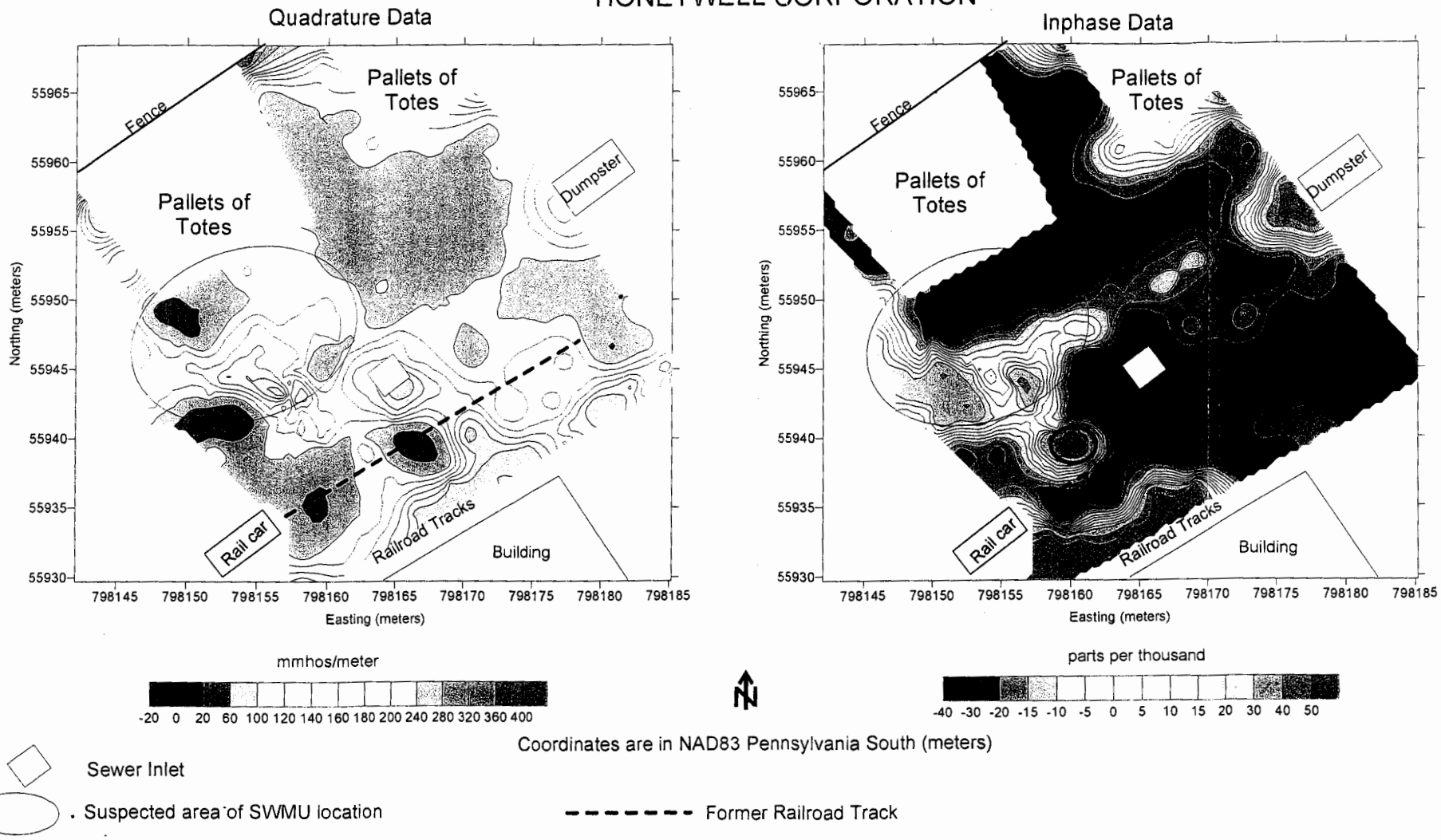
Senior Geophysicist

Attachments

FIGURE 1

EM-31 DATA
SWMU 18
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION



Coordinates are in NAD83 Pennsylvania South (meters)

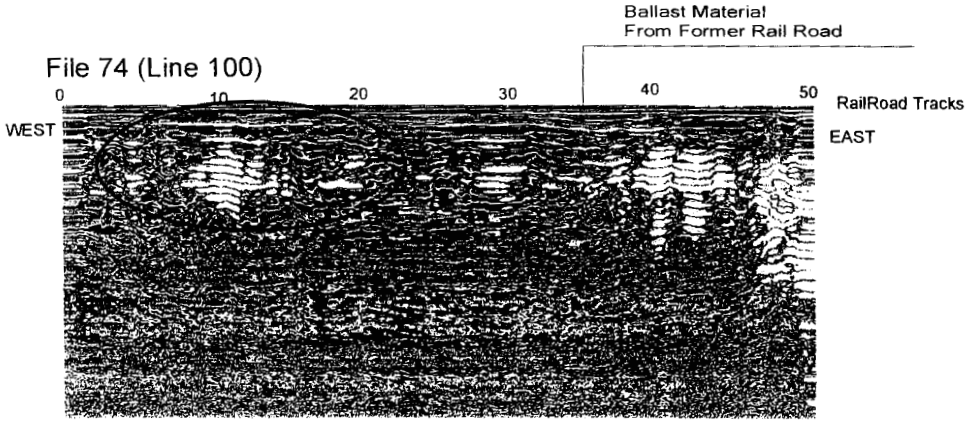
Sewer Inlet

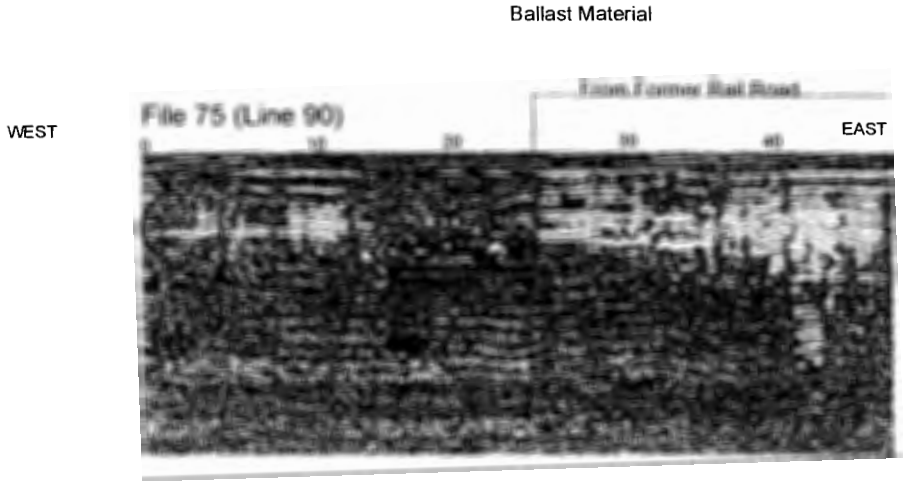
Suspected area of SWMU location

Former Railroad Track

FIGURE 2

SELECTED GPR TRAVERSES
SWMU 18
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION





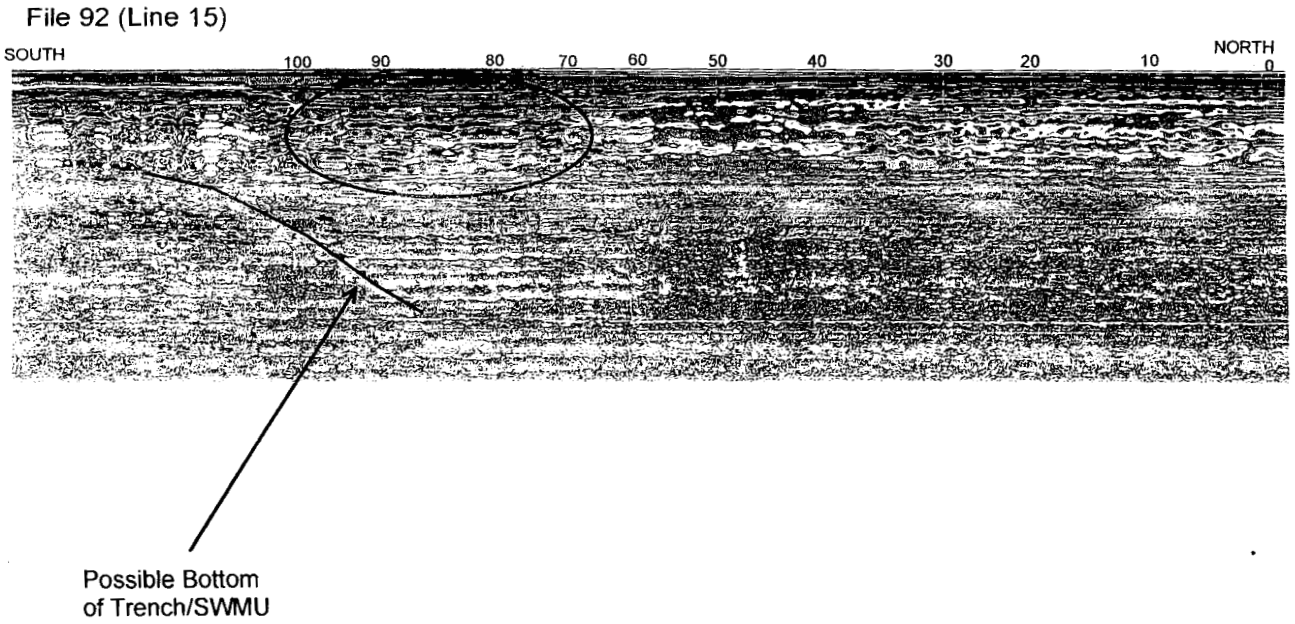
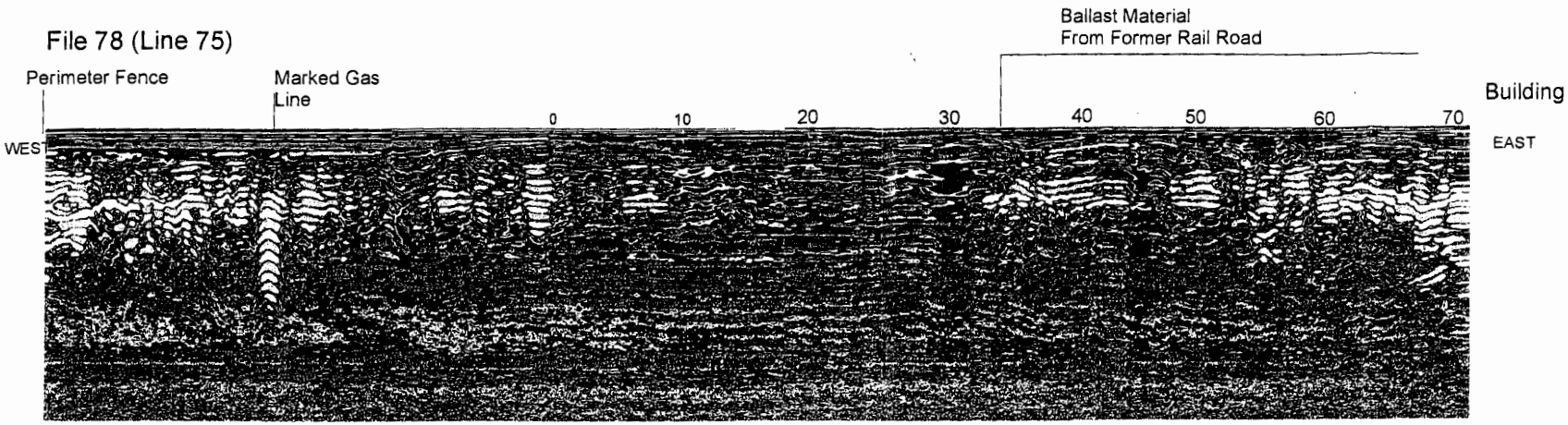
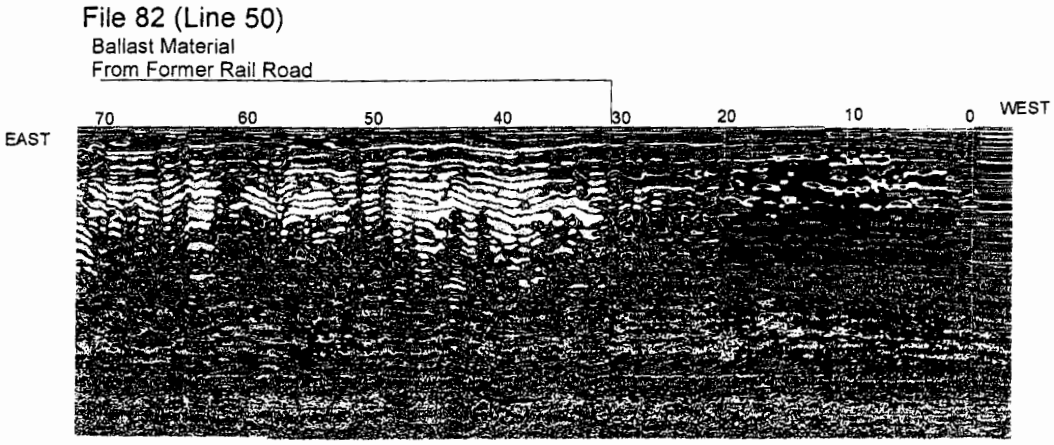


FIGURE 3
SELECTED GPR TRAVERSES
SWMU 18
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION





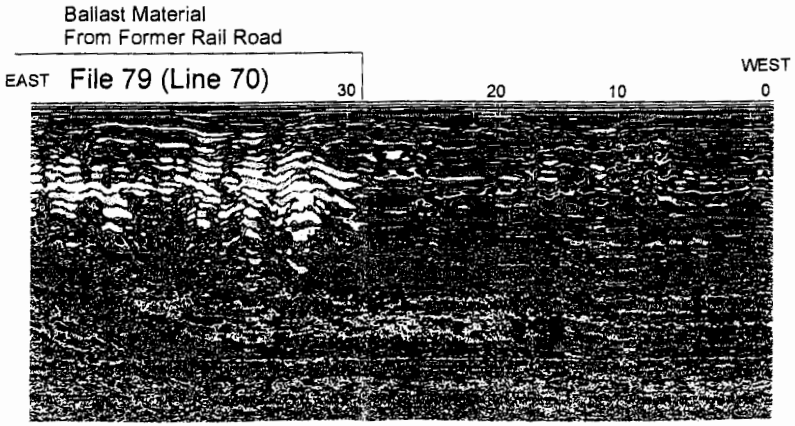
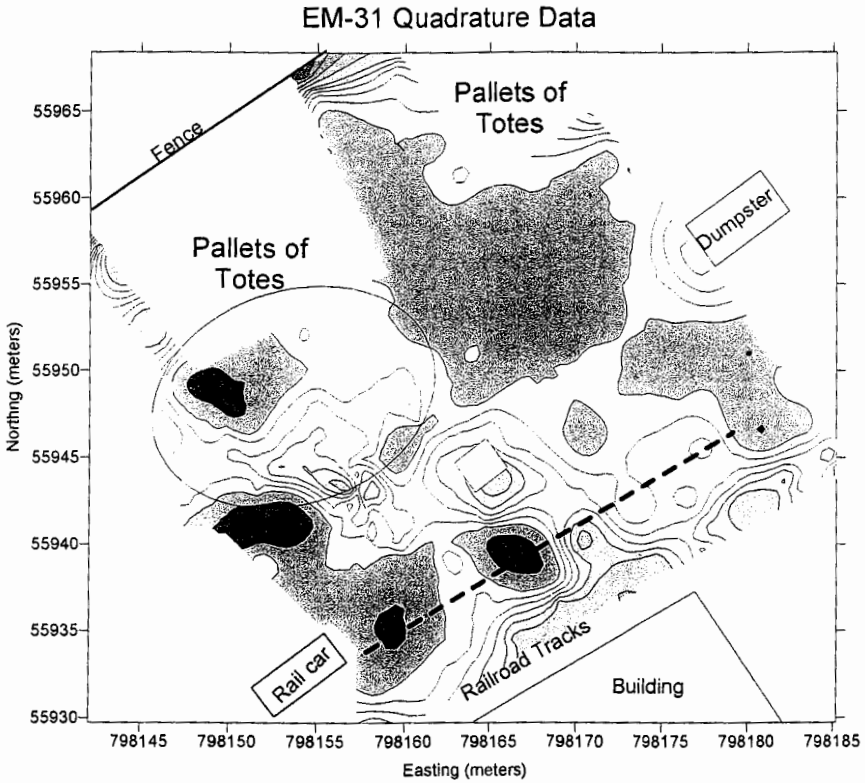
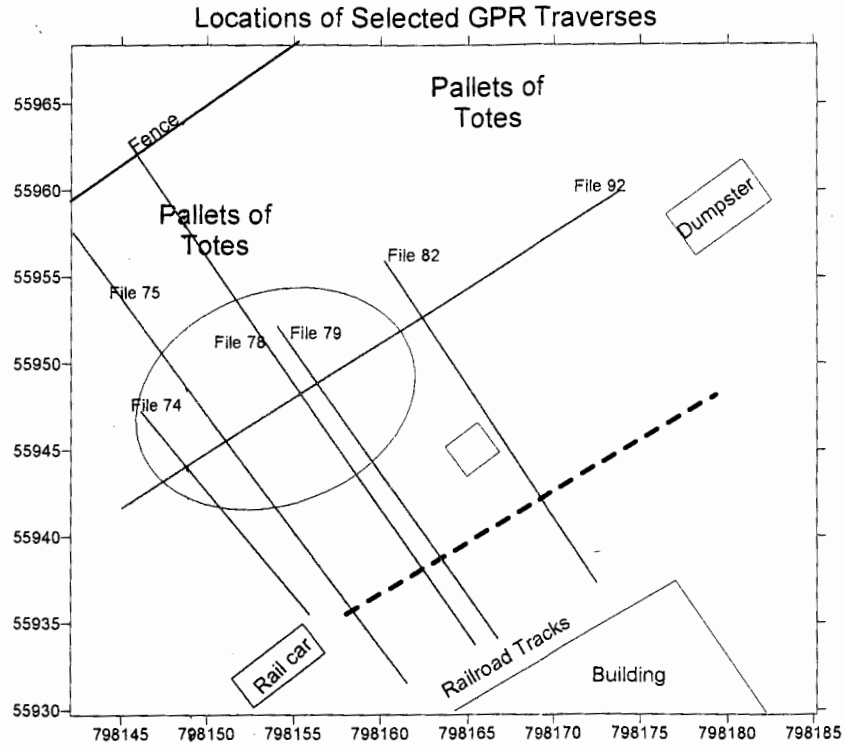
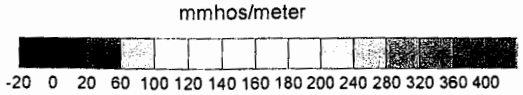


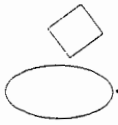
FIGURE 4
LOCATION OF SELECTED GPR TRAVERSES
SWMU 18
MONTGOMERY WATSON HARZA
HONEYWELL CORPORATION







Coordinates are in NAD83 Pennsylvania South (meters)



Sewer Inlet

Suspected area of SWMU location

Former Railroad Track

File 92 — Selected GPR Traverse Location with File Number