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NSA MID SOUTH
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STATEMENT OF BASIS SOLID WASTE MANAGEMENT UNIT 2 SOUTHSIDE LANDFILL MILLINGTON SUPPACT TN

Statement of Basis
Solid Waste Management Unit 2
Southside Landfill
Naval Support Activity Mid-South
Millington, Tennessee

INTRODUCTION

This Statement of Basis contains a summary of the location, operating history, contaminants detected, and remedy selected for Solid Waste Management Unit (SWMU) 2, Southside Landfill, Naval Support Activity Mid-South (NSA), Millington, Tennessee. It should be noted that all analytical data for soils was compared to EPA Region III Risk Based-Screening Criteria (RBCs). Groundwater analytical data was compared to Federal Drinking Water Standards Maximum Contaminant Levels (MCLs). When no groundwater MCL was available for a constituent, the tap water RBC's were used for comparison.

SPECIFIC SITE INFORMATION

SWMU 2 is the closed landfill on the Southside of NSA Mid-South (Figure 1). It reportedly received residential and industrial waste from base operations between 1942 and 1970. Some wastes, including solvent-contaminated materials were burned at the dumpsite. Today, the landfill is within a 42-acre fenced area that is covered with a combination of mature hardwoods and pines and heavy undergrowth. The site is bordered to the south by the Big Creek Drainage Canal — the discharge body for groundwater migrating beneath the landfill and surface runoff over the landfill. As a result of the waste disposal associated with the site and the absence of a landfill liner, the site was designated a SWMU that required further investigation.

SWMU 2 is part of the remaining NSA Mid-South property. The Southside landfill was initially evaluated in 1985 as part of a Confirmation Study, Verification Phase Report (CS/VP; Geraghty & Miller, 1985) during which trace levels of volatile organic compounds (VOCs) and metals were detected in groundwater beneath the landfill. In 1990 the RCRA Facility Assessment Report (RFA; ERC/EDGe, 1990) recommended the site be further evaluated given the past disposal associated with the site and the limited data set.

SUMMARY OF CONTAMINANT EVALUATION

Soil sample locations from the RCRA Facility Investigation (RFI) are provided in Figure 2 and groundwater sample locations are provided in Figures 3a and 3b. Sediment and surface water sample locations are provided in Figure 4. A summary of the number of samples collected from each media is provided below with a summary of the detected chemicals exceeding relevant screening criteria.

Soil and Sediments

Soil data was taken from multiple RFI phases and at the conclusion of the investigation, 70 soil samples were collected (19 surface and 51 subsurface) from 39 different locations (Figure 2).The following soil data is exclusively from surface soil locations (less than 2 feet). There were no landfill-related constituents detected in subsurface soils (below 2 feet). Sediments were sampled at six locations in the Big Creek Drainage Canal. There were no landfill-related constituents detected in the sediments. The constituents listed below by sampling location are polycyclic aromatic hydrocarbons (PAHs). Most PAHs have a low water solubility and tend to cling to soil particles. They are called semi-volatiles because of their limited volatility; that is, they are not very prone to evaporate at normal temperatures. Thus, these compounds, which are made up of large aromatic rings, do not readily migrate from the soil to the groundwater or the air.

Location 002S007 contained the following contaminants: benzo(a)anthracene at 32,000 micrograms per kilograms (ug/kg) which is above the EPA Region 3 Residential Risk Based Concentration (RBC-Res) of 870 ug/kg and above the EPA Region 3 Industrial Risk Based Concentration (RBC-Ind) of 7,800 ug/kg, benzo(a)pyrene at 63,000 ug/kg which is above the RBC-Res of 87 ug/kg and the RBC-Ind of 780 ug/kg, benzo(b)fluoranthene at 60,000 ug/kg which is above the RBC-Res of 880 ug/kg and the RBC-Ind of 7,800 ug/kg, benzo(k)fluoranthene was detected at 41,000 ug/kg which is above the RBC-Res of 870 ug/kg and the RBC-Ind of 7,800 ug/kg, dibenz(a,h)anthracene was detected at 12,000 ug/kg which is above the RBC-Res of 87 ug/kg, the RBC-Ind of 780 ug/kg, and Inden(1,2,3-cd)pyrene at 28,000 ug/kg which is above the RBC-Res of 870 ug/kg and the RBC-Ind of 7,800 ug/kg.

Location 002S07UA contained the following constituents: benzo(a)anthracene at 5,900 ug/kg which is above the RBC-Res of 870 ug/kg but below the RBC-Ind of 7,800 ug/kg, benzo(a)-pyrene at 5,300 ug/kg which is above the RBC-Res of 87 ug/kg and the RBC-Ind of 780 ug/kg, benzo(b)fluoranthene at 5,000 ug/kg which is above the RBC-Res of 870 ug/kg and below the RBC-Ind of 7,800 ug/kg, dibenz(a,h)anthracene was detected at 1,600 ug/kg which is above the RBC-Res of 87 ug/kg and the RBC-Ind of 780 ug/kg, heptachlor epoxide at 140 ug/kg which is above the RBC-Res of 70 ug/kg and the RBC-Ind of 630 ug/kg, aroclor-1254 at 2,700 ug/kg which is above the RBC-Ind of 320 ug/kg but below the RBC-Ind of 2,900 ug/kg, aroclor-1260 at 2,400 ug/kg which is above the RBC-Res of 320 ug/kg but below the RBC-Ind of 2,900 ug/kg.

Location 002S11UA contained the following constituents: benzo(a)anthracene at 2,800 ug/kg which is above the RBC-Res of 870 ug/kg but below the RBC-Ind of 7,800 ug/kg, benzo(a)-pyrene at 3,600 ug/kg which is above the RBC-Res of 87 ug/kg and the RBC-Ind of 780 ug/kg, benzo(b)fluoranthene at 3,800 ug/kg which is above the RBC-Res of 870 ug/kg and below the RBC-Ind of 7,800 ug/kg, dibenz(a,h)anthracene was detected at 850 ug/kg which is above the RBC-Res of 87 ug/kg and the RBC-Ind of 780 ug/kg, Inden(1,2,3-cd)pyrene at 2,200 ug/kg which is above the RBC-Res of 870 ug/kg and the RBC-Ind of 7,800 ug/kg.

Location 002S0010 contained the following constituents: benzo(a)pyrene at 850 ug/kg which is above the RBC-Res of 87 ug/kg and the RBC-Ind of 780 ug/kg, benzo(b)fluoranthene at 1,000 ug/kg which is above the RBC-Res of 870 ug/kg and below the RBC-Ind of 7,800 ug/kg, dibenz(a,h)anthracene was detected at 140 ug/kg which is above the RBC-Res of 87 ug/kg but below the RBC-Ind of 780 ug/kg, and aroclor-1254 at 400 ug/kg which is above the RBC-Ind of 320 ug/kg but below the RBC-Ind of 2,900 ug/kg.

Location 002S0011 contained the following constituents: benzo(a)anthracene at 1,300 ug/kg which is above the RBC-Res of 870 ug/kg but below the RBC-Ind of 7,800 ug/kg, benzo(a)pyrene at 1,200 ug/kg which is above the RBC-Res of 87 ug/kg and the RBC-Ind of 780 ug/kg, benzo(b)fluoranthene at 1,400 ug/kg which is above the RBC-Res of 870 ug/kg and below the RBC-Ind of 7,800 ug/kg, dibenz(a,h)anthracene was detected at 210 ug/kg which is above the RBC-Res of 87 ug/kg but below the RBC-Ind of 780 ug/kg.

Location 002S09UA contained the following constituents: benzo(a)pyrene at 140 ug/kg which is above the RBC-Res of 87 ug/kg but below the RBC-Ind of 780 ug/kg, and dibenz(a,h)anthracene was detected at 210 ug/kg which is above the RBC-Res of 87 ug/kg but below the RBC-Ind of 780 ug/kg.

Location 002S06UA contained benzo(a)pyrene at 140 ug/kg which is above the RBC-Res of 87 but below the RBC-Ind of 780 ug/kg.

Groundwater

Fluvial deposits/deep alluvium groundwater is contaminated with chlorinated solvents at SWMU 2. Fourteen groundwater monitoring wells were used to define groundwater contamination in the deep alluvial groundwater at SWMU 2. Only chlorinated volatiles (solvents) were noted in groundwater. There were no PAH's detected in groundwater at SWMU 2. Table 1 lists the VOC detections at SWMU 2, by groundwater sampling location and date.

Based on the potential of contaminated groundwater entering the Big Creek Drainage Canal, alternate protective standards were developed for groundwater monitoring purposes. In order to develop Protective Standards for the water table aquifer, mass flux within the aquifer and dilution and attenuation within Big Creek were calculated. Based on these fluxes, a resultant concentration in Big Creek was calculated and compared to target criteria. Estimated concentrations of constituents of concern in Big Creek are below the water criteria for discharges from the water table aquifer. Based on these results, protective standards were developed for the site based on the site-specific dilution and attenuation factors calculated in the flux calculations.

As contaminants migrate with groundwater and discharge into Big Creek, they undergo dilution from mixing with surface water. The amount of dilution is proportional to the ratio of groundwater to surface water, which is the dilution factor; therefore, the alternate protection standard (labeled ACL in the attached tables) is the MACL divided by the dilution factor.

To estimate flow in Big Creek, a 3 day, 20-year low flow (3Q20) for Big Creek was used, which is a more conservative estimate than the 7 day, 10-year (7Q10) low flow recommended by the TDEC Division of Water Pollution Control (de-minimis flow as defined in Chapter 1200-4-3-0.04). Flow data were provided by the U.S. Geological Survey (USGS) Tennessee Water Science Center. Mr. George Law with the USGS performed a regression analysis of low-flows and flow durations at Big Creek Drainage Canal near SWMU 2. Mr. Law used the TDEC v2.0.3 low-flow and flow-duration computer program to estimate the stream flow near SWMU 2, which is based on data obtained from three flow stations located along Big Creek near SWMU 2. Based on Mr. Law's computer model and his interpolation from the 7Q10 values, the 3Q20 for Big Creek near SWMU 2 is estimated to be 1.0 cubic foot per second (CFS).

To account for the groundwater flow and potential contaminant discharge into Big Creek, the groundwater flux, or flow through a unit area over time, is estimated along the base of the drainage canal, coincident with an area 175 feet in length and 15 feet wide. The length is based on a transect of the TCE plume, parallel to Big Creek and measuring 175 feet between the 100 ppb contours (shown on Figure 5). The width is based on the assumption that groundwater from the north side of Big Creek discharges along the north ½ of the canal base (with groundwater from the south side of Big Creek discharging along the south ½ of the canal). The hydrogeologic cross-section (Figure 5) illustrates the groundwater discharge to Big Creek. Using a mean groundwater velocity of 0.15 feet per day an estimated volume of 0.004 CFS (or 397 cubic feet per day) of groundwater discharges into Big Creek from the area impacted by TCE.

Table 2 shows the maximum allowable concentration limits (MACLs) for the solvent constituents in the groundwater. These risk-based concentrations for the various receptors were used to find the lowest acceptable concentration for Big Creek. Table 3 shows the calculated and proposed alternate protection standards for the chlorinated solvents detected in groundwater. The allowable contaminant concentrations at the point of discharge to Big Creek, and thus that at the POC, were back-calculated by dividing the MACL by the above calculated dilution factor. As shown in the table, alternate concentrations are well above the maximum detections at SWMU 2 POC wells. As an added level of safety, 1/10th of the proposed alternate protection standard will be used for future POC monitoring. As shown in the table, detected concentrations remain below the 1/10th of the alternate protection standards.

Monitoring wells 002G24DA, 002G25DA, and 002G26DA will serve as the Point of Compliance (POC) with respect to protection of surface water conditions. In addition to these wells, VOC groundwater monitoring will include 002G02DA, 002G03DA, and 002G28DA to evaluate long-term trends for Constituents of Concern (COCs) adjacent to the landfill. Water level data will be collected from the above wells in addition to 002G01DA, 002G05DA, 002G27DA, 002GGM02DA, and 002GGM02DA. Data will be used to construct a site-wide potentiometric map for each sampling event.

Surface Water

Surface water samples were collected from 7 locations (Figure 4) in Big Creek Drainage Canal to determine whether its water quality was affected by the landfill. There were no landfill related constituents detected in the surface water.

SELECTED REMEDY

The following institutional controls and monitoring will be implemented at the site as a final remedy:

1. Maintain the existing landfill cover of the landfill;
2. Maintain security fencing, gates, and signage around the landfill;
3. Monitor Groundwater and compare results to alternate protection standards;
4. Inspect the landfill cover;
5. Inspect security fence, gates, signage, and groundwater monitoring wells;
6. Sample the Big Creek Drainage Canal upstream and downstream of the landfill.
7. Report groundwater monitoring results and compliance with alternate protection standards.

REFERENCES

Ensafe/Spectra Tech, (2010, January 26). *Alternate Concentration Limits Technical Memorandum SWMU 2 – Southside Landfill*, Memphis Tennessee.

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EnSafe Inc. (2000, October 6). *RCRA Facility Investigation Report; Assembly E — SWMUs 2, 9, 14, 38, 59, and 65. NSA Mid-South, Millington, Tennessee.* Revision 2. Memphis, Tennessee.

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ERC/EDGe. (1990, September). *RCRA Facility Assessment (RFA), NAS Memphis.* Nashville, Tennessee.

Geraghty & Miller. (1985). *NACIP Confirmation Study, Verification Phase, NAS Memphis.* Tampa, Florida.

U.S. Environmental Protection Agency. (1996, October). *Drinking Water Regulations and Health Advisories*. USEPA Office of Water: Washington, D.C.

U.S. Environmental Protection Agency (2000, April). *Risk-Based Concentration Table* Region 3.

FIGURES FOR SWMU 2

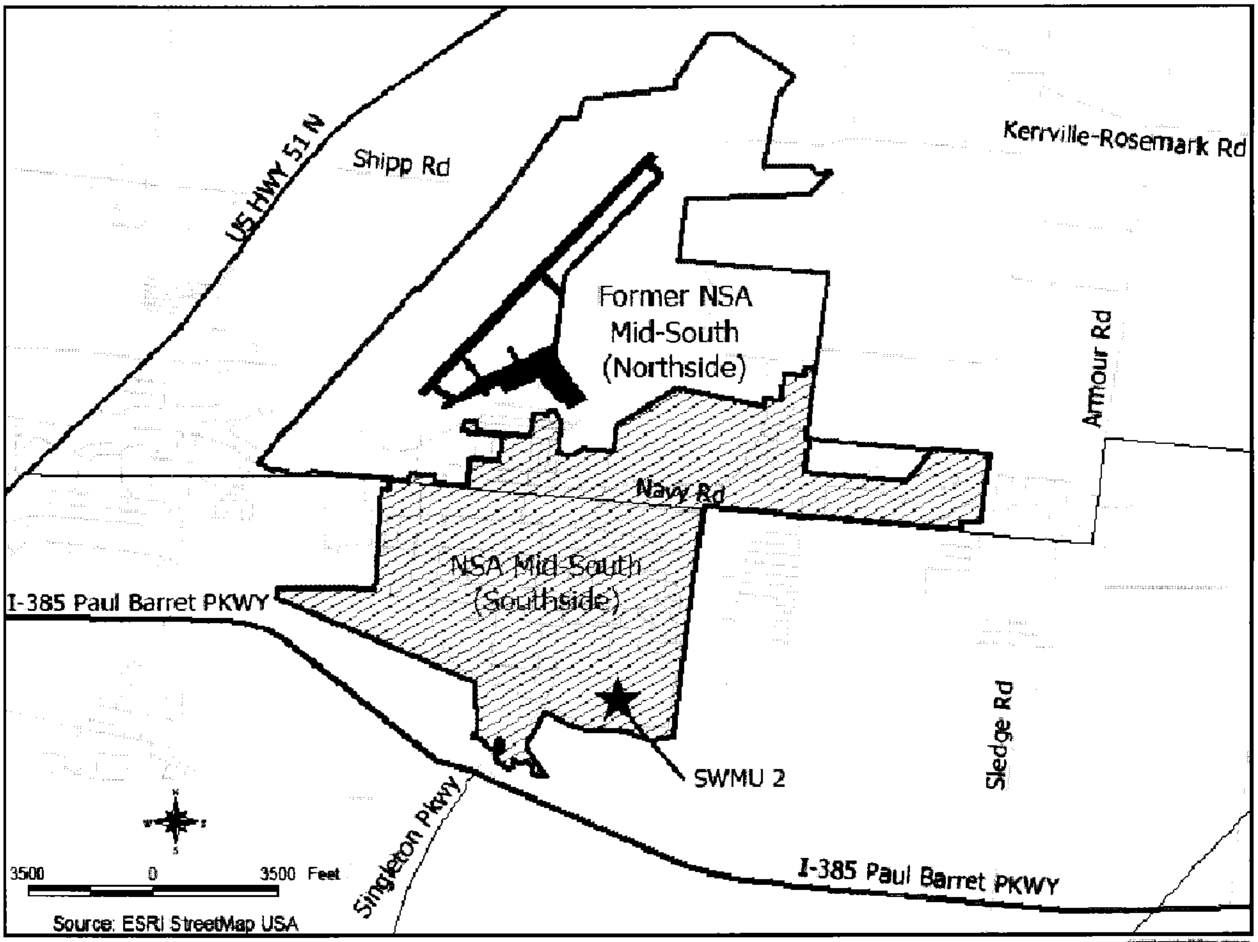


Figure 1: SWMU 2 Location at NSA Mid-South, Millington, Tennessee
Southside Landfill

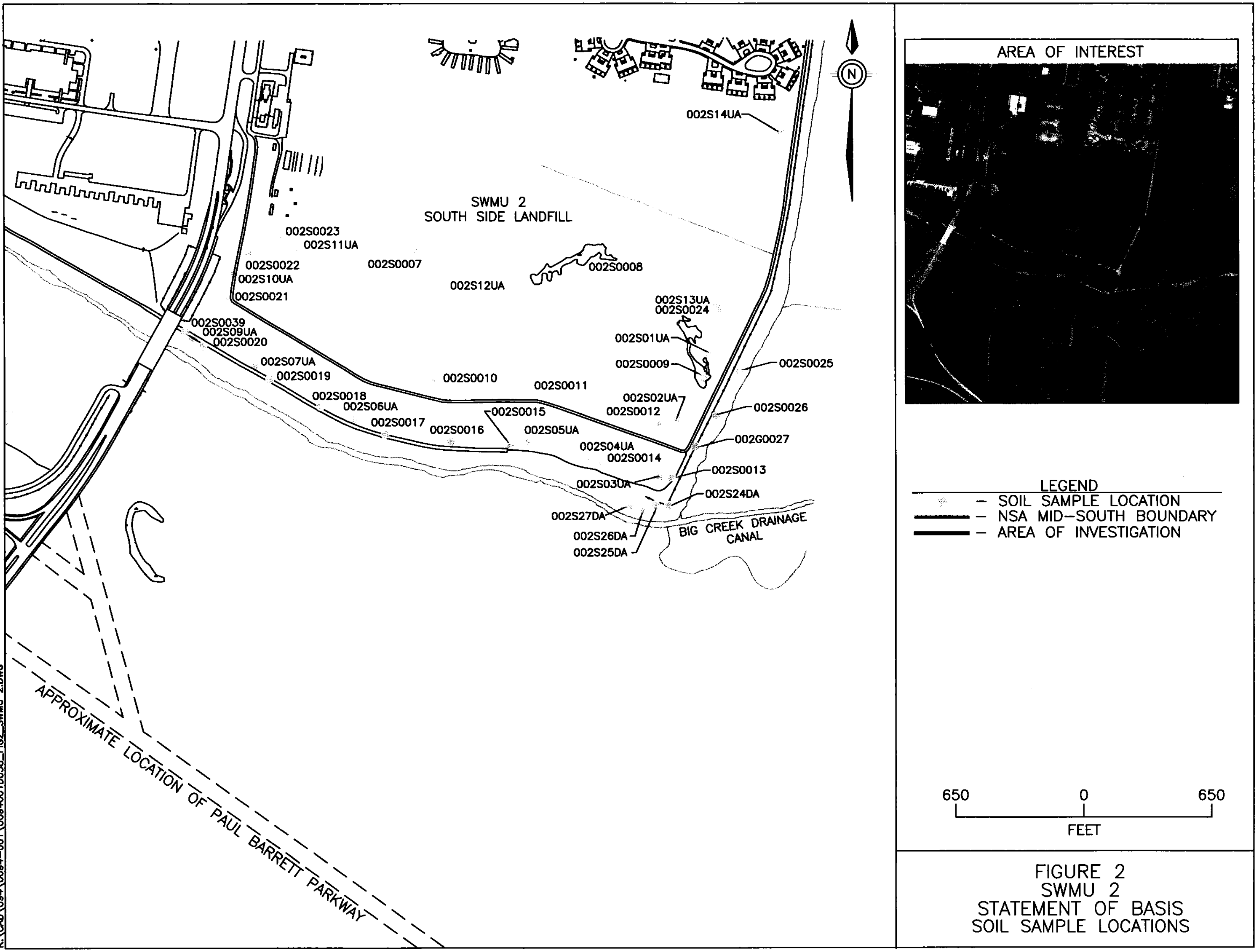


FIGURE 2
SWMU 2
STATEMENT OF BASIS
SOIL SAMPLE LOCATIONS

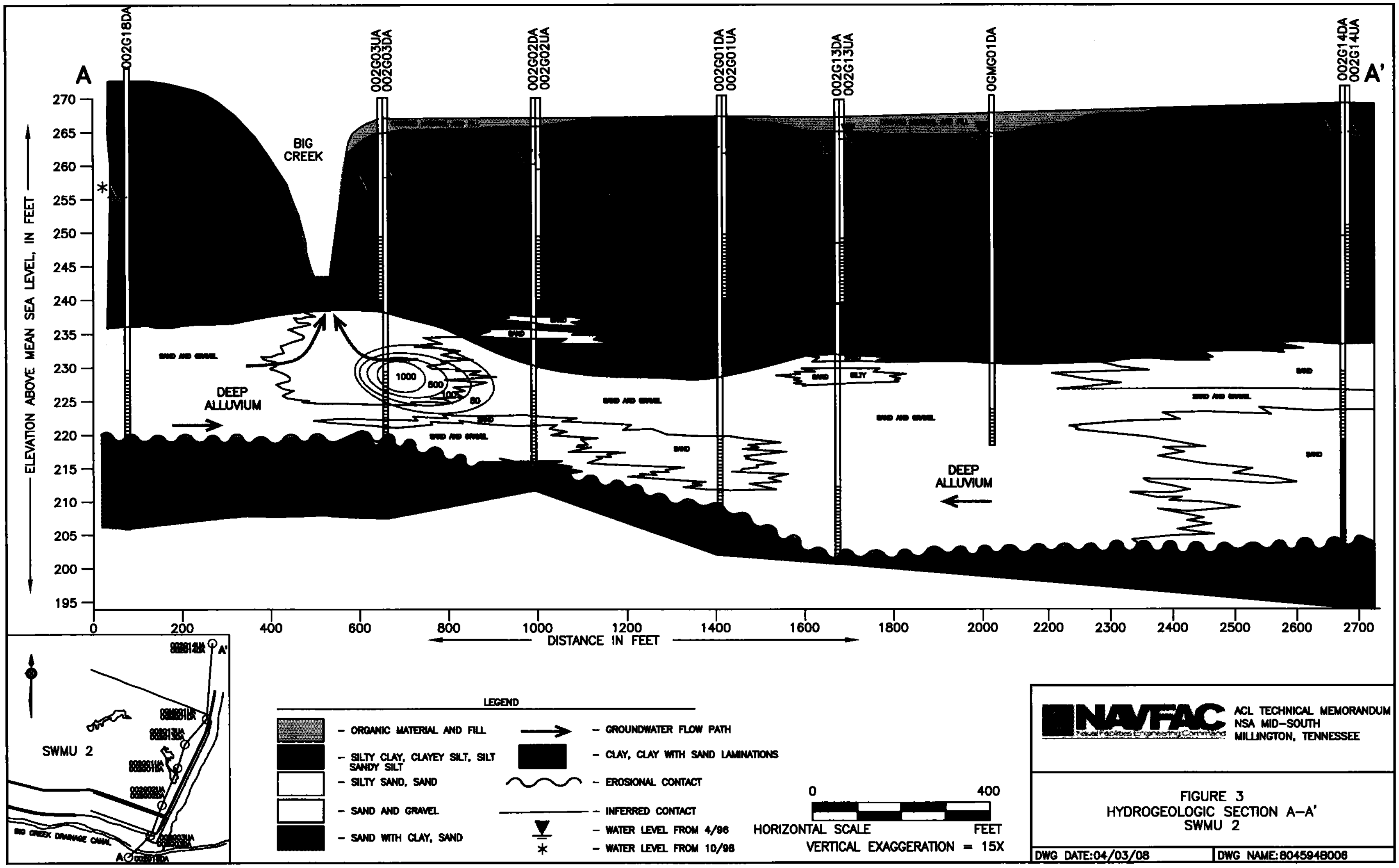
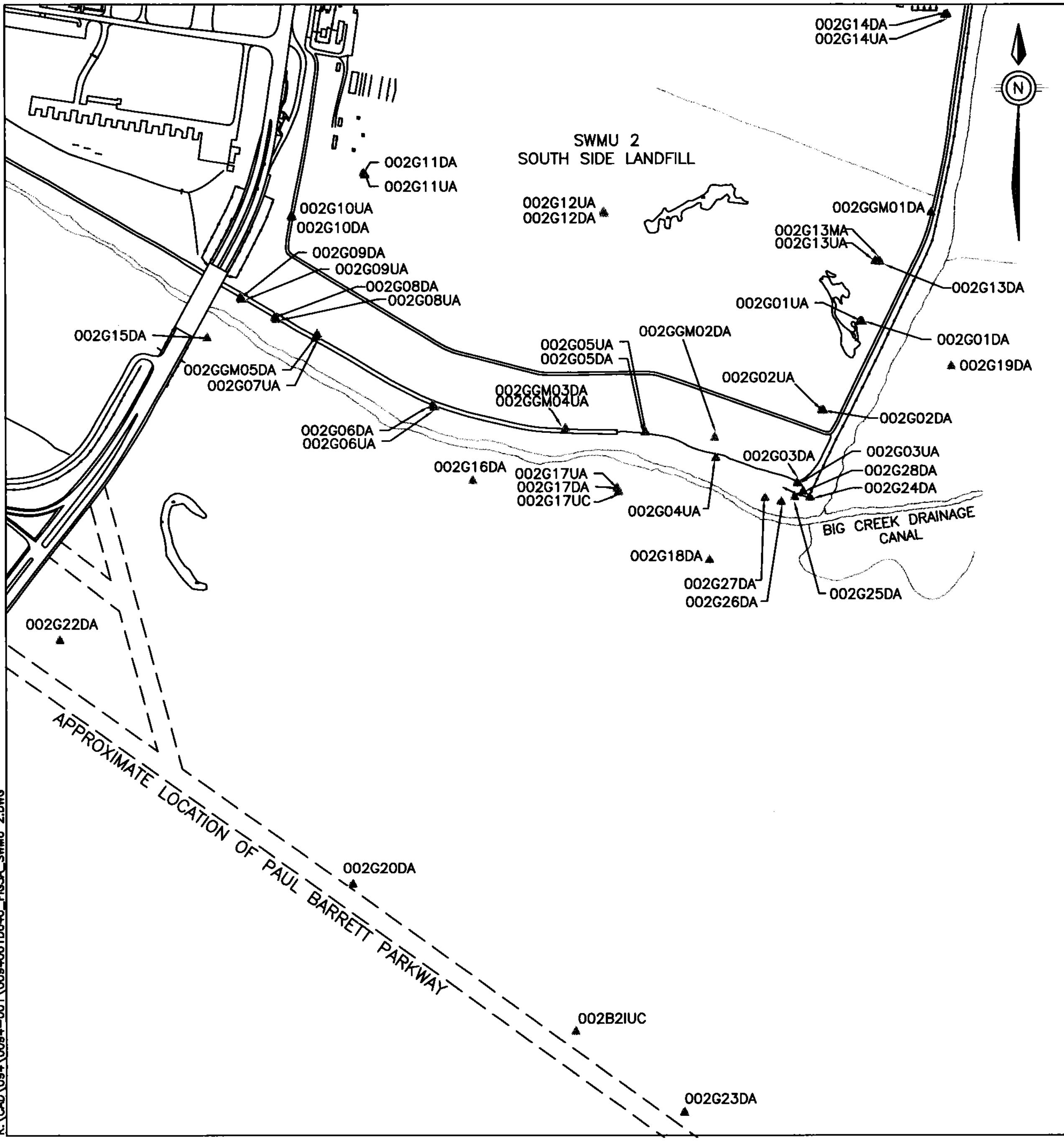
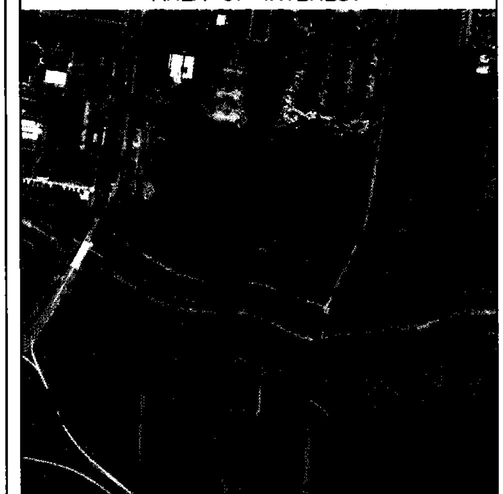


FIGURE 3
HYDROGEOLOGIC SECTION A–A'
SWMU 2



AREA OF INTEREST



LEGEND

▲ – GROUNDWATER SAMPLE LOCATION
— NSA MID–SOUTH BOUNDARY
— AREA OF INVESTIGATION

650 0 650
FEET

FIGURE 3A
SWMU 2
STATEMENT OF BASIS
GROUNDWATER SAMPLE LOCATIONS
(WELLS)

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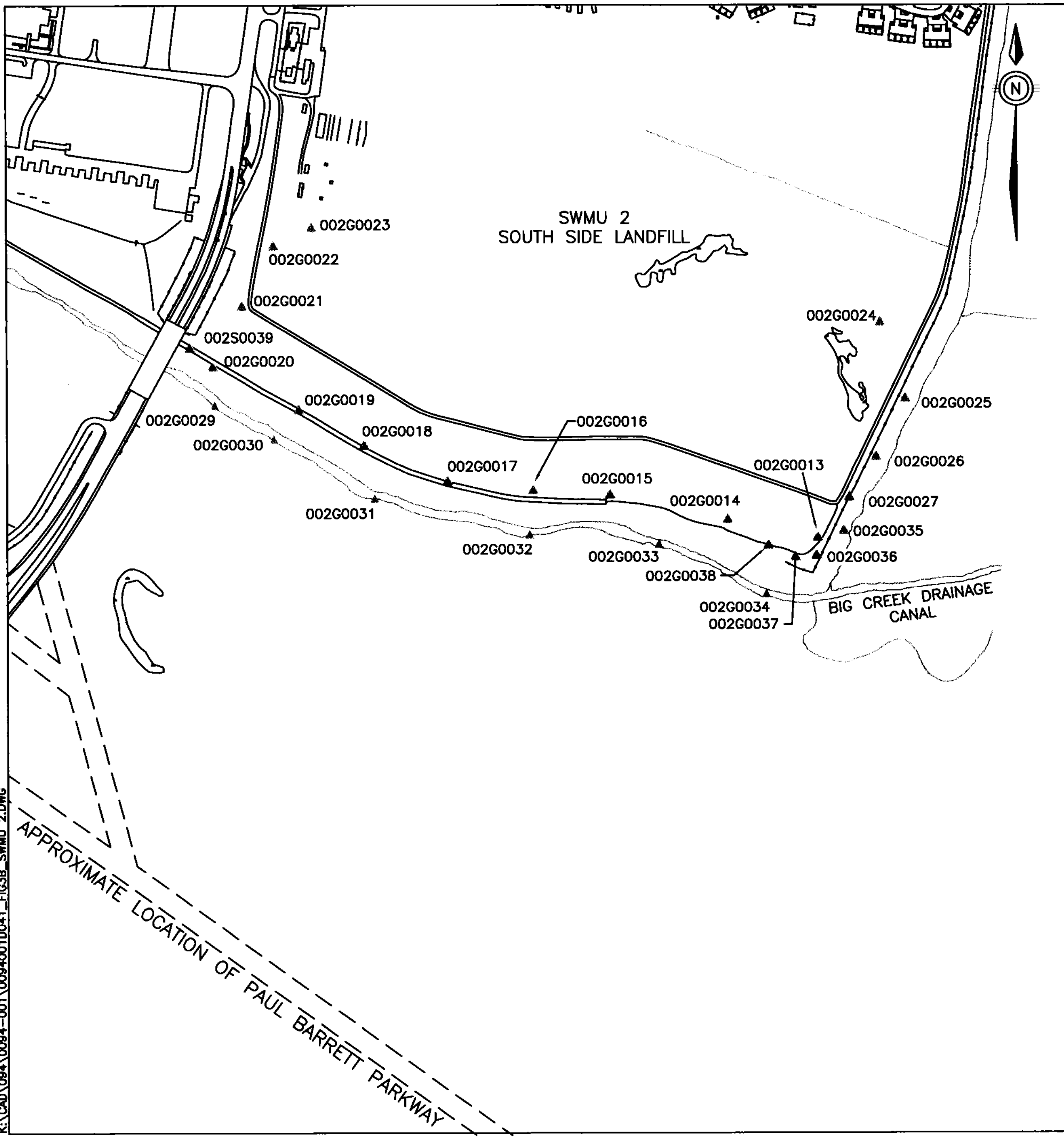
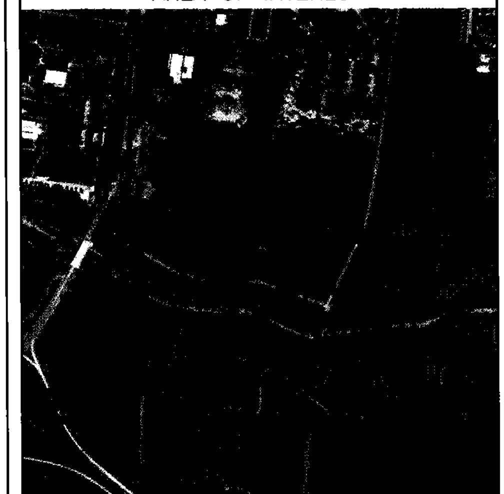


AREA OF INTEREST



LEGEND

▲ – GROUNDWATER SAMPLE LOCATION
— NSA MID-SOUTH BOUNDARY
— AREA OF INVESTIGATION

600 0 600
FEET

FIGURE 3B
SWMU 2
STATEMENT OF BASIS
GROUNDWATER SAMPLE LOCATIONS
(DIRECT PUSH SAMPLES)

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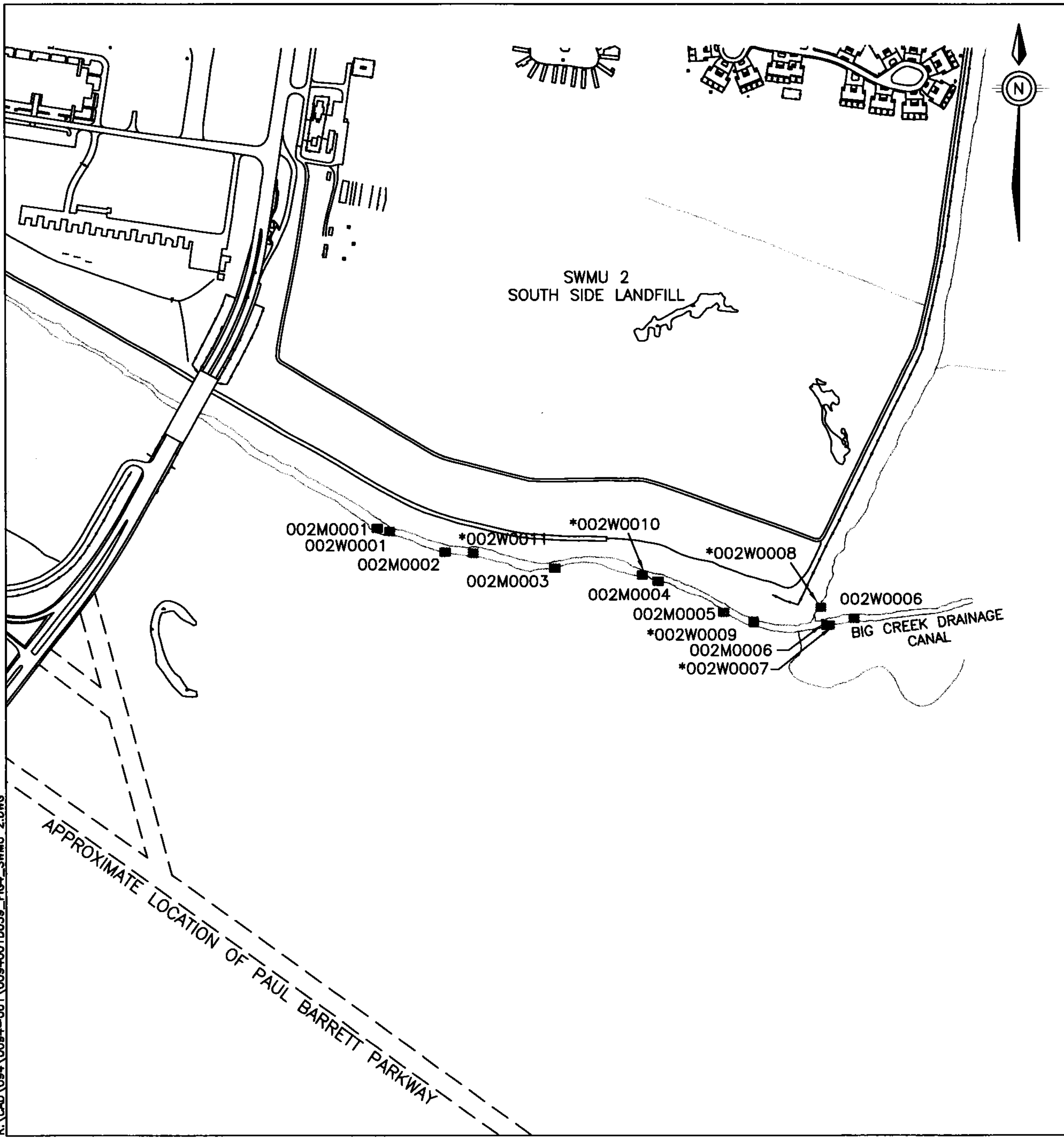
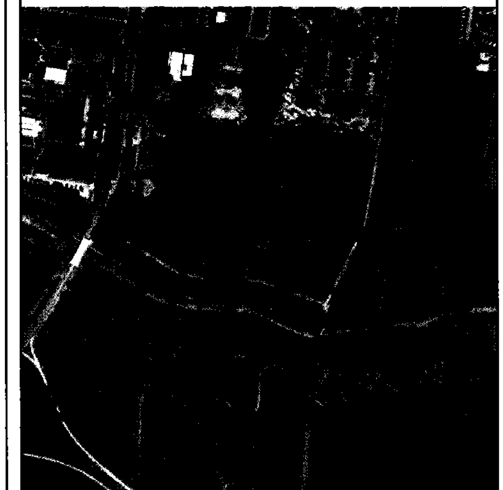
K:\CAD\094\0094-001\0094001D041_FIG3B_SWMU 2.DWG



AREA OF INTEREST



LEGEND

002M0001 ■ – SEDIMENT SAMPLE LOCATION
002W0001 ■ – SURFACE–WATER SAMPLE LOCATION
– NSA MID–SOUTH BOUNDARY
– AREA OF INVESTIGATION

*DENOTES SAMPLE COLLECTED WITH DIFFUSION SAMPLER

650 0 650
FEET

FIGURE 4
SWMU 2
STATEMENT OF BASIS
SEDIMENT AND SURFACE WATER
SAMPLE LOCATIONS

K:\CAD\094\0094-001\79_NSA_REQUEST_SID
K:\CAD\094\0094-001\0094001D039_FIG4_SWMU_2.DWG

Table 1
VOC Detections
SWMU-2 NSA-Midsouth

Monitoring Well	Constituent	Concentration (µg/L)								
		Jul-01	Jan-02	Jul-02	Sep-05	May-06	May-07	Nov-07	May-08	Nov-08
002G01DA	TCE	ND	ND	ND	NS	NS	NS	NS	NS	NS
	cis-1,2-DCE	ND	ND	ND	NS	NS	NS	NS	NS	NS
	trans-1,2DCE	ND	ND	ND	NS	NS	NS	NS	NS	NS
	VC	ND	ND	ND	NS	NS	NS	NS	NS	NS
002G02DA	TCE	7	2	11	130	50	13	21	67	38
	cis-1,2-DCE	5	2	10	250	80	17	32	120 J	240
	trans-1,2-DCE	ND	ND	2	47	ND	4	6	24	48
	VC	ND	ND	0.5 J	38	8	2 J	3	13	25
002G03DA	TCE	520	280	590	1,500	1,800	2,100	1,800	1,500 J	1,100
	1,1-DCE	ND	5	ND	3	4	5	4	6	4
	cis-1,2-DCE	800	550	830	2,200	2,300	2,500	2,300	2,800 J	2,200
	trans-1,2-DCE	190	ND	ND	580	650	680	630	690	590
	VC	ND	26	22	94	72	110	110	120	82
	1,1,2-TCA	5 J	2 J	2	ND	ND	ND	ND	ND	ND
	Xylenes	ND	ND	ND	0.6 J	ND	ND	ND	ND	ND
	Benzene	ND	ND	ND	0.8 J	ND	ND	ND	ND	ND
002G24DA	TCE	140	110	200	130	130	190	35	110	180
	1,1-DCE	ND	ND	0.8 J	0.8 J	1 J	2	ND	3	4
	cis-1,2-DCE	250	350	740	750	760	1,100	560	1,400 J	2,000
	trans-1,2-DCE	72	77	160	190	220	350	100	400	520
	VC	5	14	16	21	19	32	7	45	63
	Bromoform	ND	2	ND	ND	ND	ND	ND	ND	ND
	Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	0.3 J
	1,1,2-TCA	ND	0.4 J	ND	ND	ND	ND	ND	ND	ND
	Benzene	ND		ND	ND	ND	ND	ND	ND	ND
002G25DA	TCE	38	15	25	60	90	52	42	32	26
	Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	0.3 J
	cis-1,2-DCE	110	39	59	140	160	100	86	65 J	63
	trans-1,2-DCE	27	10	21	40	51	33	26	20	18
	1,1,2-TCA	ND	ND	ND	ND	0.6 J	ND	ND	ND	ND
	VC	ND	2	2	7	6	4	3	2	2
002G26DA	TCE	ND	7	ND	ND	ND	ND	ND	ND	ND
	cis-1,2-DCE	ND	35	ND	ND	1	ND	ND	ND	ND
	trans-1,2-DCE	ND	5	ND	ND	ND	ND	ND	ND	ND
	VC	ND	ND	ND	ND	ND	ND	ND	ND	ND
002G27DA	TCE	ND	0.8 J	ND	0.4	ND	ND	NS	NS	NS
	cis-1,2-DCE	ND	ND	ND	0.7 J	0.5 J	ND	NS	NS	NS
	trans-1,2-DCE	ND	0.5 J	ND	ND	ND	ND	NS	NS	NS
	VC	ND	ND	ND	ND	ND	ND	NS	NS	NS
002G28DA	Acetone	ND	ND	ND	ND	ND	ND	ND	ND	2 J
	TCE	74	21	97	290	400	540	450	320 J	130
	carbon disulfide	ND	0.1 J	ND	ND	ND	ND	ND	ND	ND
	1,1-DCE	ND	ND	ND	1 J	1 J	2 J	1 J	3	3
	cis-1,2-DCE	150	71	430	840	810	960	990	1,500 J	1,600
	trans-1,2-DCE	36	18	77	220	220	260	280	330	350
	VC	ND	ND	11	42	25	35	39	51	47
Surface Water Samples										
002WCENT	Acetone	ND	ND	ND	ND	4 J	ND	ND	ND	5 J
002WWEST	Acetone	ND	ND	ND	ND	ND	ND	ND	ND	5 J
	Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	0.3 J
002WEAST	Acetone	ND	ND	ND	ND	4 J	ND	ND	ND	0.3 J
	Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	0.3 J

Notes:

ug/L — micrograms per liter
NS — not sampled
ND — analyte not detected above the method detection limit
J — Estimated value

Table 2
Maximum Allowable Concentration Limits (MACLs)
NSA Mid-South SWMU 2

Constituent	SWMU 2 VOCs[a]	Source 1 Ecological MACL-acute (ug/L)	Source 1 Ecological MACL-chronic (ug/L)	Source 2 Ecological MACL-acute (ug/L)	Source 2 Ecological MACL-chronic (ug/L)	Most Stringent MACL	Notes
Vinyl Chloride	8.20E+01	NA	NA	2.40E+02	2.40E+01	2.40E+01	(4)
Trans-1,2-dichloroethene	3.50E+02	1.16E+04	1.16E+03	1.00E+05	1.00E+04	1.16E+03	(3)
cis-1,2-dichloroethene	2.80E+03	1.16E+04	1.16E+03	NA	NA	1.16E+03	(3)
Trichloroethene	2.10E+03	4.50E+04	2.19E+04	3.00E+03	3.00E+02	3.00E+02	(4)
1,1,2-Trichloroethane	5.00E+00	1.80E+04	9.40E+03	1.60E+03	1.60E+02	1.60E+02	(4)

(1) NOAA (1999). Screening Quick Reference Tables, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, September 1999.
(2) Tennessee Water Quality Criteria, Chapter 1200-4,Rule 3-.03(3)(g) — Organisms Only Criteria 3/10/2008 phone meeting with Clayton Bullington of TDEC, these numbers are chronic only.
(3) MACL — chronic was developed as 1/10 the MACL-acute.
(4) MACL— acute was developed as 10 times the MACL-chronic.
(oval) Indicates concentration at or above the most stringent MACL
a - Represents the maximum detection up to November 2008
μg/L -micrograms per liter

Table 3
Calculating Alternate Concentration Limits
NSA Mid-South SWMU 2
(units in ug/L)

Constituent	Most Stringent MACL (1)	Calculated ACL (2)	Proposed ACL (1/10 Calculated)	Max.at POC Well (02G24DA) Nov-08	Above the ACL?
Vinyl Chloride	24	5,217	522	63	No
Trans-1,2-Dichloroethene	1,160	252,174	25,217	520	No
cis-1,2-Dichloroethene	1,160	252,174	25,217	2,000	No
Trichloroethene	300	65,217	6,522	180	No
1,1,2-Trichloroethane	160	34,783	3,478	1	No

(1) See Table 1 for methodology to determine which MACLs were most stringent

(2) Alternate Concentration Limit (ACL) calculated using the following equation:

ACL = MACL/R
MACL = chronic MACL
where R = dilution factor = Vgw/Vsw or 0.0046/1 = 0.0046

Vgw = 0.0046 cubic feet per second (cfs) to Big Creek (see Appendix A for Groundwater Flow Calculations)
Vsw = 3-day 20-yr low flow = 1.0 cfs for Big Creek (see Appendix B for USGS Streamflow Estimate and Calculations)