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NSA MID SOUTH
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STATEMENT OF BASIS SOLID WASTE MANAGEMENT UNIT 2 (SWMU 2) SOUTHSIDE LANDFILL MILLINGTON SUPPACT TN
12/01/2005
TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

STATEMENT OF BASIS

SWMU 2 — Southside Landfill
Naval Support Activity Mid-South
Millington, Tennessee

Purpose of the Statement of Basis

This Statement of Basis (SB) has been prepared to inform the public and provide an opportunity to comment on the proposed remedy at solid waste management unit (SWMU) 2 — the Southside Landfill at Naval Support Activity (NSA) Mid-South, Millington, Tennessee. NSA Mid-South is responsible for corrective action at SWMU 2 as a result of its Resource Conservation and Recovery Act (RCRA) permit. The Tennessee Department of Environment and Conservation (TDEC) has determined that the proposed remedy of monitored natural attenuation and land-use controls restricting groundwater and redevelopment of the site, is protective of human health and the environment.

Site Description

SWMU 2 is the closed landfill on the Southside of NSA Mid-South's (Figure 1). It reportedly received residential and industrial waste from base operations between 1942 and 1970. 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, resulting in it undergoing a RCRA facility investigation.

Before the remedy is finalized, TDEC would like to give the public an opportunity to comment on the proposed remedy. At any time during the public comment period, the public may comment as described in the following section "How Can You Participate?" Upon closure of the public comment period, TDEC will evaluate all comments and determine if there is a need to modify the proposed remedy.

How Can You Participate?

TDEC solicits public review and comments on this SB prior to implementation of the proposed remedy as the final one. The final remedy for SWMU 2 will be incorporated into the Hazardous and Solid Waste Amendments Permit TNHW-094 for NSA Mid-South, scheduled to be updated in 2006.

Figure 1 SWMU 2 at NSA Mid-South, Millington, Tennessee

Public comment on this SB and the proposed remedy will begin on the date that a notice of the SB's availability is published in *The Millington Star* and *The Commercial Appeal*, local daily newspapers. Since community input could affect selection of a final remedy for SWMU 2, a public comment period has been established for 45 days from ***(insert date)***. If requested during the comment period, TDEC will hold a public meeting to respond to any comments or questions regarding the proposed remedy. To request a hearing or to provide

comments, contact the following person in writing within the 45-day comment period:

Mr. Roger Donovan
TDEC — Division of Solid Waste Management
5th Floor, L&C Annex
401 Church Street
Nashville, TN 37243-1538
Telephone: (615) 532-0864
Email: roger.donovan@state.tn.us

Investigative reports and documents related to SWMU 2 are referenced at the end of this SB and are included in the Administrative Record, which can be reviewed in the Information Repository that was established to provide public access to documents pertaining to the Navy's environmental program. The Information Repository is maintained at:

Millington Civic Center
8077 Wilkinsville Road
Millington, Tennessee 38053
(901) 873-5770

Background Summary

Past operations at the former Naval Air Station (NAS) Memphis included metal plating, manufacturing, and other operations that involved the use of toxic and hazardous materials. Land use changed as a result of the 1990 Base Closure and Realignment (BRAC) Act, and the name of the facility was changed from NAS Memphis to NSA Mid-South.

A significant portion of NSA Mid-South's Northside was transferred to the City of Millington, and the remaining property, including SWMU 2, was realigned (i.e., an operation was reassigned from NSA Mid-South to another facility, and/or an operation from another facility was reassigned to NSA Mid-South). Three facility operations changed: (1) Navy airfield operations ceased in October 1995, (2) training operations were realigned to NAS Pensacola in 1996, and (3) administrative operations for the Navy Bureau of Personnel were realigned from Washington, D.C., to NSA Mid-South in 1997. 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.

As required by the Navy's RCRA Permit, NSA Mid-South is required to evaluate and assess all SWMUs for potential environmental impacts. Due to the former receipt of domestic and industrial waste at the site, the Southside landfill was designated a site warranting further evaluation to determine whether it posed a risk to human health and the environment.

The subsequent *RCRA Facility Investigation* (RFI; EnSafe, 2001) focused on the nature and extent of contamination in soil across the landfill, groundwater beneath it, and sediment and surface water in the adjacent Big Creek Drainage Canal, that borders the southern perimeter of the landfill.

Analytical results from the RFI resulted in a subsequent *Corrective Measures Study* (CMS; EnSafe, 2004). The CMS included an evaluation of (1) methods to remediate the VOCs detected in groundwater and (2) whether drainage improvements over the landfill cover were needed. As a result of the RFI and CMS,

a groundwater remedy of monitored natural attenuation and land-use control restricting use of site groundwater has been selected for SWMU 2. Additionally, a land-use control that restricts residential and/or industrial development is also part of the remedy. The basis for these remedy selections are provided under the "Summary of Contaminant Evaluation" and the "Summary of Site Risk" sections of the SB.

Summary of Contaminant Evaluation

Soil sample locations from the RFI are provided in Figure 2 (Attachment 1) and groundwater sample locations are provided in Figures 3a and 3b (Attachment 1). Sediment and surface water sample locations are provided in Figure 4 (Attachment 1). 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

The soil data set is based on multiple RFI phases and at the conclusion of the investigation, 70 soil samples were collected (19 surface and 51 subsurface) from 39 different locations (see Figure 2, Attachment 1).

Contaminants detected in soil above the U.S. Environmental Protection Agency's (USEPA's) risk-based screening levels for soils include semivolatile organic compounds, pesticides, polychlorinated biphenyls (PCBs), and metals. Table 1 lists the maximum detections, sample locations, and respective soil screening criteria for residential and industrial criteria.

Table 1
Surface-Soil Contaminants (Max) Exceeding Risk-Based Screening Criteria (ppb)[a]

Sample Location	Analyte	Result	RBC-RES[b]	RBC - IND[b]
	Semi-volatile Organic Compounds (SVOCs)			
002S0007	Benzo(a)anthracene	32,000	870	7,800
002S0007	Benzo(a)pyrene	63,000	87	780
002S0007	Benzo(b)fluoranthene	60,000	880	7,800
002S0007	Benzo(k)fluoranthene	41,000	8,700	78,000
002S0007	Carbazole	1,100	32,000	290,000
002S0007	Chrysene	42,000	87,000	780,000
002S0007	Dibenz(a,h)anthracene	12,000	87	780
002S0007	Inden(1,2,3-cd)pyrene	28,000	870	7,800
	Pesticides			
002S07UA	Heptachlor Epoxide	140	70	630
	Polychlorinated Biphenyls (PCBs)			
002S07UA	Aroclor-1254	2,700	320	2,900
002S07UA	Aroclor-1260	2,400	320	2,900
	Metals (in units of ppm)[a]			
002S0008	Arsenic (RC[c] = 14.6)	26.3	0.43	3.8
002S0008	Lead (RC = 26)	1,630	400	1,300

Notes:

[a] — ppb = Parts per billion
— ppm = Parts per million

[b] — Denotes risk-based concentration (RBC), either the residential RBC (RBC-Res) or the industrial RBC (RBC-Ind); taken from *Risk-Based Concentration Table,* October 7, 1999 (USEPA, 1999)

[c] — RC denotes Reference Concentration (i.e., twice background)

Groundwater

The groundwater data set is based on 51 monitoring wells (see Figure 3a, Attachment 1) and 27 sample locations where groundwater was collected using direct-push methods (see Figure 3b, Attachment 1). Four groundwater intervals were characterized at the landfill which, from shallowest to deepest, they are: (1) the upper alluvium (UA) clays and silts, (2) the middle alluvium (MA) sands and gravels, (3) the deep alluvium (DA) sands and gravels, and (4) the Cockfield formation, which is part of the confining unit that overlies the municipal water source for the City of Millington and NSA Mid-South, the Memphis Sand aquifer. The deep alluvium served as the potable water source before municipal water was introduced to the area and is the zone identified during the RFI as the most contaminated.

Table 2 lists the maximum chemical concentrations detected in groundwater and the respective screening criteria. Chlorinated solvents, commonly used for degreasing, were the most prevalent contaminant group detected in groundwater. Trichloroethylene (TCE) was identified in 5 monitoring wells and 13 direct-push locations scattered across much of the landfill; however, the most elevated detections were identified near the landfill's southeast corner. There, concentrations were significantly above the 5 parts per billion drinking water standard for TCE, specifically at wells 002G03DA (960 ppb), 002G24DA (140 ppb), 002G25DA (38 ppb), and 002G28DA (78 ppb). The natural breakdown of TCE results in daughter products being associated with the TCE, which were similarly detected at concentrations above their drinking water standards, specifically 1,1-dichloroethylene, 1,2-dichloroethylene (including cis and trans), and vinyl chloride.

The herbicides 2-2-methyl-4-chlorophenoxy-propionic acid (MCPA) and 2-methyl-4-chlorophenoxyacetic acid (MCPP) were detected in two monitoring wells, however, detections were not repeated in a resampling of the wells. Table 2 also lists several metals that were detected above the background reference concentration in addition to either the risk-based screening criteria or MCL.

Table 2
Groundwater Contaminants Exceeding Risk- or Regulatory-Based Screening Criteria (maximum detections in ppb)[a]

Sample Location	Analyte	Result	MCL[b]	RBC-Tap Water[c]
Volatile Organic Compounds (VOCs)				
002G03DA	TCE	980	5	1.6
002G03DA	PCE	3.0	5	1.1
002G03DA	1,1-DCE	2.7	7	0.044
002G03DA	1,2-DCE	1,700	NA[d]	55
002G03DA	cis-1,2-DCE	930	70	61
002G03DA	t-1,2-DCE	290	100	120
002G03DA	Vinyl Chloride	60	2	0.19
002G03DA	1,1,2-TCA	10	5	0.19
002GMG04UA	Benzene	2	5	0.32
002G18DA	Chloro-methane	5.9	NA	2.1
002G06DA	Bromodichlo ro-methane	1.0	100	0.17
002G05UA	acetone	1,900	NA	610
Herbicides				
002G09DA	MCPA	58	NA	18
002GMG03DA	MCPP	70	NA	37
Metals (in units of ppm)[a]				
002G10DA	Arsenic	32.6	50	0.045
002G14UA	Antimony	17.7	6	15
002G07UA	Thallium	2.8	2.0	2.6
002G04UA	Chromium	730	100	110
002GMG04UA	Lead	184	15	NA

Notes:

[a] — ppb = Parts per billion
— ppm = Parts per million
[b] — Maximum Contaminant Levels (MCLs) in drinking water are from the *Drinking Water Regulations and Health Advisories* (USEPA, 1996).
[c] — Tap water RBC is from the *Risk-Based Concentration Table*, April 2000 (USEPA, 2000).
[d] — NA denotes comparison is Not Applicable.

The potential impacts associated with VOCs discharging into the Big Creek Drainage Canal via groundwater were evaluated by collecting groundwater samples from beneath the creek bed during two separate sampling events. VOCs were absent on both occasions, leading to the RFI conclusion that VOCs were undergoing natural degradation after leaving the area of the landfill and before discharging into the drainage canal (EnSafe, 2001).

Sediment

Sediment samples were collected from six locations (002M0001 through 002M0006) in the Big Creek Drainage canal, both up and down stream of the landfill (see Figure 4, Attachment 1).

Contaminants detected include the SVOC bis (2-ethylhexyl)phthalate (BEHP), the pesticide 4,4'-DDT, and several metals. The maximum contaminant concentrations, sample locations, and associated ecological sediment screening values (SSV) are listed in Table 3.

Table 3
Exceedances in Sediment
(Maximum Detections in ppm[a])

Sample Location	Contaminant	Maximum Detected Concentration	SSV[b]
002M0004	4,4'-DDT	0.005	0.003
002M0003	BEHP	1.2	0.182
002M0006	Cadmium	4.6	1
002M0006	Nickel	16.3	15.9

Notes:
[a] — ppm = Parts per million
[b] — Sediment Screening Value (SSV); values obtained from the *Ecological Screening Values – Ecological Risk Assessment Bulletin No. 2* (USEPA, 1999)

Detected contaminants were also compared to USEPA's residential and industrial RBCs for soil (not listed in the table). While arsenic did not exceed its respective SSV, it was detected (6.9 ppm) above its residential (0.43 ppm) and industrial (3.8 ppm) screening value for soil. Cadmium also exceeded its residential value (1 ppm). The nickel and cadmium detections, two of the three metals detected above the SSV, were most elevated upstream of the landfill, suggesting they were not attributable to potential landfill impacts. BEHP, which is commonly associated with plasticizers, is commonly attributed to plastic artifacts and was absent in a subsequent verification sampling event (EnSafe, 2001).

Surface Water

Surface water samples were collected from 7 locations (002W001, 002W006, 002W007 through 002W011; see Figure 4, Attachment 1) in Big Creek Drainage Canal to determine whether its water quality was affected by the landfill. Table 4 lists the maximum detections that exceeded the Fresh Water Quality Standard (FWQS) and includes cadmium, copper, and lead in a location upstream of the landfill. Similar to contaminants identified in sediment, the most elevated detections were identified upstream of the landfill, indicating groundwater impacts associated with the landfill were not present (EnSafe, 2001).

Table 4
Exceedances in Surface Water
(Maximum Detections in ppb[a])

Sample Location	Contaminant	Result	FWQS[b]
002W0006	Cadmium	3.4	0.66
002W0006	Copper	13	6.54
002W0006	Lead	5.8	1.32

Notes:
[a] — ppb = Parts per billion
[b] — FWQS – *Fresh Water Quality Standards*, specified in 40 CFR Part 131.36.

Summary of Site Risk

As part of the RFI, risks to human health and the environment from the contaminants identified at SWMU 2 were evaluated using human health and ecological risk assessments, which were developed in accordance with existing USEPA and TDEC methods.

Human Health Risk

Human health risk at SWMU 2 was assessed using the hypothetical land-use scenarios: construction/site worker, residential, recreational, and trespasser. Table 5 summarizes the populations, exposure media, and chemicals of concern associated with the evaluated media.

Table 5
Potentially Exposed Populations, Exposure Media, and Chemicals of Concern

Population	Soil (all depths)	Sediment & Surface Water	UA Ground-water	DA Ground-water	Air (from Ground-water)
Site Worker	Arsenic, SVOCs[a]	NA[b]	NA	NA	NA
Trespasser	PAHs	None	NA	NA	NA
Construction Worker	PAHs	NA	NA	NA	NA
Resident (Adult)	Arsenic, SVOCs	NA	Arsenic	Arsenic, VOCs	None
Resident (Child)	Arsenic, SVOCs	NA	Metals, Acetone	Metals, VOCs	None

Notes:
[a] — SVOCs include specifically those listed in Table 1
[b] — NA denotes Not Applicable; pathway not evaluated

- ***Sediment, and Surface Water***
  No chemicals of concern were identified for any of the scenarios evaluated for sediment and surface water in the Big Creek Drainage Canal.

- ***Groundwater***
  Chemicals of concern were identified in both the upper and deeper alluvial groundwater under the hypothetical residential scenarios. The greatest risk and hazard were attributed to the deep alluvial groundwater and principally from the following chemicals of concern: arsenic, TCE, 1,2-DCE, *cis*-1,2DCE, *trans*-1,2-DCE and vinyl chloride

- ***Soil***
  The SVOCs listed in Table 1 were identified as chemicals of concern under all the reuse scenarios. Arsenic was similarly identified as a chemical of concern for the site worker and residential scenario.

Ecological Risk

A screening level ecological risk assessment (SLERA) was performed to determine if site contamination poses an unacceptable risk to ecological receptors. Results of the SLERA concluded the site poses minimal risk, if any, to site terrestrial receptors and benthic macro-invertebrates (e.g., snails, mussels, etc) present in Big Creek Drainage Canal (EnSafe, 2001).

The absence of VOCs in groundwater and sediments collected from beneath the creek bed led to the RFI concluding that VOCs were naturally degrading before discharging into the Big Creek Drainage Canal; however, further evaluation of the natural attenuation mechanisms were recommended in a corrective measures study (EnSafe, 2001). The RFI also recommended an inspection of the landfill surface to identify whether drainage improvements or repairs to the cover were warranted (EnSafe, 2001).

Selected Remedy

The 2004 CMS study concluded that the impacted aquifer's geochemistry was favorable for the natural degradation of the VOCs; therefore monitored natural attenuation and land-use controls restricting use of the site's groundwater was recommended as the groundwater remedy. As a result of the inspection over the landfill cover, the CMS also recommended that (1) residual concrete and construction debris identified over the landfill surface be left in place to minimize potential damage to the cover, (2) all containers with residual fluid should be emptied and removed from the landfill, and (3) that hydraulic controls

to minimize water standing over the cover of the landfill be evaluated (EnSafe, 2005).

All the storage containers and related residual fluids identified during the February 2003 surface survey were removed from the landfill surface (EnSafe, 2005). Drainage improvements north of the landfill were completed in 2004. An inspection of the landfill surface in November 2005 found no standing water in areas that historically contained water, indicating the drainage improvements may be helping minimize water standing on the landfill cover. The USEPA approved the CMS report in April 2004.

The selected remedy for the site is the following:

(1) Monitored natural attenuation for the deep alluvial groundwater and land-use controls restricting its use.

(2) Land-use controls that restrict residential or commercial reuse of the property.

A land-use control implementation plan (LUCIP) will be developed to establish the remedy requirements and will be incorporated into the NSA Mid-South's Regional Shore Infrastructure Plan (RSIP). As a minimum, the LUCIP will include the following:

- Location of land subject to LUC
- Explanation of LUC (e.g., signage and fencing requirements, restrictions, etc.)
- Duration of the LUC
- Requirements and frequency of LUC inspections, including documentation requirements.

Since TDEC's goals for human health and ecological risks have been met, no alternative remedies were evaluated. The Navy's proposed remedy is considered protective of human health and the environment. The remedy meets the four general standards of corrective measures, which are:

- Overall protection of human health and the environment
- Attainment of media cleanup standards
- Controlling the sources of release
- Compliance with standards for management

References

EnSafe/Allen & Hoshall. (1996, August 27) *Technical Memorandum — Reference Concentrations.* Memphis, Tennessee.

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.

EnSafe Inc. (2004, February 27). *Corrective Measures Study Report; NSA Mid-South; SWMU 2 — Southside Landfill;* Revision 1. Memphis, Tennessee.

EnSafe Inc. (2005, June 15). *SWMU 2 Surface Container Removal Report; NSA Mid-South; Millington, Tennessee.* Revision 0. Memphis, Tennessee.

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

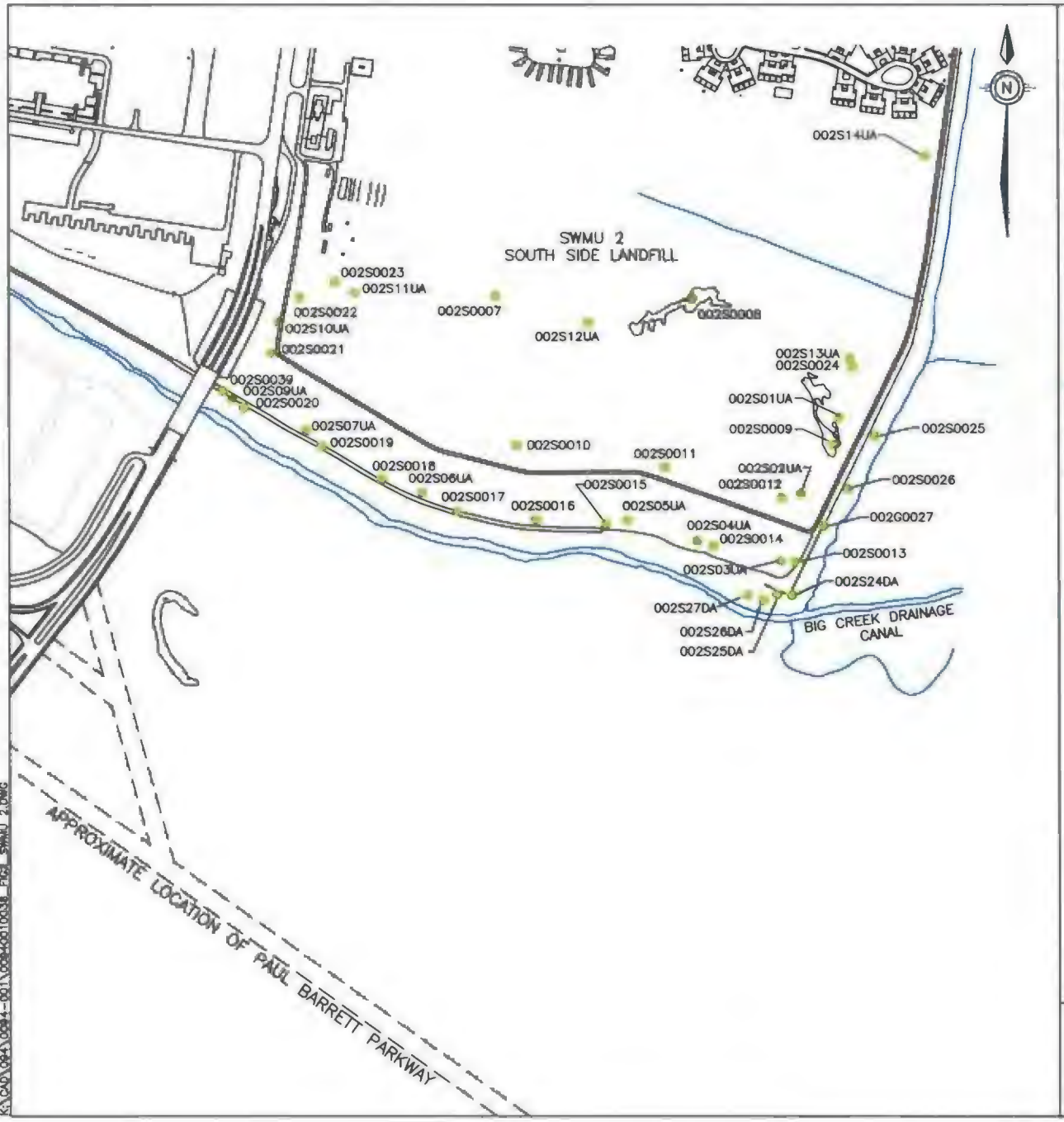
Geraghty & Miller. (1985). *NACIP Confirmation Study, Verification Phase, NAS Memphis.* Tampa, Florida.

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 (1999, August). *Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment*. USEPA Region 4 Waste Management Division. Office of Health Assessment.

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

Attachment 1
Figures



LEGEND

- SOIL SAMPLE LOCATION
- NSA MID-SOUTH BOUNDARY
- AREA OF INVESTIGATION

650 0 650

FEET

FIGURE 2
SWMU 2
STATEMENT OF BASIS
SOIL SAMPLE LOCATIONS

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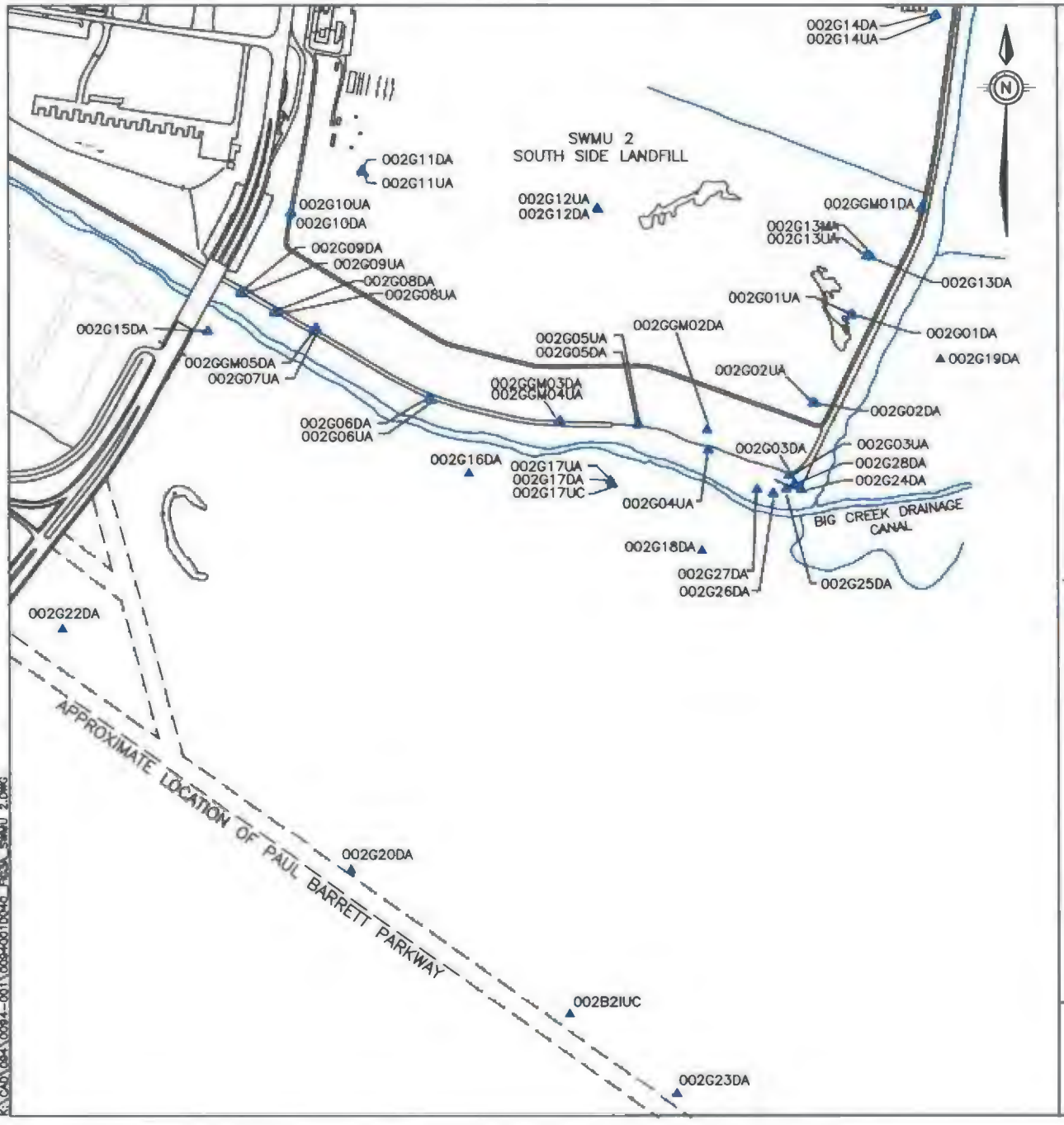

LEGEND

- ▲ – 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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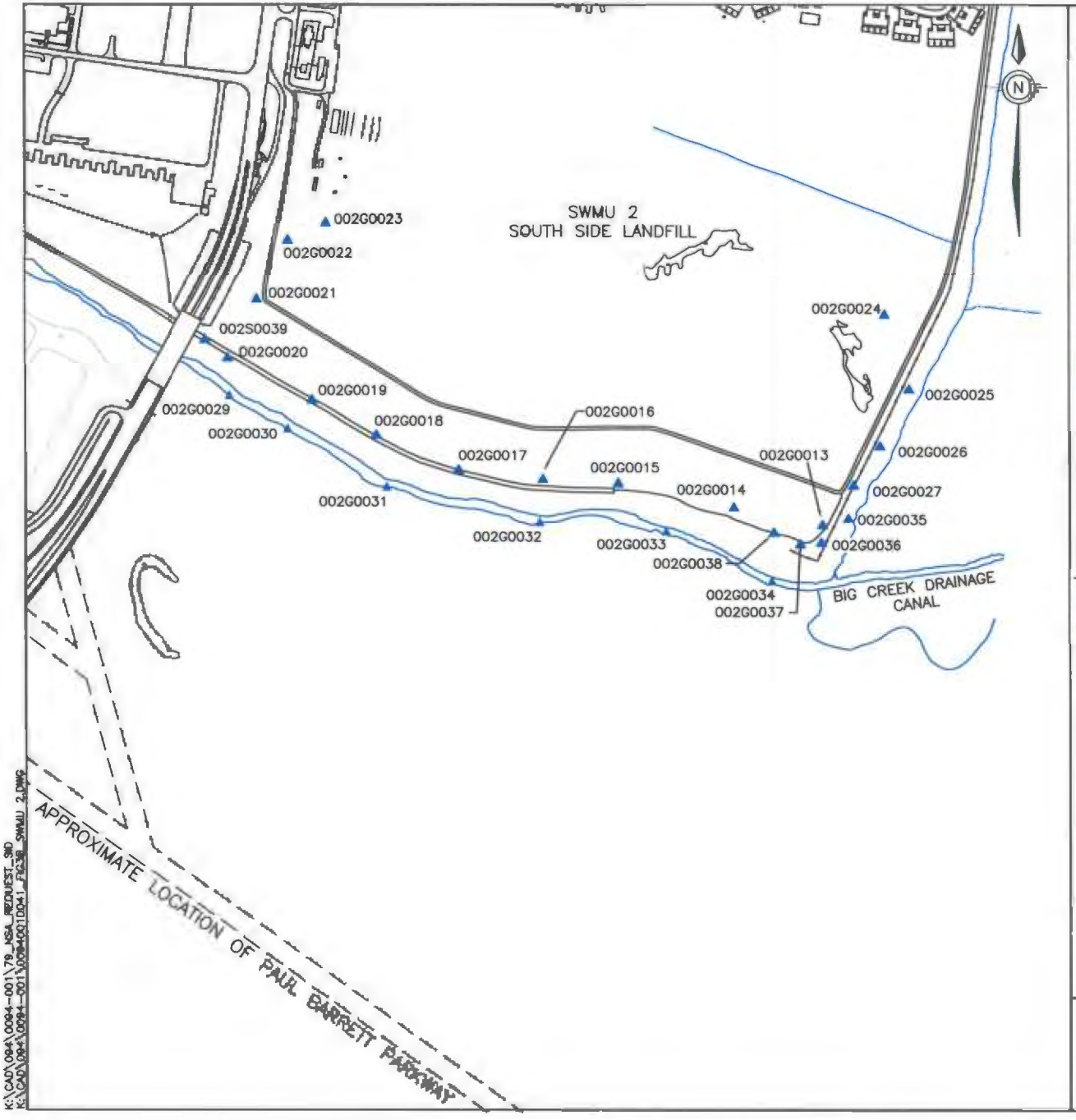

LEGEND

- ▲ – 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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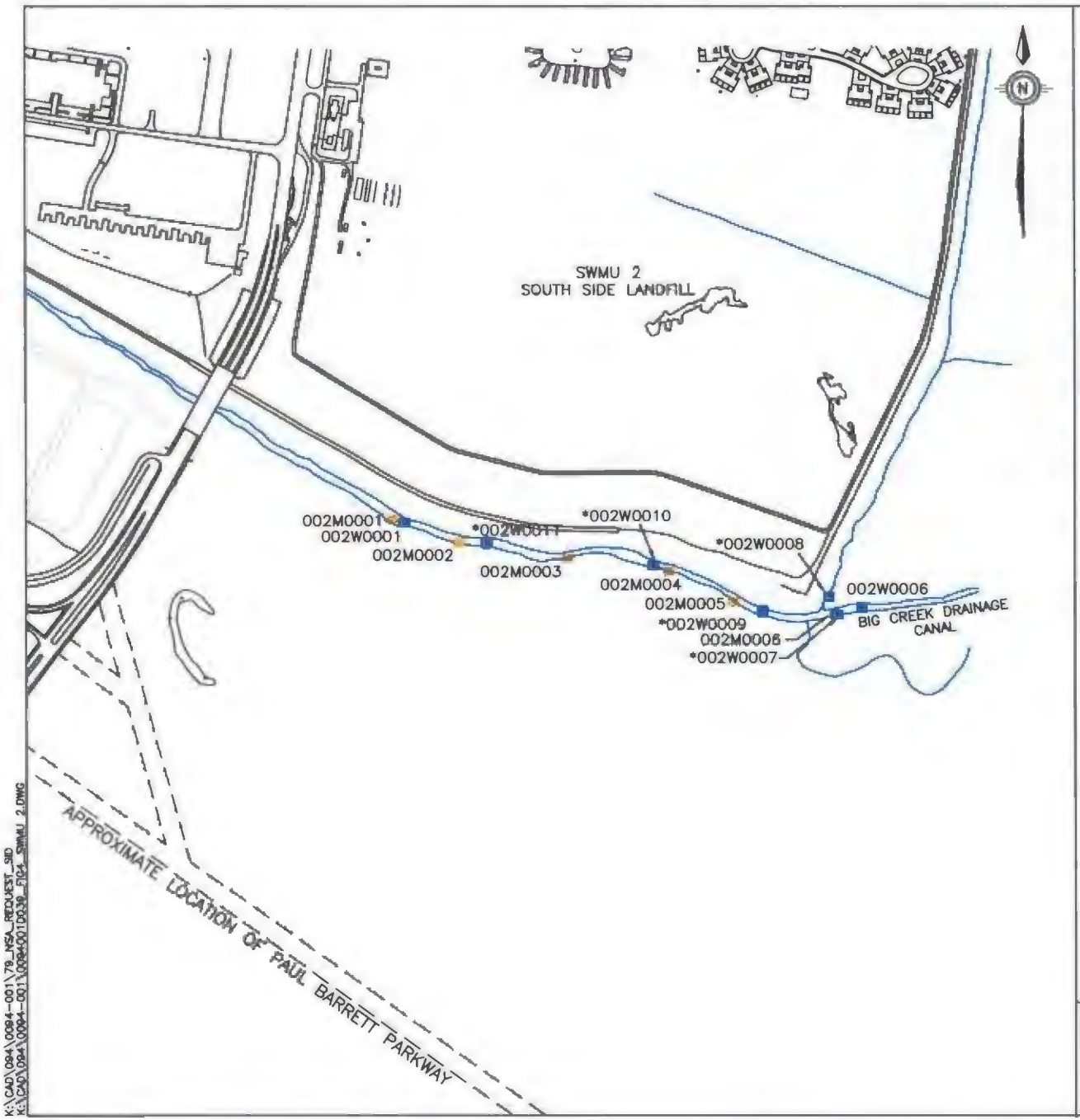

LEGEND

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_SMD
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