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NCBC GULFPORT
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LETTER REPORT REGARDING REMOVAL ACTION TECHNICAL SUPPORT CONTAMINATED SEDIMENT AND SURFACE SOIL SAMPLING AND ANALYTICAL RESULTS IN 28TH STREET ROADWORK AREA NCBC GULFPORT MS

5/26/1995

ABB ENVIRONMENTAL

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May 26, 1995

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Mr. Art Conrad
Southern Division
Naval Facilities Engineering Command
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SUBJECT: Letter Report: Removal Action Technical Support, Contaminated Sediment and Surface Soil Sampling and Analytical Results in 28th Street Roadwork Area, Naval Construction Battalion Center (NCBC), Gulfport, Mississippi, Contract No. N62467-89-D-0317

INTRODUCTION

The Removal Action Technical Support was conducted between April 6 and May 1, 1995. This program was conducted to investigate potential dioxin contamination that may impact the proposed 28th Street construction on the northern boundary of NCBC Gulfport. Sediment samples were collected from drainage channels leading from the Base, and surface soil samples were collected along 28th Street right-of-way (ROW). All samples were analyzed for dioxins and furans using U.S. Environmental Protection Agency (USEPA) Method 8290 and total organic carbon (TOC). Sediment recovery traps (SRTs) were then installed in the ditches and canals on the Base to slow the potential migration of contaminated sediments.

The Removal Action Technical Support was initiated based on the findings of the December 1995 base-wide sampling efforts. The results indicated dioxin-contaminated sediments were present in ditches that will be impacted during the 28th Street road work. The sampling phase of the Removal Action Technical Support was designed to collect sediment and surface soil samples in the ROW of construction to determine the location and extent of dioxin contamination within the limits of construction. The results of this sampling effort are included in this report, as well as recommendations for further actions including excavation of contaminated sediments and surface soils.

FIELD PROGRAM

The field program for the technical support for the removal action on 28th Street included two phases. The first phase was the sediment and surface soil sampling in the area of the proposed roadwork. The second phase was the design and installation of SRTs in the ditches on the base to slow the migration of the sediments.

Field activities for the sediment and surface soil sampling in the area of the proposed 28th Street construction were conducted from April 6 to 12, 1995. Samples were collected from seven areas of interest along the area of the proposed roadway construction as outlined in the Sample Strategy Removal

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Action Letter written to the Mississippi Department of Environmental Quality, Hazardous Waste Division (ABB Environmental Services, Inc. [ABB-ES], 1995).

The seven areas of interest with the number of samples collected at each are listed below in Table 1 (Attachment B). The Base ditches investigated during this event include the ditch draining the Site 8 area and the ditch along 11th Street.

Thirty-four sediment samples were collected from 27 individual sampling locations. Thirteen surface soil locations were sampled along 28th Street between just west of Outfall 1 and Outfall 4. The soil was collected between 0 inch to 12 inches below the surface.

Sixteen sediment samples and three surface soil samples were collected for grain size analysis. Additional samples were also collected at each location for TOC analysis.

Sediment sample locations are shown on Figures 1 through 5 (Attachment A) and designated by the sample identification (ID) numbers. Surface soil samples were collected along 28th Street between Outfall 1 and Outfall 4 and are noted by ID numbers on Figure 6 (Attachment A).

The sample ID scheme used for the sampling event is as follows: the first character, G, designates Gulfport; the second character is the sampling round number (the 28th Street sampling is round 3); the third character designates the media type with D indicating sediment and S indicating surface soil; the next three characters indicate the sample number; and the last three characters indicate the depth of the sample in inches. For example, one of the sediment samples is G3D001006.

Each sediment and surface soil sample was collected with a hand auger. After augering to the designated depth for each sample, the sediment or surface soil sample was transferred to a Pyrex™ bowl using a stainless-steel spoon. The sample was then mixed to ensure a homogeneous mixture and the appropriately labeled sample jars were filled.

All of the implements used during the sample collection were decontaminated prior to use. The decontamination procedure included (1) equipment wash with an Alconox™ and deionized (DI) water mixture, (2) DI water rinse, (3) 10 percent nitric acid solution rinse for Pyrex™ pieces, (4) isoproponal rinse for metal equipment, and (5) a final DI rinse to each piece of equipment. The equipment was placed on polyethylene plastic and allowed to dry. Each piece of sampling equipment was then wrapped in aluminum foil until used in the field.

The investigation derived waste (IDW) associated with the sediment and surface soil sampling included only expendable materials such as gloves and paper towels. No additional IDW was generated; no extraneous sediments or surface soils were removed from the sampling locations. The expendables were double-bagged in plastic bags and disposed in a NCBC solid waste dumpster.

SRTs were installed at NCBC Gulfport to slow potential migration of contaminated sediments within the ditches on the Base. Twelve SRTs were installed at strategic locations in the ditches on the Base between April 24 and May 1, 1995. The locations of these SRTs are shown on Figure 8 (Attachment A). Additionally, an existing SRT just outside the Site 8 area that was breached was repaired. The SRTs were installed by the placement of 3/4 inch to 1 1/2 inches crushed, angular gravel across the ditch. The SRTs were constructed with slopes of 3:1 upstream and downstream. Non-woven geotextile filter fabric was placed underneath a layer of gravel on the upstream slope of each SRT to trap sediment greater than 70 microns. Fencing was placed on the downstream slope of nine of the SRTs to stabilize the gravel.

Two hundred eleven cubic yards of gravel was placed; Table 2 (Attachment B) shows the approximate amount of gravel in each SRT.

ANALYTICAL PROGRAM

All samples collected were properly preserved, placed in coolers, and packed with bagged ice immediately after collection. All samples remained in the custody of the field operations leader until delivery to the courier service providing overnight shipment to Quanterra Laboratories. All samples were shipped, complete with chain-of-custody forms, to the analytical laboratory within 24 hours for analysis. Upon arrival at the laboratory, the chain of custody and preservation of the samples were checked with the contents of each cooler by laboratory personnel. After verification, the chain-of-custody form was signed by laboratory personnel and the samples accepted for analysis.

The quality assurance and quality control (QA/QC) samples collected during the field effort included duplicates, matrix spike and matrix spike duplicates (MS/MSD), rinsates, and field blanks. One duplicate sample was collected for every 10 samples of a single matrix. One set of MS/MSD samples were collected for every 20 samples of each matrix. One field blank was collected from the source of deionized, organic-free water. One equipment rinsate was collected following every other decontamination event.

Sediment and surface soil samples were analyzed in accordance with USEPA SW-846 methods (USEPA, 1986) and Naval Energy and Environmental Support Activity (NEESA) Level C documentation (NEESA, 1988) for the dioxins and furans (Method 8290). All samples were also analyzed for TOC; grain-size and hydrometer analyses were conducted on select samples.

RESULTS

Geologic observations and analytical results from the sediment and surface soil samples collected during the 28th Street sampling event are presented in this section. For each of the sediment and surface soil samples collected, a toxic equivalency (TE) was determined based on toxic equivalency factors (TEFs) for each of the dioxin and furan congeners. 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) is the congener with the highest TEF of 1.0; therefore, its result is weighed heaviest in the determination of the TE. The other congeners of dioxins and furans have smaller TEFs in proportion to their potential carcinogenic effects. Table 3 summarizes the analytical data for dioxins and furans detected in the sediment samples; Table 4 summarizes the analytical data for dioxins and furans detected in the surface soil samples.

Geologic Observations

Material characteristics of the sediment within the ditches ranged from clayey silts and silty, fine-grained sands to gravely, fine- to medium-grained sands. Varying amounts of organic matter were observed within these recent sediments. The sediment in the ditches can generally be distinguished from the sediments elsewhere in the surficial alluvium by a higher organic content, which results in a darker appearance. Additionally, the surficial alluvium outside of the ditches consists primarily of a tan to yellow fine-grained sand with some medium-grained sand and little silt, while the material in the ditches is often graded between clayey silts to gravely sands based on the depositional patterns within the ditch.

Sediment Samples

The three samples collected in Turkey Creek on Canal Road and at Ohio and Polk detected dioxin and furan compounds at very low concentrations. Higher concentrations were detected in samples collected at Outfalls 1, 3, and 4 and the Base ditches.

The highest TE value detected from the samples collected at Outfall 1 is 14 parts per trillion (ppt) in G3D015006 (Figure 2). Field notes indicate that this sample appeared to have the highest fraction of organic matter of the samples collected at this outfall. 2,3,7,8-TCDD, the dioxin compound with the highest TEF, is found in 4 out of 6 of the samples collected in this area.

Samples collected from Outfall 3 had TE values ranging from 0.049 to 91 ppt (Figure 3, Attachment A). The highest TE value of 91 ppt was detected in sample G3D007018, which was a clay/silt mix collected at a depth of 18 inches. 2,3,7,8-TCDD was detected in 12 out of the 14 sediment samples collected at Outfall 3.

Samples collected from the Outfall 4 area had TE values ranging from 6.9 to 62 ppt (Figure 4, Attachment A). Sample G3D030006 had the highest detection at 62 ppt. This sample was collected from a small basin formed by several concrete blocks just upstream of 28th Street. These blocks apparently cause sediment to settle in this localized area. 2,3,7,8-TCDD was found in each of the four samples collected at Outfall 4.

Samples collected from the Base ditches had TE values ranging from 0.30 to 33 ppt (Figure 5, Attachment A). The samples with the highest TE values, G3D001006 and G3D003006 with concentrations of 33 and 31 ppt, respectively, were located on either side of the entrance of Outfall 3. 2,3,7,8-TCDD was detected in six out of the seven samples collected along the Base ditches.

TOC analysis was conducted on all of the sediment samples. The TOC on all samples ranged from 930 to 21,000 parts per million (ppm). Grain size analysis was conducted on 16 of the sediment samples. Table 5 shows the TOC and grain-size analysis results.

In general, the sediment samples from the Outfall 3 area exhibited the highest TE values and the highest concentrations of 2,3,7,8-TCDD. It was also observed that the samples with the highest organic content, as noted in the field, generally had the higher TE values than samples without large percentages of organic material. The tendency of dioxin molecules to have an affinity for molecules containing organic carbon has been well documented (Solomons, 1988). To quantify this field observation, all sediment samples were analyzed for dioxin and furan compounds as well as TOC. With these results, several graphs were generated to examine the relationship between organic carbon and dioxin TE values from the laboratory data. Figure 8 (Attachment A) is a scatter plot relating TOC and TE (the toxicity equivalent [TEQ] on this graph) values to sample identification number. For clarity, the sample numbers on the x-axis have been numbered sequentially 1 through 34. The correlative field sample numbers are shown Table 8 (Attachment B) with the graphs.

The tendency for elevated results of organic carbon to follow elevated levels of the dioxin TE are clearly shown on Figure 8 (Attachment A). As shown on this graph, the peaks and troughs of the dioxin TE and organic carbon results mirror one another. This relationship is not observed for graph samples 23, 24, and 26. Here, elevated levels of organic carbon are reported, but they do not follow a rise in dioxin TE levels. This result is likely due to the fact that these samples were collected from 1 to 3 miles downstream of the Base where the dioxin has not migrated.

To further clarify the relationship between dioxin TE and organic carbon values, a second graph presents (Figure 9, Attachment A) the values in a bar graph format and segregates the samples based on sampling location. This graph again demonstrates that if elevated dioxin TE values are reported, they are often associated with elevated levels of organic carbon. This graph also highlights the exceptions to this relationship for samples collected off the Base and samples collected at greater depths, where dioxin has never existed.

In summary, it can be stated that a strong relationship exists between TE and organic carbon values in the shallow sediment samples collected in the ditches. This relationship may be useful in identifying potentially contaminated sediments in the field based on visual inspection of organic content.

Surface Soils

Dioxin and furan compounds were detected in all 13 surface soil samples collected. The toxic equivalencies of the samples range from 0.58 to 28 ppt. 2,3,7,8-TCDD was detected in 3 out of 13 samples: G3S002, G3S003, and G3S009.

TOC analysis was also conducted on all of the surface soil samples. The TOC concentrations in the surface soil samples ranged from 5,100 to 25,000 ppm. Grain size analyses were conducted on three of the surface soil samples. These results are also shown on Table 5 (Attachment B).

The soil samples with the highest reported TE values (G3S002, G3S003, and G3S009) are located near Outfall 3. Furthermore, these locations are located within an area that is often flooded by surface water overflow from Outfall 3 following large precipitation events. It is likely, therefore, that this surface soil contamination is the result of these overflow events from the ditch at Outfall 3.

RECOMMENDATIONS

Twenty-one of the 34 sediment samples collected and 3 of the 13 surface soil samples collected exceed the 4.7 ppt clean-up level designated by the Mississippi Department of Environmental Quality for dioxins and furans. Samples from Outfall 1, Outfall 3, Outfall 4, and the Base ditches exceed this level. The following recommendations have been based on these results. A matrix shown on Table 6 (Attachment B) was developed outlining the recommended further actions for each of the areas of interest.

Prior to the beginning of the road work, dioxin-contaminated sediments in the area of Outfall 1, Outfall 3, Outfall 4, and dioxin-contaminated surface soils near Outfall 3 should be excavated. Excavation depths should range between 1 and 3 feet in these areas. Table 7 (Attachment B) shows the approximated excavation amounts for each of these areas. The total excavation is estimated at 415 cubic yards of material. To conduct the excavation at the outfalls, each of the channels within the limits of construction will require dewatering and a temporary hydraulic barrier will need to be installed. Dismantlement and decontamination of all existing culverts at these locations is also recommended. All excavated sediments and surface soils would be temporarily stored on the Base until transferring to a facility licensed to handle dioxin-contaminated materials. Excavation should be followed by confirmatory sampling.

Additional recommendations include continued monitoring for each of the three outfall locations, the Base ditches, and for the Turkey Creek area beneath the Canal Road bridge. Periodic maintenance of the SRTs is also advised. No further action is recommended for the Turkey Creek areas both at the Canal Road bridge and at Ohio and Polk.

SUMMARY

The field program for the technical support for the removal action on 28th Street consisted of two phases. The first phase consisted of a sediment and surface soil sampling program. These samples were analyzed in accordance with USEPA SW-846 methods (USEPA, 1986) and NEESA Level C documentation (NEESA, 1988) for dioxins and furans (Method 8290). The second phase included installation of 12 SRTs to slow potential movement of contaminated sediments from the ditches at NCBC Gulfport.

This program addressed seven areas of interest identified as potential concerns for contamination: sediments from Outfall 1, Outfall 3, Outfall 4, Base ditches, Turkey Creek Bridge on Canal Road, and Turkey Creek at Ohio and Polk; and surface soils along 28th Street between east of Outfall 3 and west of Outfall 1. Dioxin and furan compounds were detected in all of the 34 sediment samples collected at the locations. These compounds were also detected in all 13 surface soil samples collected along 28th Street.

Dioxin concentrations exceeded the 4.7 ppt cleanup level designated by the State in 21 sediment samples collected from Outfall 1, Outfall 3, Outfall 4, and the Base ditches. Dioxin concentrations exceeded this level in three surface soil samples collected near the Outfall 3 area.

Recommendations for the removal action include the excavation of sediments within the limits of construction from the three outfall areas and the excavation of surface soils around Outfall 3. Continued monitoring of the Base ditches is advised. No further action is recommended for the two areas of interest on Turkey Creek.

Very truly yours,

ABB ENVIRONMENTAL SERVICES, INC.

Penny Baxter, P.G.
Task Order Manager

Karen Boles
Engineer

Attachments

ATTACHMENT A

FIGURES

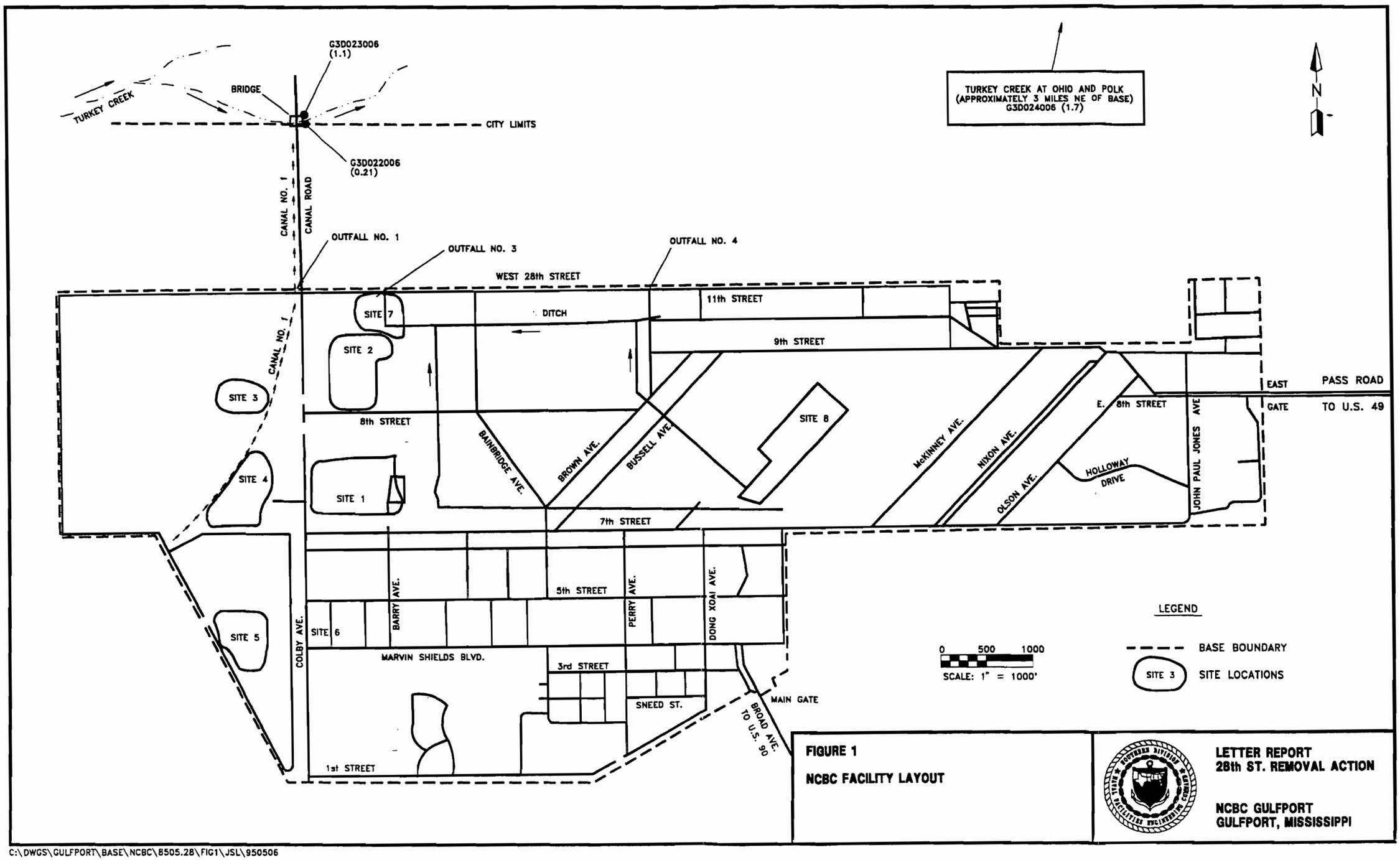

FIGURE 1

NCBC FACILITY LAYOUT

LETTER REPORT
28th ST. REMOVAL ACTION

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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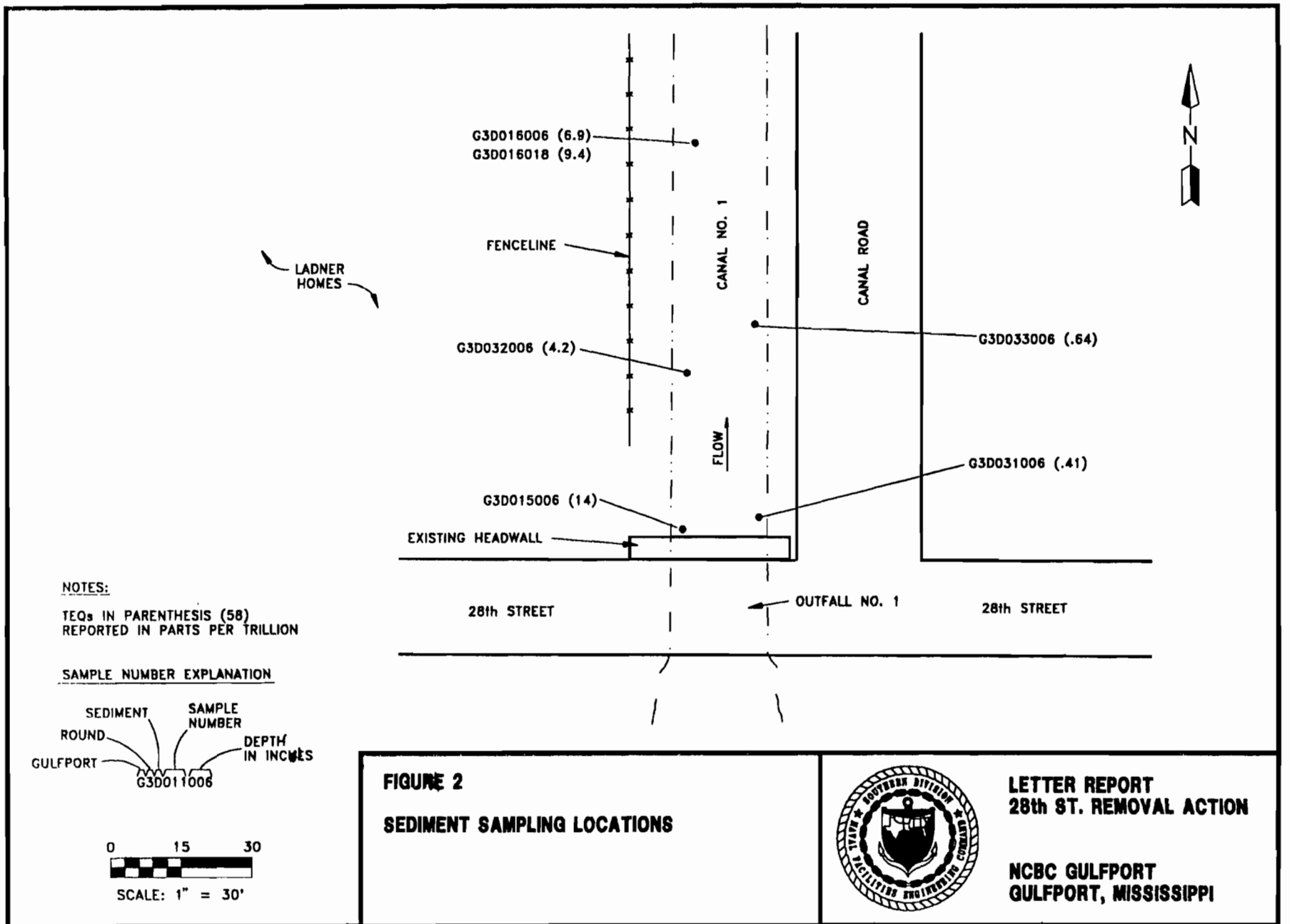

FIGURE 2

SEDIMENT SAMPLING LOCATIONS

LETTER REPORT
28th ST. REMOVAL ACTION

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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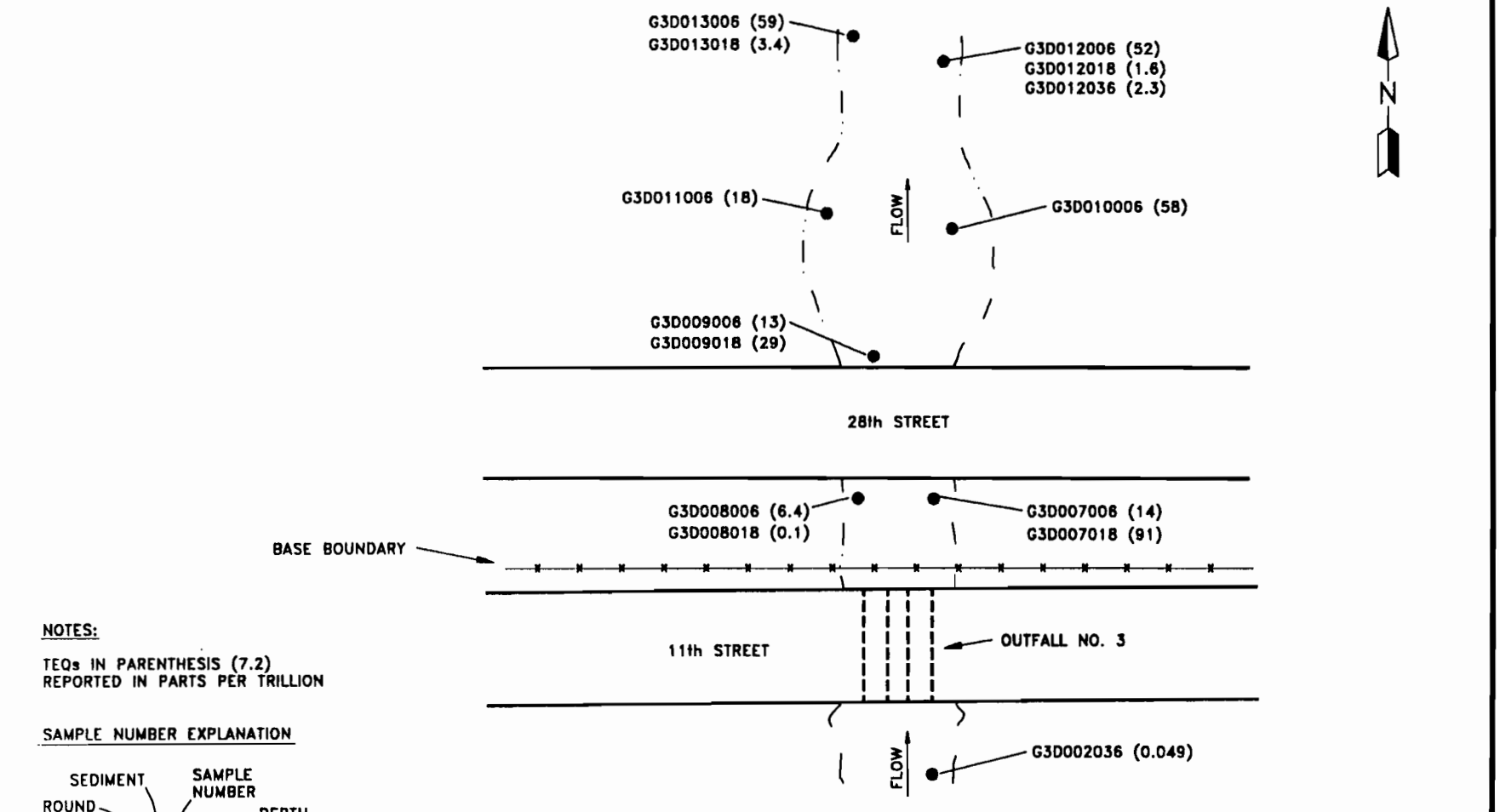
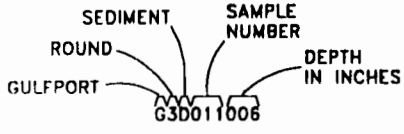


NOTES:

TEQs IN PARENTHESIS (7.2)
REPORTED IN PARTS PER TRILLION

SAMPLE NUMBER EXPLANATION



SCALE: 1" = 30'

FIGURE 3

SEDIMENT SAMPLING LOCATIONS

LETTER REPORT
28th ST. REMOVAL ACTION

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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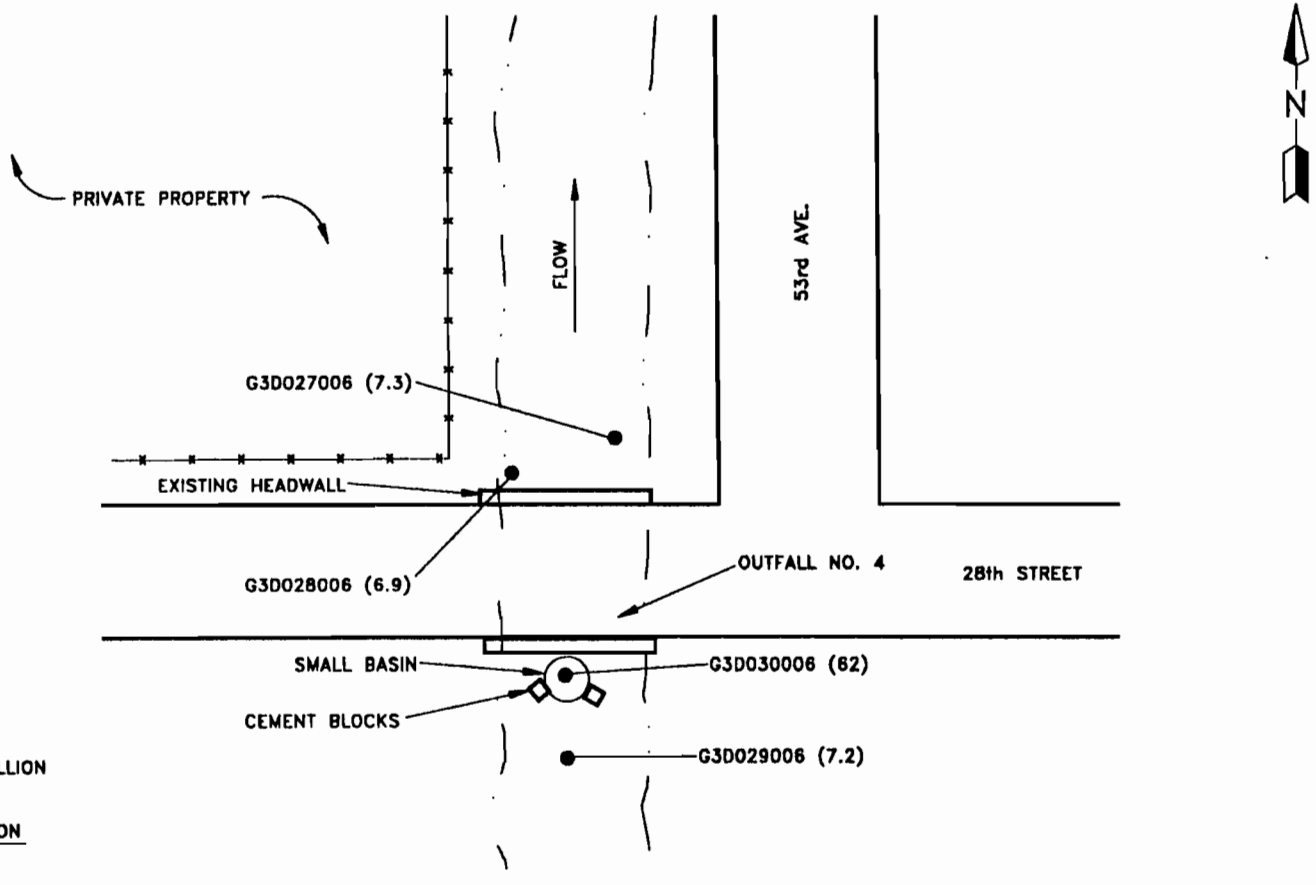
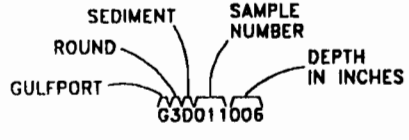
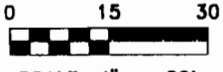


NOTES:

TEQs IN PARENTHESIS (7.2)
REPORTED IN PARTS PER TRILLION

SAMPLE NUMBER EXPLANATION





SCALE: 1" = 30'

FIGURE 4

SEDIMENT SAMPLING LOCATIONS

LETTER REPORT
28th ST. REMOVAL ACTION

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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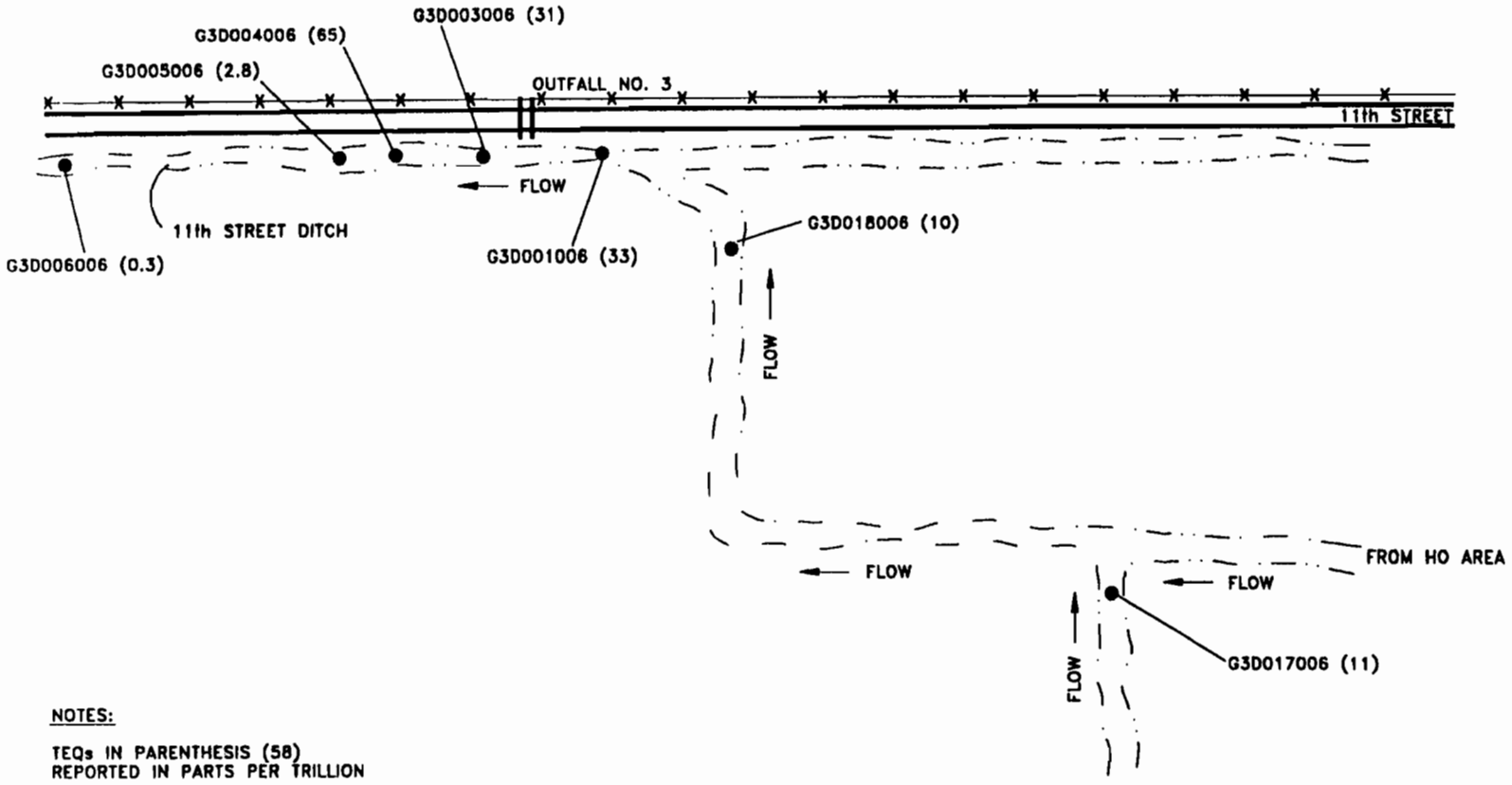

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REPORTED IN PARTS PER TRILLION

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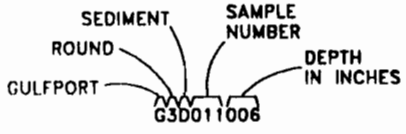

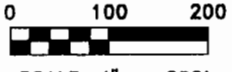

SCALE: 1" = 200'

FIGURE 5

SEDIMENT SAMPLING LOCATIONS

LETTER REPORT
28th ST. REMOVAL ACTION

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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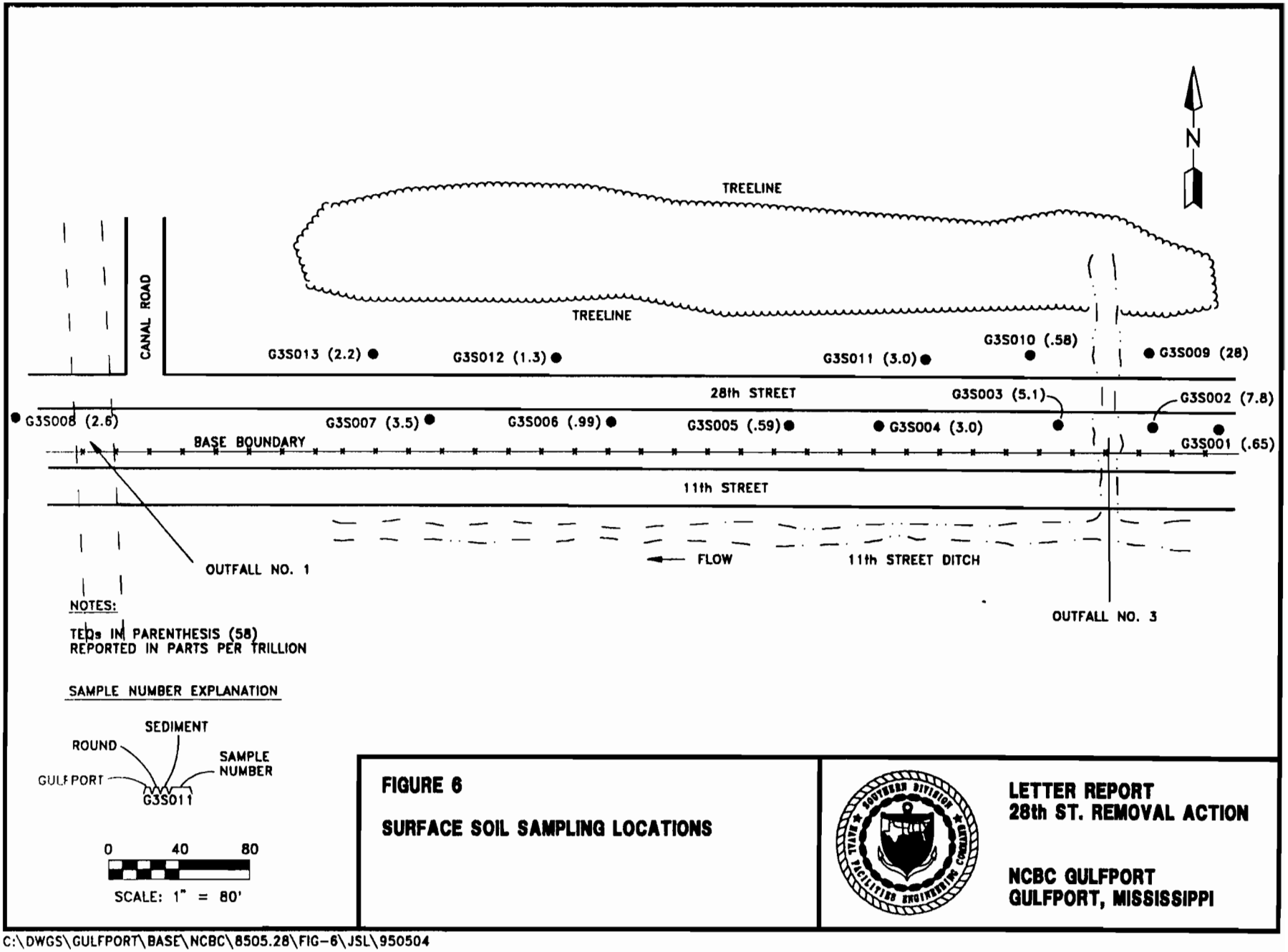

FIGURE 6

SURFACE SOIL SAMPLING LOCATIONS

LETTER REPORT
28th ST. REMOVAL ACTION

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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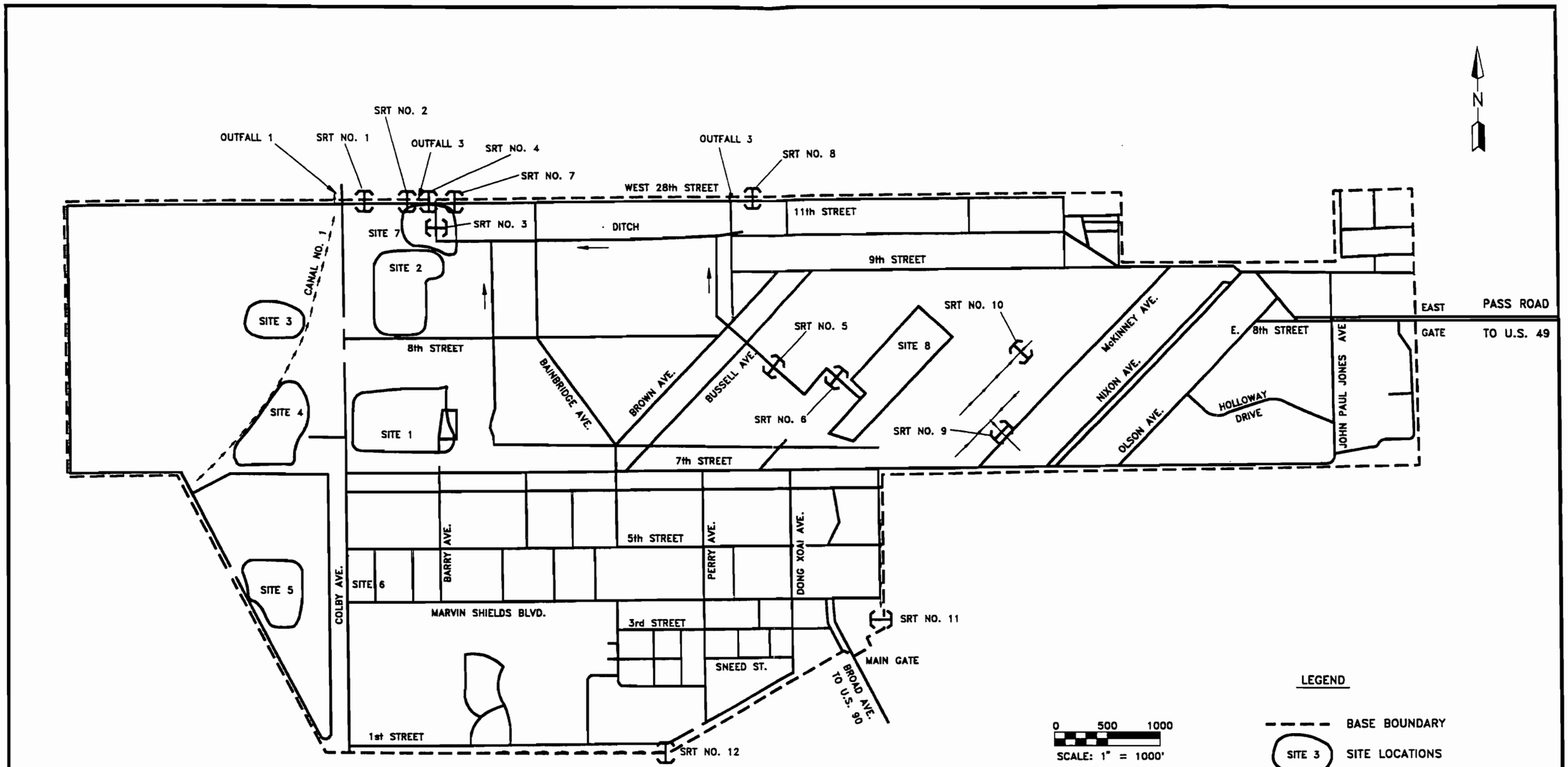

FIGURE 7

SRT LOCATIONS

LETTER REPORT
28th ST. REMOVAL ACTION

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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Figure 8
TE v TOC
Removal Action Technical Support
Naval Construction Battalion Center, Gulfport Mississippi

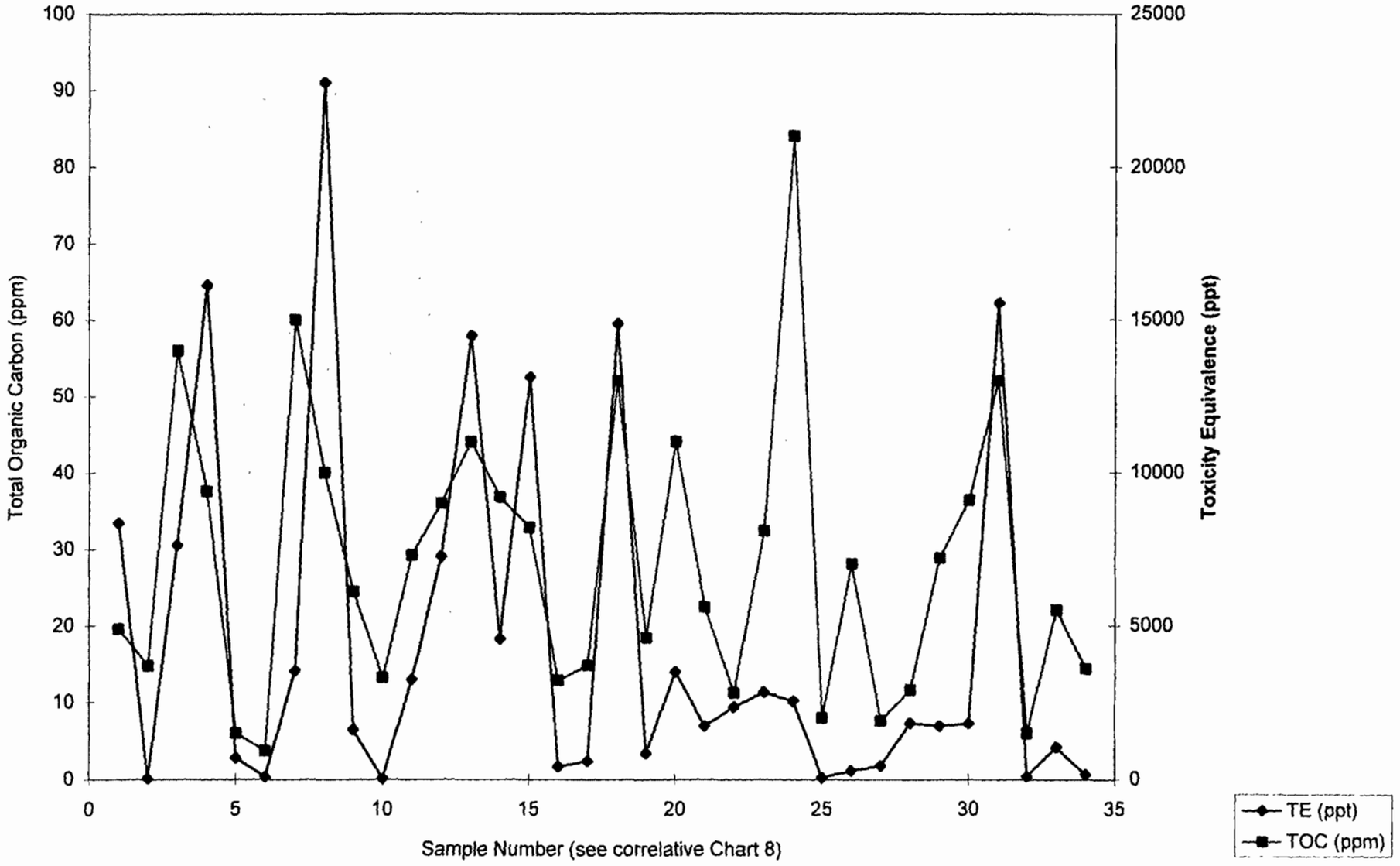
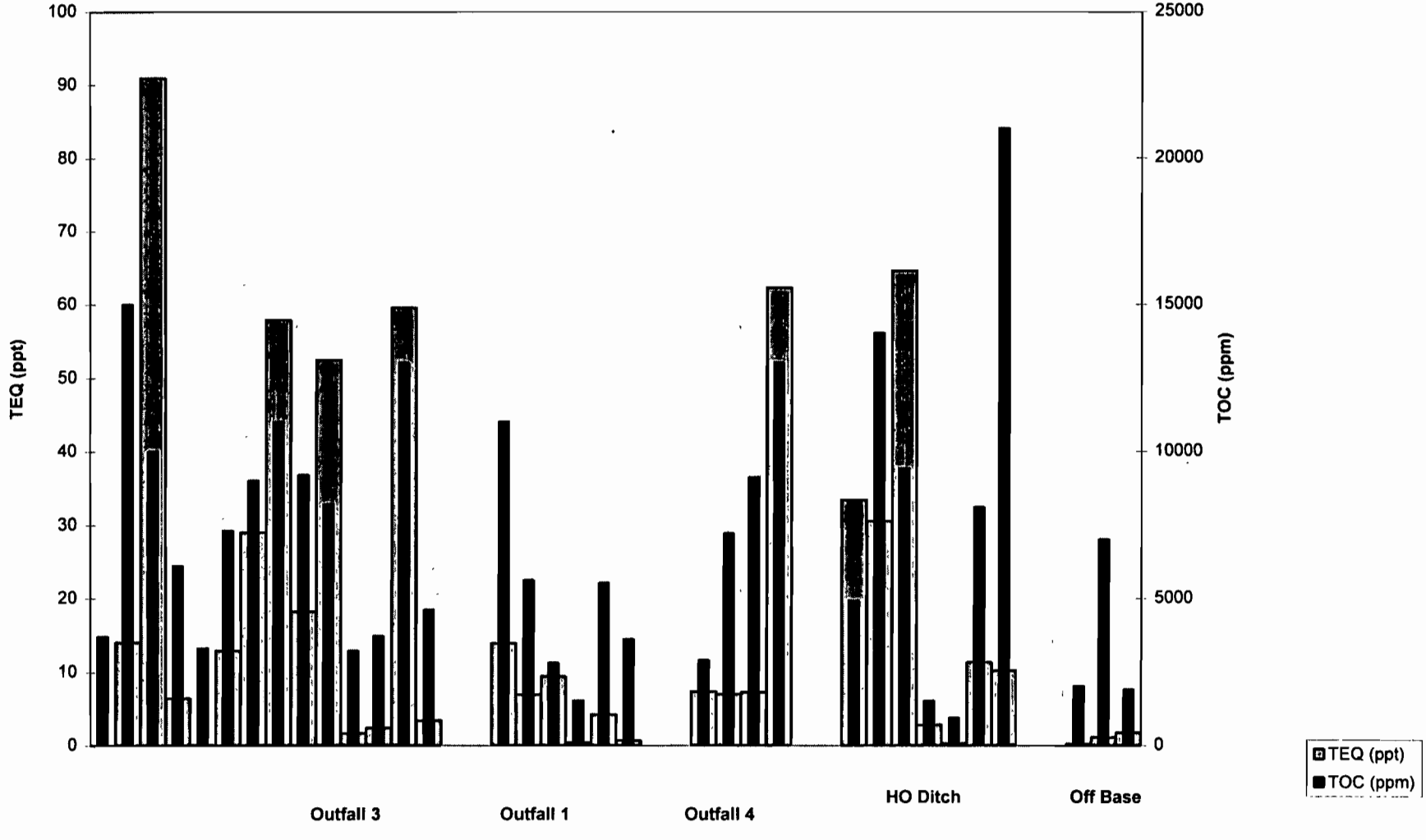


Figure 9
Graph of TOC v TEQ at Selected Locations
Removal Action Technical Support
Naval Construction Battalion Center Gulfport, Mississippi



ATTACHMENT B

TABLES

Table 1
Number of Samples Collected in Areas of Interest

Technical Support Removal Action
Naval Construction Battalion Center
Gulfport, Mississippi

Area of Concern	Number of Samples Collected
Outfall 1	6
Outfall 3	14
Outfall 4	4
Herbicide orange ditch	7
Turkey Creek Bridge on Canal Street	2
Turkey Creek at Ohio and Polk	1

Table 2
Volume of Gravel in each Sediment Recovery Trap

Technical Support Removal Action
Naval Construction Battalion Center
Gulfport, Mississippi

Sediment Recovery Trap Nos.	Volume of Gravel (cubic yards)
1	10
2	10
3	50
4	15
5	20
6	30
7	12
8	6
9	30
10	10
11	8
12	10
Total	211

Table 3
Dioxins and Furans Detected in Sediment

28th Street Sampling Event
Naval Construction Battalion Center
Gulfport, Mississippi

Analyte	TEF	G3D001006	G3D002036	G3D003006	G3D003006D1	G3D003006D2
2,3,7,8-TCDD	1	23	ND	27	23	15
1,2,3,4,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	11 J	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	11 J	ND	ND	8.3 J	ND
1,2,3,4,6,7,8-HpCDD	0.01	290	ND	110	180	53
OCDD	0.001	3,200	49 J	1,000	2,000	550
2,3,7,8-TCDF	0.1	14	ND	12	7.3	5.5
1,2,3,4,6,7,8-HpCDF	0.01	50	ND	16	30	10 J
OCDF	0.001	170	ND	64	110	35
Total TE concentration		33	0.049	31	29	17

Analyte	TEF	G3D004006	G3D005006	G3D006006	G3D007006	G3D007018
2,3,7,8-TCDD	1	55	1.5 J	ND	12	83
1,2,3,4,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	10 J	ND	ND	ND	11 J
1,2,3,7,8,9-HxCDD	0.1	22	ND	ND	ND	8.9 J
1,2,3,4,6,7,8-HpCDD	0.01	240	30	12	81	230
OCDD	0.001	2,100	980	180	1,000	2,000
2,3,7,8-TCDF	0.1	13	ND	ND	ND	9.3
1,2,3,4,6,7,8-HpCDF	0.01	38	ND	ND	21	47
OCDF	0.001	130	ND	ND	52	210
Total TE concentration		65	2.8	0.30	14	91

Analyte	TEF	G3D008006	G3D008006D1	G3D008006D2	G3D008018	G3D009006
2,3,7,8-TCDD	1	4.6 J	5.1	5.4	ND	11
1,2,3,4,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	0.01	66	35	26	ND	69
OCDD	0.001	890	390	250	90	810
2,3,7,8-TCDF	0.1	ND	ND	ND	ND	1.6 J
1,2,3,4,6,7,8-HpCDF	0.01	16	7.0 J	ND	ND	21
OCDF	0.001	130	48	35	ND	55
Total TE concentration		6.4	6	5.9	0.090	13

See notes at end of table.

Table 3 (continued)
Dioxins and Furans Detected in Sediment

28th Street Sampling Event
Naval Construction Battalion Center
Gulfport, Mississippi

Analyte	TEF	G3D009018	G3D010006	G3D011006	G3D012006	G3D012018
2,3,7,8-TCDD	1	23	51	16	47	1.6 J
1,2,3,4,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	6.8 J	8.5 J	ND	7.1 J	ND
1,2,3,7,8,9-HxCDD	0.1	6.5 J	8.3 J	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	0.01	160	180	73	140	ND
OCDD	0.001	1,900	1,900	870	1,400	31
2,3,7,8-TCDF	0.1	5.8	8.7	3.5 J	14	ND
1,2,3,4,6,7,8-HpCDF	0.01	47	43	21	35	ND
OCDF	0.001	150	150	59	130	ND
Total TE concentration		29	58	18	52	1.6

Analyte	TEF	G3D012036	G3D013006	G3D013018	G3D015006	G3D015006D1
2,3,7,8-TCDD	1	2.3 J	45	3.2 J	10	20
1,2,3,4,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	ND	15 J	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	ND	14 J	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	0.01	ND	390	8.6 J	130	110
OCDD	0.001	49	5,600	91	1,600	1,600
2,3,7,8-TCDF	0.1	ND	11	ND	6.1	11
1,2,3,4,6,7,8-HpCDF	0.01	ND	69	ND	27	26
OCDF	0.001	ND	250	ND	120	110
Total TE concentration		2.3	59	3.4	14	24

Analyte	TEF	G3D015006D2	G3D016006	G3D016018	G3D017006	G3D017006D1
2,3,7,8-TCDD	1	7.4	4.2 J	5.8	9.7	2.7 J
1,2,3,4,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	0.01	94	120	170	63	15
OCDD	0.001	1,100	990	1,300	570	150
2,3,7,8-TCDF	0.1	3.9 J	1.3 J	2.7 J	2.2 J	ND
1,2,3,4,6,7,8-HpCDF	0.01	20	27	23	13 J	ND
OCDF	0.001	75	100	77	58	ND
Total TE concentration		10	6.9	9.4	11	3.0

See notes at end of table.

Table 3 (continued)
Dioxins and Furans Detected in Sediment

28th Street Sampling Event
Naval Construction Battalion Center
Gulfport, Mississippi

Analyte	TEF	G3D017006D2	G3D018006	G3D022006	G3D023006	G3D024006
2,3,7,8-TCDD	1	16	6.5	ND	ND	ND
1,2,3,4,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	ND	ND	ND	ND	9.0 J
1,2,3,4,6,7,8-HpCDD	0.01	69	140	9.1 J	44	37
OCDD	0.001	530	1,300	120	670	470
2,3,7,8-TCDF	0.1	3.8 J	4.2 J	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	11 J	40	ND	ND	ND
OCDF	0.001	56	130	ND	ND	ND
Total TE concentration		18	10	0.21	1.1	1.7

Analyte	TEF	G3D024006D1	G3D024006D2	G3D027006	G3D028006	G3D029006
2,3,7,8-TCDD	1	ND	ND	5.9	3.4 J	6.0
1,2,3,4,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	16	15	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	0.01	64	64	61	160	50
OCDD	0.001	720	790	600	1,500	540 J
2,3,7,8-TCDF	0.1	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	ND	ND	16	32	14
OCDF	0.001	ND	ND	43	110	55 J
Total TE concentration		3.0	2.9	7.3	6.9	7.2

Analyte	TEF	G3D030006	G3D031006	G3D032006	G3D033006
2,3,7,8-TCDD	1	47	ND	1.6 J	ND
1,2,3,4,7,8-HxCDD	0.1	7.9 J	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	18	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	19	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	0.01	470	20	120	31
OCDD	0.001	4,200	190	1,100	310
2,3,7,8-TCDF	0.1	3.7 J	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	110	ND	21	ND
OCDF	0.001	300	15 J	60	15 J
Total TE concentration		62	0.41	4.2	0.64

See notes at end of table.

Table 3 (continued)
Dioxins and Furans Detected in Sediment

28th Street Sampling Event
Naval Construction Battalion Center
Gulfport, Mississippi

All values are in picograms per gram.

Notes:
TEF = toxic equivalency factors.
J = estimated value.
HpCDD = heptachlorodibenzo-p-dioxin.
TCDF = tetrachlordibenzofuran.
OCDF = octachlorodibenzofuran.
TCDD = tetrachlorodibenzo-p-dioxin.
HxCDD = hexachlorodibenzo-p-dioxin.
OCDD = octachlorodibenzodioxin.
HpCDF = heptachlorodibenzofuran.
TE = toxic equivalency.

Table 4
Dioxins and Furans Detected in Surface Soil

28th Street Sampling Event
Naval Construction Battalion Center
Gulfport, Mississippi

Analyte	TEF	G3S001	G3S002	G3S003	G3S004	G3S004D1
2,3,7,8-TCDD	1	ND	4.6 J	2.8 J	ND	ND
1,2,3,4,6,7,8-HPCDD	0.01	19	110	44	51	36
OCDD	0.001	380	1,500	760	650	470
2,3,7,8-TCDF	0.1	ND	1.9 J	1.8 J	1.3 J	ND
2,3,4,6,7,8-HxCDF	0.1	ND	ND	7.5 J	8.9 J	7.3 J
1,2,3,4,6,7,8-HpCDF	0.01	8.1 J	35	16	77	72
OCDF	0.001	ND	70	24 J	50	35
Total TE concentration		0.65	7.8	5.1	3.0	2.3

Analyte	TEF	G3S004D2	G3S005	G3S006	G3S007	G3S008
2,3,7,8-TCDD	1	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDD	0.01	26	17	34	120	110
OCDD	0.001	390	280	540	2,000	1,200
2,3,7,8-TCDF	0.1	ND	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	0.1	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	34	14	9.6 J	27	27
OCDF	0.001	20 J	ND	18 J	60	74
Total TE concentration		1.0	0.59	0.99	3.5	2.6

Analyte	TEF	G3S009	G3S010	G3S011	G3S012	G3S013
2,3,7,8-TCDD	1	25	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDD	0.01	81	16	110	20	90
OCDD	0.001	800	420	1,400	930	1,100
2,3,7,8-TCDF	0.1	6.6	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	0.1	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	22	ND	42	15 J	20
OCDF	0.001	68	ND	120	ND	31
Total TE concentration		28	0.58	3.0	1.3	2.2

All values are reported in picograms per gram.

Notes: TEF = toxic equivalency factors.
TCDD = tetrachlorodibenzo-p-dioxin.
J = estimated value.
HPCDD = heptachlorodibenzo-p-dioxin.
OCDD = octachlorodibenzodioxin.
TCDF = tetrachlordibenzofuran.
HxCDF = hexachlorodibenzofuran.
HpCDF = heptachlorodibenzofuran.
OCDF = octachlorodibenzofuran.
TE = toxic equivalency.

Table 5
Analytical Results

28th Street Sampling Event
Naval Construction Battalion Center
Gulfport, Mississippi

Sample Number	TEQ (ppt)	TOC (ppm)	Percent Clay and Silt	Percent Fine-Grained Sand	Percent Gravel
Sediment samples					
G3D001006	33.37	4,900			
G3D002006	0.049	3,700	30.5	67.7	0.1
G3D003006	30.5	14,000			
G3D004006	64.51	9,400	26.4	68.9	0
G3D005006	2.78	1,500			
G3D006006	0.3	930			
G3D007006	14.072	15,000			
G3D007018	90.9	10,000			
G3D008006	6.44	6,100	33.8	57.7	2.1
G3D008018	0.09	3,300	39.2	55.2	1.7
G3D009006	12.92	7,300	23.1	51.6	13.8
G3D009018	29.03	9,000			
G3D010006	57.83	11,000	33.7	60.9	0.4
G3D011006	18.219	9,200			
G3D012006	52.39	8,200			
G3D012018	1.63	3,200			
G3D012036	2.35	3,700			
G3D013006	59.44	13,000	35.3	50.7	1
G3D013018	3.37	4,600	22	47.7	13.7
G3D015006	13.9	11,000	9.7	52.9	21
G3D016006	6.89	5,600	1.4	25.4	28
G3D016018	9.37	2,800	1.1	21.9	32.2
G3D017006	11.3	8,100	39.7	58.2	0.1
G3D018006	10.15	21,000			
G3D022006	0.21	2,000			
G3D023006	1.11	7,000			
G3D024006	1.74	1,900			
G3D027006	7.313	2,900			
G3D028006	6.93	7,200	5.5	76.6	7.6
G3D029006	7.235	9,100			
G3D030006	62.16	13,000	19.6	52.9	4.9
G3D031006	0.405	1,500	2.9	72.9	0.3
G3D032006	4.17	5,500	3	51	2.6
G3D033006	0.635	3,600			
Surface soil samples					
G3S001		0.651	13,000	36.6	59.80.6
G3S002		7.81	25,000		
G3S003		5.114	15,000		
G3S004		3.0	6,600	12.6	75.70.3
G3S005		0.59	7,600	18.4	76.20.5
G3S006		0.994	9,000		
G3S007		3.53	13,000		

See notes at end of table.

Table 5 (Continued)
Analytical Results

28th Street Sampling Event
Naval Construction Battalion Center
Gulfport, Mississippi

Sample Number	TEQ (ppt)	TOC (ppm)	Percent Clay and Silt	Percent Fine-Grained Sand	Percent Gravel
Surface soil samples (continued)					
G3S008		2.644	8,100		
G3S009		27.558	14,000		
G3S010		0.58	16,000		
G3S011		3.04	16,000		
G3S012		1.28	6,300		
G3S013		2.231	7,600		

Notes: TEQ = toxicity equivalent.
ppt = parts per trillion.
TOC = top of casing.
ppm = parts per million.

Table 6
Removal Action: Contaminated Sediments Along 28th Street Road Work Area

Naval Construction Battalion Center
Gulfport, Mississippi

Recommended Actions	Areas of Interest						
	Sediments						Surface Soils
	Outfall 1	Outfall 3	Outfall 4	Base Ditches	Turkey Creek	Canal Bridge	28th Street
Excavate within limits of ditch(es) and canal	●	●	●				
Excavate within limits of construction	●	●	●				●
Dewatering of excavation -- pump to sediment recovery trap (1 to 2 basins)	●	●	●				
Hydraulic barrier: sheet pile installation	●	●					
Hydraulic barrier: small berm			●				
Excavate 1 foot depth	●	●	●				●
Excavate 2 feet depth or until contact zone	●	●	●				
Excavate 3 feet "plus"		●					
Isolated zone/localized excavation			●				
Temporarily store on base before transferring	●	●	●				●
Dismantlement and decontamination	●	●	●				
Confirmatory sampling	●	●	●				●
Continued monitoring	●	●	●	●		●	
Sediment recovery trap maintenance		●		●			
No further action					●	●	●

Table 7
Estimated Excavation in Volumes

Removal Action Technical Support
Naval Construction Battalion Center
Gulfport, Mississippi

Areas of Interest	Excavation Estimates (cubic yards)
Sediments at Outfall 1	87
Sediments at Outfall 3	179
Sediments at Outfall 4	53
Surface soil at Outfall 3	165
Total	484

Table 8
Sample Number Correlation

Removal Action Technical Support
Naval Construction Battalion Center
Gulfport, Mississippi

Sample Number	Graph Number
G3D001006	1
G3D002006	2
G3D003006	3
G3D004006	4
G3D005006	5
G3D006006	6
G3D007006	7
G3D007018	8
G3D008006	9
G3D008018	10
G3D009006	11
G3D009018	12
G3D010006	13
G3D011006	14
G3D012006	15
G3D012018	16
G3D012036	17
G3D013006	18
G3D013018	19
G3D015006	20
G3D016006	21
G3D016018	22
G3D017006	23
G3D018006	24
G3D022006	25
G3D023006	26
G3D024006	27
G3D027006	28
G3D028006	29
G3D029006	30
G3D030006	31
G3D031006	32
G3D032006	33
G3D033006	34

ATTACHMENT C

GLOSSARY

GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
DI	deionized
ID	identification
IDW	investigation derived waste
MS/MSD	matrix spike and matrix spike duplicates
NCBC	Naval Construction Battalion Center
NEESA	Naval Energy and Environmental Support Activity
ppm	parts per million
ppt	parts per trillion
QA/QC	quality assurance and quality control
ROW	right-of-way
SRT	sediment recovery trap
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TE	toxic equivalency
TEF	toxic equivalency factor
TEQ	toxicity equivalent
TOC	total organic carbon
USEPA	U.S. Environmental Protection Agency

ATTACHMENT D

REFERENCES

REFERENCES

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