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REPORT FOR PILOT-SCALE SOIL/SEDIMENT TREATABILITY STUDY, SITE 8 HERBICIDE ORANGE STUDY AREA NCBC GULFPORT MS

12/1/2001

TETRA TECH

Report
for
Pilot-Scale Soil/Sediment Treatability Study

Site 8
Herbicide Orange Study Area

at

Naval Construction Battalion Center

Gulfport, Mississippi

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0143

December 2001

110103/P

REPORT
FOR
PILOT-SCALE SOIL/SEDIMENT TREATABILITY STUDY

SITE 8
HERBICIDE ORANGE STUDY AREA

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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Naval Facilities Engineering Command
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North Charleston, South Carolina 29406

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DECEMBER 2001

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/kg	microgram per kilogram
AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
CBR	California Bearing Ratio
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	Contract Task Order
H20	Highway 20
HLA	Harding Lawson Associates, Inc.
HO	Herbicide Orange
hr	hour
kg	killogram
lb	pound
LLDPE	Linear Low Density Polyethylene
MCL	maximum contaminant level
MDEQ	Mississippi Department of Environmental Quality
NCBC	Naval Construction Battalion Center
ng/kg	nanogram per kilogram
pcf	pound per cubic foot
pg/L	picograms per liter
psi	pound per square inch
RBC	risk-based concentration
SOUTHDIVNAVFACENGCOM	Southern Division Naval Facility Engineering Command
SPLP	synthetic precipitation leaching procedure
SRT	sediment recovery trap
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofuran
TEQ	toxicity equivalent
TRG	target risk goal
TtNUS	Tetra Tech NUS, Inc.
UCS	Unconfined Compressive Strength
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
yd^3	cubic yards

1.0 INTRODUCTION

1.1 SCOPE AND PURPOSE

This Pilot-Scale Treatability Study Report for Naval Construction Battalion Center (NCBC) Gulfport, Site 8, Herbicide Orange Study Area (Site 8) has been prepared by Tetra Tech NUS, Inc. (TtNUS) for the Southern Division Naval Facilities Engineering Command (SOUTHDIVNAVFACENGCOM) under the Navy Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract Number N62467-94-D-0888, Contract Task Order (CTO) 0143. The purpose of this report is to describe the activities of the soil ash and sediment stabilization pilot-scale treatability study that was conducted at Site 8 of NCBC Gulfport in July and August 2001.

1.2 SITE HISTORY AND PROJECT BACKGROUND

Site 8 occupies approximately 30 acres in the north central section of NCBC Gulfport. From 1968 to 1977, the site was used by the U.S. Air Force (USAF) for the storage of approximately 850,000 gallons of Herbicide Orange (HO) in 55-gallon drums. It was originally believed that only 12 acres of the site, designated as Site 8A, had been used for HO storage, but two additional storage areas were later identified, including 17-acre Site 8B and 1-acre Site 8C. Figure 1-1 shows the location of Sites 8A, 8B, and 8C.

The main chemical of concern at the site is 2,3,7,8-tetrachlorodibenzo-p-dioxin, or TCDD, which is a manufacturing impurity of the HO. In this document, TCDD and the other dioxins found in HO will be collectively referred to as “dioxin.”

In 1977, the USAF disposed of the entire HO inventory by high-temperature incineration at sea. From 1987 to 1988, a quantity of dioxin-contaminated soil was treated on site by high-temperature incineration and the resulting ash were stored on Site 8A. This ash meets the dioxin delisting concentration criterion of 1.0 microgram per kilogram (µg/kg) set by the Mississippi Department of Environmental Quality (MDEQ, 1997).

As a result of the spills and leaks that occurred during the years of HO storage, dioxin has migrated from Site 8 to the system of on-base ditches which drain surface runoff from the site and to the off-base swampland located across 28th Street from Outfall 3. Since dioxin has an affinity for soil and is not readily water soluble, this migration has primarily occurred through the erosion and transportation of contaminated soil from the site and deposition in the sediment of the on-base ditches and off-base swampland.

Site 8A is currently used to store construction debris and dioxin-contaminated sediment excavated from ditches as part of removal actions conducted during the widening of 28th Street in 1995 and the 1997 upgrading of the sediment recovery trap (SRT) system located in the on-base drainage ditches.

The currently proposed remedial approach for the contaminated soil and sediment is to excavate dioxin-contaminated sediment from on-base drainage ditches and off-base swampland and to consolidate the excavated material on Site 8A with the incineration ash, construction debris, and contaminated sediment from previous excavation activities. The consolidated material would then be capped and the capped area used as a parking and storage area for heavy construction equipment. Based upon a MDEQ Tier I target risk goal (TRG) soil/sediment dioxin concentration criterion of 38 nanograms per kilogram (ng/kg), the currently estimated volumes of the materials to be consolidated on Site 8A are as follows [Harding Lawson Associates (HLA), 2000]:

Material	Estimated Volume (cubic yards)
Site 8A Incinerated Soil Ash	21,000
Site 8A Construction Debris	600
On-Base Ditches Contaminated Sediment	24,000
Off-Base Swamp Contaminated Sediment	13,000
Total	**58,600**

For the purpose of this report, the mixture of the above-listed media in proportion to their estimated volumes is referred to as the Material Blend. Figures 1-2 and 1-3 show the approximate areal extent of the on-base and off-base contaminated media, respectively.

A bench-scale treatability study was conducted (TtNUS, 2001a) to determine the geotechnical characteristics of the Material Blend and its suitability to support a Highway 20 (H20) loading, as defined by the American Association of State Highway and Transportation Officials (AASHTO, 1973). The evaluation criteria used to determine the suitability of the Material Blend are a minimum California Bearing Ratio (CBR) of 20 and a minimum 28-day unconfined compressive strength (UCS) of 50 pounds per square inch (psi).

The bench-scale treatability study test results indicate that the Material Blend without stabilizing reagents will not support H20 loading (TtNUS, 2001a), but that the addition of a relatively small amount of Type I Portland cement (i.e., 5 to 10 percent by weight) to the Material Blend improves its load bearing capacity so that it does satisfy the H20 criterion.

1.3 STUDY OBJECTIVES

The purpose of this pilot-scale treatability study was to determine the technical feasibility and practicality of implementing the findings of the bench-scale treatability study on a scale representative of actual remedial operations. The primary objectives of this pilot-scale treatability study are as follows:

- Determine the most effective methods for excavating and transporting the various contaminated media (incinerated soil ash, and on-base ditch and off-base swampland sediment) from their current locations to the Site 8A operations area.

- Verify the effectiveness of a mechanical vibrating screen for the removal of oversized particles from the contaminated media.

- Determine the most effective method of removing excess free water from the sediment excavated from the on-base ditches and off-base swampland.

- Determine the most effective method for mixing the various contaminated media into a homogeneous Material Blend, as well as for mixing the Material Blend with the required Portland cement additive to form the amended Material Blend.

- Determine the most effective method of placing/landfilling the amended Material Blend.

- Verify that the load bearing capacity and dioxin leachability of the amended Material Blend are within required parameters.

In addition, the following activities were planned during the pilot-scale treatability study:

- Remove all dioxin-contaminated sediment from the Edwards Property, which is located in the off-base swampland area. (As further discussed in Section 2.0, this activity will be performed in November and December 2001.)

- Verify that all dioxin-contaminated sediment has been removed from the drainage ditches of Sites 8B and 8C. (Note: An action memorandum for the time critical removal of drainage ditch sediment at Sites 8B and 8C will be issued in November 2001. Excavation should be performed within 6 months of issuance of the memorandum.)

- Stockpile at Site 8A excavated materials not used in the pilot study and any testing residues, and temporarily close Site 8A, pending the commencement of full-scale remediation operations.

1.4 DOCUMENT ORGANIZATION

This report is organized into the following three sections.

- Section 1.0 provides this brief introduction.
- Section 2.0 describes the field activities and results.
- Section 3.0 provides conclusions and recommendations.

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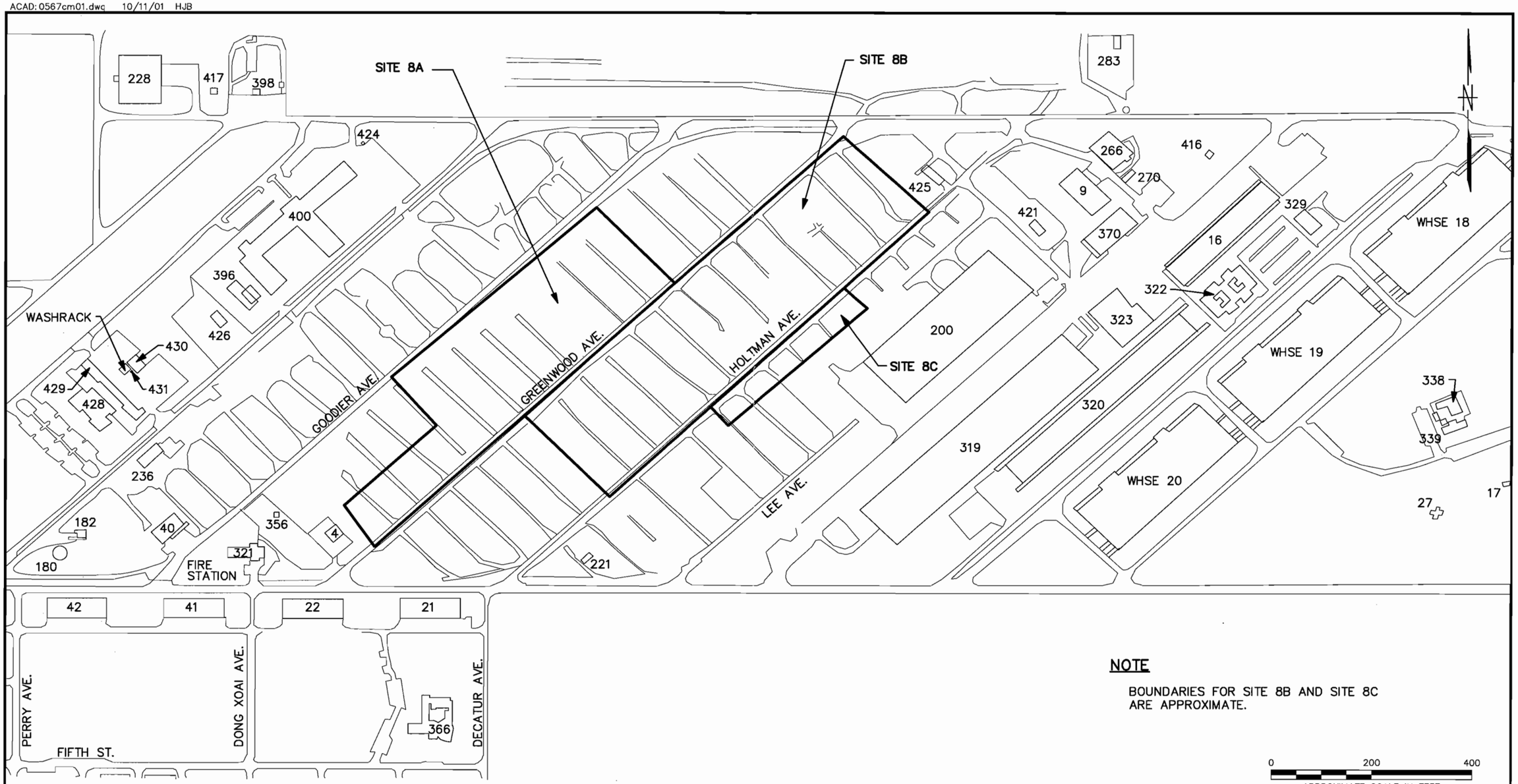

NOTE

BOUNDARIES FOR SITE 8B AND SITE 8C ARE APPROXIMATE.

SOURCE: REMEDIATION GUIDANCE DOCUMENT, HARDING LAWSON ASSOCIATES, MARCH 2000.

DRAWN BY MF DATE 7/5/01	DEPARTMENT OF THE NAVY SOUTHERN DIV FACILITIES ENGINEERING COMMAND	SITES 8A, 8B, AND 8C LOCATION MAP PILOT-SCALE TREATABILITY STUDY NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 0567
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COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-1 REV. 0

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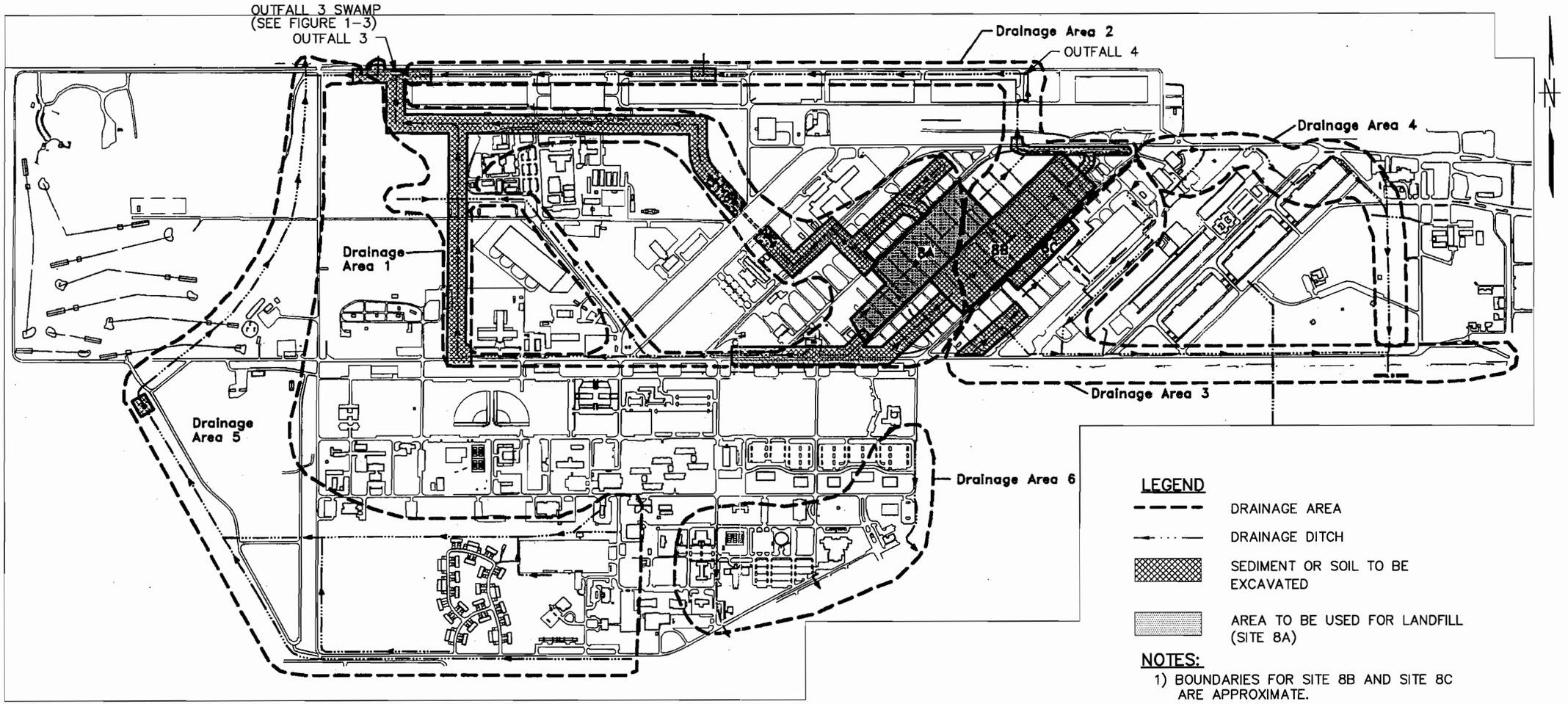

LEGEND

- DRAINAGE AREA
- DRAINAGE DITCH
- SEDIMENT OR SOIL TO BE EXCAVATED
- AREA TO BE USED FOR LANDFILL (SITE 8A)

NOTES:

1) BOUNDARIES FOR SITE 8B AND SITE 8C ARE APPROXIMATE.
2) WIDTHS ACROSS DRAINAGE DITCHES ARE NOT TO SCALE.
3) ONLY DRAINAGE DITCH AT SITES 8B & 8C ARE CONTAMINATED.

0 500 1000
APPROXIMATE SCALE IN FEET

SOURCE: REMEDIATION GUIDANCE DOCUMENT, HARDING LAWSON ASSOCIATES, MARCH 2000.

DRAWN BY HJP DATE 7/5/01	DEPARTMENT OF THE NAVY · NAVAL FACILITIES ENGINEERING COMMAND · SOUTHERN DIVISION	AREAL EXTENT OF ON-BASE CONTAMINATED MEDIA PILOT-SCALE TREATABILITY STUDY NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 0567
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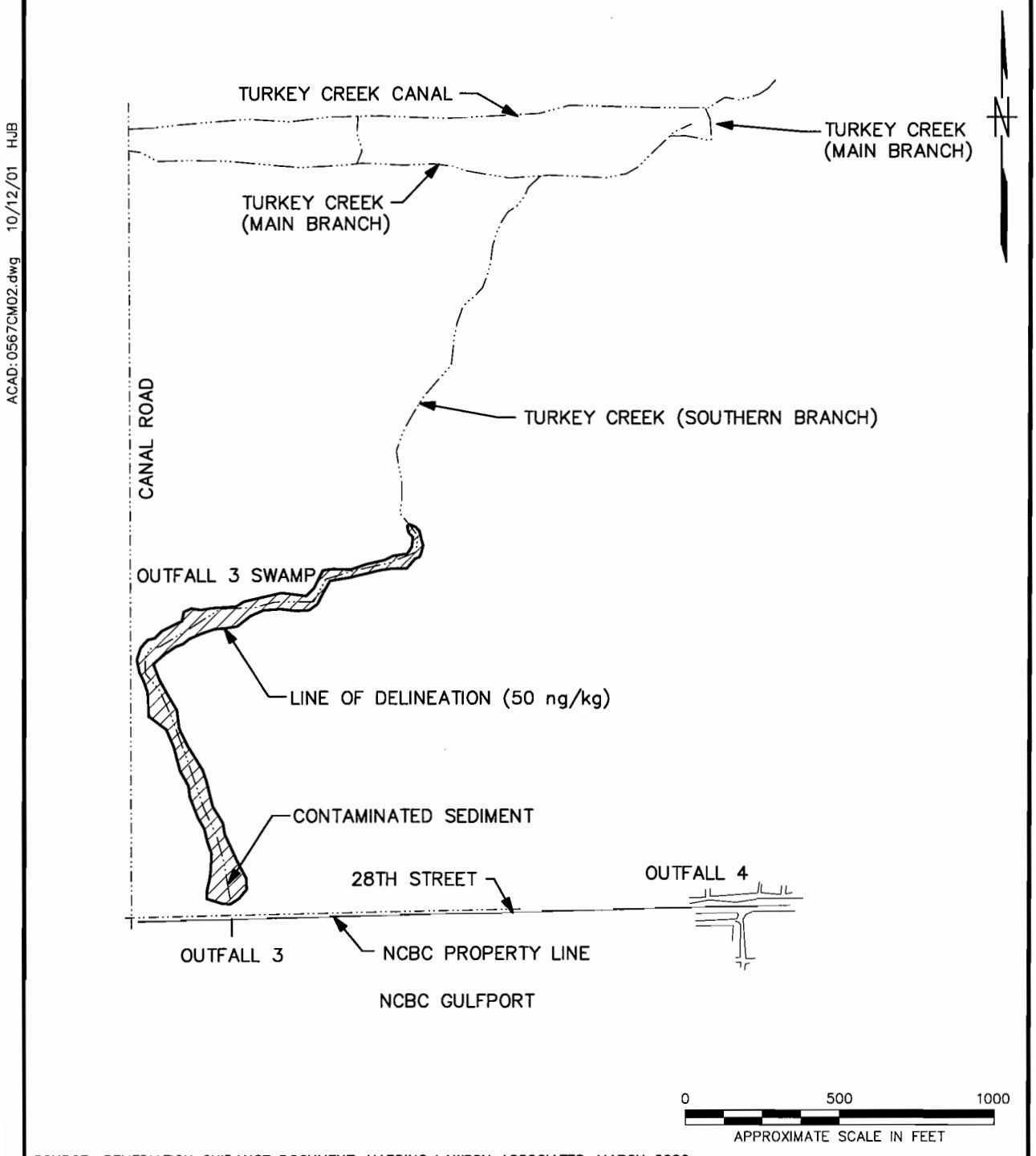

SOURCE: REMEDIATION GUIDANCE DOCUMENT, HARDING LAWSON ASSOCIATES, MARCH 2000.

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CHECKED BY SWH DATE 7/5/01			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-3 REV. 0

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ACAD: 0567CM02.dwg 10/12/01 HJB

2.0 PILOT-SCALE FIELD ACTIVITIES/RESULTS

2.1 SITE PREPARATION/LAYOUT

Pilot-scale field activities were initiated in July 2001 with the clearing and grubbing of the southwestern portion of Site 8A. These activities were performed in order to prepare an area to construct a Material Staging Pad, Test Pad, and Truck Washing Station (see Figure 2-1).

2.1.1 Material Staging Pad

The Material Staging Pad was used during pilot-scale activities for temporary storage of excavated materials and for one of two methods of material premixing. The existing soil surface of the Material Staging Pad footprint was graded to a minimum slope of 3 percent to facilitate drainage and a sump was constructed in the northern corner for drainage collection. Next, the graded soil was compacted and earthen berms were constructed along the perimeter of the pad. Segments of a 40-mil Linear Low Density Polyethylene (LLDPE) liner were then laid across the graded soil and welded at the seams, and sandbags were put in place along the perimeter to hold the liner down. A detail of the berm is provided in the Pilot-Scale Treatability Study Work Plan (TtNUS, 2001b).

2.1.2 Test Pad

Clearing and grubbing of the Test Pad Area was performed concurrently with that of the Material Staging Pad. Once clearing and grubbing was completed, the subgrade was leveled by a bulldozer and then aerated using a soil stabilizer to volatilize entrained moisture. A vibratory roller was then used for compaction to ensure a durable surface to place the Material Blend.

2.1.3 Truck Washing Station

A Truck Washing Station was constructed at the only access point to the Material Staging Pad. It was used to wash any equipment that was leaving the site to travel along the on-base or off-base roads. Wash water from the Truck Washing Station drained to the sump in the northern corner of the Material Staging Pad. A layer of gravel was placed over the LLDPE liner at the Truck Washing Station to provide traction and protect the liner.

2.2 EXCAVATION TESTS

The objectives of the excavation tests were:

- To determine the most effective method for excavating and transporting contaminated media to Site 8A under full-scale operations.

- To gather sufficient quantities of each type of contaminated medium to perform the treatability tests.

- To remove all dioxin-contaminated sediment from the Edwards property that is located in the off-base sediment swampland area.

To meet these objectives, TtNUS excavated representative volumes of on-base drainage ditch sediment, incinerated soil ash, and off-base swampland sediment. The following sections provide a brief description of the excavation and transportation operations. Photographs (*.jpg files) and videos (*.mpg files) of the excavation and transportation operations used during the pilot-scale treatability study are presented on a CD-ROM included in this report as Appendix A.

2.2.1 On-base Sediment

During the bench-scale study, two types of on-base, dioxin-contaminated sediment were observed in the drainage ditches. In the upper reaches of the drainage ditch system, the prevalent sediment type is a fine-grained sand with small amounts of vegetation and organic material, 1 to 3 inches in depth. In the lower reaches of the drainage ditch system, where free-standing water is typically observed year round, additional material consisting of decayed organic matter and settled fines is observed in an upper layer above the fine-grained sand. Both sediment types were excavated during the pilot-scale treatability study.

Sandy Sediment

Approximately 276 cubic yards (yd^3) of sandy sediment (unconsolidated material) were excavated from the drainage ditches shown on Figure 2-2. When standing water is present, the drainage ditches were excavated in sections. Prior to excavation, the surface water flow of the drainage ditch was obstructed by installing either sheet piling or placing native soil at the ends of each ditch section. Water within the obstructed section was subsequently pumped to a downstream ditch segment. The sandy sediment was then excavated from the dewatered ditch section using a wheeled excavator and loaded into 6 yd^3 dump trucks. Approximately a 6-inch thick layer of material was excavated from the bottom and side portions of the drainage ditch. Vegetative matter (e.g., grass, weeds) was observed in varying amounts in the excavated material.

In the first phase of sandy sediment excavation, liners were placed in the dump trucks to prevent liquid contained in the saturated sediment from leaking from the truck. The excavated material was then hauled

a short distance to the Material Staging Pad (approximately 400 feet) and staged for subsequent pilot-scale study activities. Dump trucks were washed in the Truck Washing Station prior to leaving the Material Staging Pad. Under these conditions and using two dump trucks in rotation, an excavation/hauling rate of 34 yd^3/hour (hr) was achieved.

One problem was encountered during the excavation of the initial batches of sandy sediment. When the material was unloaded on the Material Staging Pad, the liners often became entangled within the unloaded material. Efforts to remove the liners from the material proved extremely difficult by hand or machine without tearing the liner and leaving pieces of the liner within the excavated material. Also, after each hauled batch was unloaded onto the Material Staging Pad, replacement of the liners in the dump truck slowed down the excavation operation. During full-scale operations, the use of dump trucks with gasketed tailgates would eliminate these problems. No other logistical problems were encountered during the excavation and transport of sandy sediment to the Material Staging Pad.

Due to the proximity of the sandy sediment excavation area to the Material Staging Pad, excavation of sandy sediment was also conducted without the truck liners. Without the use of liners and using three dump trucks in rotation, an excavation/hauling rate of 104 yd^3/hr was achieved.

Sandy Sediment with Decayed Organic Matter

Approximately 120 yd^3 of sandy sediment with decayed organic matter (unconsolidated material) were excavated from the drainage ditches shown on Figure 2-3. An SRT is located downstream of this section of drainage ditch and during periods of frequent rainfall, freestanding water can be deeper than 3 feet in this section. Freestanding water was not removed prior to excavation due to the time that would have been required to dewater the ditch. The SRT filtered sediment particles resuspended by the excavation operation from the standing water as it flowed to downgradient ditch sections.

The sediment was excavated by a wheel excavator and loaded into 6 yd^3 dump trucks, which were hauled approximately 1 mile to the Material Staging Pad (2 miles per round trip). Due to the saturated condition of the excavated sediment, approximately 4 yd^3 of sediment were loaded into the dump trucks per trip to prevent spillage due to sloshing during transport. The dump trucks were washed in the Truck Washing Station prior to leaving the Material Staging Pad. Using a rotation of two dump trucks, an excavation/hauling rate of 28 yd^3/hr was achieved. Other than the problem encountered with the use of liners in the dump trucks (discussed previously), no logistical problems were encountered during the excavation and transport of sediment to the Material Staging Pad. Vegetative matter (e.g., grass, leaves, weeds) was observed in varying amounts in the excavated material.

2.2.2 Soil Ash

Incinerated soil ash was hauled to the Material Staging Pad from piles located within the boundaries of Site 8A. Numerous soil ash piles are present at Site 8A as a result of incineration operations that were conducted in the late 1980s to remediate dioxin-contaminated soils at Site 8 (HLA, 2000). The soil ash is a blackish gray, fine-grained, uniformly sized silty sand. Gravel has been placed atop the soil ash piles to reduce wind erosion of the ash.

Soil ash was excavated and loaded into 6 yd^3 dump trucks using a front end wheel loader and then hauled to the Material Staging Pad. Estimates of the volume and rate of soil ash hauled to the Material Staging Pad were not noted during the pilot-scale study due to the ash's proximity to the Material Staging Pad (varying from 300 to 700 feet) and the ease of loading and hauling of the material. No logistical problems were encountered during the excavation and transport of soil ash to the Material Staging Pad.

2.2.3 Off-base Sediment

The initial objective of the off-base, phase of the pilot-scale testing was to remove all dioxin-contaminated sediment from the Edwards property. This property is located in an off-base swampland area and TtNUS personnel attempted to access the Edwards property in July 2001 by constructing a temporary gravel haul road from a 58th Avenue right-of-way. An existing gravel road was to be extended for this purpose. During the clearing and grubbing of the initial stretch of right-of way, field personnel observed very soft ground conditions and standing water. Attempts to construct a haul road consisting of a woven geotextile overlaid by a layer of gravel were not successful. After heavy machinery made several passes along the newly constructed road, large ruts were observed. Upon consultation with the Navy, it was decided that excavation of sediment from the Edwards property would be postponed until November/December 2001 when ground conditions are expected to be drier. Excavation activities at the Edwards property will be discussed in the Edwards Property Closure Report scheduled for delivery in the spring of 2001.

To obtain the volume of off-base sediment necessary to conduct the pilot-scale study, approximately 80 yd^3 of off-base swampland sediment (unconsolidated material) were excavated from a location off Canal Road as shown on Figure 2-4. For access to the sediment, a short road (approximately 65 feet in length) was constructed consisting of a road base of trees with native soil used to fill in the voids. A geotextile liner was then laid atop the road base followed by a layer of gravel.

Once the construction of the road was completed, the sediment surrounding the road was excavated with a track excavator and loaded into 6 yd^3 dump trucks. Due to the saturated condition of the excavated sediment, approximately 4 yd^3 of sediment were loaded into the dump trucks per trip to prevent spillage due to sloshing during transport. Sediment was excavated in a width of approximately 15 feet around the

perimeter of the gravel road and to an approximate depth of 2 feet. The off-base swampland sediment is characteristic of a fine-grained silty clay and contained small amounts of vegetative matter (e.g., roots, small twigs, grass).

Using a rotation of three dump trucks, an excavation/hauling rate of 21 yd^3/hr was achieved (approximately 30 minutes per round trip for each truck). Each round trip was approximately 3.5 miles. Dump trucks were washed in the Truck Washing Station prior to leaving the Material Staging Pad. Of all the media excavated, excavation of off-base sediment resulted in the slowest operation rate. Factors that affected this rate included the following:

- The dump trucks were required to enter and exit the base through the Pass Road gate (eastern gate of the NCBC Gulfport). Use of one of the two northern entrances during full-scale operations would reduce the round-trip distance by approximately 1.5 miles per trip.

- As described in Section 2.2.1, replacement of dump truck liners slowed down the hauling process. Use of dump trucks with gasketed tailgates would reduce time needed for each round trip of the dump trucks.

- The dump trucks could not be used to full capacity due to the wetness of the sediment.

It should also be noted that off-base sediment excavation was conducted during a period of normal security procedures. Excavation activities conducted during heightened periods of security could significantly reduce the rate of sediment hauling.

2.3 SOIL SCREENING TESTS

Soil screening tests were performed to see how efficiently excavated material could first be screened to remove large vegetative matter then shredded to reduce the size of any vegetative matter that passed through the screening process. A screening plant was used to perform the screening tests. The screening plant contained a 9 yd^3 capacity hopper with a bar screen, a shredder, a 30-inch by 40-foot conveyor, and a 4-foot by 8-foot wire mesh screen.

Upon commencing the screening tests, problems were encountered with the plastic liners that were used in the dump trucks. The plastic liners became entangled in the bar screen, thus blocking any material from passing through to the hopper. Additional problems were encountered during the shredding process. The shredder was unable to handle some of the vegetative matter (roots) that passed through the screen. This vegetative matter would jam the shredder, requiring the machine to be shut down to remove the material. These circumstances caused significant delays in the soil screening process.

It is estimated that vegetative matter composed approximately 5 percent of the total volume of excavated material and consisted mostly of smaller-sized particles. Due to the observed small amount and size of the vegetative material, it was decided that screening and shredding the excavated material was not a necessary step, and any oversized material could be removed when the blended material was placed in the Test Pad lifts

2.4 FREE WATER REMOVAL TESTS

Free water removal tests were performed on the excavated off-base sediment. After the excavated sediment was hauled to the Material Staging Pad, samples were analyzed for moisture content using American Society for Testing and Materials (ASTM) Method D4643-87 (microwave method). Three samples were collected at various locations approximately 1 foot above the bottom of the off-base sediment stockpile. Additionally, samples were collected approximately 24 hours later from the same locations to approximate the free-water removal achieved during this time period. The results of this sampling are summarized below and moisture content data sheets are presented in Appendix B.

Sample ID	Initial Moisture Content (T = 0 days)	Moisture Content (T = 1 day)	% Removal
Off-base Sediment 1	27.2	24.2	11.0
Off-base Sediment 2	23.0	21.2	7.8
Off-base Sediment 3	24.0	23.5	2.1
Average	**24.7**	**23.0**	**6.9**

2.5 MIXING AND SPREADING TESTS

Mixing and spreading tests were conducted to verify that each of the components of the Material Blend could be mixed into a homogeneous mixture. Two lifts of the Material Blend were placed at the Test Pad during the pilot-scale activities and two methods of mixing/spreading were used for each of the lifts. Descriptions of these methods are presented in the following sections. Cross sections of the Test Pad are presented on Figure 2-5. The locations of the cross sections are presented on Figure 2-1.

2.5.1 Lift No. 1

For Lift No. 1, the Material Blend components (i.e., on-base sandy sediment, on-base sandy sediment with decayed organic matter, soil ash, and off-base sediment) were loaded from the four stockpiles on the Material Staging Pad using a front-end loader. The components were placed in a dump truck at a volume ratio of approximately four parts soil ash, four parts on-base sediment (three parts sandy sediment and one part sandy sediment with decayed organic matter), and two parts off-base sediment. Premixing of

the Material Blend components was performed by alternating bucket loads of the material in the dump truck until it was full. The following order was used:

- soil ash
- off-base sediment
- on-base sediment (sandy)
- on-base sediment (sandy with decayed organic matter)
- soil ash
- off-base sediment
- on-base sediment (sandy)
- soil ash
- on-base sediment (sandy)
- soil ash

Approximately 2 yd^3 of material were contained in each front loader bucket; consequently, after every three buckets, the material contained within the 6-yd^3 dump truck was hauled to the Test Pad Area. After placement of several dump-truck loads of material, a bulldozer was used to mix/spread this material at the Test Pad. The resulting loose (unconsolidated) lift of soil was approximately 11 inches thick (average), 28 feet wide, and 150 feet in length. Next, a soil stabilizer (8-foot width of cut) was used to mix the Material Blend lift. After several passes of the soil stabilizer, visual inspection of the Material Blend lift indicated a homogeneous mixture.

Next, 25 tons of Type I Portland cement, approximately 9 percent by weight of the Material Blend, were pneumatically blown onto the lift in three piles. To suppress dust generation, a thick layer of plastic sheeting was placed atop the pneumatic hose when the piles were generated. The perimeter of the plastic sheeting was held down with sandbags and large stones found on site. Additionally, the bucket of the front-end loader was placed atop the hose to prevent its movement during the unloading of Portland cement. Once the cement piles were placed, a bulldozer was used to spread the Portland cement across the lift.

After the Portland cement was spread, the soil stabilizer was used to mix the Portland cement into the Material Blend lift. After two passes of the soil stabilizer, phenolphthalein was sprayed along several vertical cross sections that were made by selected shovel excavations in the lift. Phenolphthalein in the presence of alkaline material turns pink. A uniform pink color could be observed along the sprayed cross sections, giving an indication of the homogeneous distribution of the Portland cement throughout the depth of the lift.

2.5.2 Lift No. 2

For Lift No. 2, the Material Blend components were loaded from the stockpiles in the Material Staging Pad using a front-end loader. However, in lieu of loading alternating buckets of material into the dump trucks, Material Blend was premixed in batch piles on the Material Staging Pad surface. The components of the Material Blend were premixed in 40 yd^3 batches in the same ratio used in Lift No. 1. Preliminary mixing of the batch piles was performed using a wheel excavator for approximately 15 to 20 minutes for each batch. Next, the Material Blend loaded into the dump trucks was hauled to the Test Pad. After placement of several dump-truck loads of material, a bulldozer was used to mix/spread this material into a unconsolidated lift of material approximately 7 inches thick (average), 28 feet wide, and 150 feet in length.

After the spreading of both types of pre-mixed Material Blend, the bulldozer operator reported a more difficult time spreading the material premixed by the first method (used for Lift No. 1) than the second (used for Lift No. 2). This observation is an indication that material premixed by the second method is more homogenous than that premixed by the first. However, premixing by the second method resulted in a slower material hauling rate to the Test Pad Area.

After several passes of the soil stabilizer, visual inspection of the amended Material Blend indicated a homogeneous mixture. Next, nine tons of Type I Portland cement were pneumatically blown onto Lift No. 2 in three piles to achieve an approximate 5 percent by weight Portland cement component of the amended Material Blend. Cement spreading, and cement/Material Blend mixing were conducted in the same manner as was performed for Lift No. 1. As with Lift No. 1, a uniform pink color could also be observed along Lift No. 2 cross sections sprayed with phenolphthalein, giving an indication of the homogeneous distribution of the Portland cement throughout the depth of the lift.

2.6 COMPACTION/GEOTECHNICAL TESTS

The effectiveness of the mixing and spreading tests were further evaluated by determining the geotechnical compaction and strength characteristics of the resulting Material Blend. The following sections describe the activities conducted for these purposes.

2.6.1 Moisture-Density Relationship Tests

Prior to the mixing of the Material Blend with cement at the Test Pad, 5-gallon bucket samples of the Material Blend were collected for moisture-density analysis in accordance with ASTM Method D698. The laboratory procured to perform the moisture-density analysis was Eustis Engineering Company, Inc. (Eustis), Metairie, Louisiana.

For Lift No. 1, four 5-gallon buckets of the Material Blend were collected from the locations shown on Figure 2-6. Moisture-density analysis is not be performed on soil-cement samples when the curing process has started. As a result, the Material Blend samples were collected prior to cement addition and were sent to Eustis with one 5-gallon bucket of Portland cement. Before analysis, Eustis was instructed to add Portland cement to each of the four samples to simulate the composition of Lift No. 1. Once the cement was added, sample compaction curves were generated in accordance with ASTM Method D698.

Similar to Lift No. 1, four 5-gallon buckets from Lift No. 2 were collected from the locations shown on Figure 2-7 and were shipped to Eustis, along with one 5-gallon bucket of Portland cement. For the Lift No. 2 samples, Eustis was also instructed to add cement to each of the four samples to simulate the composition of Lift No. 2. The moisture-density results for the Material Blend of Lifts No. 1 and No. 2 can be found in Appendix C and are summarized in the table below.

LIFT NO.	SAMPLE NUMBER	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
1	GFP-08-MB-01A-02	116.4	11.0
	GFP-08-MB-01B-02	117.8	10.5
	GFP-08-MB-01C-02	116.1	11.3
	GFP-08-MB-01D-02	119.0	11.0
	Average	**117.3**	**11.0**
2	GFP-08-MB-02A-02	112.7	12.9
	GFP-08-MB-02B-02	115.0	12.3
	GFP-08-MB-02C-02	112.6	13.2
	GFP-08-MB-02D-02	114.7	11.3
	Average	**113.8**	**12.4**
Bench-Scale Study Results	**Range**	**112.0 – 114.6**	**13.0 – 13.7**
	Average	**113.3**	**13.4**

The pilot-scale study results observed for Lifts No. 1 and No. 2 are fairly similar to those observed during the bench-scale study. During the bench-scale treatability study, it was determined that the maximum dry density of the samples containing 5 to 10 percent Portland cement ranged from 112.0 pounds per cubic foot (pcf) to 114.6 pcf (TtNUS, 2001a). The pilot-scale results observed for the Lift No. 2 samples fall within this range, although the results of the Lift No. 1 samples are slightly higher (the average is 3.4 percent higher). Optimal moisture content values for both Lifts No. 1 and No. 2 were lower than that observed during the bench-scale study. However, the similarity of the bench-scale and pilot-scale study results is an indication that the composition of the material used in the bench-scale study was successfully reproduced during pilot-scale operations.

Additionally, the range of results observed for each of the individual lifts fall within a fairly narrow distribution. The high and low maximum dry density value varies by only 2.5 percent for Lift No. 1 and 2.0 percent for Lift No. 2. These results are an indication of homogeneity of the individual lifts.

2.6.2 Compaction Tests/Nuclear Density Testing

After mixing with Portland cement, each lift of the amended Material Blend was compacted with a smooth drum vibratory roller to achieve a minimum 90 percent of maximum dry density.

The final combined compacted volume of both lifts is 189 yd^3. The density of the compacted amended Material Blend was field checked in accordance with ASTM Method D2922 (nuclear method). Nuclear density test results and calculations are presented in Appendix D. As discussed previously, it was determined during the bench-scale study that the maximum dry density of the samples containing 5 to 10 percent Portland cement averaged 113.3 pcf. During field testing, the field technician used this value to determine whether a minimum 90 percent compaction had been achieved.

For Lift No. 1, the density of six locations on Lift No. 1 were tested after cement mixing and one pass of the vibratory roller. All six post-mixing testing locations exceeded 90 percent of the bench scale maximum dry density average of 113.3 pcf. Additionally, all six post-mixing testing locations exceeded the average maximum dry density of 117.3 pcf calculated from the samples collected from Lift No. 1 for moisture-density relationship testing. Readings taken during the nuclear density testing indicate the average moisture content for Lift No. 1 was 17.8 percent before addition of Portland cement and 11.7 percent after addition of Portland cement.

For Lift No. 2, the Test Pad was divided into two halves. Prior to cement mixing, the southeastern half of the Test Pad was sprayed with excess water. The purpose of this activity was to determine whether a higher moisture content of the Material Blend could still generate favorable results. From the readings taken during the baseline condition (prior to addition of cement), the average moisture content of the northwestern half of the Test Pad was 19.0 percent and for the southeastern half it was 22.3 percent. Upon addition of Portland cement, mixing, and compaction, the average moisture content decreased to 16.2 percent and 18.5 percent for the northwestern and southeastern halves of the Test Pad, respectively.

Seven locations on the northwestern half of the Test Pad were tested using the nuclear density method. After one pass of the vibratory roller, two post-baseline locations exceeded 90 percent compaction using the bench scale maximum dry density average of 113.3 pcf or the pilot-scale value of 113.8 pcf for Lift No. 2. Two additional passes of the vibratory roller were required for all seven post-baseline locations to pass 90 percent compaction using both bench-scale and pilot-scale derived maximum dry density values.

Similarly, seven locations on the southeastern half of the Test Pad were tested using the nuclear density method. After one pass of the vibratory roller, two post-baseline locations exceeded 90 percent compaction using the bench-scale maximum dry density average of 113.3 pcf or the pilot-scale-derived value of 113.8 pcf for Lift No. 2. Two additional passes of the vibratory roller were required for all seven post-baseline locations to pass 90 percent compaction using both bench-scale and pilot-scale derived maximum dry density values.

In summary, one to three passes with a vibratory roller were required to achieve 90 percent maximum dry density under the varying moisture conditions in the Test Pad lifts. Areas of the Test Pad with higher moisture contents required more passes with the compactor than those with lower moisture contents. For Lift No. 1 (moisture content of 11.7 percent after cement addition), only one pass with the vibratory roller was required to achieve 90 percent maximum dry density. For Lift No. 2 (moisture content of 16.2 percent in the northwestern half and 18.5 percent in the southeastern half), three passes were required.

2.6.3 California Bearing Ratio Tests

The subcontractor procured to perform California Bearing Ratio (CBR) tests in accordance with ASTM Method D4429 was Eustis Engineering Company, Inc. CBR test results were performed at four locations on Lift No. 2 in accordance with ASTM Method D4429 as shown on Figure 2-7.

The times of these tests were performed 3 days and 7 days after the initial compaction of the Material Blend. The results of all of the CBR tests performed on the Test Pad were well in excess of the minimum CBR ratio requirement of 20. Additionally, the results of the pilot-scale study CBRs fell within the range of those observed during the bench-scale study. Complete results of the CBR tests can be found in Appendix E and are summarized in Table 2-1.

2.7 DIOXIN AND LEACHABILITY TESTS

Soil samples were collected during the pilot-scale study to verify that the dioxin contamination in the amended Material Blend is not likely to migrate from the landfill. For this purpose, samples from the Test Pad Lifts were collected for analysis.

Two samples of the Material Blend were collected from Lift No. 1 at locations shown on Figure 2-6 and two samples were collected from Lift No. 2 at locations shown on Figure 2-7. Initially, the samples were analyzed for TCDD and tetrachlorodibenzofuran (TCDF) isomers using SW-846 Method 8290. Toxicity equivalent (TEQ) concentrations of TCDD were calculated in accordance with U.S. EPA's Interim Report

on Data Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks (U.S. EPA, 1989). TCDD TEQ concentrations are presented below. All TEQ concentrations were below the MDEQ Tier I TRG soil/sediment dioxin concentration criterion of 38 ng/kg. TCDD TEQ calculations and the detected and non-detected concentrations of TCDD and TCDF isomers are presented in Appendix F.

Sample Location	TCDD TEQ (ng/kg)	SPLP Leachate TCDD TEQ (pg/L)
GFP-08-MB-01B	8.04	ND
GFP-08-MB-01C	6.34	0.0016
GFP-08-MB-02B	5.47	NA
GFP-08-MB-02C	5.67	NA

ND = No TCDD or TCDF isomers detected
NA = SPLP not performed.

Next, the Synthetic Precipitation Leaching Procedure (SPLP) was performed on the samples with the two highest TCDD TEQ concentrations. The resulting SPLP leachate was analyzed for TCDD and TCDF isomers using SW-846 Method 8290. At sample location GFP-08-MB-01B, TCDD or TCDF isomers were not detected. At, sample location GFP-08-MB-01C, the TCDD TEQ was detected at 0.0016 picograms per liter (pg/L). This concentration is below the TCDD U.S. EPA Region III risk-based concentration (RBC) of 0.45 pg/L and maximum contaminant level (MCL) of 30 pg/L. These SPLP leachate results indicate that dioxin contamination would not migrate from the landfill at concentrations harmful to human health.

Additionally, one water sample was collected from the sump of the Materials Staging Pad. The sample was collected to evaluate the potential need for treatment of removed free water that would collect in the Material Staging Pad during full-scale remediation. The TCDD TEQ for this sample was calculated as 0.0016 pg/L. This TEQ is below the U.S. EPA Region III RBC of 0.45 pg/L and MCL of 30 pg/L, indicating that water collected from the Material Staging Pad would not need to be treated before discharging to a stormwater drainage ditch.

TABLE 2-1

CALIFORNIA BEARING RATIO TESTING RESULTS
SITE 8 PILOT-SCALE SOIL/SEDIMENT TREATABILITY STUDY
NCBC GULFPORT, MISSISSIPPI

LOCATION	DEFLECTION (in)	TEST NO.	3-DAY CBR	7-DAY CBR
GFP-08-MB-02B-03 (northern half of test pad)	0.1	1	39	71
		2	47	97
		3	--	74
		Average	**43**	**81**
	0.2	1	44	73
		2	49	96
		3	--	75
		Average	**47**	**81**
GFP-08-MB-02B-04 (northern half of test pad)	0.1	1	78	76
		2	51	129
		3	72	60
		Average	**67**	**88**
	0.2	1	73	84
		2	48	127
		3	74	61
		Average	**65**	**91**
GFP-08-MB-02C-03 (southern half of test pad)	0.1	1	90	66
		2	64	55
		3	51	55
		Average	**68**	**59**
	0.2	1	84	71
		2	61	55
		3	52	49
		Average	**66**	**58**
GFP-08-MB-02C-04 (southern half of test pad)	0.1	1	176	130
		2	131	160
		3	135	185
		Average	**147**	**158**
	0.2	1	149	132
		2	116	--
		3	125	186
		Average	**130**	**159**
Bench Scale Study Results	0.1	**Range**	**35 to 160**	
	0.2	**Range**	**35 to 180**	

-- Not performed or stopped due to mechanical failure.

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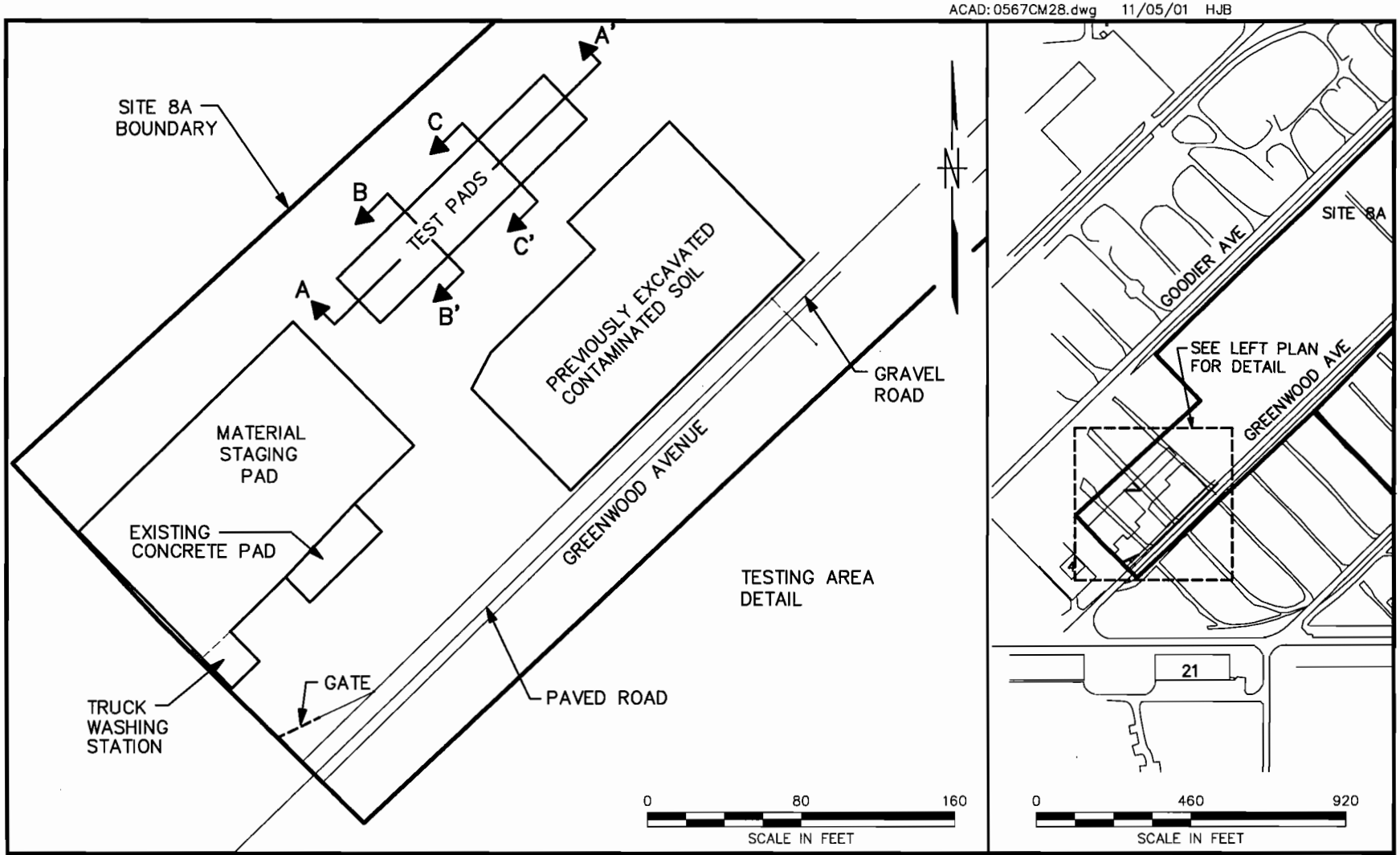
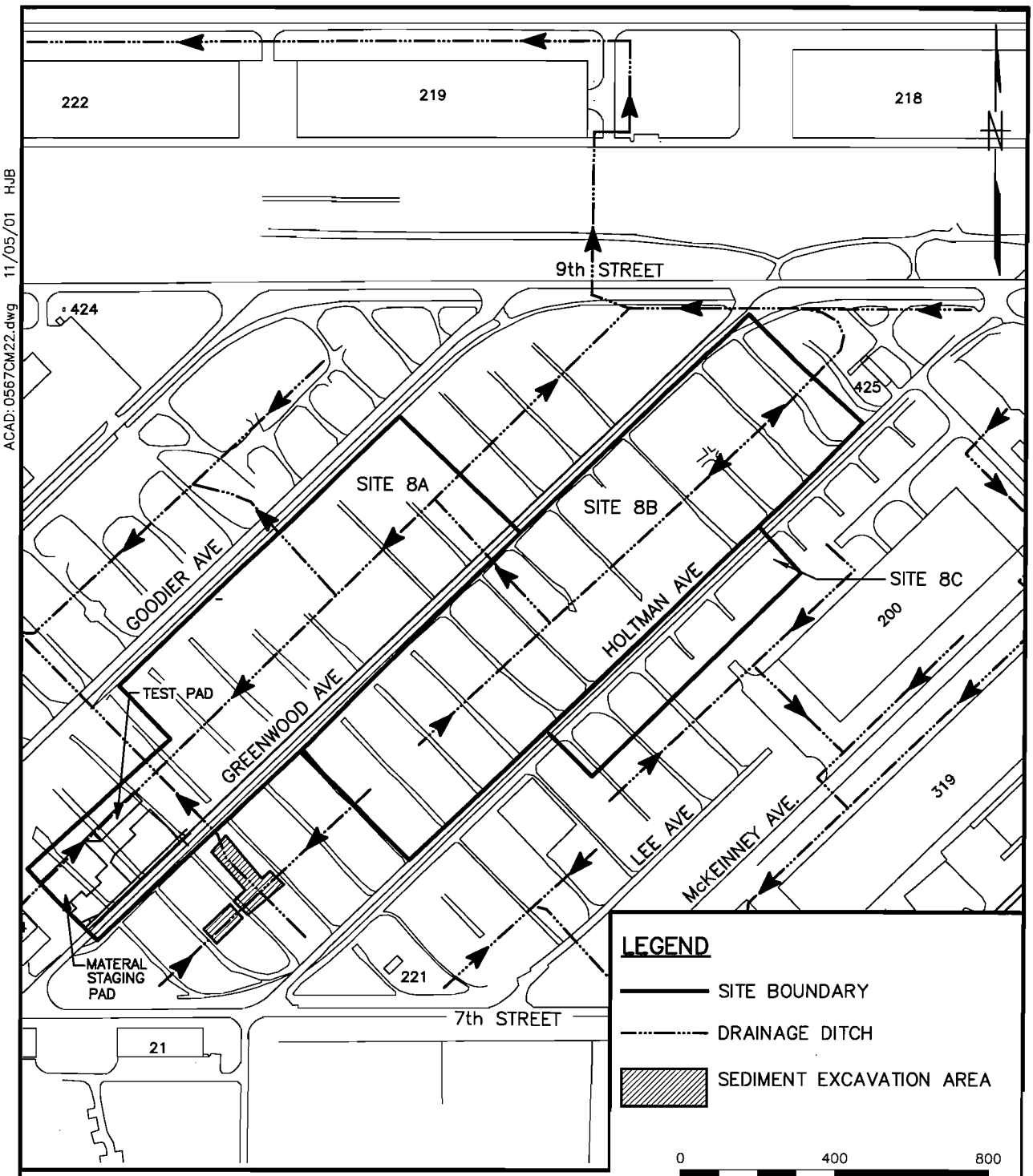
ACAD: 0567CM28.dwg 11/05/01 HJB



DRAWN BY DATE HJB 10/5/01		SITE 8A TESTING AREA PILOT-SCALE TREATABILITY STUDY NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 0567
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-1 REV. 0

FORM CADD NO. SDIV_AH.DWG – REV 0 – 1/20/98



SOURCE: REMEDIATION GUIDANCE DOCUMENT, HARDING LAWSON ASSOCIATES, MARCH 2000.

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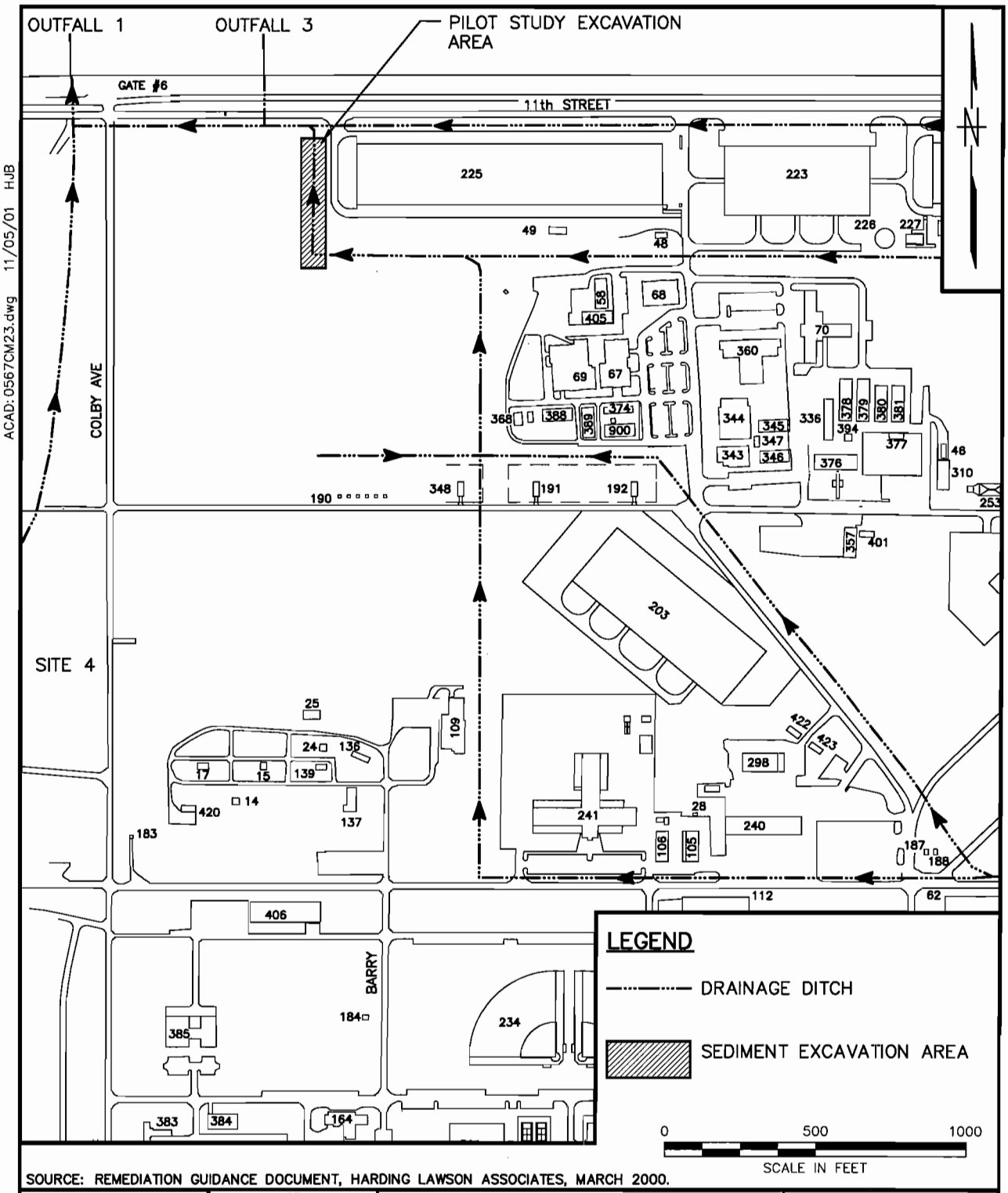
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-2 REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98



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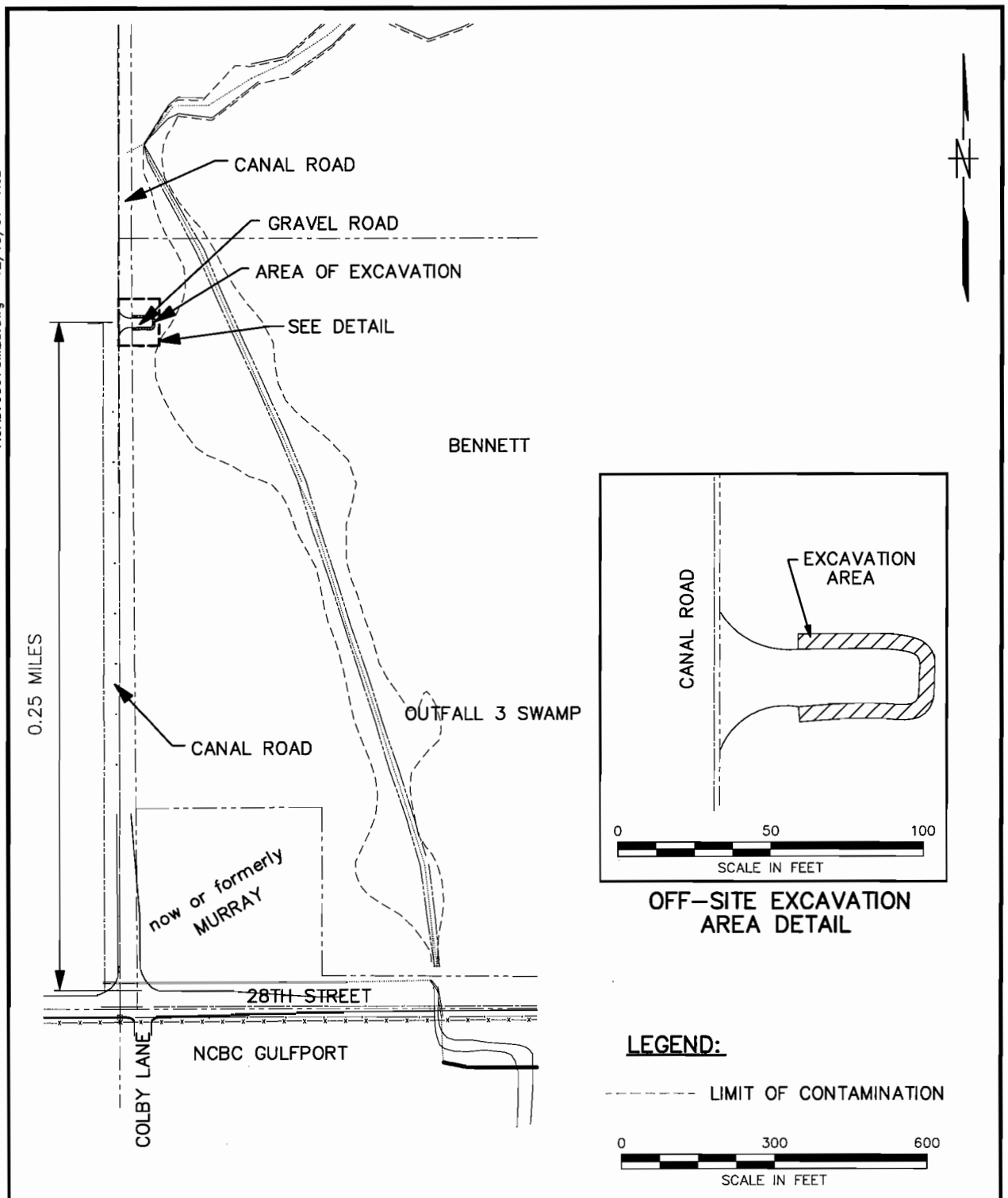
SOURCE: REMEDIATION GUIDANCE DOCUMENT, HARDING LAWSON ASSOCIATES, MARCH 2000.

DRAWN BY HJB DATE 10/4/01		ON-BASE SEDIMENT EXCAVATION AREA SEDIMENT WITH DECAYED MATTER PILOT-SCALE TREATABILITY STUDY NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 0567
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-3 / REV. 0

FORM CADD NO. SDIV_AV.DWG – REV 0 – 1/20/98



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CHECKED BY JJB DATE 12/17/01			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-4 REV. 1

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

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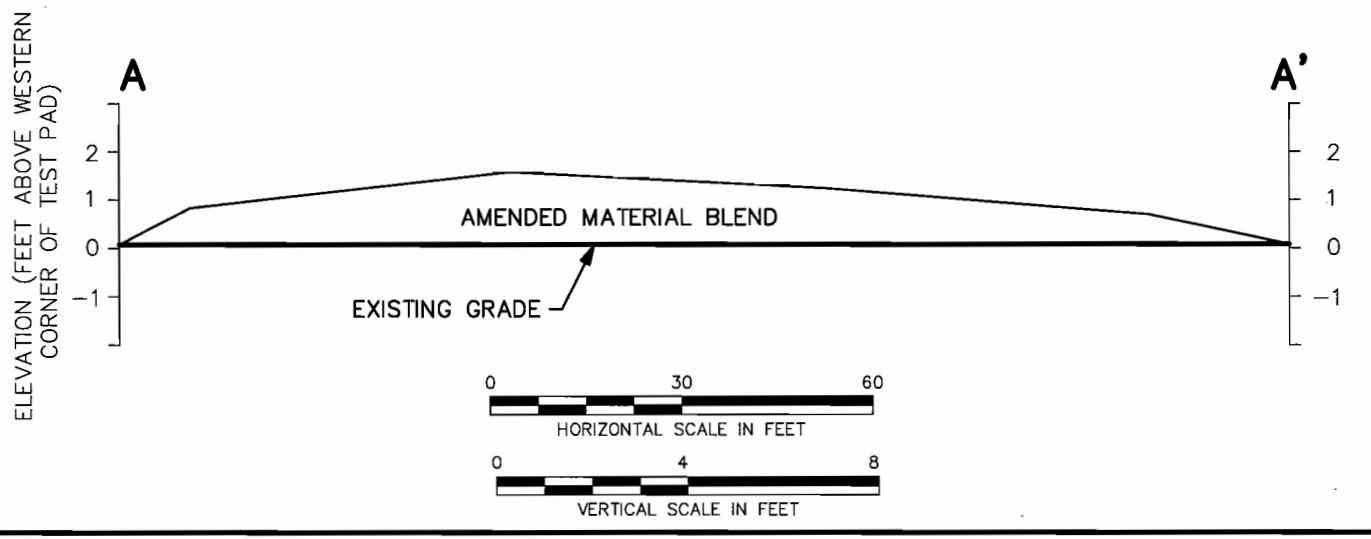
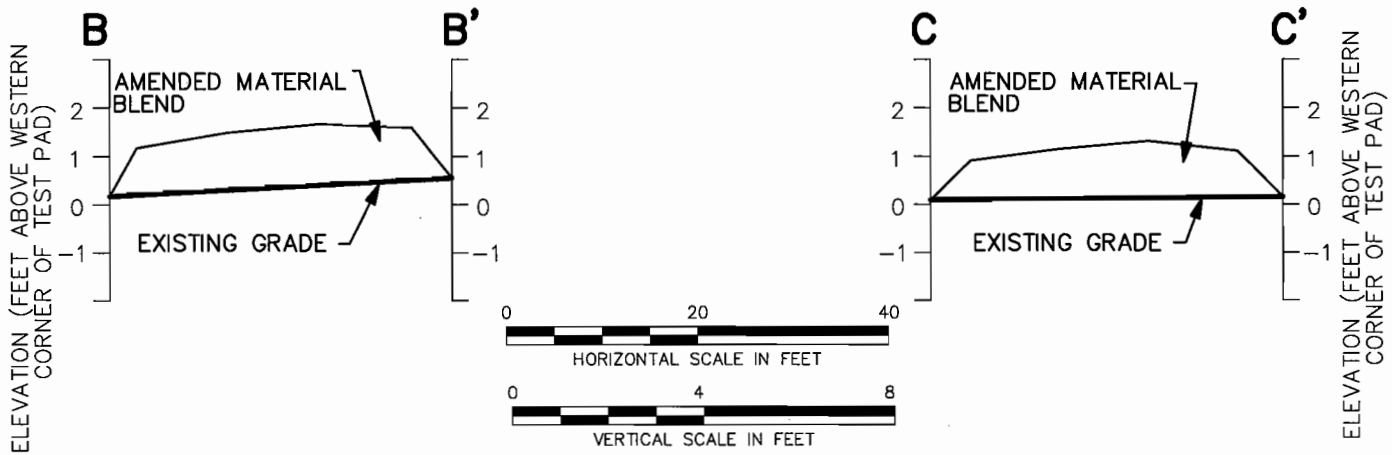
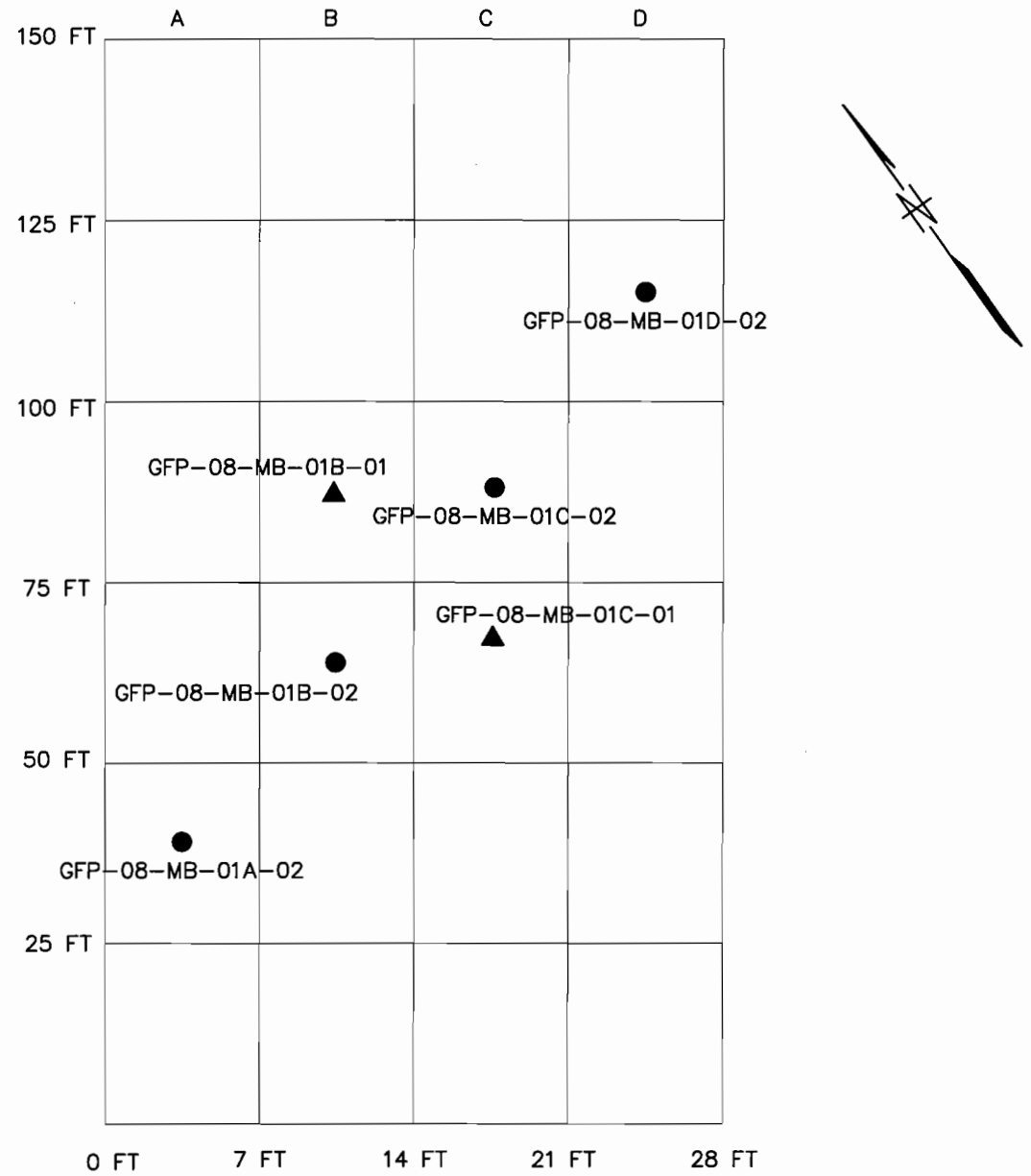




DRAWN BY DATE HJB 10/30/01		TEST PAD CROSS SECTIONS A–A', B–B', AND C–C' PILOT–SCALE TREATABILITY STUDY NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 0567
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED–AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2–5 REV. 0

FORM CADD NO. SDIV_AH.DWG – REV 0 – 1/20/98



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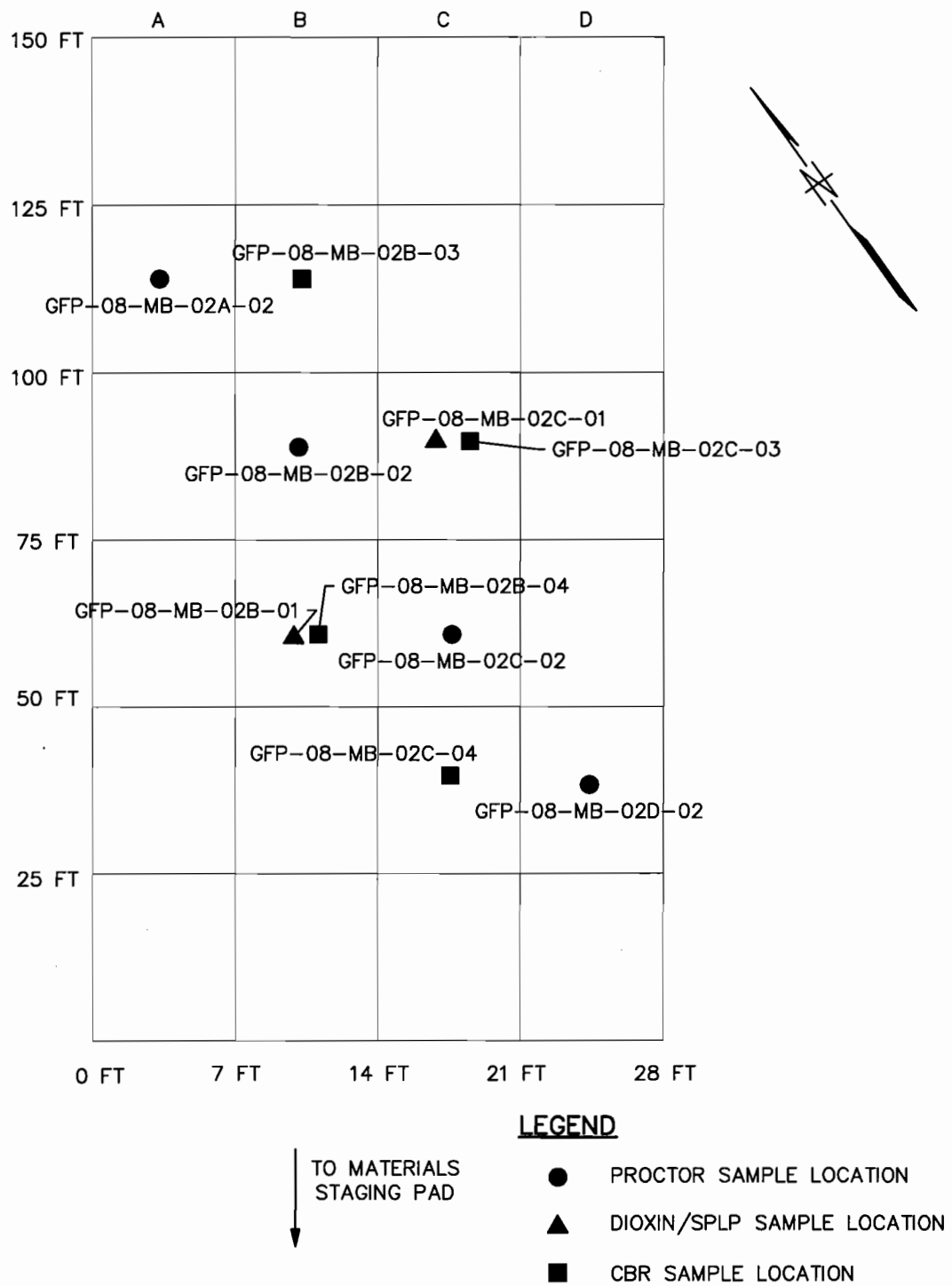
DRAWN BY HJB DATE 10/5/01		SAMPLE LOCATION MAP (LIFT NO.1) PILOT-SCALE TREATABILITY STUDY NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 0567
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 2-6 REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98



ACAD:0567CM27.dwg 11/05/01 HJB

DRAWN BY HJB DATE 10/5/01		SAMPLE LOCATION MAP (LIFT NO.2) PILOT-SCALE TREATABILITY STUDY NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 0567
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 2-7 REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

The following conclusions were drawn from the results of the pilot-scale treatability study:

- A wheel excavator was an effective piece of machinery for excavating and loading on-base sediment into dump trucks for transport. Similarly, a track excavator was an effective piece of machinery for excavating and loading off-base sediment. Furthermore, a front-end loader was effective for loading soil ash into dump trucks for transport.

- Excavation of off-base swampland sediment could not be effectively conducted during the rainy (summer) season and had to be postponed to a dryer (late fall) season.

- The use of plastic liners in the dump trucks slowed down the material hauling and blending processes.

- It is estimated that vegetative matter composed approximately 5 percent of the total volume of excavated material and consisted mostly of smaller-sized particles and that did not require a soil screening process.

- Excavated off-base sediment exhibited an average 6.9 percent moisture reduction 24 hours after being staged on the Material Staging Pad.

- Two methods of premixing the Material Blend were conducted. The first method involved loading alternating bucket loads of the Material Blend components into dump trucks until the trucks were full and then hauling the material to the Test Pad. The second method involved premixing the Material Blend components in batch piles at the Material Staging Pad with a wheel excavator and then transporting the premixed material to the Test Pad in the dump trucks. After the spreading of both types of premixed Material Blend at the Test Pad, the bulldozer operator reported a more difficult time spreading material premixed by the first method than the second method. This observation is an indication that material premixed by the second method is more homogenous than that premixed by the first method. However, premixing by the second method resulted in a slower material-hauling rate to the Test Pad Area.

- The soil stabilizer effectively mixed the Material Blend at the Test Pad. Regardless of the initial premixing method used, visual observation of the Material Blend after one pass of the soil stabilizer

indicated a homogenous blend. The effectiveness of mixing is supported by the narrow distribution of the moisture-density relationship results for each lift. Additionally, the soil stabilizer effectively mixed Type I Portland cement into the Material Blend, as shown by use of a phenolphthalein indicator.

- The similarity of the bench-scale and pilot-scale moisture-density testing results is an indication that the composition of the Material Blend used in the bench-scale study was successfully reproduced during pilot-scale operations.

- Pilot-scale study activities indicated that one to three passes with a vibratory roller are required to achieve compaction results that are a minimum 90 percent of maximum dry density. Areas of the Test Pad with higher moisture contents required more passes with the vibratory roller that those with lower moisture contents. For the Lift No. 1 (moisture content of 11.7 percent after cement addition), only one pass with the vibratory roller was required to achieve 90 percent maximum dry density. For Lift No. 2 (moisture content of 16.2 percent in the northwestern half and 18.5 percent in the southeastern half), three passes were required.

- The results of all of the CBR tests performed on the Test Pad were well in excess of the minimum CBR ratio requirement of 20. These results were achieved by the third day of curing.

- SPLP leachate results indicate that dioxin contamination contained in the amended Material Blend would not migrate from the landfill at concentrations harmful to human health.

- Dioxin analysis conducted on a water sample collected from the Material Staging Pad sump indicates that water collected from the pad during full-scale operations would not need to be treated before discharging to a stormwater drainage ditch.

3.2 RECOMMENDATIONS

The following recommendations are made based on the results of the pilot-scale treatability study:

- Excavation of off-base swampland sediment should not be conducted during the rainy season (typically May to September). Excavation of this material should be slated for the drier months.

- The use of dump trucks with gasketed tailgates should be considered for material transport during full-scale operations. Eliminating the need to replace the dump truck's plastic liners on each round trip would increase the material-hauling rate. Additionally, this action would eliminate material

handling problems that were encountered with the plastic liners during pilot-scale material blending activities.

- In lieu of use of a mechanical vibrating screen or shredder, oversized material could be removed manually when the Blended Material is placed in the Test Pad lifts.

- Use of either method of Material Blend premixing would be acceptable. Regardless of the premixing method used, the use of the soil stabilizer for final mixing at the Test Pad produced a homogeneous Material Blend lift.

- Based on CBR results, dewatering of the Material Blend components would not be required during full-scale operations.

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APPENDIX A

PILOT-SCALE STUDY
PHOTOGRAPHS AND MOVIES

APPENDIX A

PILOT-SCALE TREATABILITY STUDY PHOTOGRAPHS AND MOVIES
NAVAL CONSTRUCTION BATALLION CENTER
GULFPORT, MISSISSIPPI

PHOTOGRAPHS

TITLE	DESCRIPTION
Canal Road	This photograph shows the temporary road that was built off Canal Road. The purpose of this road was twofold (1) provide a suitable base for the excavator to access the excavation area, and (2) to evaluate the capability of the road to accommodate dump trucks traveling in and out of the swamp area. The method of building the road consisted of cutting down trees and placing them side by side, filling in the voids with excess dirt, laying geotextile, and then placing gravel.
Cement Pile	This photograph depicts the Portland cement piles that were deposited on the Lift No. 2.
Compacting Lift	This photograph shows the compaction of Lift No. 2. A smooth-drummed vibratory roller was used for compaction.
On-Base Sediment (Sandy Material with Decayed Organic Matter)	Seen in this photograph is the excavation of on-base (muck) sediment. The depth of the water in the ditch during excavation was approximately 5 feet.
Placing Lift No. 2	The bulldozer in the photograph is in the process of spreading the Material Blend around to form Lift No. 2.
Placing Cement	This photograph illustrates the method followed to place the Portland cement onto the test pad lifts. The front-end loader was used to hold the hose of the cement truck into place. A heavy liner was place on the lift to limit the amount of dust generated during the process. Sand bags were used to hold the liner in place. To further secure the liner, the shovel of the bulldozer was placed on the liner at the opposite end of the hose.
Spreading Cement	This photograph shows the Portland cement being spread across Lift No. 2 with the bulldozer. Approximately 2 inches of cement were placed.
Tilled vs. Untilled Lift	This picture demonstrates the purpose of the soil stabilizer. The dark portion of the test pad lift has been mixed using the mixer, while the lighter portion of the Test Pad has the cement unmixed on top.
Tilling Cement	This photograph shows the machine used for mixing the lifts.

APPENDIX A

PILOT-SCALE TREATABILITY STUDY PHOTOGRAPHS AND MOVIES
NAVAL CONSTRUCTION BATALLION CENTER
GULFPORT, MISSISSIPPI

MOVIES

TITLE	DESCRIPTION
Canal Road Excavation	In this movie, excavation of off-base sediment is occurring at the road that was built off Canal Road.
Canal Road Tree Placement	The cutting of trees from the area off of Canal Road is seen in this movie. Once cut, the excavator would lift and place the trees side by side to form a road.
On-Base Ditch Excavation	This clip shows the on-base drainage ditches on Site 8A that were excavated to remove contaminated sediment. The composition of the sediment in these drainage ditches consisted primarily of sand.
On-Base Muck Excavation	This clip shows the excavation of on-base drainage ditches located near Outfall 3. The material excavated from this area consisted primarily of organic soil (muck).
Placing Lift No. 2	This movie illustrates the placement of Lift No. 2 using a bulldozer.
Site 8 Layout	In this movie, an explanation is given as to the layout of Site 8.
Site 8A Description	The location and components of Site 8A are described in this clip. Also, a narrative is provided describing points of interest surrounding Site 8A
Site 8B Description	An explanation of the location and description of Site 8B is provided in the video.
Soil Mixing	In this video, the mixing of the Material Blend using the excavator is seen. Initially, mixing of the Material Blend was attempted using alternating dump trucks. This method proved useful. However, using the excavator added to the mixing consistency of the Material Blend.
Test Pad Rolling	This movie illustrates the compaction of the 1st test pad lift using a smooth drum vibratory roller.
Tilling Lift No. 2	In this video, the vertical mixing of the cement into the Material Blend lift is occurring using the soil stabilizer.

APPENDIX B

MOISTURE CONTENT TEST RESULTS

MOISTURE CONTENT DATA SHEET
ASTM METHOD D 4643 - 87

SOIL/SEDIMENT PILOT-SCALE TREATABILITY STUDY
SITE 8 FEASIBILITY STUDY
NCBC GULFPORT – GULFPORT, MISSISSIPPI
CTO O143

DATE: July 30, 2001

SAMPLE ID: Off-Base Sediment 1 (Initial)

MEDIUM: Off-Base Sediment

OBSERVATIONS: Light brown, fine-course grained, silty sand, cohesive

WEIGHTS:

Item	Weight (grams)
Wet Material + Drying Dish	758
Drying Dish	16
Wet Material	742

Dry Material + Drying Dish	556
Drying Dish	16
Dry Material	540

MOISTURE CONTENT:

$$\text{Percent Moisture} = \frac{(\text{Weight Wet Material} - \text{Weight Dry Material})}{\text{Weight Wet Material}} \times 100$$

$$\text{Percent Moisture} = \frac{(742\ \text{g} - 540\ \text{g})}{742\ \text{g}} \times 100 = 27.2\ \%$$

MOISTURE CONTENT DATA SHEET
ASTM METHOD D 4643 - 87

SOIL/SEDIMENT PILOT-SCALE TREATABILITY STUDY
SITE 8 FEASIBILITY STUDY
NCBC GULFPORT – GULFPORT, MISSISSIPPI
CTO O143

DATE: July 31, 2001

SAMPLE ID: Off-Base Sediment 1 (t = 1 day)

MEDIUM: Off-Base Sediment

OBSERVATIONS: Light brown, fine-course grained, silty sand, cohesive

WEIGHTS:

Item	Weight (grams)
Wet Material + Drying Dish	771
Drying Dish	16
Wet Material	755

Dry Material + Drying Dish	588
Drying Dish	16
Dry Material	572

MOISTURE CONTENT:

$$\text{Percent Moisture} = \frac{(\text{Weight Wet Material} - \text{Weight Dry Material})}{\text{Weight Wet Material}} \times 100$$

$$\text{Percent Moisture} = \frac{(755\text{ g} - 572\text{ g})}{755\text{ g}} \times 100 = 24.2\ \%$$

MOISTURE CONTENT DATA SHEET
ASTM METHOD D 4643 - 87

SOIL/SEDIMENT PILOT-SCALE TREATABILITY STUDY
SITE 8 FEASIBILITY STUDY
NCBC GULFPORT – GULFPORT, MISSISSIPPI
CTO O143

DATE: July 30, 2001

SAMPLE ID: Off-Base Sediment 2 (Initial)

MEDIUM: Off-Base Sediment

OBSERVATIONS: Light brown, fine-course grained, silty sand, cohesive

WEIGHTS:

Item	Weight (grams)
Wet Material + Drying Dish	626
Drying Dish	16
Wet Material	610

Dry Material + Drying Dish	486
Drying Dish	16
Dry Material	470

MOISTURE CONTENT:

$$\text{Percent Moisture} = \frac{(\text{Weight Wet Material} - \text{Weight Dry Material})}{\text{Weight Wet Material}} \times 100$$

$$\text{Percent Moisture} = \frac{(610\text{ g} - 470\text{ g})}{610\text{ g}} \times 100 = 23.0\ \%$$

MOISTURE CONTENT DATA SHEET
ASTM METHOD D 4643 - 87

SOIL/SEDIMENT PILOT-SCALE TREATABILITY STUDY
SITE 8 FEASIBILITY STUDY
NCBC GULFPORT – GULFPORT, MISSISSIPPI
CTO O143

DATE: July 31, 2001

SAMPLE ID: Off-Base Sediment 2 (t = 1 day)

MEDIUM: Off-Base Sediment

OBSERVATIONS: Light brown, fine-course grained, silty sand, cohesive

WEIGHTS:

Item	Weight (grams)
Wet Material + Drying Dish	747
Drying Dish	16
Wet Material	731

Dry Material + Drying Dish	592
Drying Dish	16
Dry Material	576

MOISTURE CONTENT:

$$\text{Percent Moisture} = \frac{(\text{Weight Wet Material} - \text{Weight Dry Material})}{\text{Weight Wet Material}} \times 100$$

$$\text{Percent Moisture} = \frac{(731\ \text{g} - 576\ \text{g})}{731\ \text{g}} \times 100 = 21.2\ \%$$

MOISTURE CONTENT DATA SHEET
ASTM METHOD D 4643 - 87

SOIL/SEDIMENT PILOT-SCALE TREATABILITY STUDY
SITE 8 FEASIBILITY STUDY
NCBC GULFPORT – GULFPORT, MISSISSIPPI
CTO O143

DATE: July 30, 2001

SAMPLE ID: Off-Base Sediment 3 (Initial)

MEDIUM: Off-Base Sediment

OBSERVATIONS: Light brown, fine-course grained, silty sand, cohesive

WEIGHTS:

Item	Weight (grams)
Wet Material + Drying Dish	640
Drying Dish	16
Wet Material	624

Dry Material + Drying Dish	490
Drying Dish	16
Dry Material	474

MOISTURE CONTENT:

$$\text{Percent Moisture} = \frac{(\text{Weight Wet Material} - \text{Weight Dry Material})}{\text{Weight Wet Material}} \times 100$$

$$\text{Percent Moisture} = \frac{(624\ \text{g} - 474\ \text{g})}{624\ \text{g}} \times 100 = 24.0\ \%$$

MOISTURE CONTENT DATA SHEET
ASTM METHOD D 4643 - 87

SOIL/SEDIMENT PILOT-SCALE TREATABILITY STUDY
SITE 8 FEASIBILITY STUDY
NCBC GULFPORT – GULFPORT, MISSISSIPPI
CTO O143

DATE: July 31, 2001

SAMPLE ID: Off-Base Sediment 3 (t = 1 day)

MEDIUM: Off-Base Sediment

OBSERVATIONS: Light brown, fine-course grained, silty sand, cohesive

WEIGHTS:

Item	Weight (grams)
Wet Material + Drying Dish	672
Drying Dish	16
Wet Material	656

Dry Material + Drying Dish	518
Drying Dish	16
Dry Material	502

MOISTURE CONTENT:

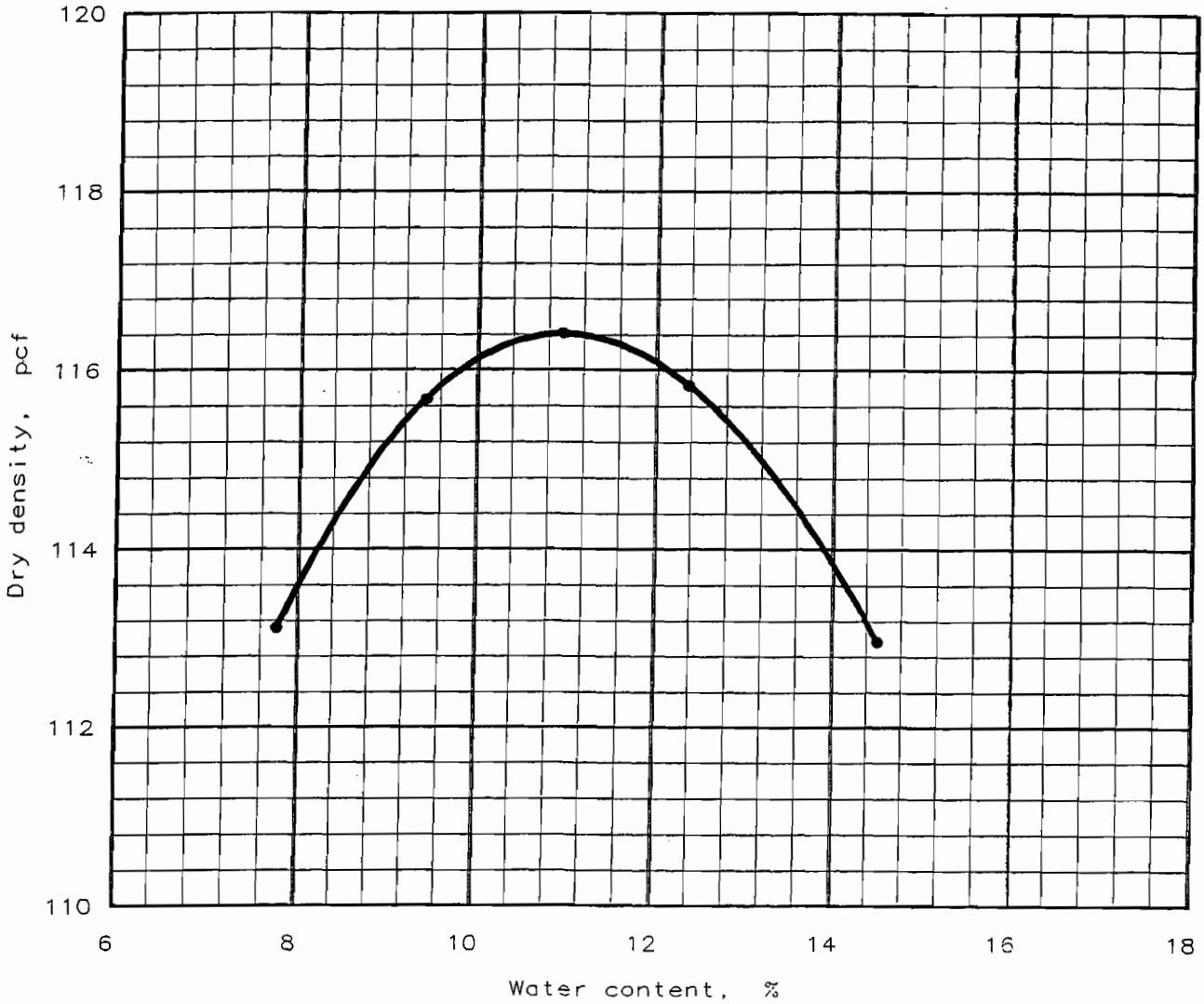
$$\text{Percent Moisture} = \frac{(\text{Weight Wet Material} - \text{Weight Dry Material})}{\text{Weight Wet Material}} \times 100$$

$$\text{Percent Moisture} = \frac{(656\text{ g} - 502\text{ g})}{656\text{ g}} \times 100 = 23.5\ \%$$

APPENDIX C

MOISTURE DENSITY RELATIONSHIP TEST RESULTS

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-78 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC							

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 116.4 pcf Optimum moisture = 11.0 %	Dk Gr CLAYEY SAND w/ rts & gravel

Project No.: 17103
Project: U.S.N. Study Site #8
Location: Gulfport, Mississippi
Sample ~~No.1~~ GFP-08-MB-01A-02
Date: 8-19-01 JJB 09/25/01

Remarks:
Onsite Material
7.5% cement added
by weight

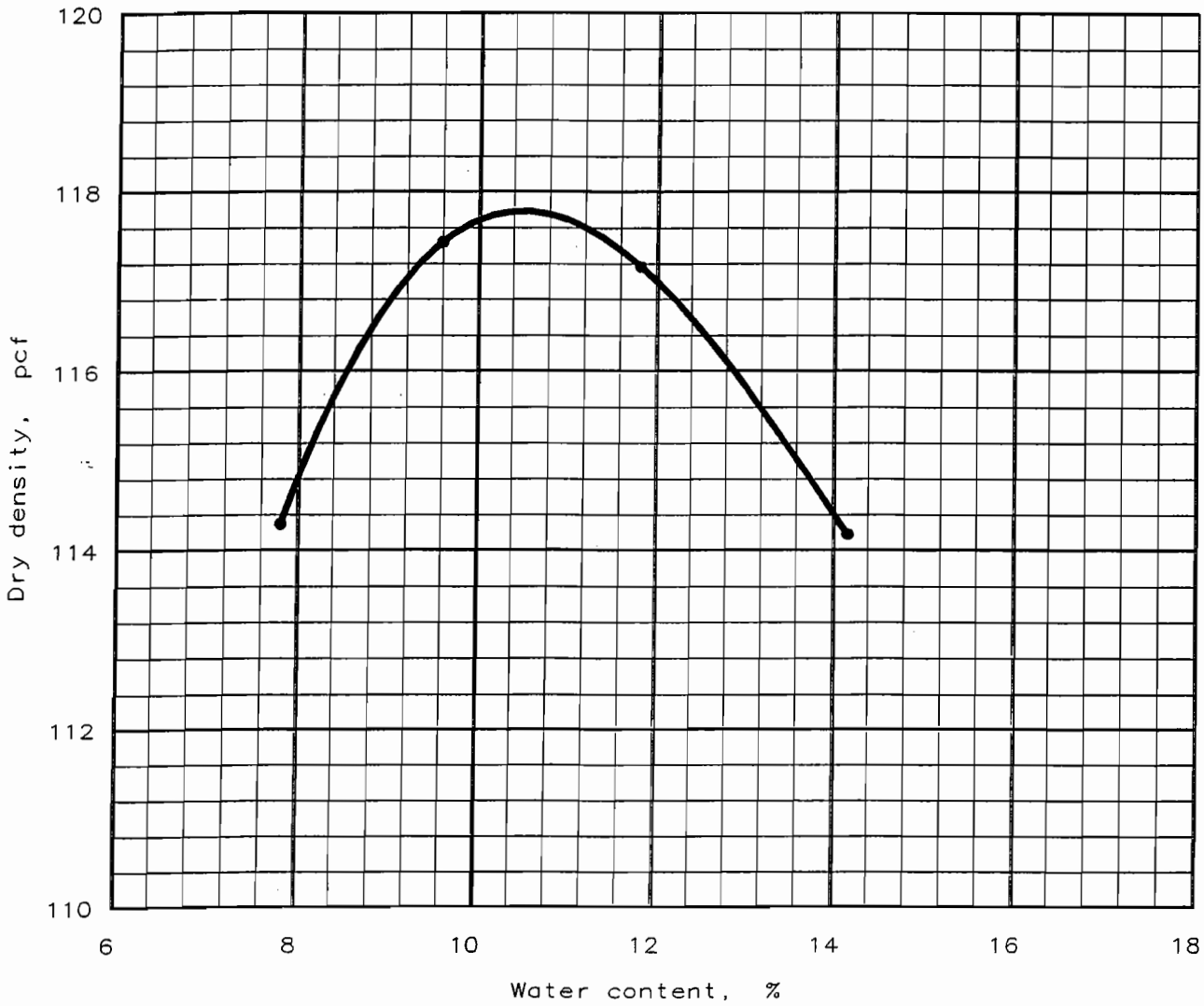
MOISTURE-DENSITY RELATIONSHIP TEST

EUSTIS ENGINEERING COMPANY, INC.

ENC. NO.: _____

ENCLOSURE 1

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-78 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC							

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 117.8 pcf Optimum moisture = 10.5 %	Dk Gr CLAYEY SAND w/ rts & gravel

Project No.: 17103
Project: U.S.N. Study Site #8
Location: Gulfport, Mississippi
Sample ~~No.2~~ GFP-08-MB-01B-02
Date: 8-19-01 JJB 09/25/01

Remarks:
Onsite Material
7.5% cement added
by weight

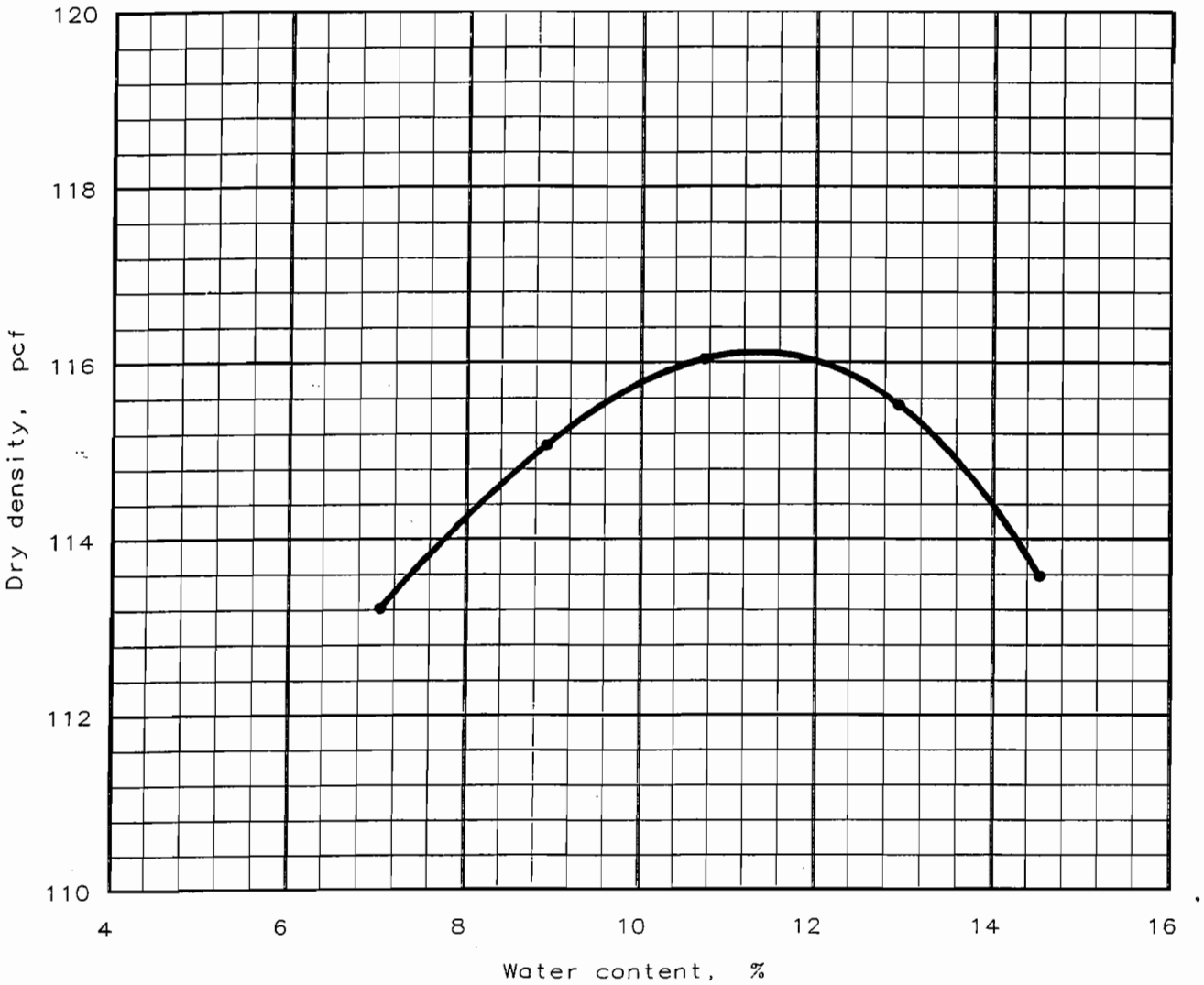
MOISTURE-DENSITY RELATIONSHIP TEST

EUSTIS ENGINEERING COMPANY, INC.

ENC. NO.: _____

ENCLOSURE 2

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-78 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC							

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 116.1 pcf Optimum moisture = 11.3 %	Dk Gr CLAYEY SAND w/ rts & gravel

Project No.: 17103
Project: U.S.N. Study Site #8
Location: Gulfport, Mississippi
Sample ~~No.3~~ GFP-08-MB-01C-02
Date: 8-19-01 JJB 09/25/01

Remarks:
Onsite Material
7.5% cement added
by weight

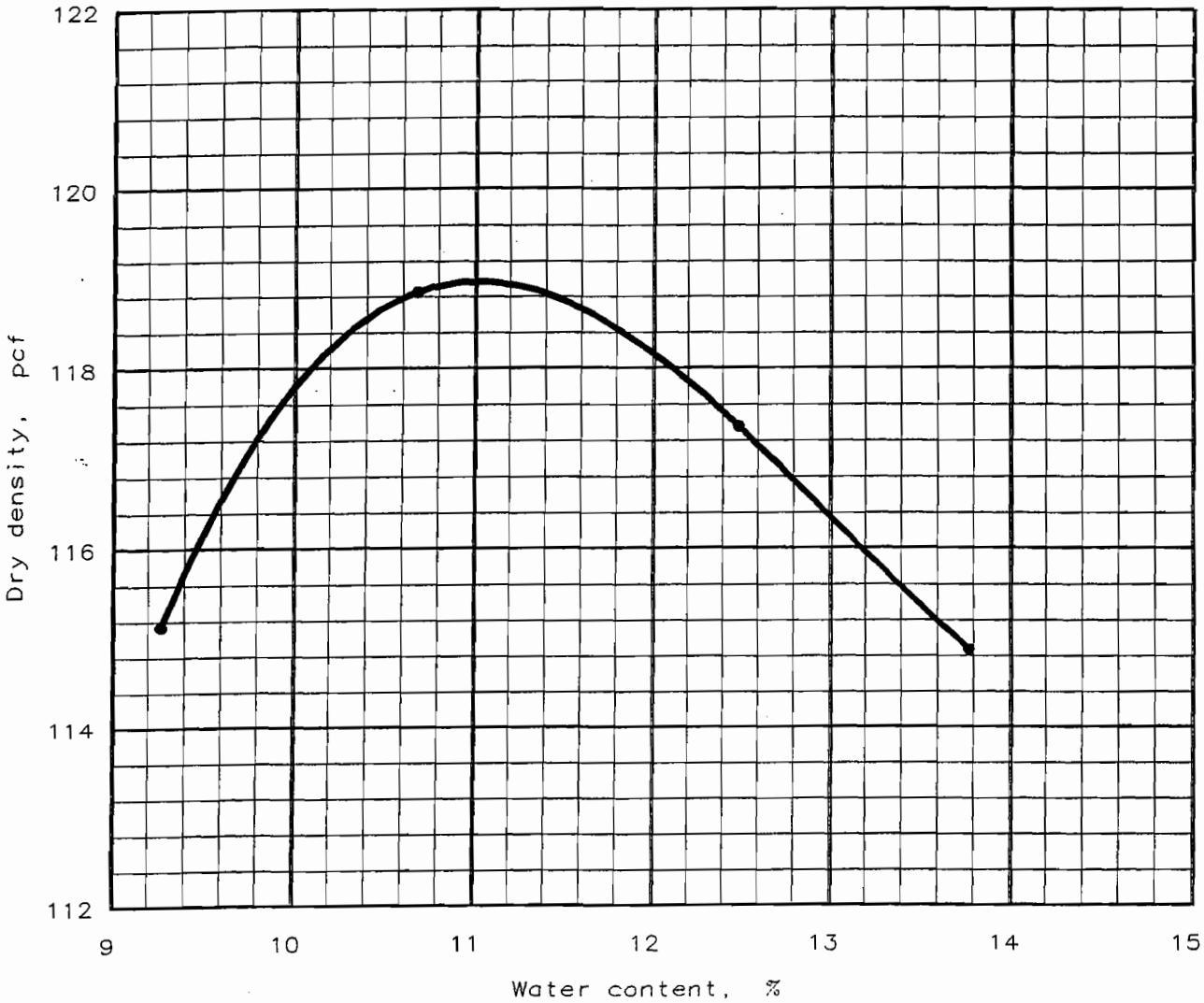
MOISTURE-DENSITY RELATIONSHIP TEST

EUSTIS ENGINEERING COMPANY, INC.

ENC. NO.: _____

ENCLOSURE 3

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-78 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC							

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 119.0 pcf Optimum moisture = 11.0 %	Dk Gr CLAYEY SAND w/ rts & gravel

Project No.: 17103
Project: U.S.N. Study Site #8
Location: Gulfport, Mississippi
Sample ~~No.4~~ GFP-08-MB-01D-02
JJB 9/23/01
Date: 8-19-01

Remarks:
Onsite Material
7.5% cement added
by weight

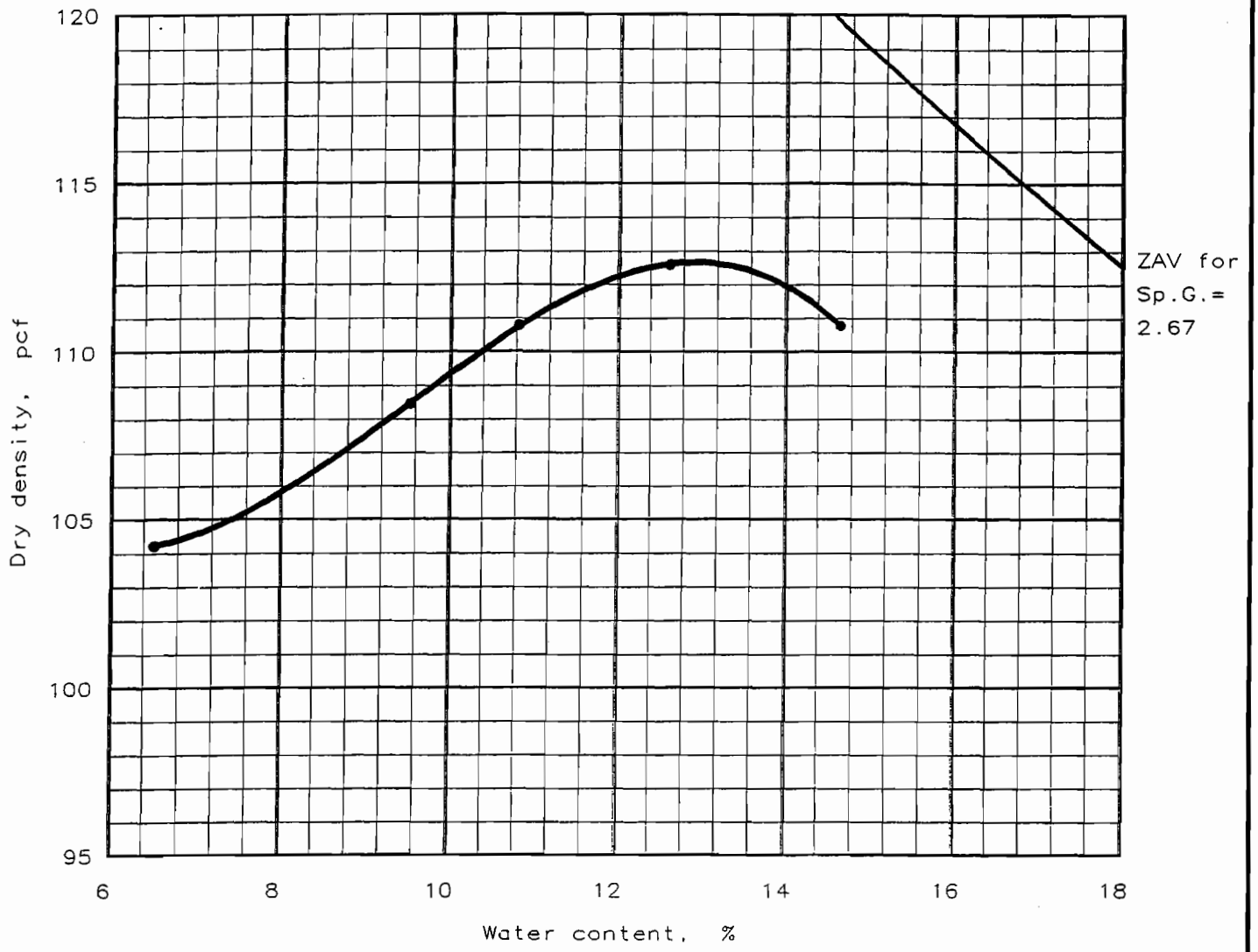
MOISTURE-DENSITY RELATIONSHIP TEST

EUSTIS ENGINEERING COMPANY, INC.

ENC. NO.: _____

ENCLOSURE 4

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Procedure A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC			2.67				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 112.7 pcf Optimum moisture = 12.9 %	Dk Gr CLAYEY SAND w/ roots & gravel

Project No.: 17103
Project: USN - Study Site # 8 / Gulfport, Miss.
Location: Storage of Dioxin Contaiminated Soil
Naval Construction Battalion Center
Date: 8-24-01

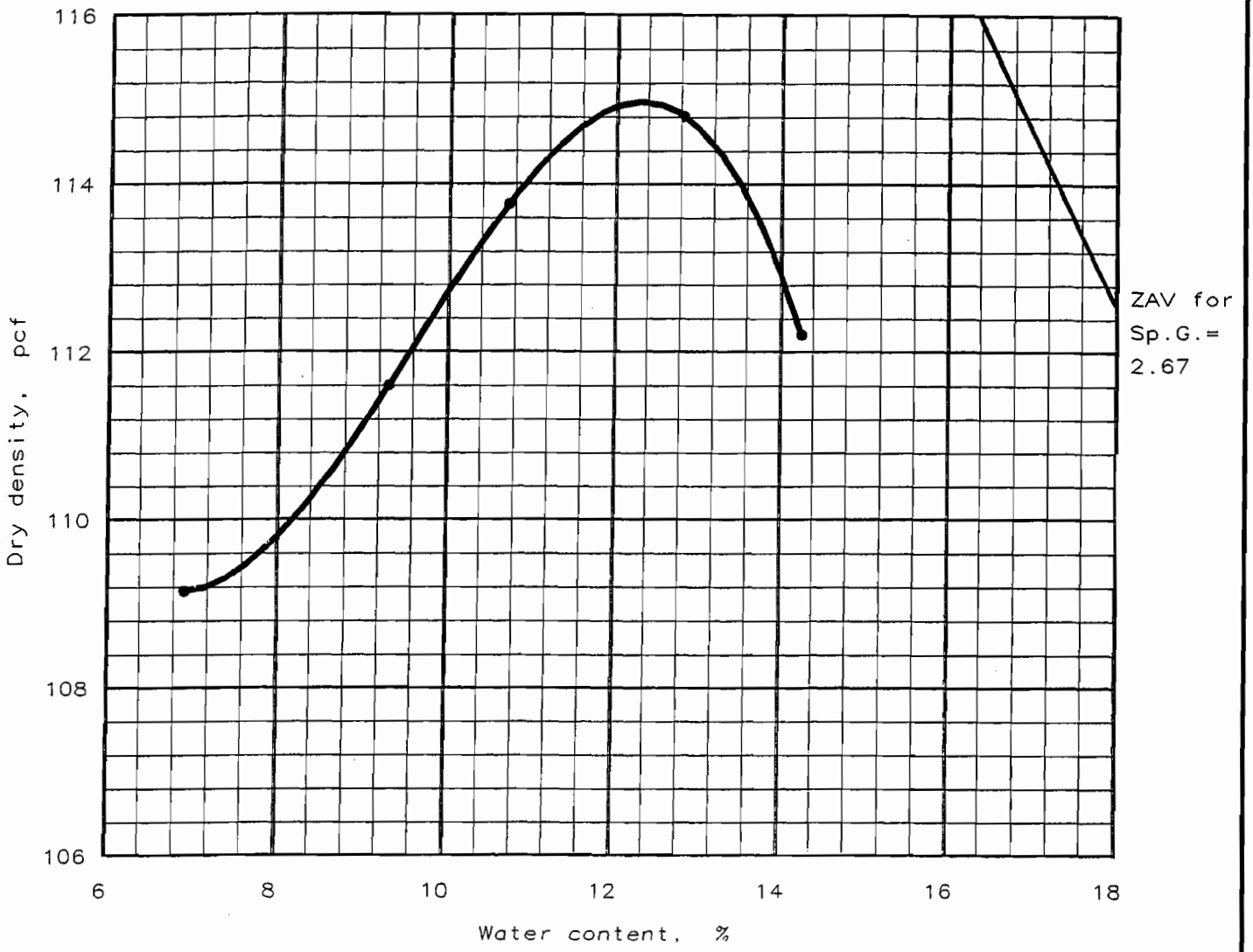
MOISTURE-DENSITY RELATIONSHIP TEST

EUSTIS ENGINEERING COMPANY, INC.

Remarks:
+ 5% Cement by Weight
~~Sample A~~
Sampled 8-21-01 @ 1000
GFP-08-MB-02A-02
JJB 09/25/01
ENC. NO.: _____

ENCLOSURE 1

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Procedure A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC			2.67				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 115.0 pcf Optimum moisture = 12.3 %	Dk Gr CLAYEY SAND w/ roots & gravel

Project No.: 17103
Project: USN - Study Site # 8 / Gulfport, Miss.
Location: Storage of Dioxin Contaiminated Soil
Naval Construction Battalion Center
Date: 8-24-01

MOISTURE-DENSITY RELATIONSHIP TEST

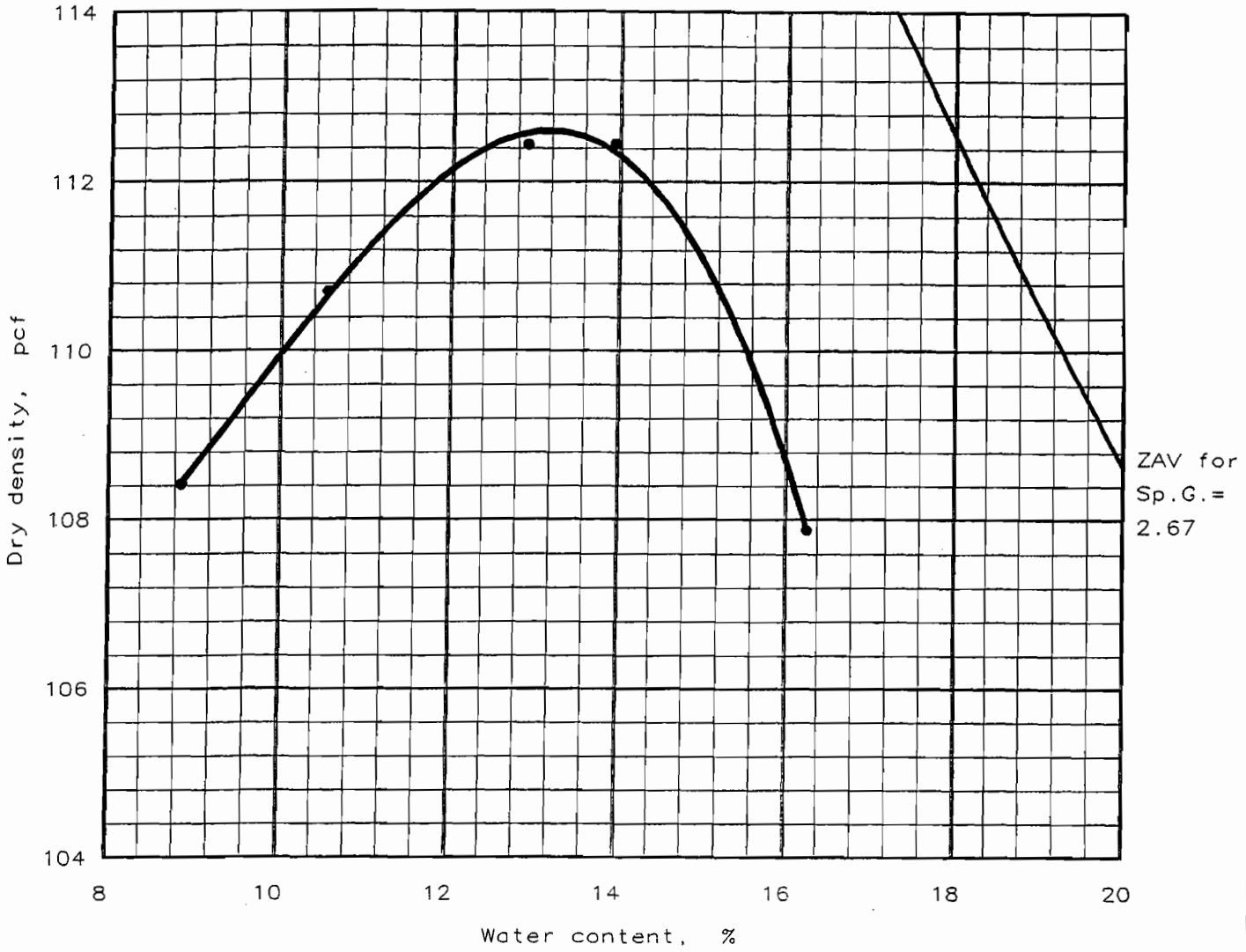
EUSTIS ENGINEERING COMPANY, INC.

Remarks:
+ 5% Cement by Weight
~~Sample B~~
Sampled 8-21-01 @ 1000
GFP-08-MB-02B-02
JJB 09125101

ENC. NO.: _____

ENCLOSURE 2

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Procedure A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC			2.67				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 112.6 pcf Optimum moisture = 13.2 %	Dk Gr CLAYEY SAND w/ roots & gravel

Project No.: 17103
Project: USN - Study Site # 8 / Gulfport, Miss.
Location: Storage of Dioxin Contaiminated Soil
Naval Construction Battalion Center
Date: 8-24-01

Remarks:
+ 5% Cement by Weight
~~Sample C~~
Sampled 8-21-01 @ 1000
GFP-08-MB-022-02
JJB 09/25/01

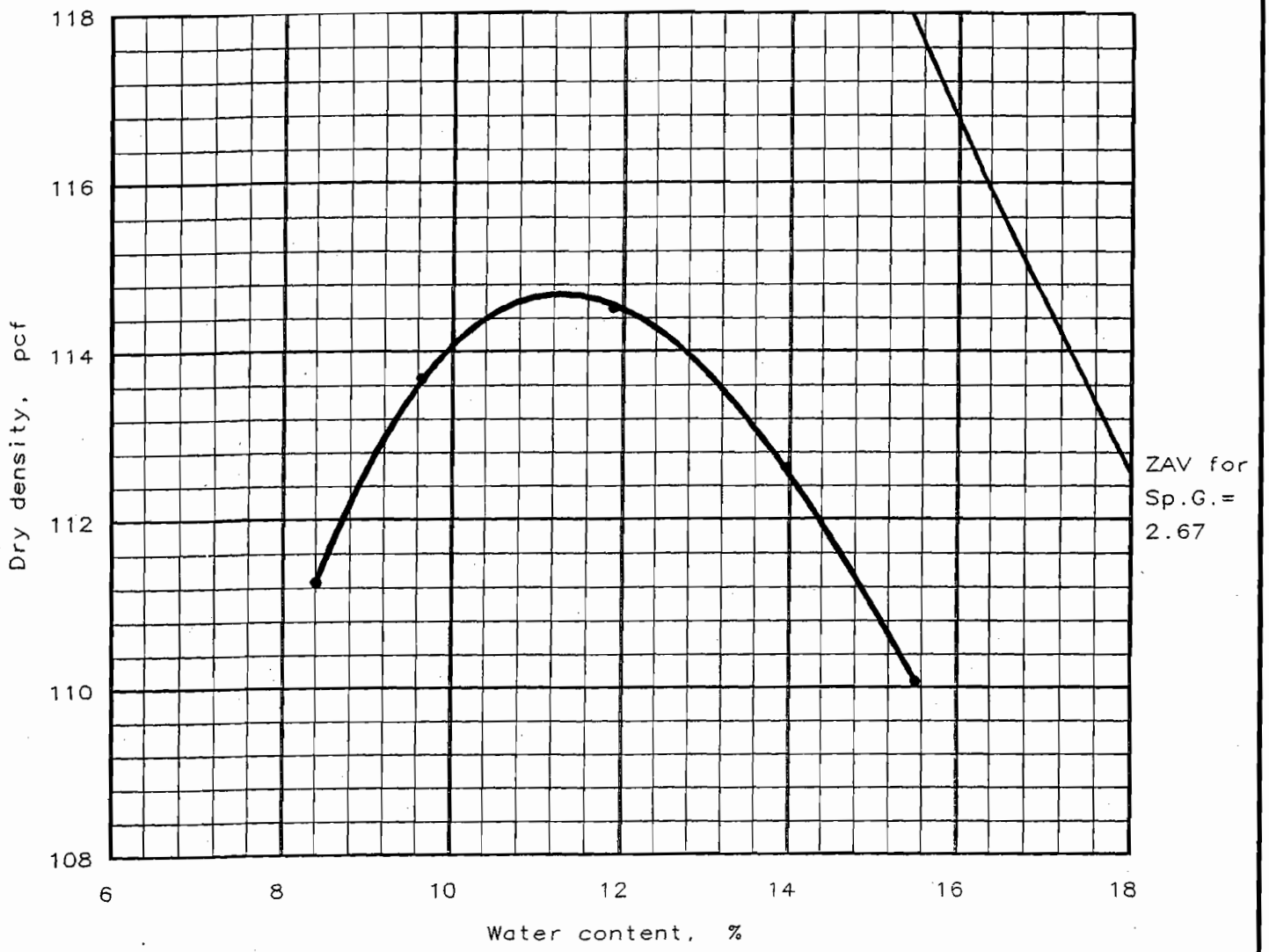
MOISTURE-DENSITY RELATIONSHIP TEST

EUSTIS ENGINEERING COMPANY, INC.

ENC. NO.: _____

ENCLOSURE 3

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Procedure A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC			2.67				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 114.7 pcf Optimum moisture = 11.3 %	Dk Gr CLAYEY SAND w/ roots & gravel

Project No.: 17103
Project: USN - Study Site # 8 / Gulfport, Miss.
Location: Storage of Dioxin Contaiminated Soil
Naval Construction Battalion Center
Date: 8-24-01

Remarks:
+ 5% Cement by Weight
Sample D
Sampled 8-21-01 @ 1000
GFP-08-MB-020-02
JJB 9/25/01

MOISTURE-DENSITY RELATIONSHIP TEST

EUSTIS ENGINEERING COMPANY, INC.

ENC. NO.: _____

ENCLOSURE 4

APPENDIX D

NUCLEAR DENSITY TEST RESULTS

CLIENT:	**NCBC Gulfport**	JOB NUMBER:	N0567
SUBJECT:	**Site 8 Pilot-Scale Treatability Study**		
BASED ON:	Density testing and bench-scale and pilot scale Proctor results	DRAWING NUMBER:	
DESIGN BY: JJB DATE: 10/31/01	CHECKED BY: DATE:	APPROVED BY: MEA	DATE: 12/17/01

PURPOSE:

To calculate percent compaction of the amended lifts of Material Blend.

APPROACH:

Density testing of the lifts was conducted using the Nuclear Method (ASTM Method D2922). Output from the density testing resulted in a saturated unit weight (γ_{sat}) and moisture content (w).

Dry unit weight (γ_d) is calculated by the following equation:

$$\gamma_d = \gamma_{sat}/(1 + w)$$ (Al-khafaji and Andersland, 1992, p. 87)

Furthermore, % compaction is calculated as follows:

$$\% \text{ compaction} = (\gamma_d/\gamma_{max}) \times 100$$ (Al-khafaji and Andersland, 1992, p. 128)

Where γ_{max} = maximum dry density

Percent compaction values for Lift 1 are calculated using the average bench-scale and Lift-1-specific maximum dry density.

Percent compaction values for Lift 2 are calculated using the average bench-scale and Lift-2-specific maximum dry density.

Percent compaction required is 90 percent.

ASSUMPTIONS:

- During the bench-scale study, the average maximum dry density was calculated to be 113.3 pcf for Material Blend samples amended with Portland cement at 5 to 10 percent by weight (TtNUS, 2001).
- Lift 1 samples analyzed during the pilot-scale study indicated an average maximum dry density of 117.3 pcf.
- Lift 2 samples analyzed during the pilot-scale study indicated an average maximum dry density of 113.8 pcf.

CALCULATIONS:

See attached sheets.

CLIENT:	**NCBC Gulfport**		JOB NUMBER:	N0567
SUBJECT:	**Site 8 Pilot-Scale Treatability Study**			
BASED ON:	Density testing and bench-scale and pilot scale Proctor results		DRAWING NUMBER:	
DESIGN BY: JJB DATE: 10/31/01		CHECKED BY: DATE:	APPROVED BY: MEA	DATE: 12/17/01

REFERENCES:

Al-Khalfaji and Andersland, 1992. Geotechnical Engineering and Soil Testing. Sauders College Publishing: New York.

TtNUS (Tetra Tech NUS, Inc.), 2001. *Report, Bench-Scale Soil/Sediment Treatability Study, Site 8, Herbicide Orange Study Area at Naval Construction Battalion Center, Gulfport, Mississippi*. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina. March.

Lift 1 Density Testing Results (Nuclear Method)

Lift 1 Baseline Measurements (before addition of Portland cement)

Test Location	γ_{sat} (pcf)	w (%)	γ_d (pcf)
1	124.2	15.3	107.7
2	122.0	17.3	104.0
3	121.8	17.2	103.9
4	125.1	21.4	103.0

Baseline average wet density = 123.3 pcf
Baseline average dry denisity = 104.7 pcf
Baseline average moist. content = 17.8 %

γ_{max} = 113.3 (Bench-scale obtained value)
117.3 (Pilot-scale obtained value)

Lift 1 Measurements (after cement mixing and one pass with vibratory compactor)

				γ_{max} = 113.3 pcf		γ_{max} = 117.3 pcf	
Test Location	γ_{sat} (pcf)	w (%)	γ_d (pcf)	% Compaction	Pass/Fail	% Compaction	Pass/Fail
5	128.5	12	114.7	101%	YES	98%	YES
6	122.4	12.5	108.8	96%	YES	93%	YES
7	123	10.7	111.1	98%	YES	95%	YES
8	119	10.2	108.0	95%	YES	92%	YES
9	126.2	12	112.7	99%	YES	96%	YES
10	128.4	12.9	113.7	100%	YES	97%	YES

Average wet density = 124.6 pcf
Average dry denisity = 111.5 pcf
Average moist. content = 11.7 %

EUSTIS ENGINEERING COMPANY, INC.
Geotechnical Engineers
Metairie, Louisiana

Date 17 Aug 01

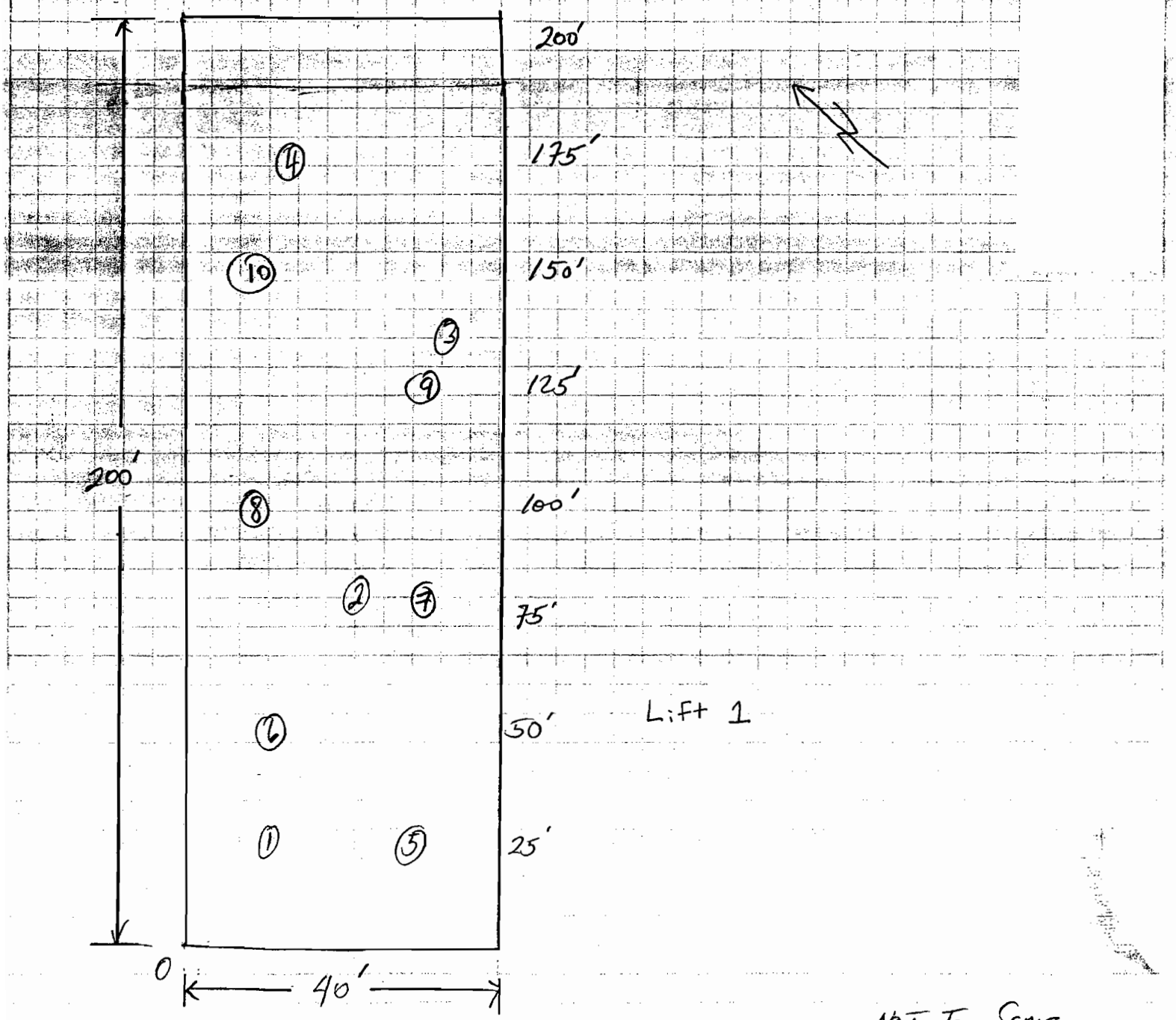
Job 17103

Project USN - STUDY SITE #1

By J. ALCHIN

Subject LOCATION OF DENSITIES

Checked By



7th St SIDE

Lift 2 Density Testing Results (Nuclear Method) - Southeastern Portion of Test Pad

Baseline Measurements (before addition of portland cement)

Test Location	γ_{sat} (pcf)	w (%)	γ_d (pcf)
1	121.7	20.4	101.1
2	117.9	22	96.6
3	114.7	23.9	92.6
4	119.7	25.3	95.5
5	119.7	22.2	98.0
6	116.5	20	97.1
7	122.4	22	100.3

Baseline average wet density = 118.9 pcf
Baseline average dry denisity = 97.3 pcf
Baseline average moist. content = 22.3 %

γ_{max} = 113.3 pcf (Bench-scale obtained value)
113.8 pcf (Pilot-scale obtained value)

Locations 15-21 (After cement addition and one pass with vibratory compactor)
Retest 1 (After second pass with vibratory compactor)
Retest 2 (After third pass with vibratory compactor)

					γ_{max} = 113.3 pcf		γ_{max} = 113.8 pcf	
Test Location	γ_{sat} (pcf)	w (%)	Avg. w (%)	γ_d (pcf)	% Compaction	Pass/Fail	% Compaction	Pass/Fail
15	122.6	17.3	17.7	104.5	92%	YES	92%	YES
Retest 1	125	18.1		105.8	93%	YES	93%	YES
16	121.7	18.4	18.8	102.8	91%	YES	90%	YES
Retest 1	115.8	19.5		96.9	86%	NO	85%	NO
Retest 2	125.5	18.6		105.8	93%	YES	93%	YES
17	120.6	18.8	18.9	101.5	90%	NO	89%	NO
Retest 1	123.8	18.9		104.1	92%	YES	91%	YES
18	119.6	20.1	20.2	99.6	88%	NO	88%	NO
Retest 1	124.3	20.2		103.4	91%	YES	91%	YES
19	114.2	18.6	18.4	96.3	85%	NO	85%	NO
Retest 1	121.7	18.2		103.0	91%	YES	90%	YES
20	116.3	17.5	18.4	99.0	87%	NO	87%	NO
Retest 1	116.9	18.5		98.6	87%	NO	87%	NO
Retest 2	124.3	19.3		104.2	92%	YES	92%	YES
21	110.1	16.4	17.2	94.6	83%	NO	83%	NO
Retest 1	117.6	18.4		99.3	88%	NO	87%	NO
Retest 2	118.9	16.8		101.9	90%	YES	90%	YES

Average Moisture Content = 18.5 %

(1) - Calculated using the bench-scale obtained value
(2) - Calculated using the pilot-scale obtained value.

Lift 2 Density Testing Results (Nuclear Method) - Northwestern Portion of Test Pad

Baseline Measurements (before addition of Portland cement)

Test Location	γ_{sat} (pcf)	w (%)	γ_d (pcf)
8	109.7	16.1	94.5
9	115.2	17.7	97.9
10	119.3	19.3	100.0
11	118.7	18.5	100.2
12	124	19.8	103.5
13	122.1	23.8	98.6
14	117.7	18.1	99.7

Baseline average wet density = 118.1 pcf
Baseline average dry density = 99.2 pcf
Baseline average moist. content = 19.0 %

γ_{max} = 113.3 pcf (Bench-scale obtained value)
113.8 pcf (Pilot-scale obtained value)

Locations 22 - 28 (After cement addition and one pass with vibratory compactor)
Retest 1 (After second pass with vibratory compactor)
Retest 2 (After third pass with vibratory compactor)

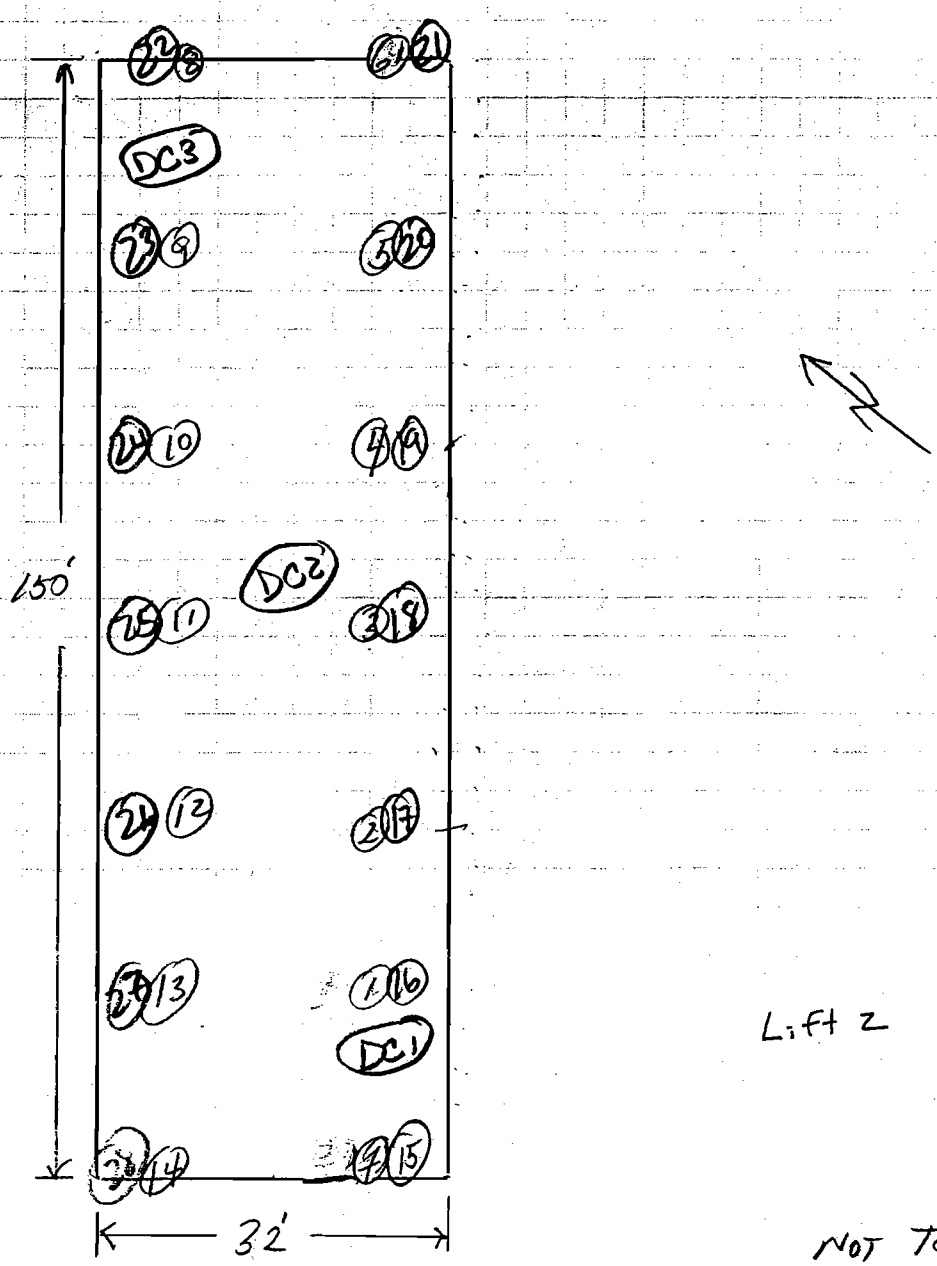
					γ_{max} = 113.3 pcf		γ_{max} = 113.8 pcf	
Test Location	γ_{sat} (pcf)	w (%)	Avg. w (%)	γ_d (pcf)	% Compaction	Pass/Fail	% Compaction	Pass/Fail
22	115.9	15.1	14.9	100.7	89%	NO	88%	NO
Retest 1	117.8	14.7		102.7	91%	YES	90%	YES
23	111.5	16.3	15.8	95.9	85%	NO	84%	NO
Retest 1	116.2	16.1		100.1	88%	NO	88%	NO
Retest 2	118	15.4		102.3	90%	YES	90%	YES
24	123	17.8	16.0	104.4	92%	YES	92%	YES
Retest 1	119.8	14.1		105.0	93%	YES	92%	YES
25	109.4	12.6	14.3	97.2	86%	NO	85%	NO
Retest 1	126.4	16		109.0	96%	YES	96%	YES
26	114.9	15.7	16.7	99.3	88%	NO	87%	NO
Retest 1	123.3	17.6		104.8	93%	YES	92%	YES
27	121.6	19	18.4	102.2	90%	YES	90%	NO
Retest 1	124.7	17.7		105.9	94%	YES	93%	YES
28	124.4	17.5	17.7	105.9	93%	YES	93%	YES
Retest 1	126	17.9		106.9	94%	YES	94%	YES

Average Moisture Content = 16.2 %

(1) - Calculated using the bench-scale obtained value
(2) - Calculated using the pilot-scale obtained value.

EUSTIS ENGINEERING COMPANY, INC.
Geotechnical Engineers
Metairie, Louisiana

Date 21 Aug 01
Job 17103
Project USN - Study Site #8
By J. Alcan
Subject Location of Densities
Checked By



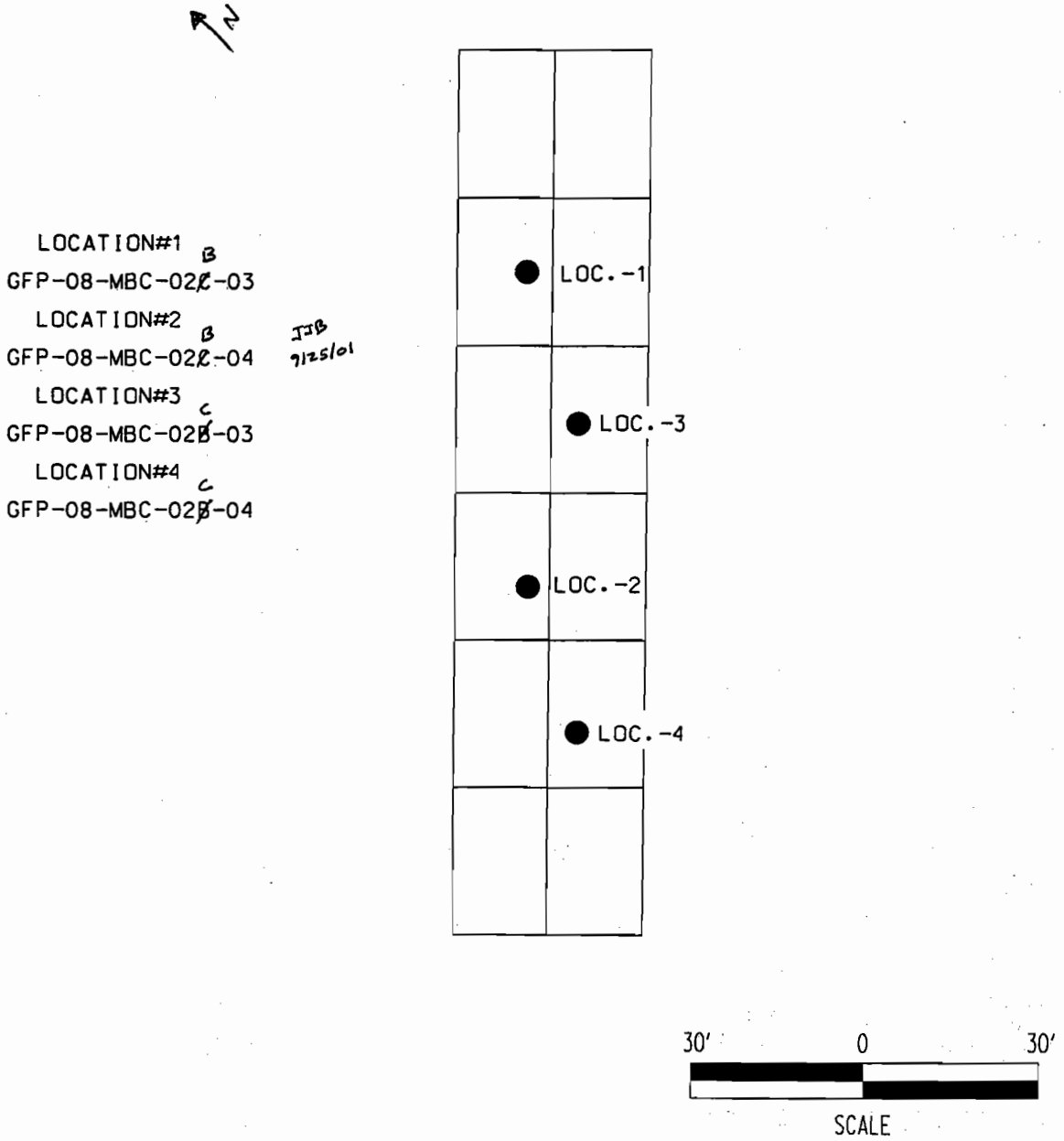
Lift 2

NOT TO SCALE

7th St Side

APPENDIX E

CALIFORNIA BEARING RATIO TEST RESULTS



EUSTIS ENGINEERING COMPANY, INC.

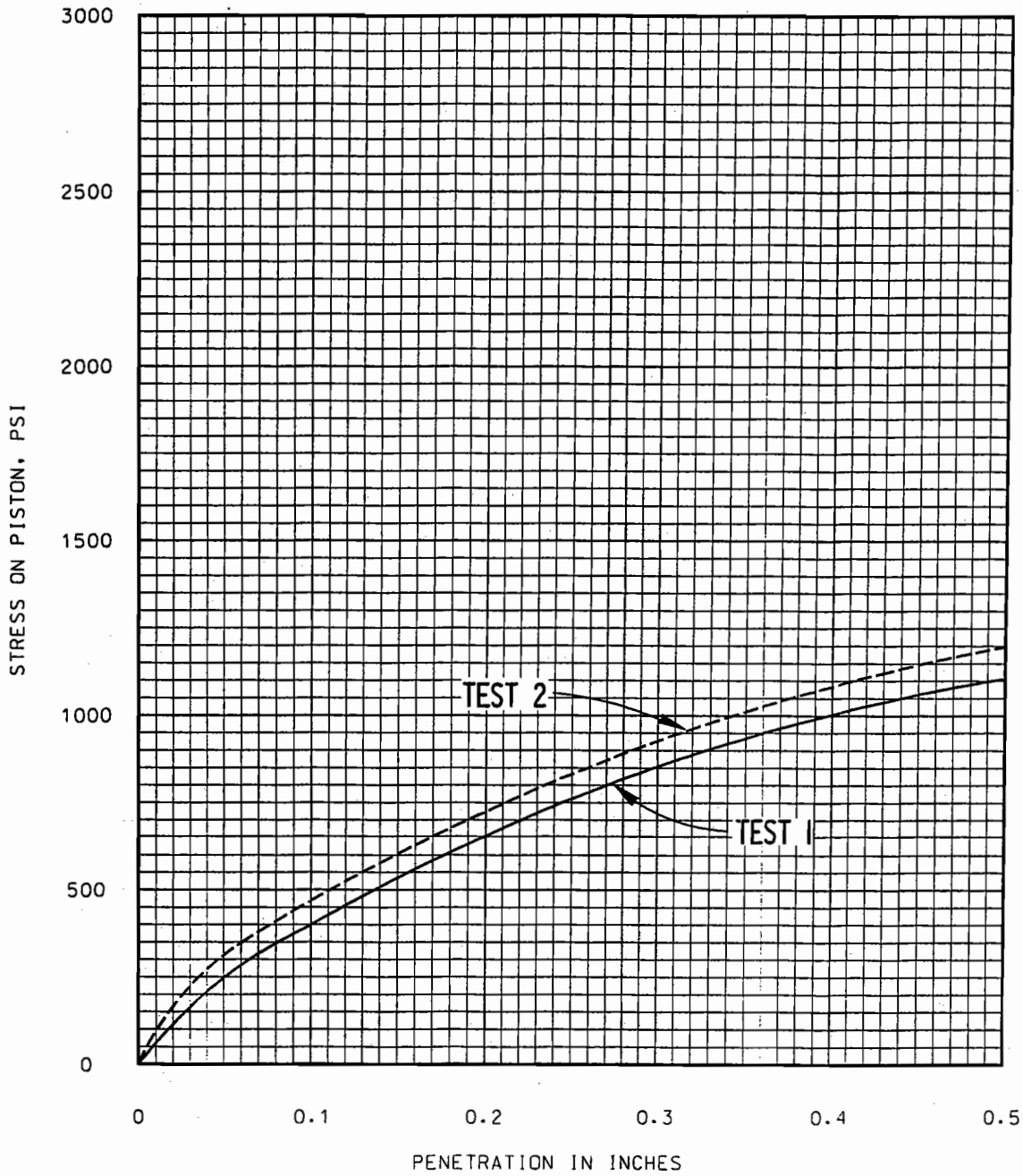
GEOTECHNICAL ENGINEERS

3011 28TH STREET METAIRIE, LOUISIANA

LOCATION OF CBR TESTS

U.S. NAVY
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT(HARRISON COUNTY), MISSISSIPPI

DRAWN BY: O. LAFONT	PLOT DATE: 31 AUG. 2001	CADD FILE: FIGURE 1.DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 1



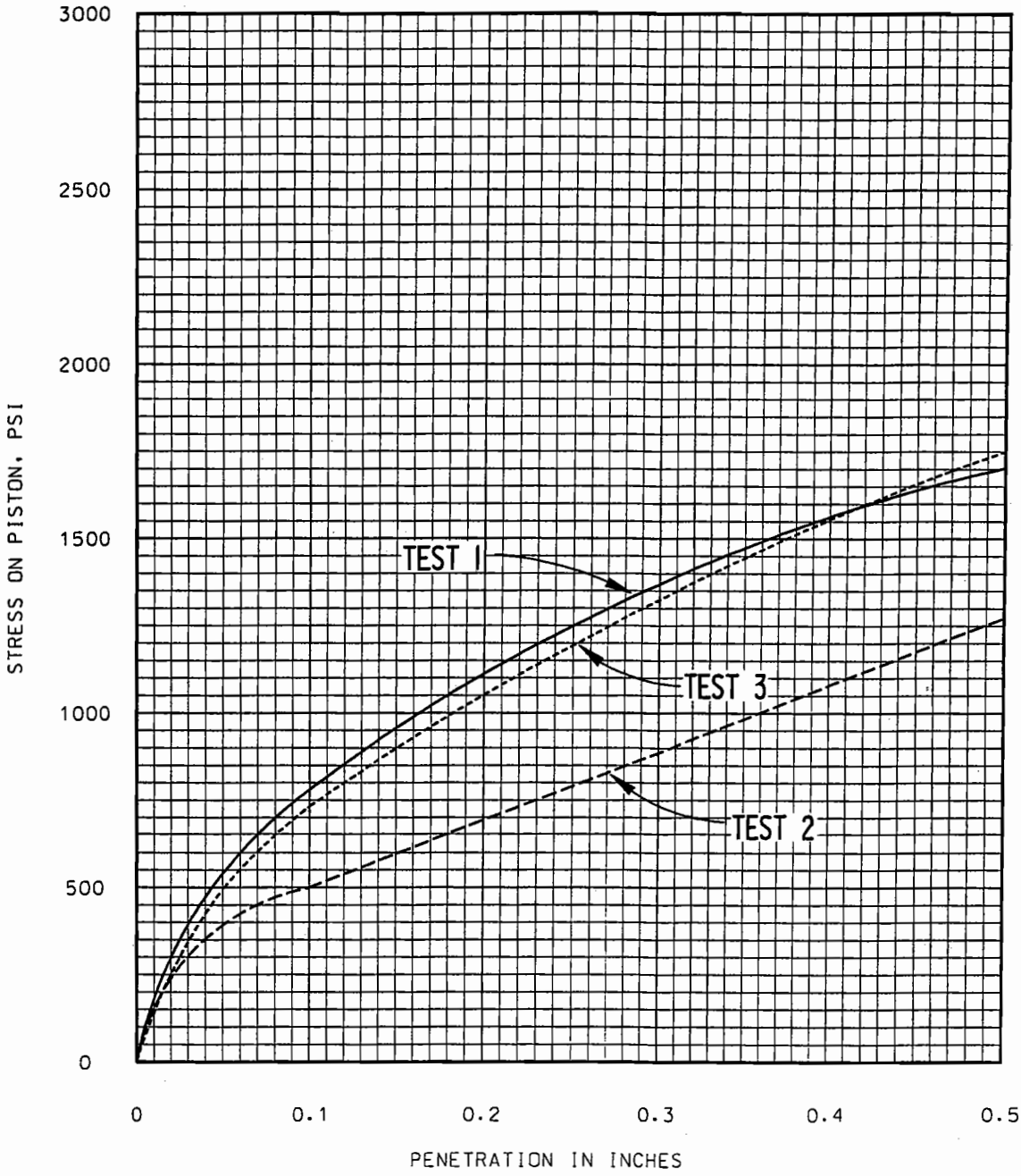
DATE OF TEST: 24 AUGUST 2001
PORTLAND CEMENT STABALIZED SUBGRADE

DEFLECTION, INCHES	CBR	TEST NO.
0.1	39	1
0.1	47	2
0.1	AVE.43	
0.2	44	1
0.2	49	2
0.2	AVE.47	

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

CALIFORNIA BEARING RATIO
LOCATION#1
GFP-08-MBC-02C-03; 3 DAY TEST
U.S. NAVY 09/25/01 33B
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT(HARRISON COUNTY), MISSISSIPPI

DRAWN BY: D. LAFONT	PLOT DATE: 31 AUG. 2001	CADD FILE: FIGURE 1.DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 2



DATE OF TEST: 24 AUGUST 2001
PORTLAND CEMENT STABALIZED SUBGRADE

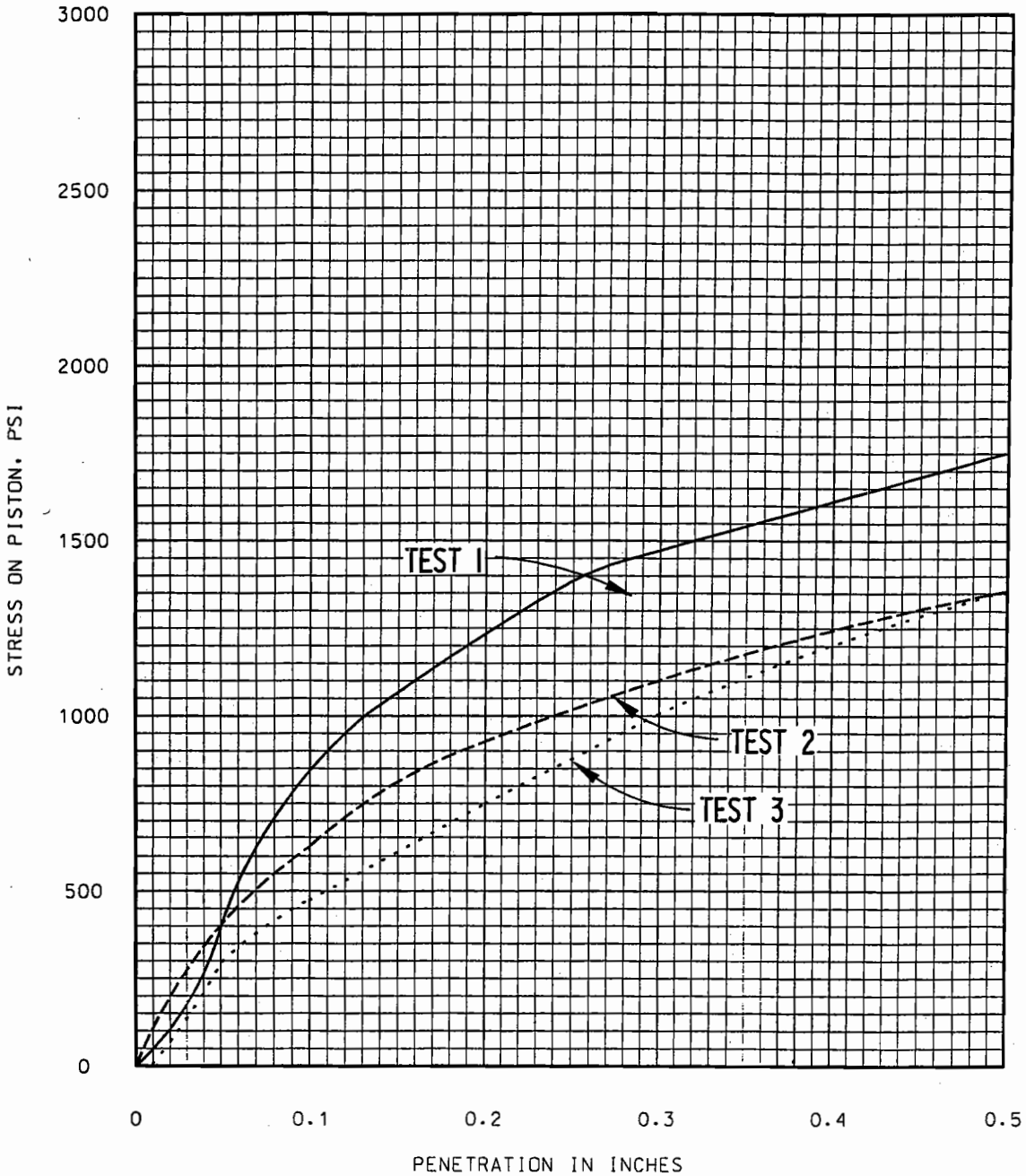
DEFLECTION, INCHES	CBR	TEST NO.
0.1	78	1
0.1	51	2
0.1	72	3
0.1	AVE.67	
0.2	73	1
0.2	48	2
0.2	74	3
0.2	AVE.65	

NOTE: A 0.01 INCH ADJUSTMENT IS NECESSARY ON TESTS NO. 1 AND 3 FOR SEATING CORRECTION.

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

CALIFORNIA BEARING RATIO
LOCATION #2
GFP-08-MBC-020-04; 3 DAY TEST
U.S. NAVY JB 09/25/01
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT(HARRISON COUNTY), MISSISSIPPI

DRAWN BY: D. LAFONT	PLOT DATE: 31 AUG. 2001	CADD FILE: FIGURE 1.DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 3



DATE OF TEST: 24 AUGUST 2001
PORTLAND CEMENT STABALIZED SUBGRADE

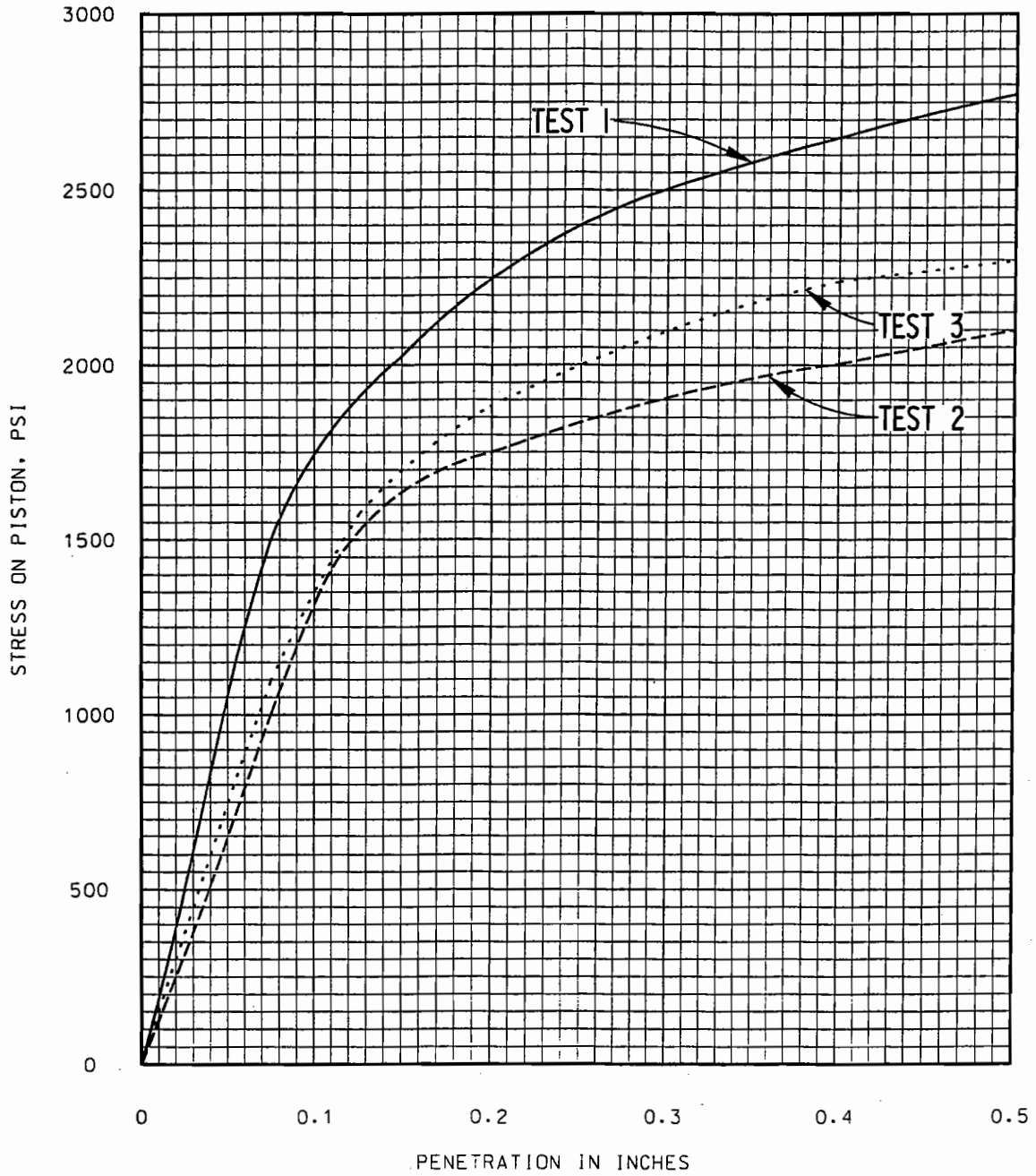
DEFLECTION, INCHES	CBR	TEST NO.
0.1	90	1
0.1	64	2
0.1	51	3
0.1	AVE.68	
0.2	84	1
0.2	61	2
0.2	52	3
0.2	AVE.66	

NOTE: A 0.01 INCH ADJUSTMENT IS NECESSARY ON TESTS NO. 1 AND 3 FOR SEATING CORRECTION.

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

CALIFORNIA BEARING RATIO
LOCATION #3
GFP-08-MBC-02B-03: 3 DAY TEST
U.S. NAVY 338 04/25/01
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT (HARRISON COUNTY), MISSISSIPPI

DRAWN BY: D. LAFONT	PLOT DATE: 31 AUG. 2001	CADD FILE: FIGURE 1.DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 4



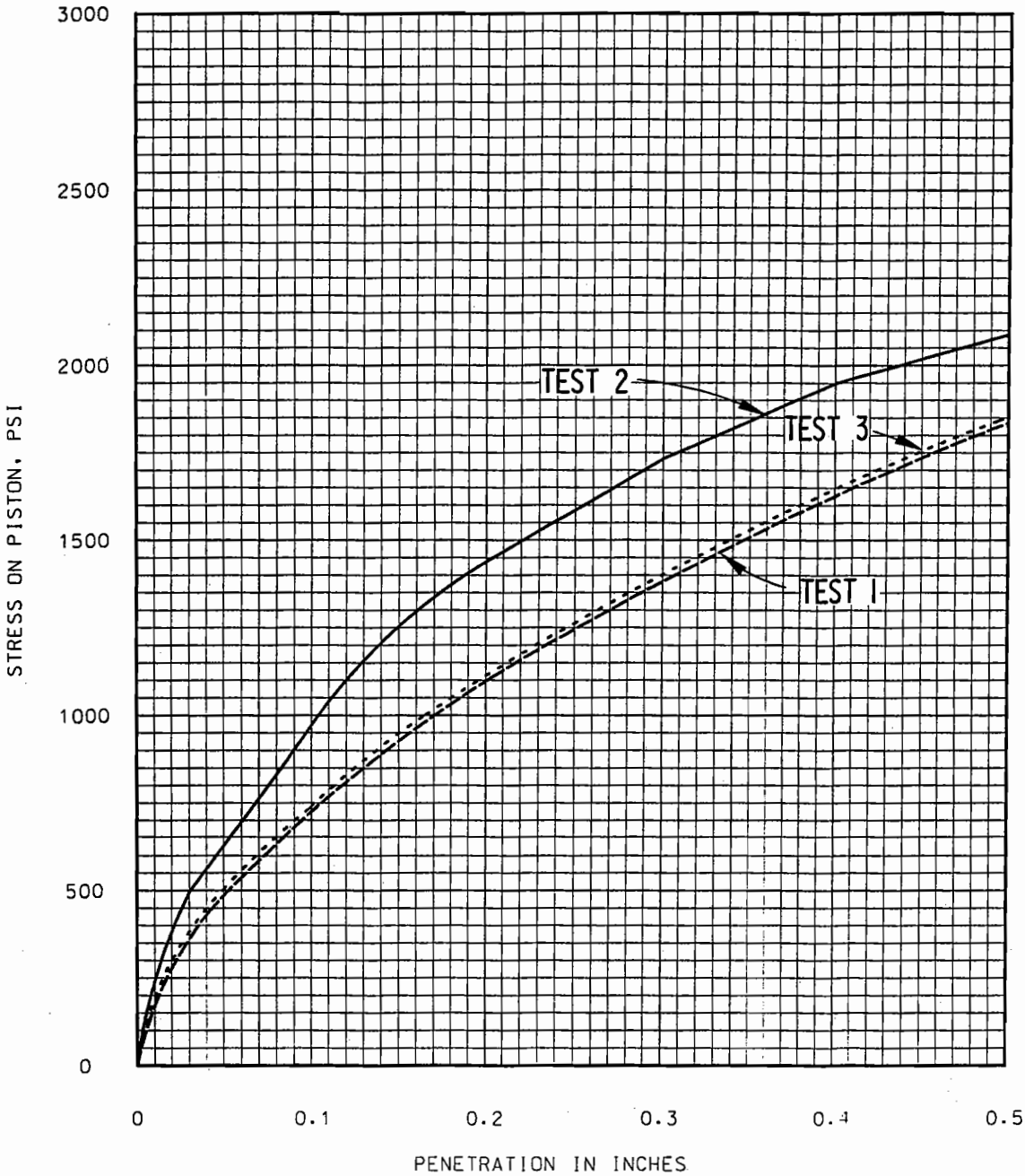
DATE OF TEST: 24 AUGUST 2001
PORTLAND CEMENT STABALIZED SUBGRADE

DEFLECTION, INCHES	CBR	TEST NO.
0.1	176	1
0.1	131	2
0.1	135	3
0.1	AVE.147	
0.2	149	1
0.2	116	2
0.2	125	3
	AVE.130	

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

CALIFORNIA BEARING RATIO
LOCATION #4
GFP-08-MBC-02~~8~~-04: 3 DAY TEST
U.S. NAVY 09/25/01 JJB
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT(HARRISON COUNTY), MISSISSIPPI

DRAWN BY: D. LAFONT	PLOT DATE: 31 AUG. 2001	CADD FILE: FIGURE .DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 5



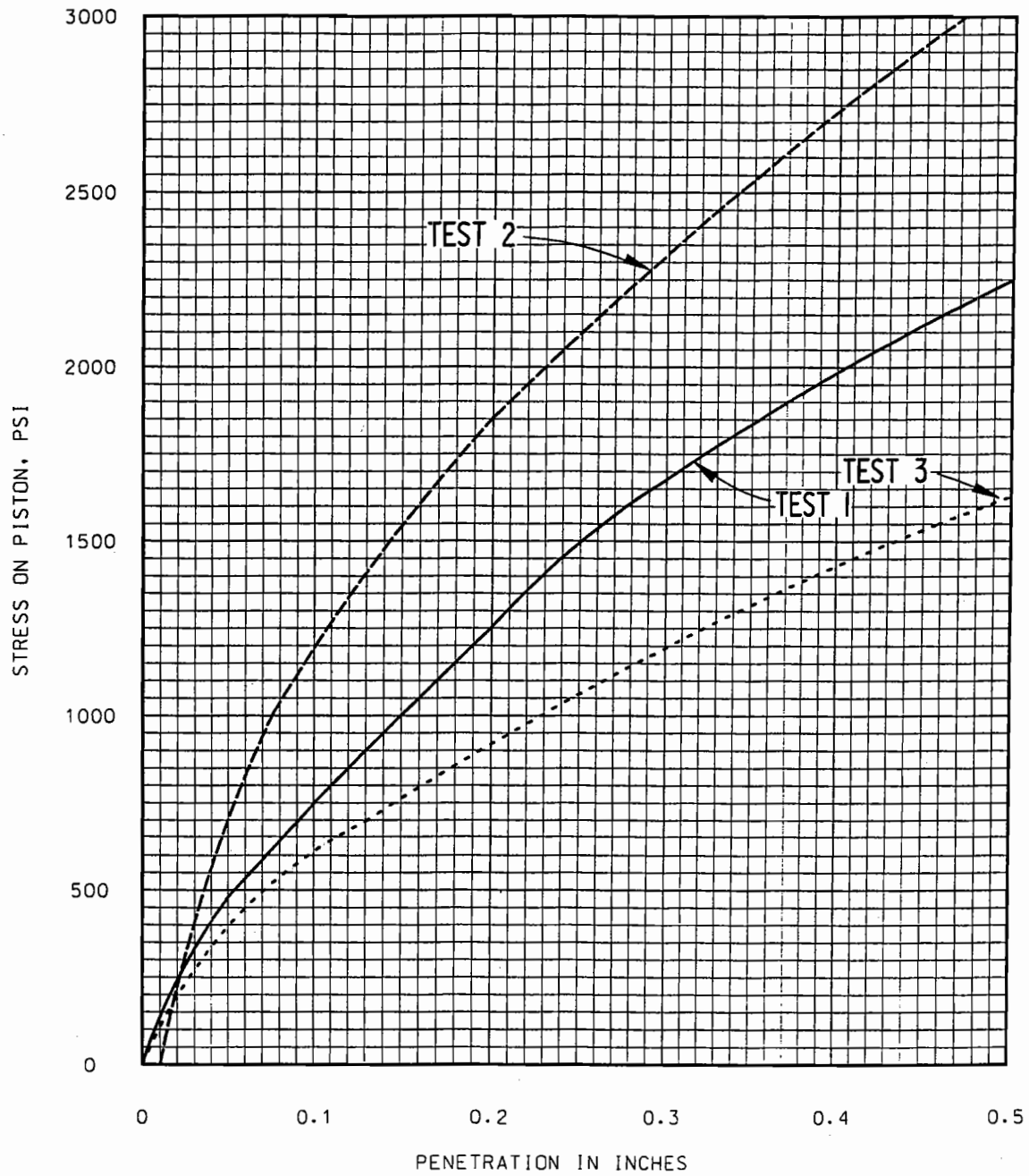
DATE OF TEST: 28 AUGUST 2001
PORTLAND CEMENT STABALIZED SUBGRADE

DEFLECTION. INCHES	CBR	TEST NO.
0.1	71	1
0.1	97	2
0.1	74	3
0.1	AVE. 8	
0.2	73	1
0.2	96	2
0.2	75	3
	AVE. 8	

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

CALIFORNIA BEARING RATIO
LOCATION #1
GFP-08-MBC-02ℓ-03; 7 DAY TEST
U.S. NAVY JJB 09/25/01
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT(HARRISON COUNTY), MISSISSIPPI

DRAWN BY: D. LAFONT	PLOT DATE: 31 AUG. 2001	CADD FILE: FIGURE 1.DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 6



DATE OF TEST: 28 AUGUST 2001
PORTLAND CEMENT STABALIZED SUBGRADE

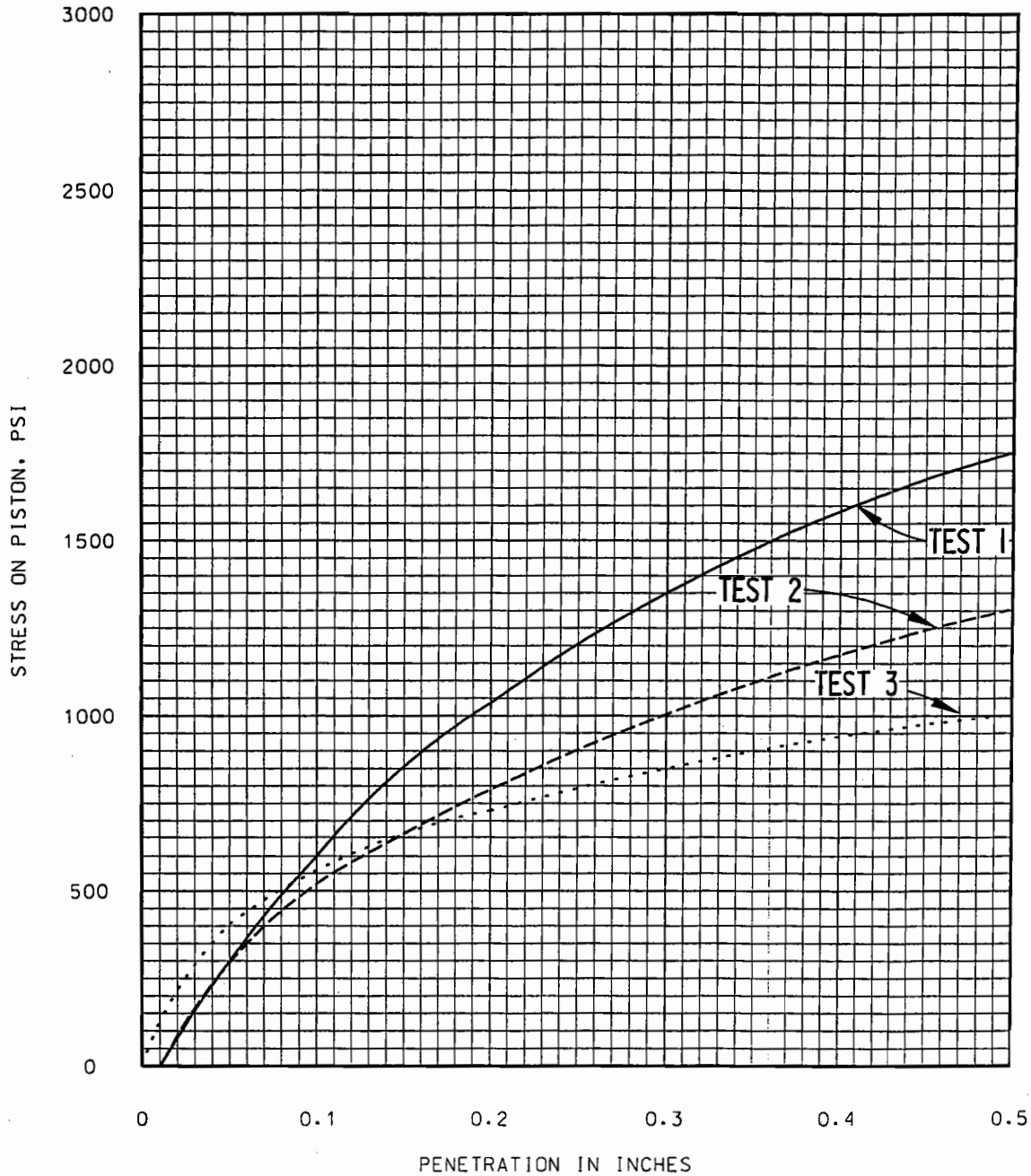
DEFLECTION, INCHES	CBR	TEST NO.
0.1	76	1
0.1	129	2
0.1	60	3
0.1	AVE. 88	
0.2	84	1
0.2	127	2
0.2	61	3
	AVE. 91	

NOTE: A 0.01 INCH ADJUSTMENT IS NECESSARY ON TEST 2 FOR SEATING CORRECTION.

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

CALIFORNIA BEARING RATIO
LOCATION #2
GFP-08-MBC-02~~0~~B-04: 7 DAY TEST
U.S. NAVY 09/25/01 338
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT(HARRISON COUNTY), MISSISSIPPI

DRAWN BY: D. LAFONT	PLOT DATE: 31 AUG. 2001	CADD FILE: FIGURE 1.DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 7



DATE OF TEST: 28 AUGUST 2001
PORTLAND CEMENT STABALIZED SUBGRADE

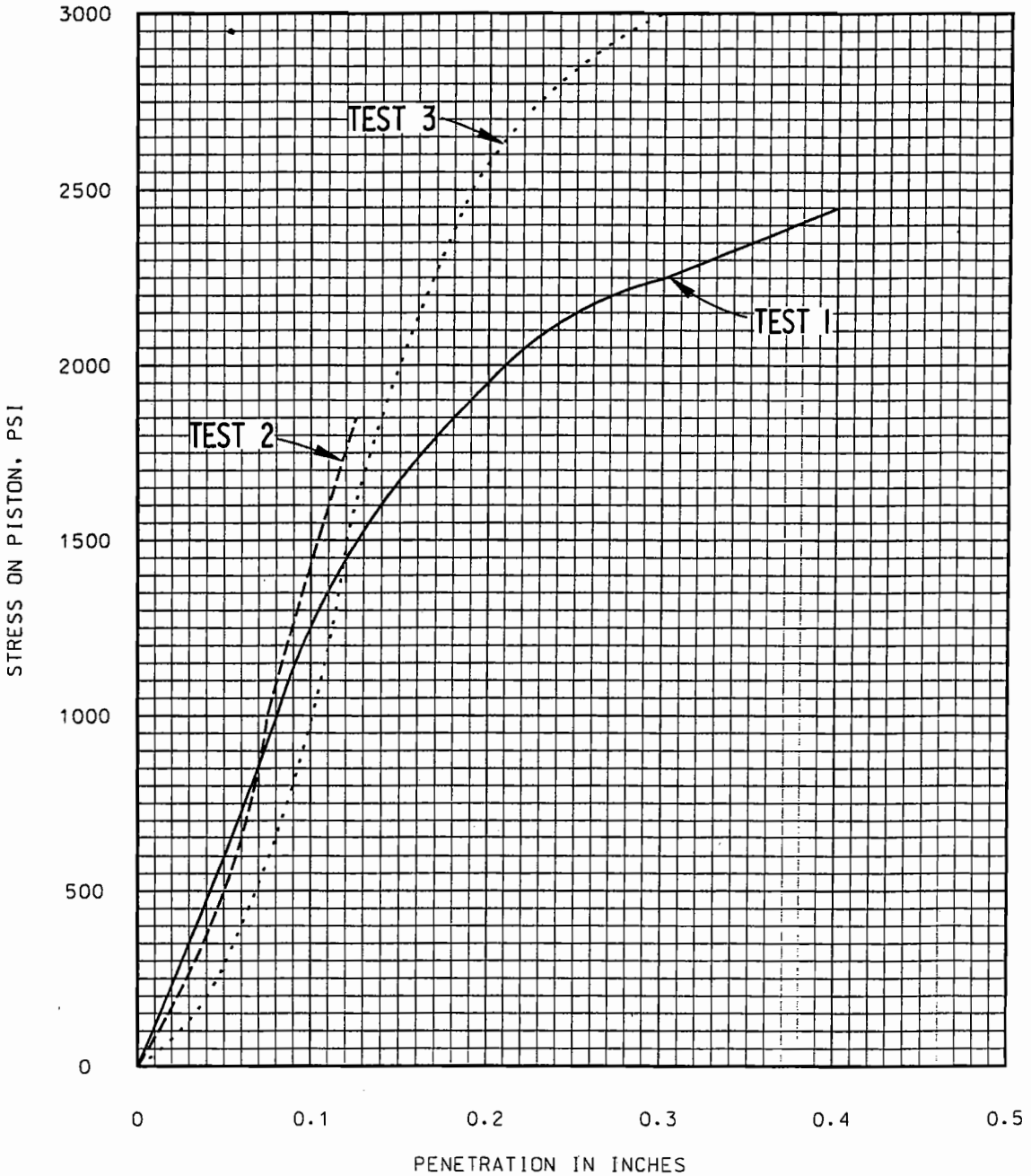
DEFLECTION, INCHES	CBR	TEST NO.
0.1	66	1
0.1	55	2
0.1	55	3
0.1	AVE. 59	
0.2	71	1
0.2	55	2
0.2	49	3
0.2	AVE. 58	

NOTE: A 0.01 INCH ADJUSTMENT IS NECESSARY ON TESTS 1 AND 2 FOR SEATING CORRECTION.

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

CALIFORNIA BEARING RATIO
LOCATION #3
GFP-08-MBC-02~~8~~-03; 7 DAY TEST
U.S. NAVY JJB 09/25/01
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT(HARRISON COUNTY), MISSISSIPPI

DRAWN BY: D. LAFONT	PLOT DATE: 31 AUG. 2001	CADD FILE: FIGURE 1.DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 8



DATE OF TEST: 28 AUGUST 2001
PORTLAND CEMENT STABALIZED SUBGRADE

DEFLECTION, INCHES	CBR	TEST NO.
0.1	130	1
0.1	160	2
0.1	185	3
0.1	AVE.158	
0.2	132	1
0.2	186	3
	AVE.159	

NOTE: SEATING CORRECTIONS WERE NECESSARY FOR ALL THREE TESTS. THE CORRECTIONS WERE: 0.005, 0.01, AND 0.038 INCH FOR THE RESPECTIVE TESTS.

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

CALIFORNIA BEARING RATIO
LOCATION #4
GFP-08-MBC-02[illegible]-04: 7 DAY TEST
U.S. NAVY JJB 09/25/01
PILOT SCALE
SOIL/SEDIMENT TREATABILITY STUDY
AT SITE 8
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT(HARRISON COUNTY), MISSISSIPPI

DRAWN BY: D. LAFONT	PLOT DATE: 31 AUG. 200[illegible]	CADD FILE: FIGURE 1.DGN
CHECKED BY: T.H.S.	JOB NO. 17103	ENCLOSURE 9

APPENDIX

JOB NO. 17103

DATE: 8/24/01

No. 1

JJB 09/25/01

TECHNICIAN: T. Croal

LOCATION: GFP -08-MB1-02-03 THREE DAY TEST

MATERIAL: Clayey sand with roots, pine needles, grass and visqueen (stabilized with Portland Cement)

DEPTH BELOW SURFACE IN INCHES: Surface

CALIFORNIA BEARING RATIO

PENETRATION IN INCHES	TEST NO. 1				TEST NO. 2				TEST NO. 3			
	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR
.025	.45	454	152		.65	656	220					
.050	.72	726	243		.89	898	301					
.075	.94	948	318		.110	1110	372					
.100	.115	1160	389	39	.138	1392	466	47				
.125	.135	1362	456		.157	1584	530					
.150	.157	1584	530		.178	1796	601					
.175	.178	1796	601		.198	1997	669					
.200	.196	1977	662	44	.218	2199	736	49				
.250	.232	2340	784		.245	2471	828					
.300	.255	2572	861		.272	2744	919					
.350	.274	2764	926		.299	3016	1010					
.400	.300	3026	1013		.325	3278	1098					
.450	.325	3278	1098		.344	3470	1162					
.500	.346	3490	1169		.357	3601	1206					

PROVING RING NO. 20975

SURCHARGE: 30 LB

* Determine from calibration curve. (Load = 10.09 x Dial Divisions)

** Divide load by the piston area. Piston Area = 2.986 $in.^2$

EUSTIS ENGINEERING COMPANY, INC.

JOB NO. 17103

DATE: 8/28/01

No. 1 JJB

TECHNICIAN: T. Croal

LOCATION: GFP -08-MB1-02B-03 09/25/01 SEVEN DAY TEST

MATERIAL: Clayey sand with roots, pine needles, grass, and visqueen (stabilized with Portland Cement)

DEPTH BELOW SURFACE IN INCHES: Surface

CALIFORNIA BEARING RATIO

PENETRATION IN INCHES	TEST NO. 1				TEST NO. 2				TEST NO. 3			
	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR
.025	92	928	311		139	1402	470		98	989	331	
.050	138	1392	466		189	1906	638		144	1453	486	
.075	173	1745	584		241	2431	814		182	1835	615	
.100	209	2109	706	71	286	2886	966	97	220	2220	743	74
.125	242	2441	818		330	3329	1114		247	2492	834	
.150	272	2744	919		369	3722	1247		279	2814	943	
.175	299	3016	1010		401	4045	1355		308	3107	1041	
.200	324	3269	1094	73	426	4298	1439	96	335	3308	1132	75
.250	369	3722	1247		472	4761	1595		378	3813	1277	
.300	416	4196	1405		515	5195	1740		420	4237	1419	
.350	457	4609	1544		551	5558	1861		458	4620	1547	
.400	482	4862	1628		579	5841	1956		490	4943	1655	
.450	516	5205	1743		605	6103	2044		521	5256	1760	
.500	545	5498	1841		632	6375	2135		543	5578	1848	

PROVING RING NO. 20975

SURCHARGE: 30 LB

* Determine from calibration curve. (Load = 10.09 x Dial Divisions)
** Divide load by the piston area Piston Area = 2.986 in.^{2}

EUSTIS ENGINEERING COMPANY, INC.

JOB NO. 17103 DATE: 8/24/01

No. 2 JJB 09/25/01 TECHNICIAN: T. Croal

LOCATION: GFP -08-MCB-02C-04 THREE DAY TEST

MATERIAL: Clayey sand with roots, pine needles, grass and visqueen (stabilized with Portland Cement)

DEPTH BELOW SURFACE IN INCHES: Surface

CALIFORNIA BEARING RATIO

PENETRATION IN INCHES	TEST NO. 1				TEST NO. 2				TEST NO. 3			
	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR
.025	.110	1110	372		.85	857	287		.105	1059	355	
.050	.158	1594	534		.110	1110	372		.142	1432	480	
.075	.200	2018	676		.132	1332	446		.180	1816	608	
.100	.232	2340	784	78	.150	1513	507	51	.212	2139	716	72
.125	.260	2623	878		.165	1664	557		.245	2471	828	
.150	.278	2804	939		.180	1816	608		.273	2754	922	
.175	.305	3077	1030		.199	2007	672		.303	3056	1024	
.200	.325	3278	1098	73	.212	2138	716	48	.327	3298	1105	74
.250	.369	3722	1246		.247	2491	834		.352	3551	1189	
.300	.400	4035	1351		.271	2734	915		.399	4025	1348	
.350	.426	4297	1439		.299	3016	1010		.432	4358	1459	
.400	.452	4520	1527		.322	3248	1088		.454	4580	1534	
.450	.475	4792	1605		.352	3551	1189		.486	4902	1642	
.500	.499	5034	1686		.376	3793	1270		.510	5145	1723	

PROVING RING NO. 20957 SURCHARGE: 30 LB

* Determine from calibration curve. (Load = 10.09 x Dial Divisions)
** Divide load by the piston area Piston Area = 2.986 $in.^2$

EUSTIS ENGINEERING COMPANY, INC.

JOB NO. 17103 DATE: 8/28/01

No. 2 TECHNICIAN: T. Croal

LOCATION: GFP -08-MB~~C~~-02~~C~~-04 SEVEN DAY TEST

MATERIAL: Clayey sand with roots, pine needles, grass, and visqueen (stabilized with Portland Cement)

DEPTH BELOW SURFACE IN INCHES: Surface

CALIFORNIA BEARING RATIO

PENETRATION IN INCHES	TEST NO. 1				TEST NO. 2				TEST NO. 3			
	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR
.025	98	989	331		96	968	324		66	666	223	
.050	140	1412	473		220	2219	743		115	1160	389	
.075	182	1836	615		300	3026	1013		150	1513	507	
.100	225	2270	760	76	354	3572	1196	120***	177	1786	598	60
.125	262	2643	885		410	4136	1385		204	2058	689	
.150	302	3046	1020		462	4660	1561		230	2320	777	
.175	340	3430	1149		512	5165	1730		255	2572	861	
.200	375	3783	1267	84	550	5550	1859	124***	272	2744	919	61
.250	441	4449	1490		632	6375	2135		312	3147	1054	
.300	499	5034	1686		698	7041	2358		350	3531	1182	
.350	544	5488	1838		755	7616	2551		386	3894	1304	
.400	582	5871	1906		806	8131	2723		420	4237	1419	
.450	624	6295	2108		863	8706	2915		455	4590	1537	
.500	662	6678	2236		935	9432	3159		482	4862	1628	

PROVING RING NO. 20975 SURCHARGE: 30 LB

* Determine from calibration curve. (Load = 10.09 x Dial Divisions)

** Divide load by the piston area Piston Area = 2.986 $in.^2$

*** These field CBR values were adjusted. See Enclosure 7

EUSTIS ENGINEERING COMPANY, INC.

JOB NO. 17103 DATE: 8/24/01

No. 3 TECHNICIAN: T. Croal

LOCATION: GFP -08-MB~~C~~-02~~B~~-03 THREE DAY TEST

JJB 09/25/01

MATERIAL: Clayey sand with roots, pine needles, grass and visqueen (stabilized with Portland Cement)

DEPTH BELOW SURFACE IN INCHES: Surface

CALIFORNIA BEARING RATIO

PENETRATION IN INCHES	TEST NO. 1				TEST NO. 2				TEST NO. 3			
	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR
.025	.90	404	135		.65	656	220		.36	363	122	
.050	.118	1190	399		.118	1190	399		.85	857	287	
.075	.199	2007	672		.158	1594	534		.118	1190	399	
.100	.250	2522	844	84	.190	1917	642	64	.137	1382	463	46
.125	.290	2925	980		.218	2199	736		.162	1634	547	
.150	.324	3268	1095		.240	2421	811		.183	1846	618	
.175	.348	3510	1176		.255	2572	861		.204	2058	689	
.200	.365	3682	1233	82	.272	2744	919	61	.222	2239	750	50
.250	.406	4096	1372		.305	3077	1030		.265	2673	895	
.300	.440	4439	1487		.331	3339	1118		.300	3026	1013	
.350	.454	4580	1534		.350	3531	1182		.331	3339	1118	
.400	.482	4862	1628		.370	3732	1250		.356	3591	1203	
.450	.500	5044	1689		.388	3914	1311		.380	3833	1284	
.500	.519	5235	1753		.405	4085	1368		.403	4065	1361	

PROVING RING NO. 20975

SURCHARGE: 30 LB

* Determine from calibration curve. (Load = 10.09 x Dial Divisions)
** Divide load by the piston area Piston Area = 2.986 in.^{2}

Note: Tests No. 1 and No. 3 CBR values were adjusted to a higher value than given here due to seating corrections. See Enclosure 4

EUSTIS ENGINEERING COMPANY, INC.

JOB NO. 17103 DATE: 8/28/01

No. 3 TECHNICIAN: T. Croal

LOCATION: GFP -08-MBC-02 03 SEVEN DAY TEST

MATERIAL: Clayey sand with roots, pine needles, grass, and visqueen (stabilized with Portland Cement)

DEPTH BELOW SURFACE IN INCHES: Surface

CALIFORNIA BEARING RATIO

PENETRATION IN INCHES	TEST NO. 1				TEST NO. 2				TEST NO. 3			
	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR
.025	15	414	139		19	524	126		30	828	277	
.050	35	966	323		34	938	314		44	1214	406	
.075	52	1434	480		45	1241	416		50	1379	462	
.100	65	1793	600	60***	53	1462	490	49***	60	1655	554	55
.125	80	2207	739		62	1710	573		65	1793	600	
.150	92	2538	850		72	1986	665		72	1986	665	
.175	104	2869	961		81	2234	748		75	2069	693	
.200	112	3090	1035	69***	87	2400	803	54***	79	2179	730	49
.250	130	3598	1201		99	2731	915		85	2345	785	
.300	144	3972	1330		109	3007	1007		92	2538	850	
.350	160	4414	1478		117	3228	1081		99	2731	915	
.400	175	4828	1617		125	3448	1155		102	2814	942	
.450	185	5103	1709		132	3641	1219		105	2897	970	
.500	190	5214	1755		140	3862	1293		109	3007	1007	

PROVING RING NO. 20205 SURCHARGE: 30 LB

* Determine from calibration curve. (Load = 27.586 x Dial Reading)

** Divide load by the piston area Piston Area = 2.986 in.^{2}

*** These field CBR values were adjusted. See Enclosure 8

EUSTIS ENGINEERING COMPANY, INC.

JOB NO. 17103 DATE: 8/24/01

No. 4 JJB 04/25/01 TECHNICIAN: T. Croal

LOCATION: GFP -08-MBC-02B-04 THREE DAY TEST

MATERIAL: Clayey sand with roots, pine needles, grass and visqueen (stabilized with Portland Cement)

DEPTH BELOW SURFACE IN INCHES: Surface

CALIFORNIA BEARING RATIO

PENETRATION IN INCHES	TEST NO. 1				TEST NO. 2				TEST NO. 3			
	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR
.025	.140	1412	473		.89	898	301		.98	998	331	
.050	.248	2502	838		.188	1896	635		.222	2239	750	
.075	.447	4509	1510		.300	3026	1013		.325	3278	1098	
.100	.520	5245	1757	176	.388	3914	1311	131	.400	4035	1351	135
.125	.570	5750	1426		.455	4590	1537		.467	4711	1578	
.150	.602	6073	2034		.482	4862	1628		.508	5124	1716	
.175	.635	6406	2145		.503	5074	1699		.547	5518	1848	
.200	.664	6698	2243	149	.517	5215	1747	116	.555	5599	2000	125
.250	.712	7182	2405		.547	5518	1848		.592	5972	1875	
.300	.744	7505	2513		.566	5710	1912		.622	6275	2101	
.350	.759	7656	2564		.582	5871	1966		.645	6505	2179	
.400	.780	7868	2635		.592	5972	2000		.660	6658	2230	
.450	.791	7979	2672		.605	6103	2044		.668	6738	2257	
.500	.796	8030	2684		.616	6274	2081		.676	6819	2284	

PROVING RING NO. 20975 SURCHARGE: 30 LB

* Determine from calibration curve. (Load = 10.09 x Dial Divisions)
** Divide load by the piston area Piston Area = 2.986 $in.^2$

EUSTIS ENGINEERING COMPANY, INC.

JOB NO. 17103

DATE: 8/28/01

No. 4

TECHNICIAN: T. Croal

LOCATION: GFP -08-MBC-02B-04 SEVEN DAY TEST

JJB 09/25/01

MATERIAL: Clayey sand with roots, pine needles, grass, and visqueen (stabilized with Portland Cement)

DEPTH BELOW SURFACE IN INCHES: Surface

CALIFORNIA BEARING RATIO

PENETRATION IN INCHES	TEST NO. 1				TEST NO. 2				TEST NO. 3			
	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR	PROVING RING READING	LOAD,* LBS	BEARING VALUE,** PSI	CBR
.025	81	817	274		55	555	186		30	303	101	
.050	180	1816	608		150	1513	507		90	908	304	
.075	275	2774	929		311	3137	1050		176	1775	595	
.100	375	3784	1267	127	425	4288	1436	144	315	3178	1064	106
.125	450	4539	1520		550	5548	1858		485	4892	1638	
.150	502	5064	1696		Mechanical Failure				591	5962	1997	
.175	545	5498	1841						698	7041	2358	
.200	577	5822	1950	130					773	7798	2611	174
.250	636	6416	2149						842	8494	2844	
.300	667	6728	2253						886	8938	2993	
.350	700	7061	2365						932	9402	3145	
.400	725	7313	2449						Mechanical Failure			
.450	Mechanical Failure											
.500												

PROVING RING NO. 20975

SURCHARGE: 30 LB

* Determine from calibration curve. (Load = 10.09 x Dial Reading)

** Divide load by the piston area Piston Area = 2.986 in.^{2}

NOTE: Seating corrections were made on each of these tests as shown on Enclosure 9

EUSTIS ENGINEERING COMPANY, INC.

APPENDIX F

DIOXIN ANALYSIS DATA
AND TEQ CALCULATIONS

CTO143-NCBC GULFPORT
SPLP DATA
SOUTHWEST LABORATORY
SDG: 47371

SAMPLE NUMBER:	GFP-08-MB-01B-02			GFP-08-MB-01C-02								
SAMPLE DATE:	08/17/01			08/17/01			/ /			/ /		
LABORATORY ID:	47371.06			47371.07								
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	0.0 %			0.0 %			100.0 %			100.0 %		
UNITS:	PG/L			PG/L								
FIELD DUPLICATE OF:												

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
1,2,3,4,6,7,8,9-OCDD	47.1	U	A	25.3	U	A						
1,2,3,4,6,7,8,9-OCDF	0.80	U		1.6	J	C						
1,2,3,4,6,7,8-HPCDD	0.46	U		0.47	U							
1,2,3,4,6,7,8-HPCDF	0.99	U		0.38	U							
1,2,3,4,7,8,9-HPCDF	1.31	U		0.50	U							
1,2,3,4,7,8-HXCDD	1.52	U		0.75	U							
1,2,3,4,7,8-HXCDF	1.40	U		1.14	U							
1,2,3,6,7,8-HXCDD	1.43	U		0.70	U							
1,2,3,6,7,8-HXCDF	1.0	U		1.14	U							
1,2,3,7,8,9-HXCDD	1.39	U		0.68	U							
1,2,3,7,8,9-HXCDF	1.30	U		1.50	U							
1,2,3,7,8-PECDD	0.55	U		0.56	U							
1,2,3,7,8-PECDF	1.52	U		1.57	U							
2,3,4,6,7,8-HXCDF	1.02	U		1.18	U							
2,3,4,7,8-PECDF	1.43	U		1.47	U							
2,3,7,8-TCDD	1.29	UJ	C	1.47	UJ	C						
2,3,7,8-TCDF	1.70	UJ	C	1.0	UJ	C						
TOTAL HPCDD	0.46	U	A	3.559	U	A						
TOTAL HPCDF	0.99	U		0.38	U							
TOTAL HXCDD	1.39	U		0.68	U							
TOTAL HXCDF	1.0	U		1.14	U							
TOTAL PECDD	0.55	U		0.56	U							
TOTAL PECDF	1.43	U		1.47	U							
TOTAL TCDD	1.29	UJ	C	1.47	UJ	C						
TOTAL TCDF	1.70	UJ	C	1.0	UJ	C						

CTO143-NCBC GULFPORT
SOIL DATA
SOUTHWEST LABORATORY
SDG: 47371

JJB 10/31/01

JJB 10/31/01

SAMPLE NUMBER:	GFP-08-MB-01B-01			GFP-08-MB-01C-01			GFP-08-MBC-02B-01			GFP-08-MBC-02C-01		
SAMPLE DATE:	08/17/01			08/17/01			08/21/01			08/21/01		
LABORATORY ID:	47371.01			47371.02			47371.03			47371.04		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	88.4 %			89.6 %			86.4 %			84.2 %		
UNITS:	NG/KG = PG/G			NG/KG = PG/G			NG/KG = PG/G			NG/KG = PG/G		
FIELD DUPLICATE OF:												
	RESULT	**QUAL**	**CODE**	**RESULT**	**QUAL**	**CODE**	**RESULT**	**QUAL**	**CODE**	**RESULT**	**QUAL**	**CODE**
1,2,3,4,6,7,8,9-OCDD	531.4			300.9			729			529.5		
1,2,3,4,6,7,8,9-OCDF	47.49			16.77			91.09			56.58		
1,2,3,4,6,7,8-HPCDD	55.61			29.14			76.11			56.77		
1,2,3,4,6,7,8-HPCDF	11.62			5.938			21.67			14.15		
1,2,3,4,7,8,9-HPCDF	0.77			0.329			1.161			0.781		
1,2,3,4,7,8-HXCDD	0.63			0.431	U	W	0.606			0.574		
1,2,3,4,7,8-HXCDF	1.064			0.521			1.044			0.818		
1,2,3,6,7,8-HXCDD	1.778			1.033			2.257			1.749		
1,2,3,6,7,8-HXCDF	2.061			1.03			2.808			2.231		
1,2,3,7,8,9-HXCDD	1.997			1.741			1.843			1.85		
1,2,3,7,8,9-HXCDF	0.124	U		0.081	U		0.069	U		0.082	U	
1,2,3,7,8-PECDD	0.327	U	W	0.327	U	W	0.198	U	W	0.275		
1,2,3,7,8-PECDF	0.235	U		0.204	U		0.184	U		0.238	U	
2,3,4,6,7,8-HXCDF	0.374			0.229			0.712			0.437		
2,3,4,7,8-PECDF	0.226	U		0.196	U		0.177	U		0.229	U	
2,3,7,8-TCDD	5.989			5.21			2.736			3.432		
2,3,7,8-TCDF	0.457	UJ	C	0.573	UJ	C	4.669	UJ	C	0.319	J	C
TOTAL HPCDD	148.1			79.23			160.6			126.2		
TOTAL HPCDF	41.81			17.93			70.42			46.82		
TOTAL HXCDD	21.29			13.06			23.9			18.47		
TOTAL HXCDF	18.79			7.982			23.12			16.49		
TOTAL PECDD	0.596			0.424			0.439			0.275		
TOTAL PECDF	10.71			7.817			6.943			5.805		
TOTAL TCDD	6.712			6.088			2.736			3.432		
TOTAL TCDF	4.665	J	C	2.858	J	C	1.907	J	C	2.25	J	C

CTO143-NCBC GULFPORT
WATER DATA
SOUTHWEST LABORATORY
SDG: 47371

SAMPLE NUMBER:	GFP-08-SW-01-01		
SAMPLE DATE:	08/21/01	/ /	/ /	/ /
LABORATORY ID:	47371.05			
QC_TYPE:	NORMAL			
% SOLIDS:	0.0 %	100.0 %	100.0 %	100.0 %
UNITS:	PG/L			
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
1,2,3,4,6,7,8,9-OCDD	631.8	J	N01N03									
1,2,3,4,6,7,8,9-OCDF	20.05	J	N01N03									
1,2,3,4,6,7,8-HPCDD	53.56	J	N01N03									
1,2,3,4,6,7,8-HPCDF	14.13	U	W									
1,2,3,4,7,8,9-HPCDF	6.853	UJ	N01									
1,2,3,4,7,8-HXCDD	8.156	UJ	CN01									
1,2,3,4,7,8-HXCDF	5.158	UJ	N01									
1,2,3,6,7,8-HXCDD	7.097	UJ	N01									
1,2,3,6,7,8-HXCDF	4.954	UJ	N01									
1,2,3,7,8,9-HXCDD	7.236	UJ	N01									
1,2,3,7,8,9-HXCDF	6.911	UJ	CN01									
1,2,3,7,8-PECDD	8.165	UJ	N01									
1,2,3,7,8-PECDF	7.741	UJ	N01									
2,3,4,6,7,8-HXCDF	5.529	UJ	N01									
2,3,4,7,8-PECDF	7.427	UJ	N01									
2,3,7,8-TCDD	353.1	UJ	N01									
2,3,7,8-TCDF	1064	UJ	CN01									
TOTAL HPCDD	109.4	J	N01N03									
TOTAL HPCDF	4.661	UJ	N01									
TOTAL HXCDD	7.097	UJ	N01									
TOTAL HXCDF	4.954	UJ	N01									
TOTAL PECDD	8.165	UJ	N01									
TOTAL PECDF	7.427	UJ	N01									
TOTAL TCDD	353.1	UJ	N01									
TOTAL TCDF	1064	UJ	CN01									

DIOXIN TEQ CALCULATIONS
SITE 8 PILOT-SCALE TREATABILITY STUDY
NCBC GULFPORT, MISSISSIPPI

Sample		GFP-08-MB-01B-01		GFP-08-MB-01C-01		GFP-08-MB-02B-01		GFP-08-MB-02C-01	
Location		GFP-08-MB-01B		GFP-08-MB-01C		GFP-08-MB-02B		GFP-08-MB-02C	
Units		NG/KG		NG/KG		NG/KG		NG/KG	
	EPA TEF		**TEQ***		**TEQ***		**TEQ***		**TEQ***
OCDD	0.001000	531.400000	0.531400	300.900000	0.300900	729.000000	0.729000	529.500000	0.529500
OCDF	0.001000	47.490000	0.047490	16.770000	0.016770	91.090000	0.091090	56.580000	0.056580
1,2,3,4,6,7,8-HPCDD	0.010000	55.610000	0.556100	29.140000	0.291400	76.110000	0.761100	56.770000	0.567700
1,2,3,4,6,7,8-HPCDF	0.010000	11.620000	0.116200	5.938000	0.059380	21.670000	0.216700	14.150000	0.141500
1,2,3,4,7,8,9-HPCDF	0.010000	0.770000	0.007700	0.329000	0.003290	1.161000	0.011610	0.781000	0.007810
1,2,3,4,7,8-HXCDD	0.100000	0.630000	0.063000		0.000000	0.606000	0.060600	0.574000	0.057400
1,2,3,4,7,8-HXCDF	0.100000	1.064000	0.106400	0.521000	0.052100	1.044000	0.104400	0.818000	0.081800
1,2,3,6,7,8-HXCDD	0.100000	1.778000	0.177800	1.033000	0.103300	2.257000	0.225700	1.749000	0.174900
1,2,3,6,7,8-HXCDF	0.100000	2.061000	0.206100	1.030000	0.103000	2.808000	0.280800	2.231000	0.223100
1,2,3,7,8,9-HXCDD	0.100000	1.997000	0.199700	1.741000	0.174100	1.843000	0.184300	1.850000	0.185000
1,2,3,7,8,9-HXCDF	0.100000								
1,2,3,7,8-PECDD	0.500000							0.275000	0.137500
1,2,3,7,8-PECDF	0.050000								
2,3,4,6,7,8-HXCDF	0.100000	0.374000	0.037400	0.229000	0.022900	0.712000	0.071200	0.437000	0.043700
2,3,4,7,8-PECDF	0.500000								
2,3,7,8-TCDD	1.000000	5.989000	5.989000	5.210000	5.210000	2.736000	2.736000	3.432000	3.432000
2,3,7,8-TCDF	0.100000							0.319000	0.031900
TOTAL HPCDD	0.000000	148.100000	0.000000	79.230000	0.000000	160.600000	0.000000	126.200000	0.000000
TOTAL HPCDF	0.000000	41.810000	0.000000	17.930000	0.000000	70.420000	0.000000	46.820000	0.000000
TOTAL HXCDD	0.000000	21.290000	0.000000	13.060000	0.000000	23.900000	0.000000	18.470000	0.000000
TOTAL HXCDF	0.000000	18.790000	0.000000	7.982000	0.000000	23.120000	0.000000	16.490000	0.000000
TOTAL PECDD	0.000000	0.596000	0.000000	0.424000	0.000000	0.439000	0.000000	0.275000	0.000000
TOTAL PECDF	0.000000	10.710000	0.000000	7.817000	0.000000	6.943000	0.000000	5.805000	0.000000
TOTAL TCDD	0.000000	6.712000	0.000000	6.088000	0.000000	2.736000	0.000000	3.432000	0.000000
TOTAL TCDF	0.000000	4.665000	0.000000	2.858000	0.000000	1.907000	0.000000	2.250000	0.000000
Total TEQ			8.038290		6.337140		5.472500		5.670390

*TEQ values based on concentrations
multiplied by TEF values.

DIOXIN TEQ CALCULATIONS
SITE 8 PILOT-SCALE TREATABILITY STUDY
NCBC GULFPORT, MISSISSIPPI

Sample		GFP-08-SW-01-01		GFP-08-MB-01B-02		GFP-08-MB-01C-02	
Location		GFP-08-SW-01		GFP-08-MB-01B		GFP-08-MB-01C	
Units		PG/L		PG/L		PG/L	
	EPA TEF		**TEQ***		**TEQ***		**TEQ***
OCDD	0.001000	631.800000	0.631800				
OCDF	0.001000	20.050000	0.020050			1.600000	0.001600
1,2,3,4,6,7,8-HPCDD	0.010000	53.560000	0.535600				
1,2,3,4,6,7,8-HPCDF	0.010000						
1,2,3,4,7,8,9-HPCDF	0.010000						
1,2,3,4,7,8-HXCDD	0.100000						
1,2,3,4,7,8-HXCDF	0.100000						
1,2,3,6,7,8-HXCDD	0.100000						
1,2,3,6,7,8-HXCDF	0.100000						
1,2,3,7,8,9-HXCDD	0.100000						
1,2,3,7,8,9-HXCDF	0.100000						
1,2,3,7,8-PECDD	0.500000						
1,2,3,7,8-PECDF	0.050000						
2,3,4,6,7,8-HXCDF	0.100000						
2,3,4,7,8-PECDF	0.500000						
2,3,7,8-TCDD	1.000000						
2,3,7,8-TCDF	0.100000						
TOTAL HPCDD	0.000000	109.400000	0.000000				
TOTAL HPCDF	0.000000						
TOTAL HXCDD	0.000000						
TOTAL HXCDF	0.000000						
TOTAL PECDD	0.000000						
TOTAL PECDF	0.000000						
TOTAL TCDD	0.000000						
TOTAL TCDF	0.000000						
Total TEQ			1.187450		0.000000		0.001600

*TEQ values based on concentrations
multiplied by TEF values.

APPENDIX G

OTHER PILOT-SCALE STUDY REPORT CALCULATIONS

CLIENT: NCBC Gulfport		JOB NUMBER: N0567	
SUBJECT: Lift 1 and Lift 2 Calculations			
BASED ON: Field Measurements		DRAWING NUMBER:	
DESIGN BY: JJB DATE: 10/31/01	CHECKED BY: DATE:	APPROVED BY: MDA	DATE: 12/17/01

PURPOSE:

To calculate:

1) The average thickness of each lift of loose Material Blend prior to cement addition.
2) The approximate volume of each lift prior to cement addition.
3) The percentage of Portland cement (by weight) applied to each lift.

APPROACH:

1) Prior to addition of cement to the lift, the thickness of each lift of loose Material Blend was measured at several points with a ruler. Based on the measurements taken, an average thickness per lift segment is calculated.

2) The volume of the loose lift (prior to cement addition) was calculated. For each lift segment, the average thickness is multiplied by the lift's width (28 feet) and the segment length (either 12.5 feet or 25 feet). The volume of the segments are then added.

3) To calculate the percentage of Portland cement applied to each lift (by weight), the following steps were taken.

   a) The weight of the lift (prior to cement addition) was computed by multiplying the volume (calculated in Step 2) by the wet density of the lift (as determined by nuclear density readings taken prior to cement addition).
   b) The following equation was then used:

$$\% \text{ Portland cement (by weight)} = \text{weight of cement}/(\text{weight of lift} + \text{weight of cement})$$

ASSUMPTIONS:

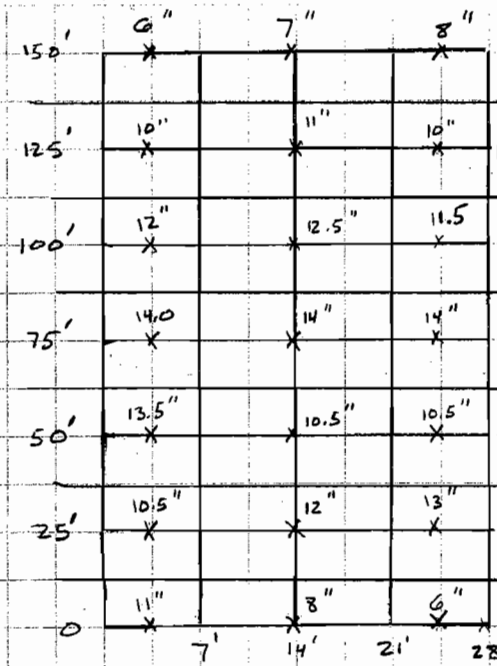
- Baseline wet density of Lift 1 = 123.3 pcf (as shown in Appendix D)
- Baseline wet density of Lift 2 = 118.5 pcf (as shown in Appendix D)

CALCULATIONS:

See attached sheets.

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 2 OF 3

CLIENT	JOB NUMBER
NCBC Gulfport	0567
SUBJECT Lift 1 Calculations	
BASED ON Field Measurements	**DRAWING NUMBER**
BY JJB 10/31/01	**CHECKED BY** / **APPROVED BY** MEA / **DATE** 12/17/01



$\left(\frac{6+7+8}{3}\right) = 7"$ $\quad (12.5')(28')\left(\frac{7"}{12}\right) = 204.2$ cf

$\left(\frac{10+11+10}{3}\right) = 10.33$ $\quad (25')(28')\left(\frac{10.33}{12}\right) = 602.6$ cf

12" $\quad (25)(28)\left(\frac{12}{12}\right) = 700$ cf

14" $\quad (25)(28)\left(\frac{14}{12}\right) = 816.7$

11.5" $\quad (25)(28)\left(\frac{11.5}{12}\right) = 670.8$

11.83 $\quad (25)(28)\left(\frac{11.83}{12}\right) = 690.1$

8.33 $\quad (12.5)(28)\left(\frac{8.33}{12}\right) = 243.0$

1) Avg thickness = $(7 + 10.33 + 12 + 14 + 11.5 + 11.83 + 8.33)/7 = 10.71" = 0.89'$

2) Lift 1 Volume Estimate = $204.2 + 602.6 + 700 + 816.7 + 670.8 + 690.1 + 485.9$

$= 3927.4\ ft^3$

$= 145\ yd^3$

3a) Lift 1 baseline wet density (from nuclear density test results) = 123.3 lb/cf

Lift 1 weight = $(3,927.4\ cf)(123.3\ lb/cf)\left(\frac{1\ ton}{2000\ lbs}\right) = 242.1$ tons

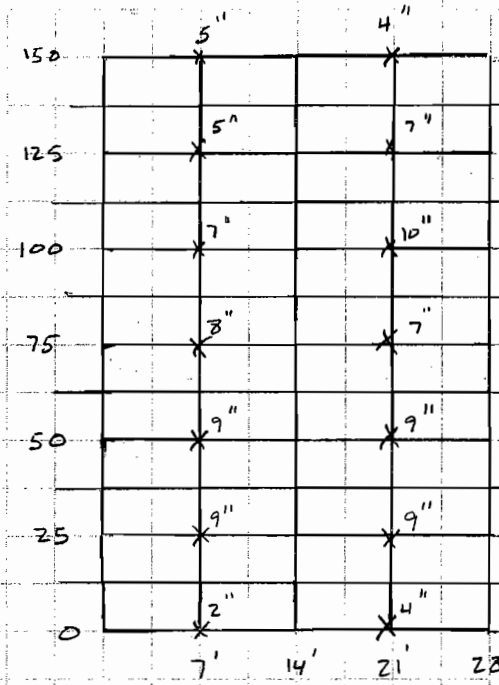
25 tons of cement applied to the first 1 Ft

3b) % Portland cement (by weight) = $\frac{25\ tons}{(242.1 + 25\ tons)} = 9.4\ \%$

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 3 OF 3

CLIENT	JOB NUMBER
NCBC Gulfport	
SUBJECT	
Lift 2 Calculations	
BASED ON	**DRAWING NUMBER**
Field Measurements	

BY	CHECKED BY	APPROVED BY	DATE
JJB 10/31/01		MEA	12/17/01



4.5"	$(12.3)(28)(\frac{4.5}{12}) = 131.3$ cf
6"	$(25)(28)(\frac{6}{12}) = 350$ cf
8.5"	$(25)(28)(\frac{8.5}{12}) = 495.8$ cf
7.5"	$(25)(28)(\frac{7.5}{12}) = 437.5$ cf
9"	$(25)(28)(\frac{9}{12}) = 525$ cf
9"	$(25)(28)(\frac{9}{12}) = 525$ cf
3"	$(12.5)(28)(\frac{3}{12}) = 87.5$ cf

1) Avg thickness = $(4.5 + 6 + 8.5 + 7.5 + 9 + 9 + 3)/7 = 6.8"$
= $0.57'$

2) Lift 2 Volume Estimate = $(131.3 + 350 + 495.8 + 437.5 + 525 + 525 + 87.5)$
= 2,552.1 cf
= 94.5 cy

3a) Lift 2 baseline wet density (from nuclear density test results) = 118.5 pcf

Lift 2 weight = $(2552.1 \text{ cf})(118.5 \text{ pcf})(\frac{1 \text{ ton}}{2000 \text{ lb}}) = 151.2$ tons

9 tons of portland cement applied to Lift 2

3b) % Portland cement (by weight) = $\frac{9 \text{ tons}}{(151.2 + 9) \text{ tons}} = 5.6\%$

CLIENT: NCBC Gulfport		JOB NUMBER: N0567
SUBJECT: Excavation/Hauling Rate Calculations		
BASED ON: Log Book Notes		DRAWING NUMBER:
DESIGN BY: JJB DATE: 10/31/01	CHECKED BY: [illegible] DATE: 11-2-01	APPROVED BY: DATE:

PURPOSE:

To calculate the rate of excavation and hauling of off-base sediment and on-base sediment (sand and organic fines) to the Materials Staging Pad.

APPROACH:

During the pilot-scale study, the number of truckloads of excavated material taken to the Materials Staging Pad were tracked over time. Based on these data and assumptions regarding the volume of material in each truckload, a rate is estimated.

ASSUMPTIONS:

- To prevent sloshing of saturated material [on-base sediment (organic fines) and off-base sediment], only 4 cubic yards of material were loaded into each 6 cubic yard dump truck.
- Six cubic yards of on-base sediment (sand) were loaded into each dump truck.

CALCULATIONS:

See attached sheets.

CLIENT	JOB NUMBER
NCBC Gulfport	N0567

SUBJECT: Excavation / Hauling Rate Calcs

BASED ON	DRAWING NUMBER
Log Book Notes	

BY	CHECKED BY	APPROVED BY	DATE
JJB 10/31/01	JJW 11-2-01		

Off base Sediment

7/30	1535	10th	load	leaves	181 minutes to move	14 loads
7/30	1836	23rd	load	leaves		
8/1	0026	24th	load	leaves	49 minutes to move	6 loads
8/1	0715	29th	load	leaves		

230 min — 20 loads × 4 cy/load = 80 cy

$\frac{80\ cy}{230\ min} \times \frac{60\ min}{1\ hr} \approx 21\ cy/hr$ with 3 truck operation

On base Sand

8/15	0830	start	165 minutes	with liners
	1115	20 load Finished		
	1215	Resume	45 minutes	
	1300	24th load Finished		

210 min — 24 load × 6 cy/load = 144 cy

$\frac{144\ cy}{210\ min} \times \frac{60\ min}{hr} \approx 41\ cy/hr$ ← using liner

8/16	1415	start		
	1845	Complete 26 loads @ 6cy/load = 156 cy	over 90 minutes	

$\frac{156\ cy}{90\ min} \times \frac{60\ min}{hr} = 104\ cy/hr$ ← w/o liners

On base Organic Fines

8/15	1440	start Exc.		
	1545	Finish 6 loads @ 4cy/load = 24 cy	over	65 minutes
8/16	0930	start		
	1015	Finish 6 loads @ 4cy/load = 24 cy		45 minutes
8/18	1000	start		
	1105	Finish 5 load, stop	20 cy	65 min
	1235	Resume		
	1400	stop	52 cy	85 min
			120 cy	260 min

$\left(\frac{100}{250}\right)(60) = 28\ cy/hr$

CLIENT:	NCBC GULPORT		JOB NUMBER:	0567-0100200
SUBJECT:	PILOT-SCALE TREATABILITY STUDY - TEST PAD VOLUME CALCULATION (COMPACTED)			
BASED ON:			DRAWING NUMBER:	
BY: JLM Date: 10-17-01		CHECKED BY: JJB Date: 11/2/01	APPROVED BY:	DATE:

OBJECTIVE:

To calculate the compacted volume of Material Blend placed on the test pads during Site 8 Pilot-Scale Treatability Study activities at NCBC Gulfport using TERRAMODEL Computer Software.

APPROACH:

1. Survey existing ground surface and test pad surface coordinates (surveyed during the Pilot-Scale Treatability Study construction activities).

2. Create point files with the surveyed coordinates.

3. Import the point files into TERRAMODEL and calculate the compacted volume of Material Blend in the test pads.

REFERENCES

1) Spectra Precision Software Inc., 2000. TERRAMODEL for Windows, Version 9.70.01.

CALCULATIONS

1. Coordinate Elevations

The figure on Page 2 of 5 illustrates the locations along the existing ground surface and test pad surface that were surveyed. The survey points used for the existing ground surface consisted of the bottom of slope locations along the length of the test pads, plus the corner points at the end of the test pad ramps. Table 1 and Table 2 on Pages 3-4 of 5 summarize the coordinates and calculates the elevation of the survey points assuming a reference elevation of 100.00 ft mean sea level (msl).

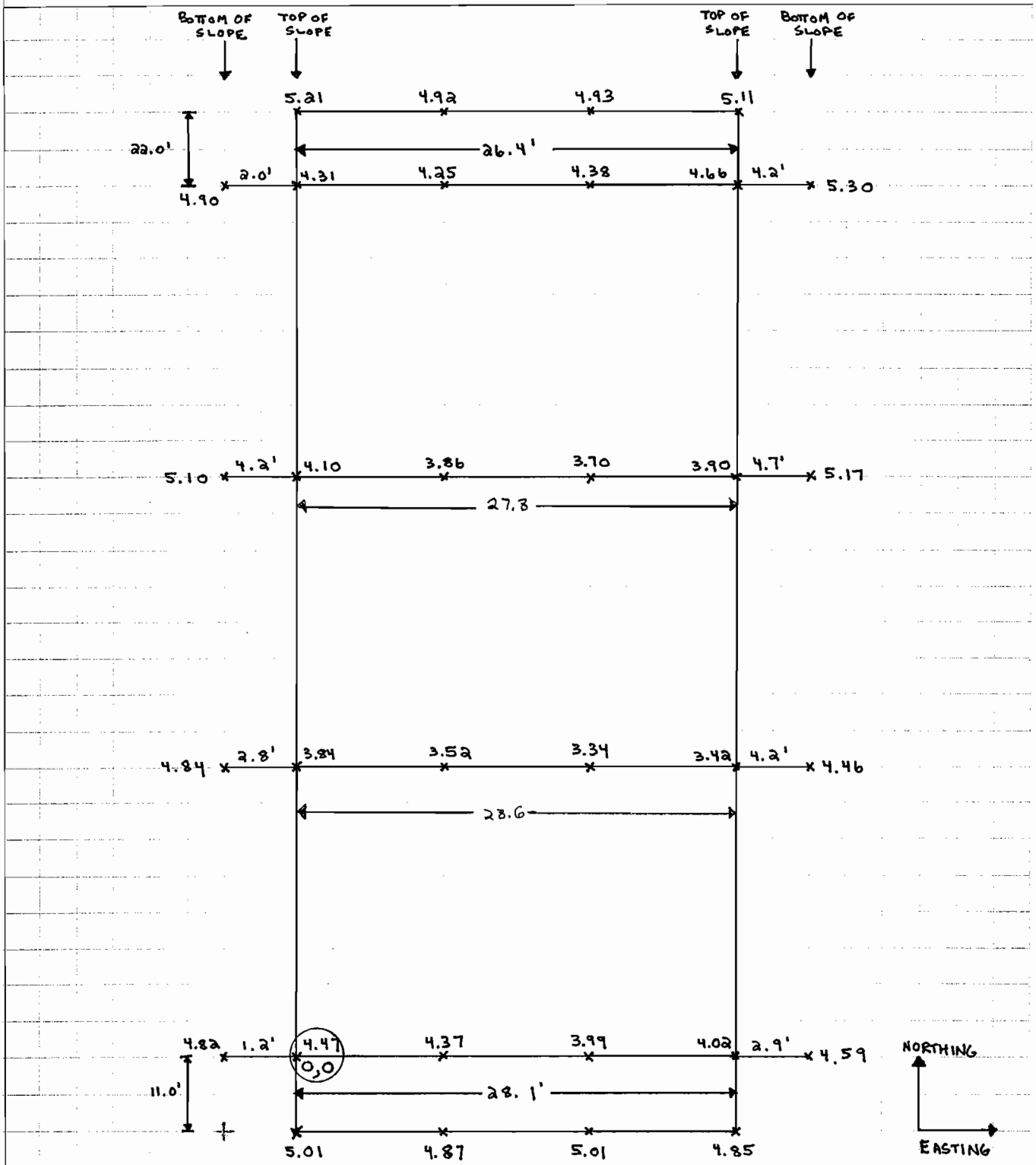
2. Test Pad Volume

Using TERRAMODEL, the total volume of Material Blend found in the test pads is 188.6 cubic yards (cy) of compacted material. TERRAMODEL output is provided on Page 5 of 5.

CLIENT	JOB NUMBER
NCBC GULFPORT	0567-0100200

SUBJECT: PILOT-SCALE TREATABILITY STUDY - TEST PADS VOLUME CALCULATION

BASED ON	DRAWING NUMBER		
BY: JLM	CHECKED BY:	APPROVED BY:	DATE: 10-17-01



EXISTING GROUND SURFACE ELEVATIONS
SITE 8 PILOT-SCALE TREATABILITY STUDY
NAVAL CONSTRUCTION BATALLION CENTER
GULFPORT, MISSISSIPPI

POINT NO.	NORTHING	EASTING	SURVEY (ft)	ELEVATION[1] (ft msl)
1	-11.0000000000	0.0000000000	5.01	94.99
2	-11.0000000000	28.1000000000	4.85	95.15
3	0.0000000000	-1.2000000000	4.82	95.18
4	0.0000000000	31.0000000000	4.59	95.41
5	50.0000000000	-2.8000000000	4.84	95.16
6	50.0000000000	32.8000000000	4.46	95.54
7	100.0000000000	-4.2000000000	5.10	94.90
8	100.0000000000	32.5000000000	5.17	94.83
9	150.0000000000	-2.0000000000	4.90	95.10
10	150.0000000000	30.6000000000	5.30	94.70
11	172.0000000000	0.0000000000	5.21	94.79
12	172.0000000000	26.4000000000	5.11	94.89

(1) Assumed reference elevation of 100.00 ft msl.

TEST PAD AREA ELEVATIONS
SITE 8 PILOT-SCALE TREATABILITY STUDY
NAVAL CONSTRUCTION BATALLION CENTER
GULFPORT, MISSISSIPPI

POINT NO.	NORTHING	EASTING	SURVEY (ft)	ELEVATION[1] (ft msl)
1	-11.0000000000	0.0000000000	5.01	94.99
2	-11.0000000000	9.3666666667	4.87	95.13
3	-11.0000000000	18.7333333333	5.01	94.99
4	-11.0000000000	28.1000000000	4.85	95.15
5	0.0000000000	-1.2000000000	4.82	95.18
6	0.0000000000	0.0000000000	4.47	95.53
7	0.0000000000	9.3666666667	4.37	95.63
8	0.0000000000	18.7333333333	3.99	96.01
9	0.0000000000	28.1000000000	4.02	95.98
10	0.0000000000	31.0000000000	4.59	95.41
11	50.0000000000	-2.8000000000	4.84	95.16
12	50.0000000000	0.0000000000	3.84	96.16
13	50.0000000000	9.5333333333	3.52	96.48
14	50.0000000000	19.0666666667	3.34	96.66
15	50.0000000000	28.6000000000	3.42	96.58
16	50.0000000000	32.8000000000	4.46	95.54
17	100.0000000000	-4.2000000000	5.10	94.90
18	100.0000000000	0.0000000000	4.10	95.90
19	100.0000000000	9.2666666667	3.86	96.14
20	100.0000000000	18.5333333333	3.70	96.30
21	100.0000000000	27.8000000000	3.90	96.10
22	100.0000000000	32.5000000000	5.17	94.83
23	150.0000000000	-2.0000000000	4.90	95.10
24	150.0000000000	0.0000000000	4.31	95.69
25	150.0000000000	8.8000000000	4.25	95.75
26	150.0000000000	17.6000000000	4.38	95.62
27	150.0000000000	26.4000000000	4.66	95.34
28	150.0000000000	30.6000000000	5.30	94.70
29	172.0000000000	0.0000000000	5.21	94.79
30	172.0000000000	8.8000000000	4.92	95.08
31	172.0000000000	17.6000000000	4.93	95.07
32	172.0000000000	26.4000000000	5.11	94.89

(1) Assumed reference elevation of 100.00 ft msl.
Indicates the locations of the ramps.

Spectra Precision Software, Inc.
5901 Peachtree-Dunwoody Rd., Suite A-300
Atlanta, GA 30328-5548
800-235-4972
Wed Oct 17 14:42:41 2001

PROJECT: C:\Spectra\Terramodel Files\Gulfport\Pilot Scale Study.pro

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DTM TO DTM VOLUME

Cut and Fill Volumes

Shrinkage/swell factors: Cut 1.0000 Fill 1.0000

Original DTM Layer Name	# of Points	Final DTM Layer Name	# of Points
POINTS_EXISTING	12	POINTS_LIFT	32

Cut Volume (Cu. Yd.)	Cumulative Cut Volume	Fill Volume (Cu. Yd.)	Cumulative Fill Volume
0.0	0.0	188.6	188.6

Net Difference: 188.6 Cu. Yd. BORROW