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ONE-HUNDRED PERCENT REMEDIAL DESIGN SITE 8 NCBC GULFPORT MS
10/1/2004
TETRA TECH NUS

REVISION 0
OCTOBER 2004

100% Remedial Design
for
Site 8 – Herbicide Orange Storage Area
and
Off-Base Area of Contamination

Naval Construction Battalion Center
Gulfport, Mississippi

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0272

October 2004

REVISION 0
OCTOBER 2004

100% REMEDIAL DESIGN
for
SITE 8 – HERBICIDE ORANGE STORAGE AREA
and
OFF-BASE AREA OF CONTAMINATION

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0272

OCTOBER 2004

PREPARED UNDER THE SUPERVISION OF:

ROBERT FISHER
TASK ORDER MANAGER
TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA

APPROVED FOR SUBMITTAL BY:

DEBRA M. HUMBERT
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

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REVISION 0
OCTOBER 2004

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ACRONYM LIST

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
AASHTO	American Association of State Highway and Transportation Officials
ABB-ES	ABB-Environmental Services, Inc.
AFESC	Air Force Engineering and Service Center
AOC	Area of Contamination
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
BOD	Basis of Design
CBR	California Bearing Ratio
CCI	CH2M Hill Constructors, Inc.
CEQ	Council on Environmental Quailty
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action Navy
COPC	chemical of potential concern
CTO	Contract Task Order
CWA	Clean Water Act
DBH	diameter at breast height
DI	design index
DPT	direct push technology
EISOPQAM	Environmental Investigation Standard Operating Procedures and Quality Assurance Manual
FFS	Focused Feasibility Study
FWS	United States Fish and Wildlife Service
HLA	Harding Lawson Associates
HO	herbicide orange
H20	AASHTO Highway 20 loading
MCL	maximum contaminant level
MDEQ	Mississippi Department of Environmental Quality
µg/kg	microgram per kilogram
NAD 83	Mississippi State Plane Coordinate System, North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NCBC	Naval Construction Battalion Center
ng/kg	nanograms per kilogram
Navy	United States Department of the Navy

NRCS	Natural Resources Conservation Service
NTCHS	National Technical Committee for Hydric Soils
NWS	National Weather Service
PCB	polychlorinated biphenyl
PDI	pre-design investigation
PFO	Palustrine Forested
pg/L	picograms per liter
PRG	preliminary remediation goal
PRSC	post-removal site control
psi	pounds per square inch
RA	remedial action
RAO	remedial action objective
RBC	risk-based concentration
RCC	roller-compacted concrete
RD	remedial design
RME	reasonable maximum exposure
SCS	United States Department of Agriculture, Soil Conservation Service
Site 8	Herbicide Orange Storage Area
SPLP	synthetic precipitation leaching procedure
SRT	sediment recovery trap
SVOC	semivolatile organic compound
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ	toxicity equivalent (of TCDD)
TPH	total petroleum hydrocarbons
TRG	target remediation goal
TtNUS	Tetra Tech NUS, Inc.
UCS	unconfined compressive strength
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USC	United States Code
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
VSAP	verification sampling and analysis plan
yd^3	cubic yards

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This report provides the basis for a remedial design (RD) at Site 8 - Herbicide Orange Storage Area (Site 8) and contiguous on-base drainage channels at the Naval Construction Battalion Center (NCBC or "base") and an associated off-base Area of Contamination (AOC) in Gulfport, Mississippi. The RD and subsequent remedial action (RA) are being performed pursuant to an Agreed Order between the Mississippi Department of Environmental Quality (MDEQ) and the United States Department of the Navy (Navy), and the United States Air Force (USAF) (MDEQ, 1997). As part of the RA for Site 8, the Navy will:

- Excavate dioxin-contaminated sediment from on-base drainage channels contiguous to Site 8 and from an associated off-base AOC located north of the base, and excavate soil ash located at Site 8.
- Consolidate, homogenize, and stabilize soil ash and contaminated sediment within a portion of Site 8.
- Construct a cap over the stabilized material.
- Perform verification sampling of excavated areas.
- Restore the on-base drainage channels and off-base AOC affected by excavation activities.
- Implement land-use controls.
- Perform long-term monitoring.

Tetra Tech NUS, Inc. (TtNUS) prepared this Basis of Design (BOD) under the Comprehensive Long-term Environmental Action Navy (CLEAN) Program, Contract No. N62467-94-D-0888, Contract Task Order (CTO) 0272.

NCBC Gulfport is located in the southeastern corner of Mississippi, approximately 2 miles north of the Gulf of Mexico. The base is located primarily in the western portion of the City of Gulfport in Harrison County. Figure 1-1 shows the location of the base in relation to the City of Gulfport and the Gulf of Mexico. The off-base AOC is located north of NCBC, across 28th Street near Outfall 3. The base occupies 1,100 acres with an average elevation of approximately 30 feet above sea level. A map of NCBC Gulfport is provided as Figure 1-2.

This report summarizes the design basis for the remedial alternative selected in the Focused Feasibility Study (FFS) for Site 8 (TtNUS, 2003a). This alternative, which includes the components outlined above, was selected to protect public health, welfare, and the environment from exposure to dioxins that are byproduct contaminants of the herbicide orange (HO) formerly stored at Site 8. HO is a herbicide formulation used during the Vietnam War to defoliate trees and shrubbery. It is an equal mixture of two

agricultural herbicides [2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T)] in a diesel fuel or jet fuel mixture. Spills and leaks of HO occurred within Site 8, contaminating the surface soil and sediment with the mixture components, 2,4,5-T and 2,4-D, as well as byproduct contaminants (dioxins and furans), primarily 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Concentrations of 2,4,5-T and 2,4-D have degraded over time; however, dioxin and furan concentrations have remained above regulatory limits. Throughout this report, TCDD and its chemically related dioxin and furan congeners will be collectively referred to as "dioxins."

The Navy's goal is to begin the RA at Site 8, affected on-base areas, and the off-base AOC as quickly as possible to protect human health and the environment and to comply with Applicable or Relevant and Appropriate Requirements (ARARs) as required by the United States Environmental Protection Agency (USEPA) and MDEQ.

The extent and nature of contamination and the associated risks at Site 8 and within the on-base drainage channels and off-base AOC were derived from the investigations conducted by Versar Inc., Harding Lawson Associates (HLA), ABB-Environmental Services, Inc. (ABB-ES), and TtNUS. The reports generated from the previous studies include the following.

- Versar Inc., October 1991. Ash and Ground-water Sampling and Analysis Plan, Delisting Petition Support, NCBC Gulfport Mississippi. Prepared for EG&G Idaho, Inc.

- ABB-ES, December 1994 to August 1997. Technical Memorandums No. 1 through 6, Site A – Former Herbicide Orange Storage Area, Groundwater Sampling Events. NCBC Gulfport, Mississippi. Prepared for Southern Division Naval Facilities Engineering Command (SOUTHDIVNAVFACENGCOM), North Charleston, South Carolina.

- ABB-ES, September 1995. Letter Report, Interim Removal Action – 28th Street Road Construction, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- ABB-ES, February 1996. Soil and Sediment Dioxin Triplicate Study, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- ABB-ES, May 1997. Results of Community Survey and Exposure Assessment, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- ABB-ES, August 1997. Addendum to Delisting Petition 0759, Area A, Former Herbicide Orange Storage Area, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- ABB-ES, January 1998. Phase I Summary Report for On-site and Off-site Delineation Activities, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- ABB-ES, April 1998. On Site Interim Corrective Measures Report, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- ABB-ES, June 1999. Surface Water and Sediment Dioxin Delineation, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- ABB-ES, 2000. Agreed Order Dioxin Delineation Studies, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- HLA, December 1998. Swamp Delineation Sampling, Phases III and IV. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- HLA, August 1999. Swamp Delineation Sampling, Phases V and VI. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- HLA, August 1999. Sediment and Surface Water Dioxin Delineation Report, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- HLA, December 1999. Groundwater Monitoring Report, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- HLA, August 2000. Remediation Planning Document, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- HLA, March 2001. Human Health Risk Assessment and Screening Level Ecological Risk Assessment of Dioxins and Furans Associated with Former Herbicide Orange Storage at NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- TtNUS, March 2001. Report for Bench-Scale Soil/Sediment Treatability Study, Site 8, Herbicide Orange Study Area, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- TtNUS, December 2001. Report for Pilot-Scale Soil/Sediment Treatability Study, Site 8, Herbicide Orange Storage Area at NCBC Gulfport, Mississippi. Prepared for the SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- TtNUS, August 2002. Excavation and Confirmation Sampling Report for the Edwards Property, Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- TtNUS, February 2003. Draft Human Health Risk Assessment of Groundwater Associated with Site 8 Former Herbicide Orange Storage Area, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- TtNUS, March 2003. Focused Feasibility Study, Revision 2, Site 8 Herbicide Orange Storage Area at NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- TtNUS, April 2003. Draft Site Characterization Report, Off-base Area of Contamination, NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

- TtNUS, June 2004. Draft Tier 3 Ecological Risk Evaluation, Steps 1 through 3 for Off-base Area of Contamination Associated with Site 8 - Herbicide Orange Storage Area at NCBC Gulfport, Mississippi. Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina.

1.2 REPORT ORGANIZATION

The report is organized in the following sections:

- Section 1.0 provides this introduction and summary of the Basis of Design.

- Section 2.0 summarizes site characteristics including site history, soils, geology, hydrogeology, surface water hydrology, description and extent of contamination, and risk assessment.

- Section 3.0 summarizes the pre-design investigation (PDI) activities and bench- and pilot-scale treatability studies.

- Section 4.0 presents the selected remedy from the FFS and discusses design requirements for the RA.

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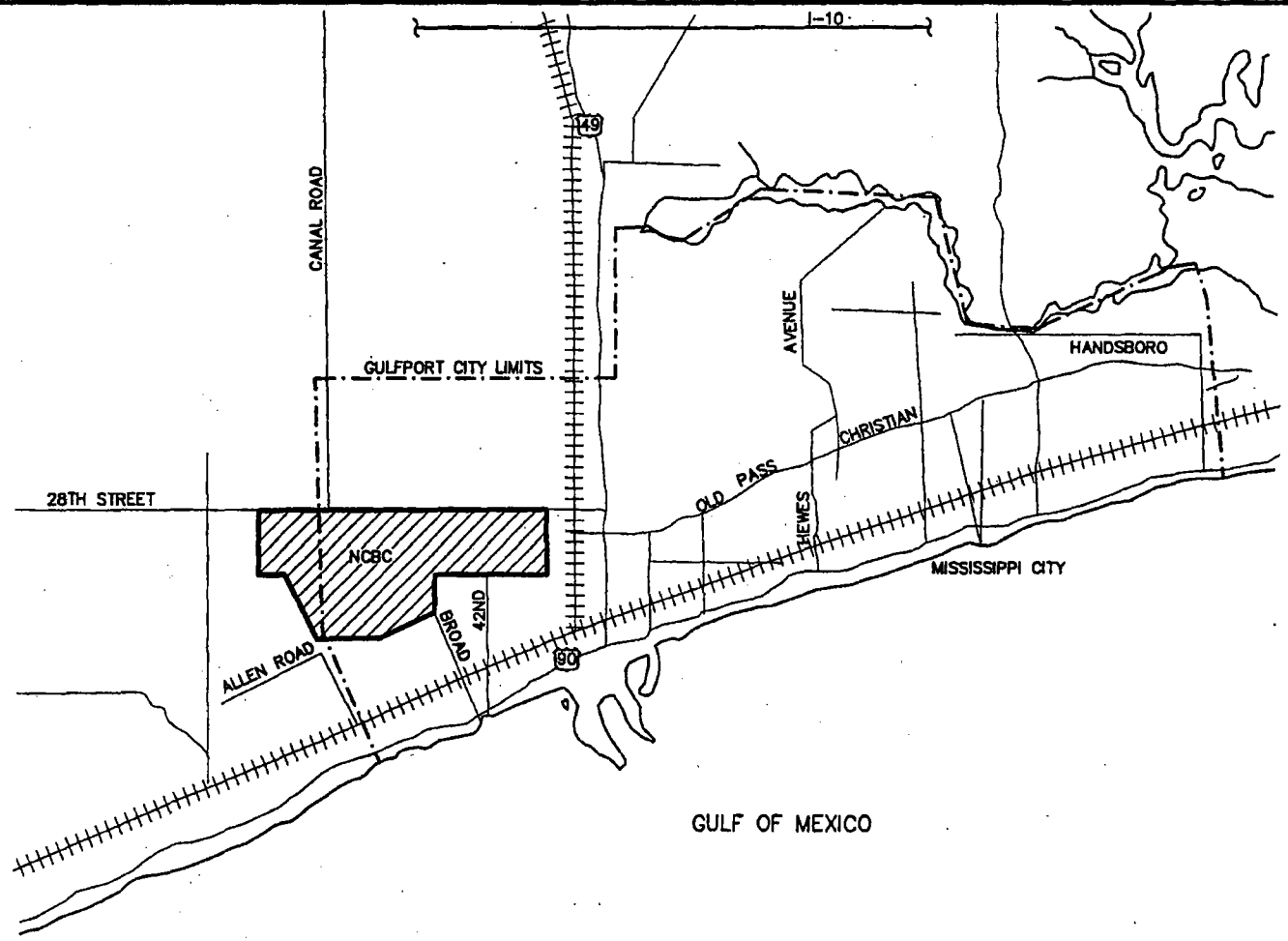

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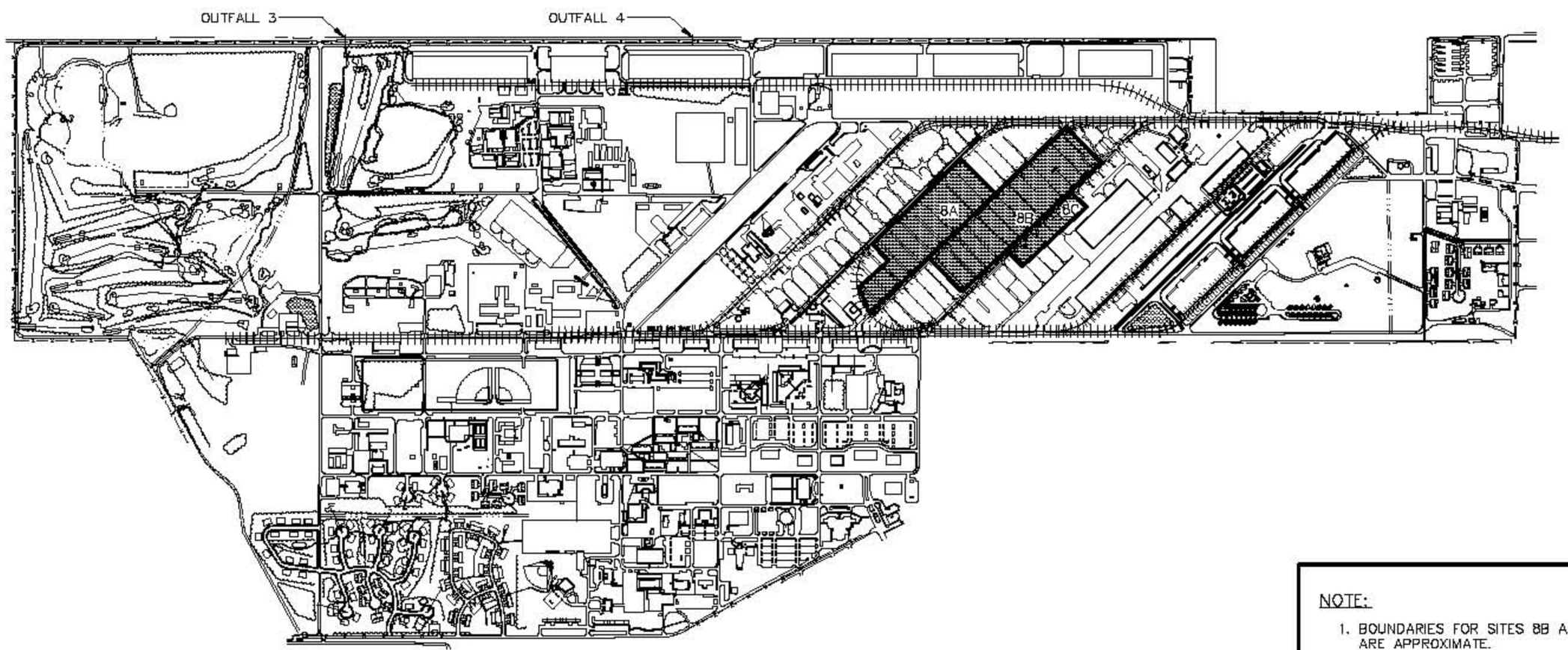

NOTE:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.

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SCALE IN FEET

SOURCE: BASEMAP.DWG, PUBLIC WORKS DEPARTMENT, NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MS, JUNE 2001

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DATE: MF 11/14/02
CHECKED BY DATE: JJB 5/13/03
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INSTALLATION MAP
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
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REV. 0

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2.0 EXISTING SITE CHARACTERISTICS

2.1 SITE DESCRIPTION

Site 8 consists of three contiguous storage areas (Areas A, B, and C) (hereinafter referred to as Site 8A, Site 8B, and Site 8C) located in the north-central portion of NCBC Gulfport (Figure 1-2). The main former HO drum storage area, Site 8A, which encompasses approximately 13 acres, has an undulating surface due to previous remedial activities and is covered with light vegetation. The surface soil in non-stabilized areas is typically a fine- to medium-grained sand. Approximately one-third of Site 8A consists of stabilized areas where HO drums were stored.[1] Site 8A includes the upper reaches of the drainage areas for the eastern two-thirds of the base. Surface drainage from Site 8A flows to the northwest, exiting the base at Outfall 3 into a drainage system that feeds Canal No. 1, which flows north to Turkey Creek (TtNUS, 2003a). Prior to 1995, the surface water that exited the base via Outfall 3 discharged to wetlands (the off-base AOC) that are a part of the Turkey Creek drainage basin (HLA, 2000). Sites 8B and 8C encompass approximately 18 acres, are relatively flat, and have almost no vegetation. Sites 8B and 8C were also used for storage of drums containing HO. The Site 8B and 8C surface soils consist of fine- to medium-grained sand, and approximately one-third of these areas are stabilized with Portland cement. Sites 8B and 8C are also located at the head of local drainage basins. Surface water from Site 8B flows north and exits the base at Outfall 4, discharging to the Turkey Creek drainage basin. Surface water from Site 8C drains to the southeast, exiting the base at Outfall 2 into Brickyard Creek (TtNUS, 2003a).

2.2 SITE HISTORY

Prior to 1968, Site 8 was used as an equipment storage and staging area. Around 1961, the surface soils were stabilized with Portland cement to provide a hardened surface for heavy equipment operation and storage. Between 1968 and 1977, Site 8 was used by the USAF as a storage area for drums containing HO. In 1977, the HO drums were removed from Site 8, transported to port by railroad, and placed on a ship for destruction by incineration in the South Pacific. The release of dioxins at Site 8 was confirmed in 1977, and the site was fenced and left inactive until 1985 (TtNUS, 2003a). It was originally believed that 13 acres of Site 8 were used to store approximately 850,000 gallons of HO. This 13-acre area is currently referred to as Site 8A (HLA, 2000).

In 1985, the USAF began operations to clean up the dioxin-contaminated soils that remained on site following the removal of the drums of HO. The contamination of soils resulted from spills and leaks during

[1] The surface soil in storage areas at NCBC is typically stabilized using Portland cement to improve the load-bearing capacity and thus provide a surface suitable for equipment storage and staging.

the 10 years that HO was stored at Site 8. Through a Research, Development and Demonstration permit obtained through the USEPA Region IV, the USAF conducted test burns to demonstrate that incineration was capable of reducing dioxin concentrations in site soils to less than the USEPA criterion (as of 1985) of 1.0 microgram per kilogram (µg/kg). During the test burns, two additional areas outside the original 13 acres were identified and verified as previous storage locations for drums containing HO. These two areas were designated as Sites 8B and 8C. Following USEPA acceptance of the test burn data, full-scale incineration of dioxin-contaminated soils from Sites 8A, 8B, and 8C was conducted. The incineration process was conducted within the boundaries of Site 8A and was completed in 1988. The ash that remained from the incineration process was stored and currently remains on Site 8A. Although the soils within Sites 8A, 8B, and 8C were incinerated, the drainage channels that carry surface water and sediment from these sites to the lower reaches of the local drainage basin were not addressed during this remedial effort (HLA, 2000).

Between 1987 and January 2001, access to Site 8A was restricted and operations were not conducted within site boundaries. Since January 2001, activities conducted within Site 8 include the construction of a new loading ramp in anticipation of using the site as a storage and staging area (TtNUS, 2003a) and the performance of a pilot-scale treatability study for remediating soil ash and contaminated on-base and off-base AOC sediments (TtNUS, 2001b). In August 2002, the Navy performed a sediment removal action in the drainage channels of Sites 8B and 8C. Approximately 2,600 cubic yards (yd^3) of sediments were excavated from 3,800 linear feet of drainage channels and were transported to Site 8A [CH2M Hill Constructors, Inc. (CCI), 2003].

Remedial activities were also conducted within the off-base AOC. As part of pilot-scale activities in November and December 2001, dioxin-contaminated sediment located within the off-base AOC was excavated and transported to Site 8A. Approximately 1,000 yd^3 of material located on property owned by Mr. H. A. Edwards (the Edwards property) were excavated. A sediment recovery trap (SRT) was installed at the western extent of the excavation to prevent recontamination of this area from upgradient sources. Verification sampling on the remediated Edwards property determined that the 95-percent upper confidence limit of the mean dioxin concentrations [total toxicity equivalents (TEQ) of TCDD] was below the MDEQ unrestricted Tier 1 target remediation goal (TRG) of 4.26 nanograms per kilogram (ng/kg) (TtNUS, 2002). Additionally, in April 2003, 30 yd^3 of dioxin-contaminated sediment were excavated from an area adjacent to a culvert that runs beneath Canal Road. The excavation was performed to enable the city of Gulfport to perform a culvert replacement project. An SRT was installed at the eastern extent of the excavation (TtNUS, 2003d).

For additional details on site history, refer to Section 1.3 of the Remediation Planning Document (HLA, 2000).

2.3 PREVIOUS INVESTIGATIONS

Dioxin-related investigations at Site 8 have been conducted since 1977. These investigations included the Initial HO Monitoring Programs (1977 to 1984), the Comprehensive Soil Characterization and Confirmation Studies (1984 to 1988), and the Dioxin Delineation Studies (1995 to 1999). A summary of each investigation is provided below. The source of the following information regarding the previous investigations is the FFS (TtNUS, 2003a), unless otherwise stated.

Initial HO Monitoring Programs (1977 to 1984) – Conducted by the USAF Occupational and Environmental Health Laboratory as part of the plan to incinerate all remaining HO stockpiles at sea [Air Force Engineering and Service Center (AFESC), 1984]. These programs focused on the following issues:

- Off-site migration of dioxin
- Migration levels of 2,4-D; 2,4,5-T; and dioxins at Site 8
- Long-term degradation potential of 2,4-D; 2,4,5-T; and dioxins
- Potential vertical migration

These studies included collection of soil, surface water, sediment, and biota samples for analysis using the best method available at that time (what is currently referred to as a low-resolution method). The findings were as follows:

- Confirmation that Site 8A was contaminated with HO and TCDD.

- Levels of 2,4-D and 2,4,5-T in soil were rapidly decreasing (a reported 60 percent reduction over a 6-month period in 1981 and 1982).

- TCDD levels remained relatively consistent over time, suggesting significant persistence in the environment.

- TCDD was not detected in the surface water.

- Low levels (less than 50 ng/kg) of TCDD were discovered in sediment and biota samples downstream of Site 8A.

- Migration of dioxin from Site 8 occurs primarily through soil erosion.

Comprehensive Soil Characterization and Confirmation Studies (1984 to 1988) - Conducted by EG&G Idaho, Inc. and the AFESC to delineate the horizontal and vertical extent of HO and dioxin at Site 8 and to provide an estimate of contaminated soil potentially requiring remediation (AFESC, 1998).

Approximately 2,500 samples were collected and analyzed using a grid sampling approach with a 20-foot node spacing. The major findings of these studies were as follows:

- Soil concentrations of TCDD above 1 µg/kg were restricted to 2 feet in depth.
- Soil samples contained a maximum TCDD level of 310 µg/kg.
- Soil cement contained TCDD concentrations up to 1,000 µg/kg.
- Assuming an action level of 1.0 µg/kg TCDD, approximately 27,000 yd^3 of soil were above action levels at Site 8 in 1987.
- Analysis of confirmation samples collected from the excavated areas and analysis of ash resulting from the incineration process showed that residual concentrations of dioxins were below 4.7 µg/kg.

Technical Memorandums Nos. 1 through 6, Former Herbicide Orange Storage Area, Groundwater Sampling Events (May 1994 to August 1995) - A quarterly groundwater monitoring program conducted by ABB-ES designed to determine the impact of the dioxin-contaminated ash on groundwater quality at Site 8A (ABB-ES, 1997a). Activities included the following:

- Six rounds of quarterly groundwater samples were collected from four permanent monitoring wells installed in the shallow aquifer.
- The first four rounds of samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), herbicides, dioxins, metals, and miscellaneous parameters. Samples collected during the final two rounds were collected for confirmatory purposes and were analyzed for dioxins only.
- Monitoring wells were installed surrounding the soil ash piles.

Dioxin Delineation Studies (1995 to 1999) - A series of studies (delineation Phases I through VI) conducted to assess the remaining dioxin-contaminated soil and sediment (ABB-ES, 1998a; HLA 1998, 1999a, and 1999c). These studies included the following:

- Delineation and characterization of dioxin in on-base soil and sediment.

- Delineation and characterization of dioxin in off-base soil and sediment. Included in the off-base studies were several phases of additional delineation activities north of the NCBC Outfall 3 known then as the Outfall 3 Swamp, and referred to in this report as the off-base AOC.

- Examination of potential impacts to groundwater at Site 8. It was shown that dioxin contamination at Site 8 was restricted to a shallow zone of soil and that it was not migrating into groundwater.

- Performance of a baseline human health and ecological risk assessment.

In addition to the studies conducted, ABB-ES completed interim corrective measures at the NCBC. The corrective measures included the construction of two new SRTs, the replacement of two existing SRTs and the rehabilitation of one SRT. These SRTs are located within the on-base drainage channel system. SRTs significantly reduce the off-site migration of dioxin-contaminated soil or sediment (HLA, 2000).

Groundwater Monitoring Report (October 1998 to February 1999) - A supplemental investigation designed to further define and characterize site-related contamination in groundwater resulting from the storage of incinerated soils at Site 8A (HLA, 1999b). Activities included the following:

- During Phase I (October 1998), shallow and intermediate groundwater samples were collected from 24 temporary well locations using Direct Push Technology (DPT) boring techniques. Samples from six wells were collected for characterization purposes and were analyzed for VOCs, SVOCs, pesticides/PCBs, selected chlorinated herbicides, and dioxins. Samples from 18 wells were collected for delineation purposes and were analyzed for dioxins and VOCs only.

- During Phase II (February 1999), groundwater samples were collected from 10 permanent monitoring well locations. The Phase II monitoring wells were screened at shallow, intermediate, and deep depths. Groundwater samples collected from all 10 well locations were analyzed for VOC, SVOCs, pesticides/PCBs and chlorinated herbicides. Groundwater samples collected from 7 of 10 well locations were analyzed for dioxins only.

Site Characterization Report for NCBC Gulfport Off-base Area of Contamination (February and April 2002) - A study to characterize the vertical extent of sediment contamination in the swamp north of Outfall 3 and the shallow groundwater directly below sediment contamination (TtNUS, 2003e). This report represented the seventh phase of delineation studies at the off-base AOC.

- Shallow groundwater samples were collected from six temporary well locations within the off-base AOC.

- Seven sediment samples were collected at the surface and at a depth of 18 to 24 inches below ground surface (bgs).

- The study found that sediment contamination was limited to the top 18 inches of sediment.

2.4 SURFACE WATER HYDROLOGY

The source for the following surface water drainage information and associated figures is the Remediation Planning Document (HLA, 2000).

The NCBC surface water drainage is collected and transported to several outfalls via a network of drainage channels. These drainage channels collect surface water from six drainage areas throughout the NCBC. These drainage areas are shown on Figure 2-1. Sites 8A, 8B, and 8C contribute to Drainage Area 1 (majority of Site 8A and small part of Site 8B), Drainage Area 2 (remainder of Sites 8A and 8B and small part of Site 8C), and Drainage Area 3 (remainder of Site 8C). The drainage patterns of Drainage Areas 1, 2, and 3 are presented in Figures 2-2, 2-3, and 2-4, respectively. Throughout the year, flow throughout the majority of the on-base drainage channels is perennial. The remainder of the drainage channels (upgradient) are dry for part of the year.

As shown on Figures 2-2 and 2-3, Drainage Areas 1 and 2 drain to the northwest corner of the base and exit the base at Outfall 3 (Figure 2-1). Drainage leaving the base via Outfall 3 flows underneath 28th Street and prior to 1995, discharged to the wetland located on the northern site of 28th Street (the off-base AOC). In 1995, the run-off leaving the base through Outfall 3 was rerouted to the west to discharge into Canal No. 1. Drainage in Canal No. 1 flows north to Turkey Creek.

An old drainage ditch (main channel) excavated to convey surface water through the southern portion of the off-base AOC extends approximately 1,800 feet from Outfall 3 northwestward to Canal Road. The surface topography of the area adjacent to this main channel is relatively level, prone to flooding, and densely vegetated. Surface water at the northern end of this drainage channel empties into Canal No. 1 and a natural drainage feature that trends east-northeast. This natural drainageway, the southern branch

of Turkey Creek, continues to the northeast until it reaches the confluence with the main branch of Turkey Creek.

2.5 SOILS

In April 1994, four monitoring wells (GPT-A-1 through GPT-A-4) were installed within Site 8A. Soil samples were collected from two of the monitoring well soil borings (GPT-A-1 and GPT-A-2) and submitted to a geotechnical laboratory for soil classification (ABB-ES, 1997a). In February 1999, 10 monitoring wells (GPT-08-05 through GPT-08-14) were installed around the perimeter of Site 8 (HLA, 1999b). The locations of these soil borings/monitoring wells are identified on Figure 2-5.

In December 1999, HLA supervised the drilling of 22 soil borings within Sites 8A, 8B, and within the railroad loop northeast of Site 8A. The locations of these soil borings are identified on Figure 2-5. From each of the soil borings, soil samples were collected and submitted to a geotechnical laboratory for soil classification. In addition, HLA collected eight soil samples from on-base drainage channels and 12 samples within the off-base AOC. These samples were also submitted to a geotechnical laboratory for soil classification (HLA, 2000). The locations of these samples are identified on Figures 2-6 and 2-7.

In general, the soils found on base are granular with isolated locations of silty-clay, and off-base AOC soils were found to be mostly silty-clays with isolated areas of granular soils. The soil boring logs and geotechnical results associated with this sampling are provided in Appendix A. Survey coordinates of the permanent monitoring wells are also provided in Appendix A.

2.6 NATURE AND EXTENT OF CONTAMINATION

2.6.1 <u>On-base Soil and Sediment</u>

Investigations conducted prior to 1995 identified 2,4-D, 2,4,5-T, and dioxins in media as contaminants related to the storage and handling of HO at Site 8. Investigations occurring since 1995 have confirmed the earlier levels of dioxins, but have not produced results with measurable 2,4-D or 2,4,5-T. These observations have been attributed to the persistence (i.e., low volatility, resistance to chemical breakdown) of dioxins in the environment. The results of herbicide analyses have confirmed the chemical breakdown of 2,4-D and 2,4,5-T below detectable limits. All other analytes [VOCs, SVOCs, total petroleum hydrocarbons (TPH), pesticides and PCBs] were detected at concentrations that did not result in unacceptable human health or ecological risks. These results confirm historical data that HO and its related contaminants were the only hazardous material stored at Site 8 (TtNUS, 2003a).

The dioxin delineation studies (ABB-ES, 2000) identified a large area of surface soil and sediment contaminated with dioxin. The source for this dioxin contamination was the 55-gallon drums of HO formerly stored at Site 8. Leaks from these drums contaminated surface soil over a large area of Site 8. The highly organophilic nature of dioxins prevented contamination from migrating deeper than approximately 2 feet bgs. Subsequent transport and deposition of contaminated sediments in the hydrologically connected network of on-base drainage channels resulted in the contamination of these drainage channels. Figures 2-8 through 2-10 present the results of sediment and surface water sampling used to delineate the extent of contamination within the on-base drainage channels.

Surface water has not been impacted by previous HO storage activities at Site 8. Surface water samples have consistently produced results that confirm that the dioxin transportation mechanism in the drainage channels is through the bedload sediments and not as dissolved or suspended particles in surface water (ABB-ES, 1995). Figure 2-11 presents the overall extent of on-base dioxin-contaminated sediment delineated to 38.2 ng/kg, which is the MDEQ Tier 1 TRG for restricted (industrial/occupational) use and the preliminary remediation goal (PRG) established in the FFS (TtNUS, 2003a).

2.6.2 Off-base AOC Sediment

The levels of TCDD in sediment are significantly lower in the off-base wetlands immediately north of NCBC Outfall 3 (i.e., the off-base AOC). The hydrogeologic conditions in these wetlands [a combination of relatively low maximum stream velocity and highly organic sediment (ABB-ES, 2000)] result in a favorable depositional environment. Hence, very low (less than 10 ng/kg) levels of dioxin migrated past the Edwards property located approximately 4,000 feet downgradient from the NCBC's Outfall 3. In 2001, contaminated sediment from the Edwards property, the farthest downgradient area of the drainage channels, were excavated and transported to Site 8A (TtNUS, 2002). The remaining off-base drainage channels impacted by dioxin contamination are contained within property currently owned by Mr. G. D. Arndt (the Arndt property) and Mr. P. W. Bennett (the Bennett property). Within this drainage channel reach, dioxin-contaminated sediment has also been deposited outside the banks of the drainage channels as a result of high flow conditions during major storm events. Figure 2-12 presents the extent of contamination within the off-base AOC.

The limits of excavation were determined based on terrain changes and the results of previous studies (ABB-ES, 1998a; HLA 1998, 1999a, and 1999c). As determined in these studies, the primary transport mechanism of dioxin-contaminated sediment in the off-base AOC drainage channels are the high surface water velocities associated with major storm events. These storm events are responsible for the downstream migration of dioxin-contaminated sediment; however, the deposition of these sediments is influenced by the elevation changes associated with three terraces identified along the drainage patterns. Each terrace, described below, has unique depositional patterns, soil types, and vegetation:

- Terrace 1 is located at the lowest elevation and forms the main channel. The soil surface consists mainly of organic-rich silts and clays, and soil becomes increasingly sandy below this surface layer. This terrace supports very little understory vegetation due to frequent flooding and poor drainage and was identified to be the most likely to contain significant levels of dioxin contamination.

- Terrace 2 forms a margin that borders the Terrace 1 main channel but at elevations slightly higher than Terrace 1. The organic-rich surface soil layer is thinner and contains some sand. Terrace 2 supports more understory vegetation, which visually distinguishes it from Terrace 1.

- Terrace 3 occurs along the highest elevations in the study area. The soils are well-drained, dark brown, fine to medium sands that support abundant understory vegetation. These coarser-grained soils are the main feature distinguishing between Terrace 3 and Terrace 2.

As determined in previous delineation studies, the boundary between Terrace 2 and Terrace 3 typically represents the limit where dioxin-contaminated sediment has been deposited outside the banks of the drainage channels as a result of the high flow conditions during major storm events. The boundary between these two terraces is shown on Figure 2-12 and serves as the delineation limit for sediment contaminated at concentrations greater than 38.2 ng/kg, the MDEQ Tier 1 TRG for restricted (industrial/occupational) use and the PRG established in the FFS (TtNUS, 2003a) for the Arndt and Bennett properties. Sediment sampling conducted in later phases of the off-base AOC delineation studies validates this terrace-based delineation methodology.

Since 1995, the base has not been a source of additional dioxin-contaminated sediment for the off-base AOC due to the installation of SRTs in the on-base drainage channels and the rerouting of discharge from the base drainage system from Outfall 3 to Canal No. 1.

2.6.3 On-base and Off-base Groundwater

Dioxin results reported for the most recent (1999) groundwater samples collected at Site 8 do not exceed the current MDEQ TRG or the USEPA Maximum Contaminant Level (MCL) of 30 picograms per liter (pg/L). Dioxin results for several shallow groundwater samples collected within the off-base AOC do exceed these criteria; however, turbidity levels reported for most of the shallow groundwater samples indicate that the dioxin concentrations detected may be, in part, a function of suspended particulates. Remedial actions taken to address soil and sediment are expected to indirectly address dioxin impacts to groundwater. This assumption will be confirmed by the verification sampling to be conducted in the off-base AOC.

2.6.4 Estimated Volume of Contaminated Media

Based on the PRGs established in the FFS and vertical delineation sampling conducted in 2002 (TtNUS, 2003e), it was estimated that a total of approximately 71,000 yd^3 of contaminated media would need to be stabilized at Site 8 (TtNUS, 2003a). However, based on volume calculation refinements provided in Appendix B, the estimated volume of contaminated media is as follows:

Material	Estimated Volume (yd^3)
Site 8A Soil Ash	23,000
On-base Drainage Channels - Contaminated Sediment	20,200(1)
Off-base AOC - Contaminated Sediment	28,800(2)
TOTAL	**72,000**

1. Includes approximately 2,600 yd^3 of sediment excavated from Site 8B and 8C drainage channels in the fall of 2002. The sediment currently is stored at Site 8A.
2. Includes approximately 1,030 yd^3 of sediment excavated from the Edwards property in the fall of 2001. The sediment currently is stored at Site 8A.

2.7 HUMAN HEALTH AND ECOLOGICAL ASSESSMENTS

A risk assessment (HLA, 2001) was conducted to determine if contamination in surface soil, groundwater, and sediment related to the former storage and handling of HO at NCBC Gulfport poses potential health risks to individuals under current and/or foreseeable future site conditions. Further, the analytical methods and quantitation limits of the data set were reviewed to ensure that the information was usable for the risk assessment. For additional information regarding the risk assessments performed for Site 8A and the associated drainage systems, refer to the FFS (TtNUS, 2003a) and the human health and ecological risk assessment (HLA, 2001).

Human Health - Surface soil and sediment samples were separated into two categories (on-base and off-base). Dioxin levels in surface soil and sediment at Site 8 and related drainage systems exceeded screening levels [USEPA Region III Risk-Based Concentration (RBC) values and MDEQ Tier 1 screening levels] in both categories. The chemicals of potential concern (COPCs) were defined as HO-related chemicals detected in at least one sample at concentrations greater than these risk-based screening concentrations. The results indicated that dioxin levels exceeded screening levels for soil and sediment at Site 8 and related drainage systems. None of the surface water samples concentrations exceeded screening level concentrations. The primary on-base risk driver for soil is the on-base resident population where the reasonable maximum exposure (RME) is greater than the MDEQ acceptable risk range. The

primary risk driver for sediment is the on-base residential population, which has an RME greater than the MDEQ acceptable risk range.

A human health risk assessment amendment was also performed for Site 8 to address groundwater risks for current and potential future land-use scenarios (TtNUS, 2003b). Similar to surface soil and sediment, groundwater samples were separated into on-base and off-base categories. Dioxin levels in groundwater (both on-base and off-base) exceeded screening levels established by the USEPA and MDEQ. However, many of the samples were turbid, which may account for much of the detected dioxin concentrations. The primary risk driver for groundwater is the hypothetical on-site resident that is exposed to surface water/groundwater in the wetland north of Outfall 3.

Ecological - In 2001, the Navy performed a screening level ecological risk assessment that evaluated potential risk to ecological.

In 2004, the Navy performed a Tier 3 Ecological Risk Evaluation in accordance with Mississippi Brownfield regulations (TtNUS, 2004). This Tier 3 Ecological Risk Evaluation, conducted to develop remedial goals, incorporated USEPA guidance (USEPA, 1997a) for Step 3 of a baseline ecological risk assessment to estimate potential risks to ecological receptors. The Draft Tier 3 Ecological Risk Evaluation Report was submitted to the NCBC Gulfport Tier 1 Partnering Team in June 2004 and approval is pending. The following paragraphs contain a summary of this draft report.

Exposure pathways evaluated in the report consisted of direct contact with sediment resulting in toxicity to invertebrates and ingestion of contaminated sediment and food items by wildlife that prey on fish and sediment invertebrates. Effects to wildlife were evaluated by comparing modeled ingested doses to threshold oral toxicity reference values, which are dioxin doses associated with adverse effects on growth, survival, or reproduction. The mink was used to represent mammals that prey upon fish and sediment invertebrates in the off-base AOC. Birds that prey on fish and sediment invertebrates in the off-base AOC were represented by the green heron and the belted kingfisher.

Under current conditions, risks to sediment-dwelling invertebrates exist. However, the Navy has proposed to excavate dioxin-contaminated sediment in the off-base AOC to achieve the 38.2 ng/kg MDEQ Tier 1 Target Remediation Goal for restricted (industrial and occupational) use, a value based on human health risk rather than ecological risk. Because of the topography at the off-base AOC, sample locations outside the proposed remedial area delineated by 38.2 ng/kg concentrations are slightly higher in elevation, and these drier areas provide poor conditions (and consequently less exposure) for sediment-associated organisms. Sample locations where dioxin concentrations exceed 38.2 ng/kg coincide with areas of organic-rich muck sediment. These areas comprise habitat for sediment

organisms. Therefore, contamination remaining after remediation based on a sediment remediation goal of 38.2 ng/kg would be expected to pose minimal risk (due to minimal exposure) to sediment-associated organisms.

Sediment remedial goals for protection of wildlife were developed as indicated in the following table. A sediment remedial goal based on risk to wildlife is defined as the sediment concentration that would result in a food-chain hazard quotient of 1.0.

Receptor	Sediment Remedial Goal for Protection of Wildlife
Mink	86 ng/kg
Green heron	125 ng/kg
Belted king fisher	142 ng/kg

Because these remedial goals are greater than the 38.2 ng/kg sediment remedial goal proposed for protection of human health in the off-base AOC, the remediation of sediment to 38.2 ng/kg will also be protective of ecological wildlife.

This BOD has been prepared with the assumption that a 38.2 ng/kg remedial goal will be sufficient to address human health and ecological risk concerns. If after review of the Draft Tier 3 Ecological Evaluation Report, the NCBC Gulfport Partnering Team decides this remedial goal is not sufficient to protect ecological receptors and that a lower remedial goal is needed, refinement of sediment delineation contours, recalculation of associated excavation volumes in the off-base AOC, and other revisions to this BOD will be required.

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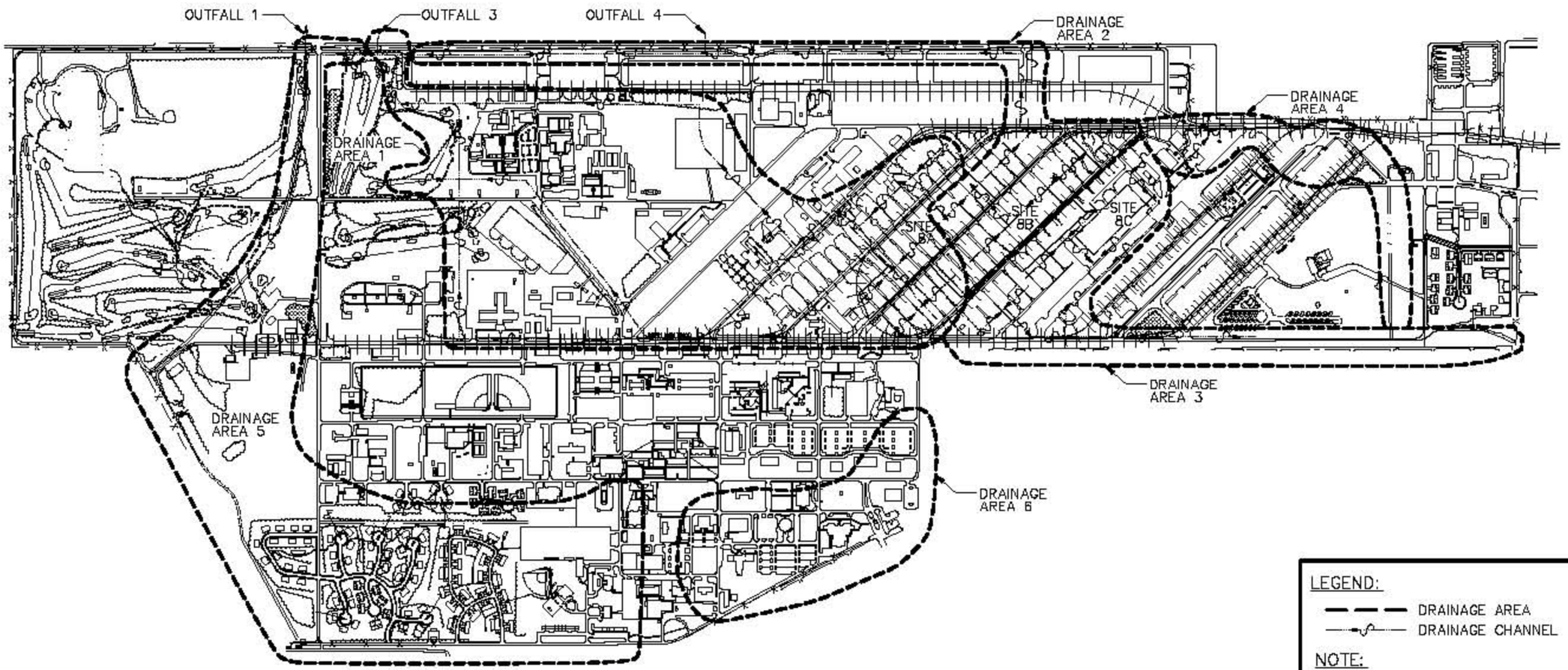

LEGEND:

DRAINAGE AREA

DRAINAGE CHANNEL

NOTE:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.

0 1000 2000

SCALE IN FEET

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 11/18/02

CHECKED BY JJB DATE 5/13/03

COST/SCHED-AREA

SCALE AS NOTED

ON-BASE SURFACE WATER DRAINAGE
AREAS 1 THROUGH 6
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379

APPROVED BY DATE

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DRAWING NO. FIGURE 2-1 REV. 0

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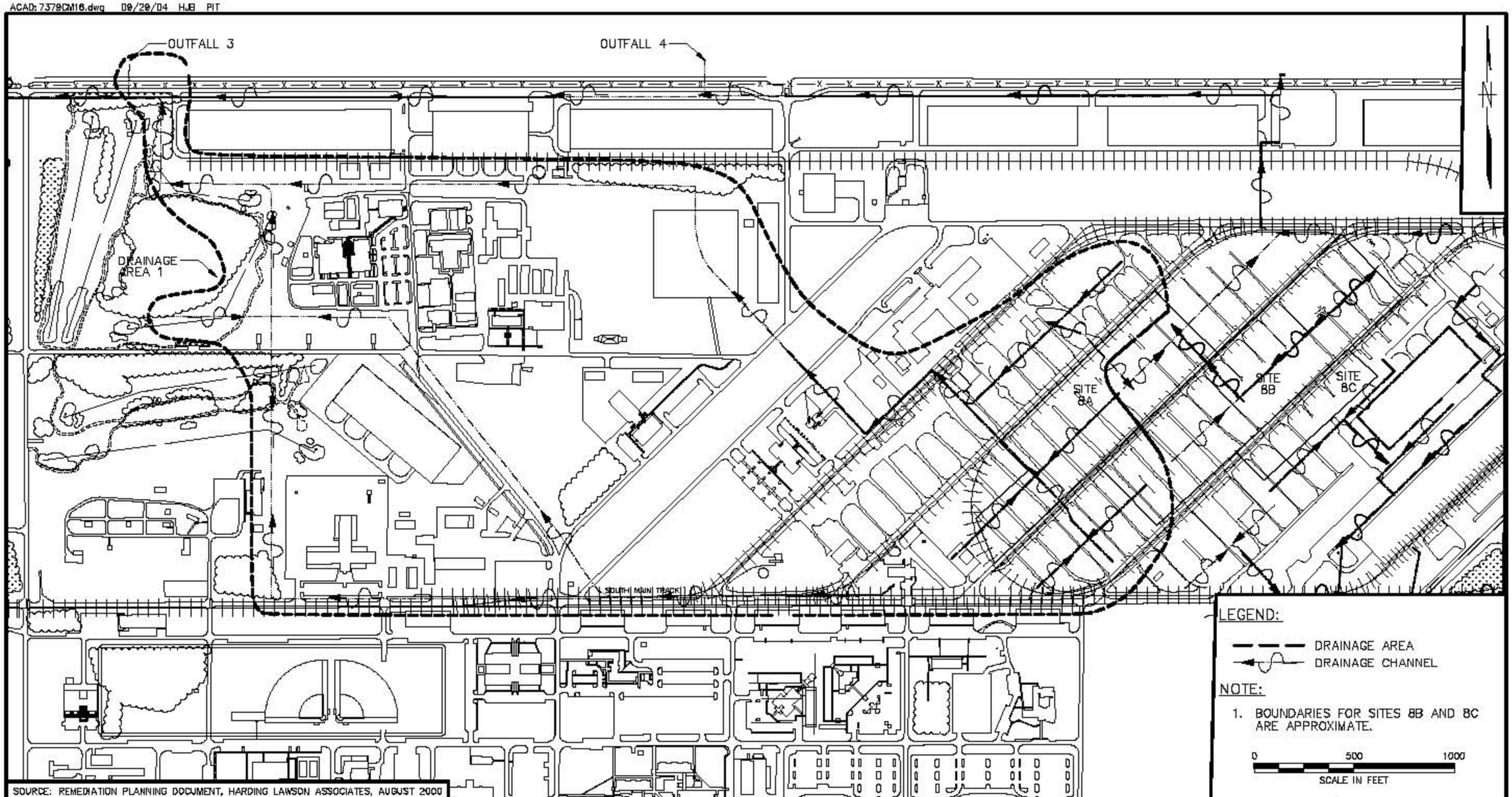

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

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DRAWN BY MF DATE 11/19/02
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COST/SCHED-AREA
SCALE AS NOTED

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DRAINAGE AREA 1
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

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DRAWING NO. FIGURE 2-2
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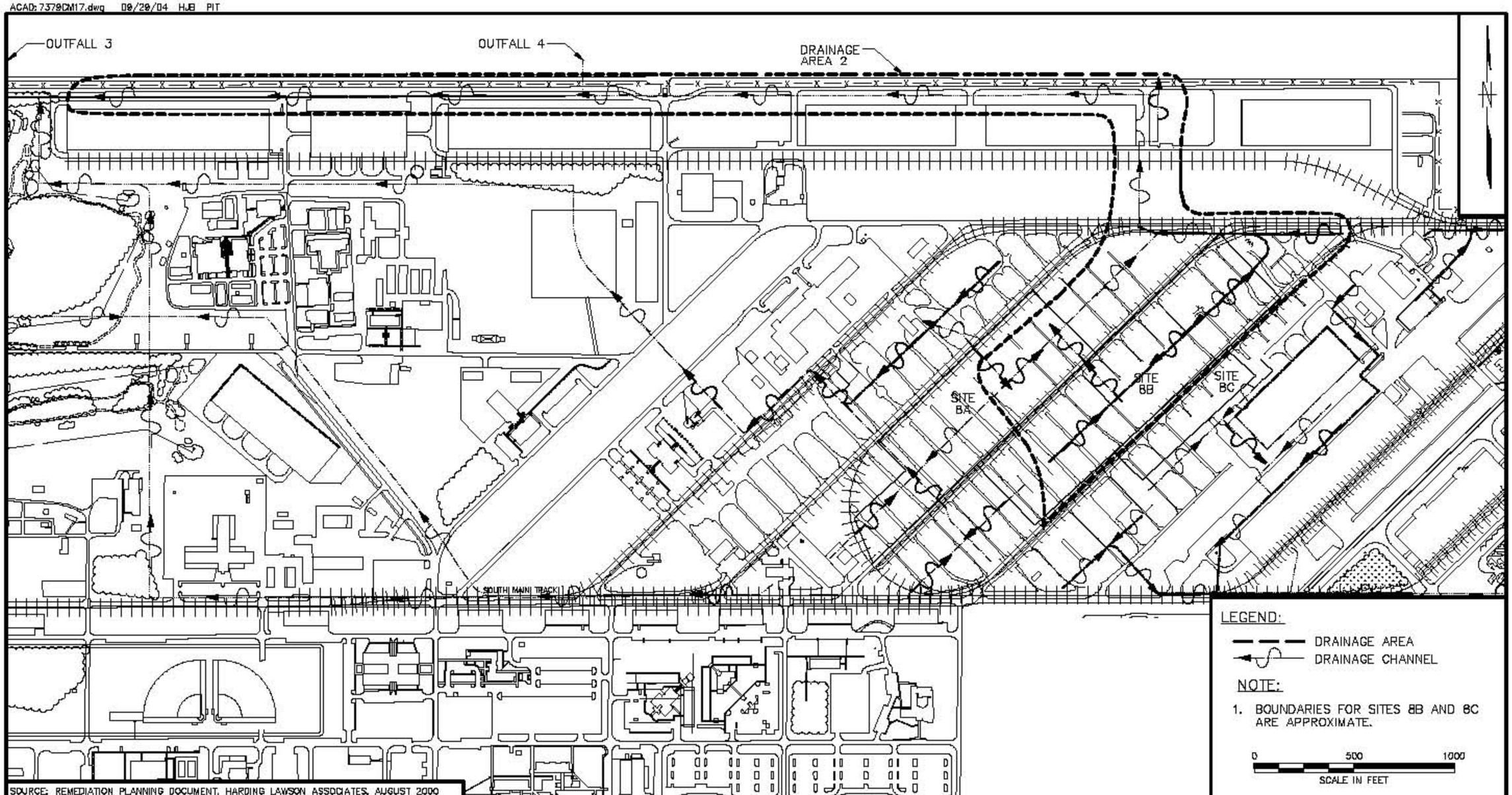

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

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DRAINAGE AREA 2
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

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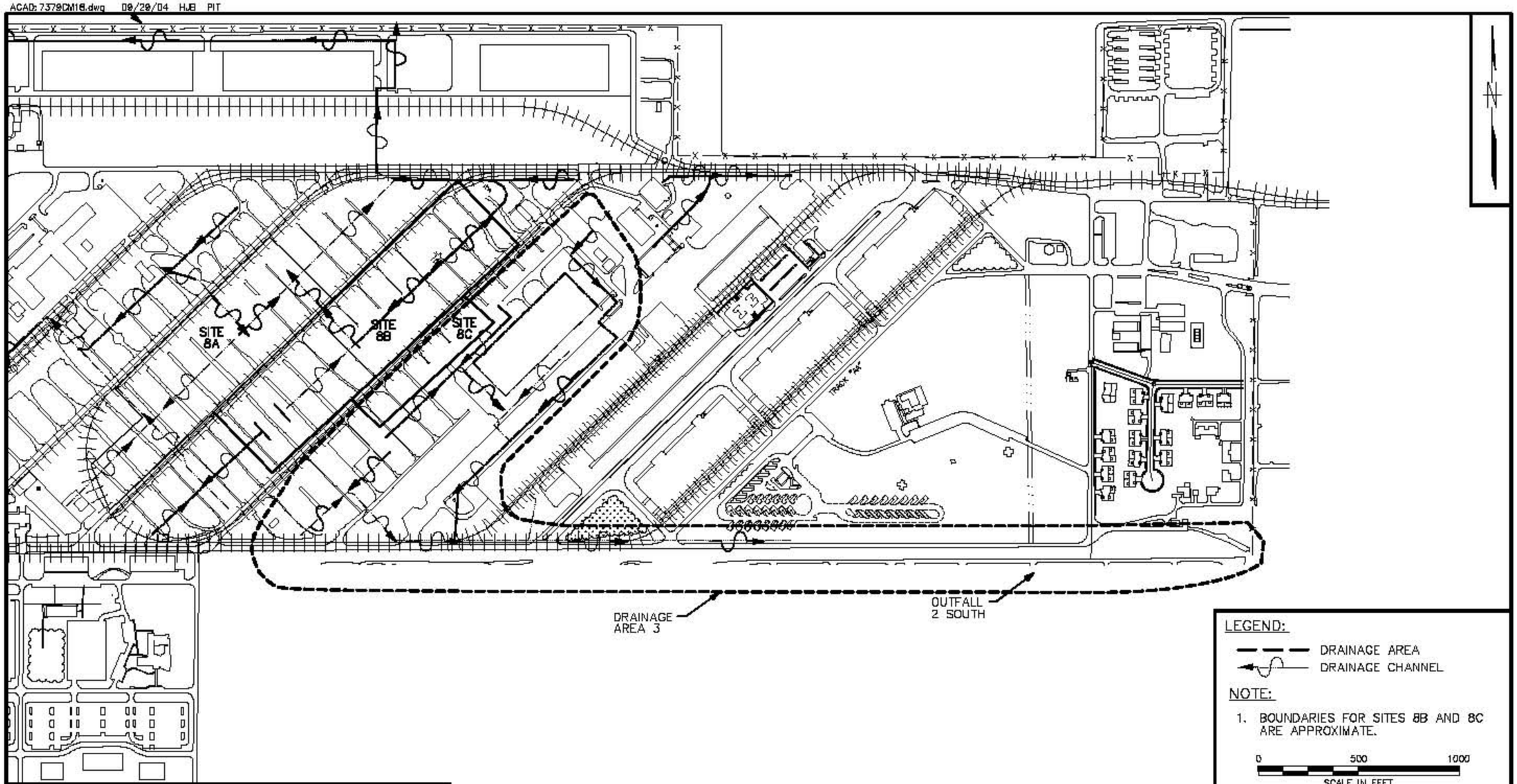

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

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COST/SCHED-AREA
SCALE AS NOTED

DRAINAGE AREA 3
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
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DRAWING NO. FIGURE 2-4
REV. 0

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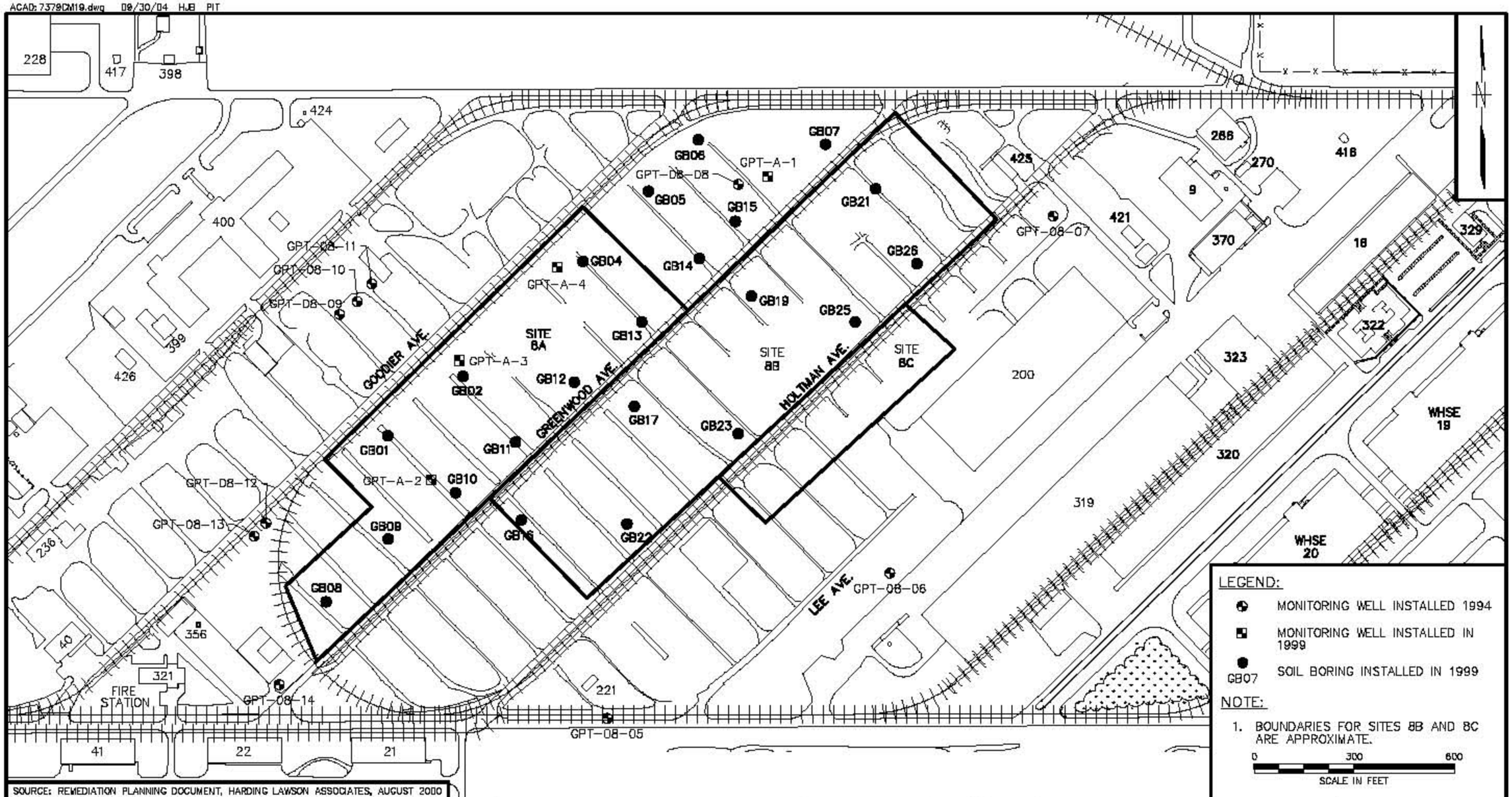

LEGEND:

- MONITORING WELL INSTALLED 1994
- MONITORING WELL INSTALLED IN 1999
- GB07 SOIL BORING INSTALLED IN 1999

NOTE:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.

0 300 600
SCALE IN FEET

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 11/19/02
CHECKED BY JJB DATE 5/13/03
COST/SCHED-AREA
SCALE AS NOTED

SITE 8 SOIL BORING AND MONITORING WELL LOCATIONS
SITE 8 BASIS OF DESIGN
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GULFPORT, MISSISSIPPI

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APPROVED BY DATE
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DRAWING NO. FIGURE 2-5
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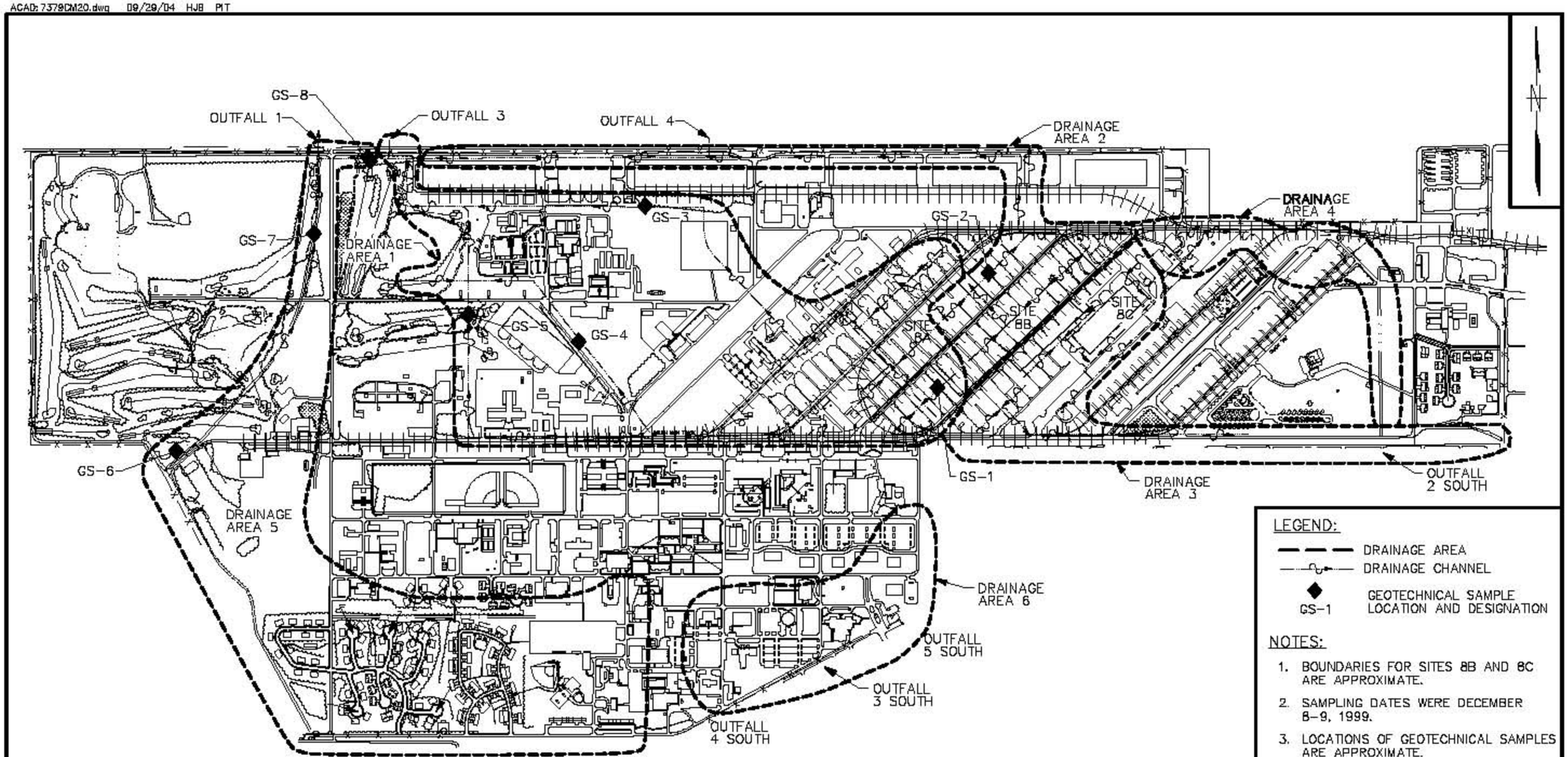

LEGEND:

- DRAINAGE AREA
- DRAINAGE CHANNEL
- GS-1 GEOTECHNICAL SAMPLE LOCATION AND DESIGNATION

NOTES:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.
2. SAMPLING DATES WERE DECEMBER 8-9, 1999.
3. LOCATIONS OF GEOTECHNICAL SAMPLES ARE APPROXIMATE.

0 1000 2000
SCALE IN FEET

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 11/19/02
CHECKED BY JJB DATE 5/13/03
COST/SCHED-AREA
SCALE AS NOTED

ON-BASE GEOTECHNICAL SAMPLING LOCATIONS
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
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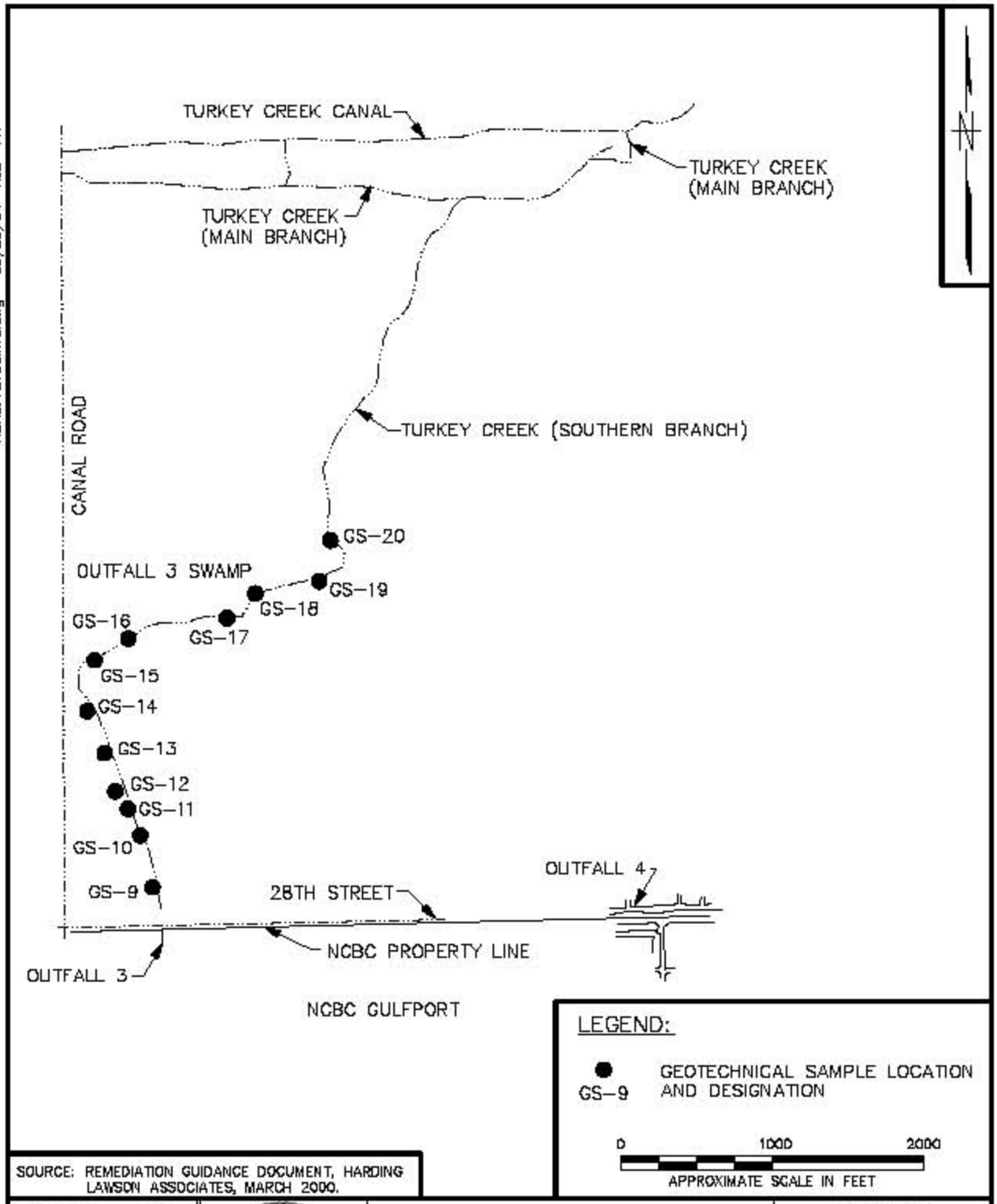

SOURCE: REMEDIATION GUIDANCE DOCUMENT, HARDING LAWSON ASSOCIATES, MARCH 2000.

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CHECKED BY JJB DATE 5/13/03			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-7 REV. 0

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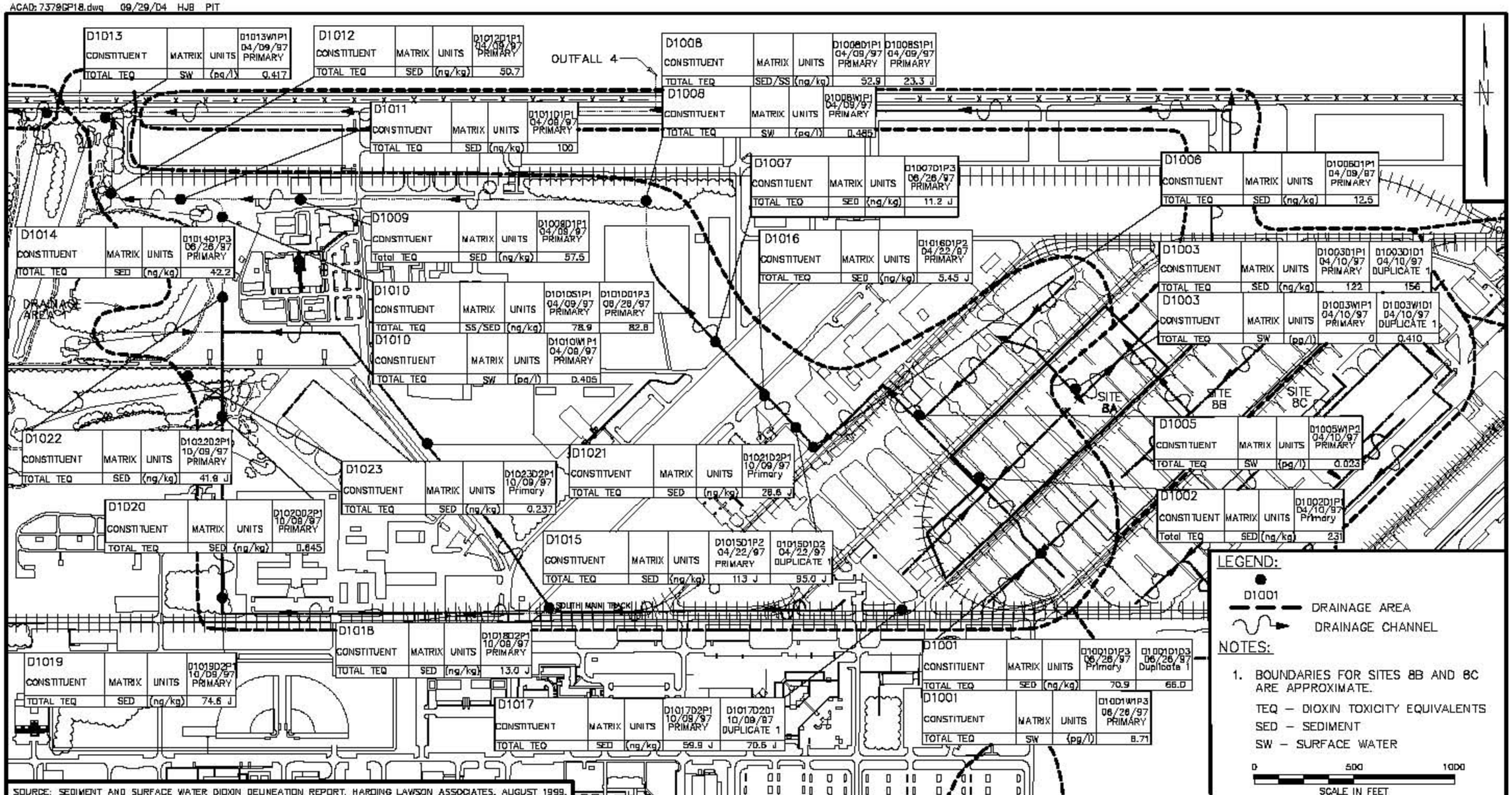

SOURCE: SEDIMENT AND SURFACE WATER DIOXIN DELINEATION REPORT, HARDING LAWSON ASSOCIATES, AUGUST 1999.

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COST/SCHED–AREA
SCALE AS NOTED

PHASE I AND II SURFACE WATER AND SEDIMENT RESULTS
DRAINAGE AREA 1
SITE 8 BASIS OF DESIGN
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GULFPORT, MISSISSIPPI

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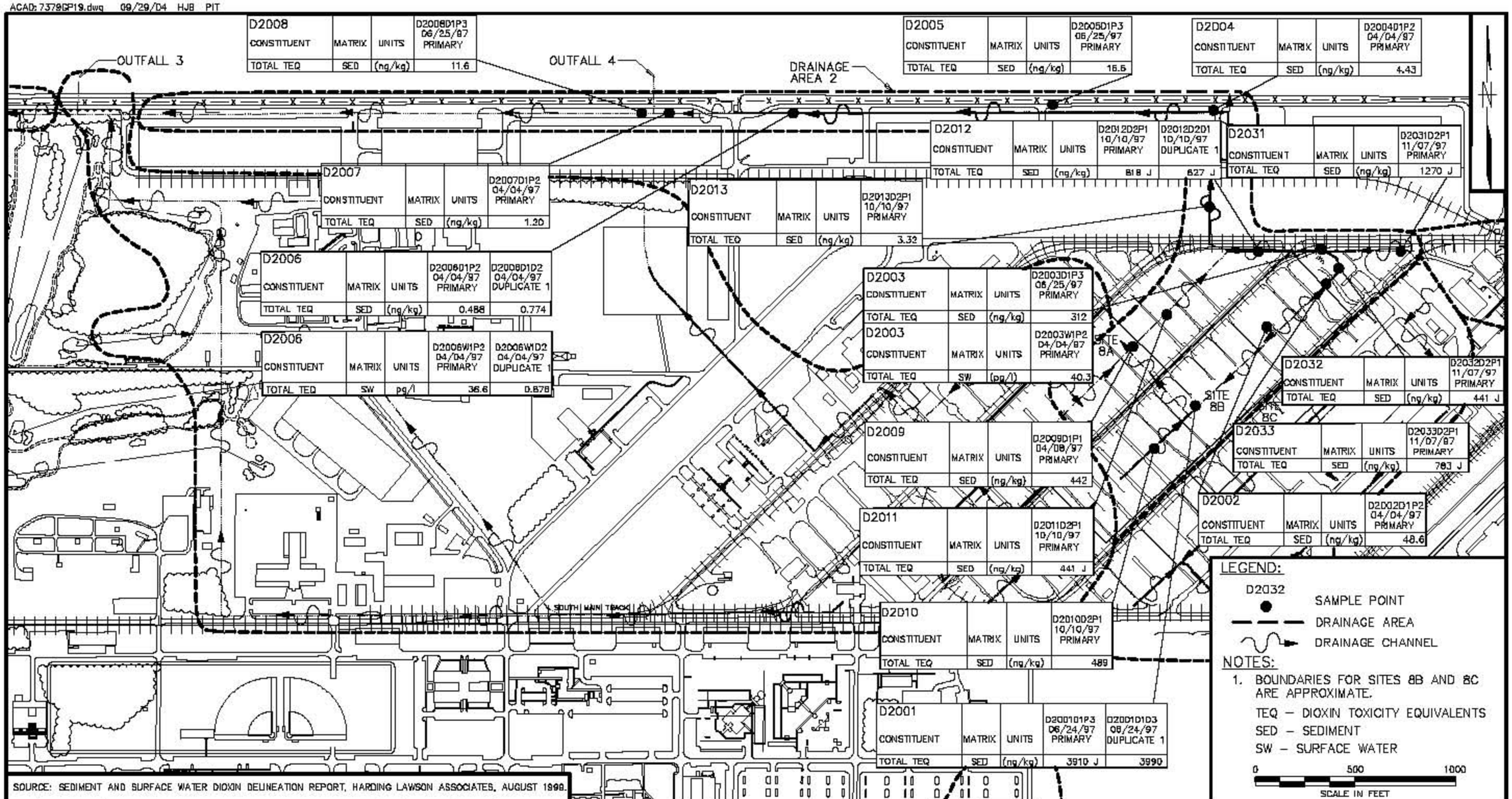


SOURCE: SEDIMENT AND SURFACE WATER DIOXIN DELINEATION REPORT, HARDING LAWSON ASSOCIATES, AUGUST 1998.

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

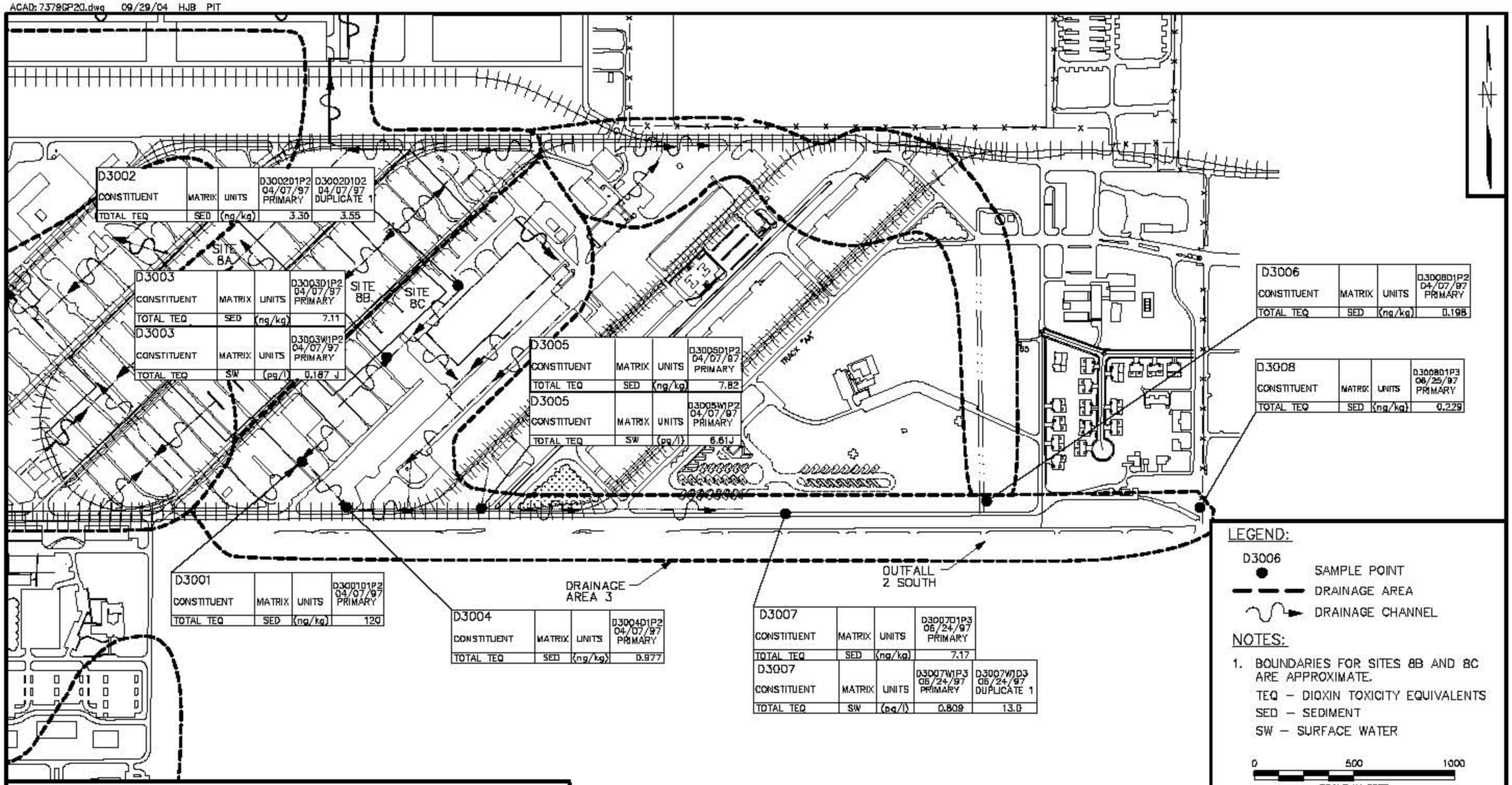
DRAWN BY DM DATE 4/23/03
CHECKED BY JJB DATE 5/13/03
COST/SCHED–AREA
SCALE AS NOTED

PHASE I AND II SURFACE WATER AND SEDIMENT RESULTS
DRAINAGE AREA 2
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2–9 REV. 0

FORM CADD NO. 5DIV_8H.DWG – REV 0 – 1/20/98

ACAD: 7379GP20.dwg 09/29/04 HJB PIT



D3002 CONSTITUENT	MATRIX	UNITS	D3002D1P2 04/07/97 PRIMARY	D3002D1D2 04/07/97 DUPLICATE 1
TOTAL TEQ	SED	(ng/kg)	3.30	3.55

D3003 CONSTITUENT	MATRIX	UNITS	D3003D1P2 04/07/97 PRIMARY
TOTAL TEQ	SED	(ng/kg)	7.11

D3003 CONSTITUENT	MATRIX	UNITS	D3003W1P2 04/07/97 PRIMARY
TOTAL TEQ	SW	(pg/l)	0.187 J

D3005 CONSTITUENT	MATRIX	UNITS	D3005D1P2 04/07/97 PRIMARY
TOTAL TEQ	SED	(ng/kg)	7.82

D3005 CONSTITUENT	MATRIX	UNITS	D3005W1P2 04/07/97 PRIMARY
TOTAL TEQ	SW	(pg/l)	6.61J

D3006 CONSTITUENT	MATRIX	UNITS	D3006D1P2 04/07/97 PRIMARY
TOTAL TEQ	SED	(ng/kg)	0.198

D3008 CONSTITUENT	MATRIX	UNITS	D3008D1P3 06/25/97 PRIMARY
TOTAL TEQ	SED	(ng/kg)	0.229

D3001 CONSTITUENT	MATRIX	UNITS	D3001D1P2 04/07/97 PRIMARY
TOTAL TEQ	SED	(ng/kg)	120

D3004 CONSTITUENT	MATRIX	UNITS	D3004D1P2 04/07/97 PRIMARY
TOTAL TEQ	SED	(ng/kg)	0.977

D3007 CONSTITUENT	MATRIX	UNITS	D3007D1P3 06/24/97 PRIMARY
TOTAL TEQ	SED	(ng/kg)	7.17

D3007 CONSTITUENT	MATRIX	UNITS	D3007W1P3 06/24/97 PRIMARY	D3007W1D3 06/24/97 DUPLICATE 1
TOTAL TEQ	SW	(pg/l)	0.809	13.0

LEGEND:

D3006 ● SAMPLE POINT

DRAINAGE AREA

DRAINAGE CHANNEL

NOTES:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.

TEQ – DIOXIN TOXICITY EQUIVALENTS

SED – SEDIMENT

SW – SURFACE WATER

0 500 1000

SCALE IN FEET

SOURCE: SEDIMENT AND SURFACE WATER DIOXIN DELINEATION REPORT, HARDING LAWSON ASSOCIATES, AUGUST 1999.

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 4/23/03

CHECKED BY JJB DATE 5/13/03

COST/SCHED–AREA

SCALE AS NOTED

PHASE 1 SURFACE WATER AND SEDIMENT RESULTS
DRAINAGE AREA 3
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379

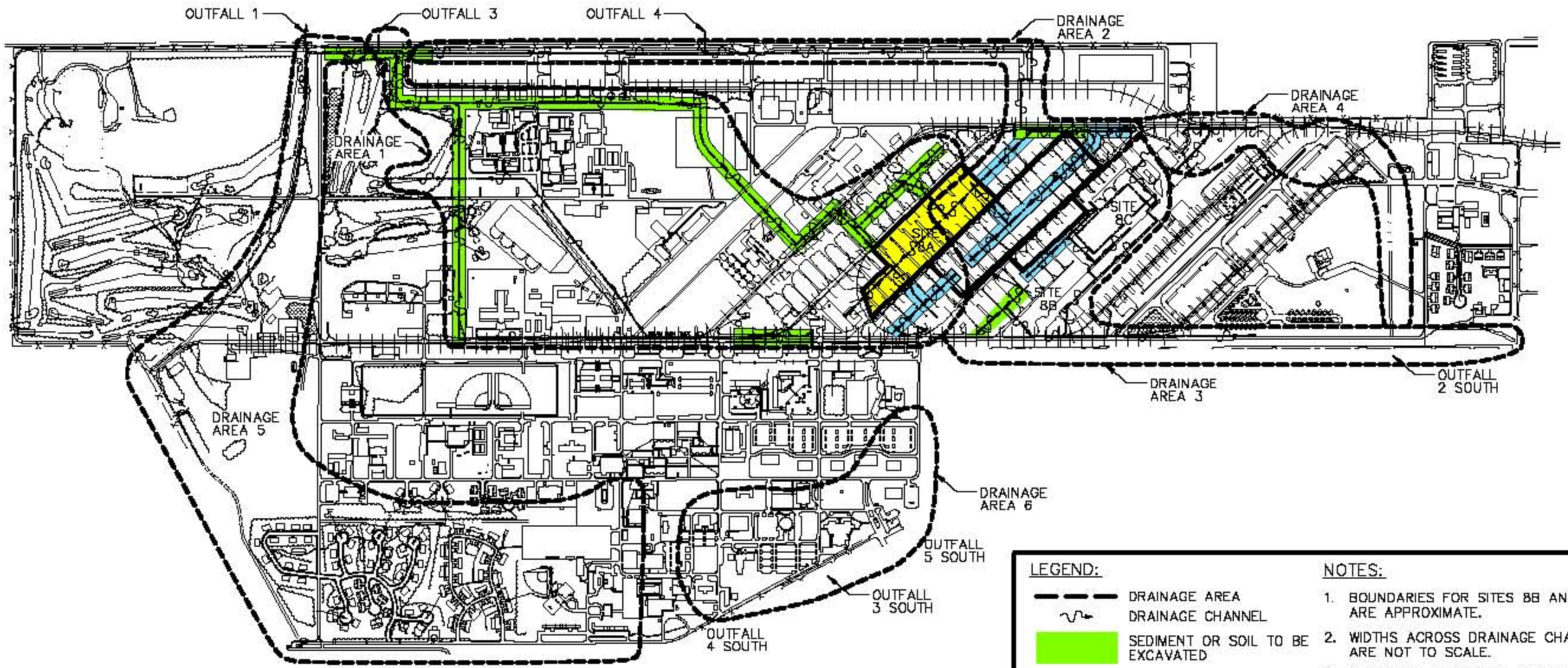
APPROVED BY DATE

APPROVED BY DATE

DRAWING NO. FIGURE 2–10 REV. 0

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

ACAD: 7378GP22.dwg 08/28/04 HJB PIT



LEGEND:

- DRAINAGE AREA
- DRAINAGE CHANNEL
- SEDIMENT OR SOIL TO BE EXCAVATED
- BOUNDARY OF CAP (SITE 8A)
- SEDIMENT OR SOIL EXCAVATED (CCI, 2003)

NOTES:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.
2. WIDTHS ACROSS DRAINAGE CHANNELS ARE NOT TO SCALE.
3. SEDIMENTS IN SITE 8A DRAINAGE CHANNELS WILL ALSO BE EXCAVATED FOR STABILIZATION PURPOSES.

0 1000 2000
SCALE IN FEET

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

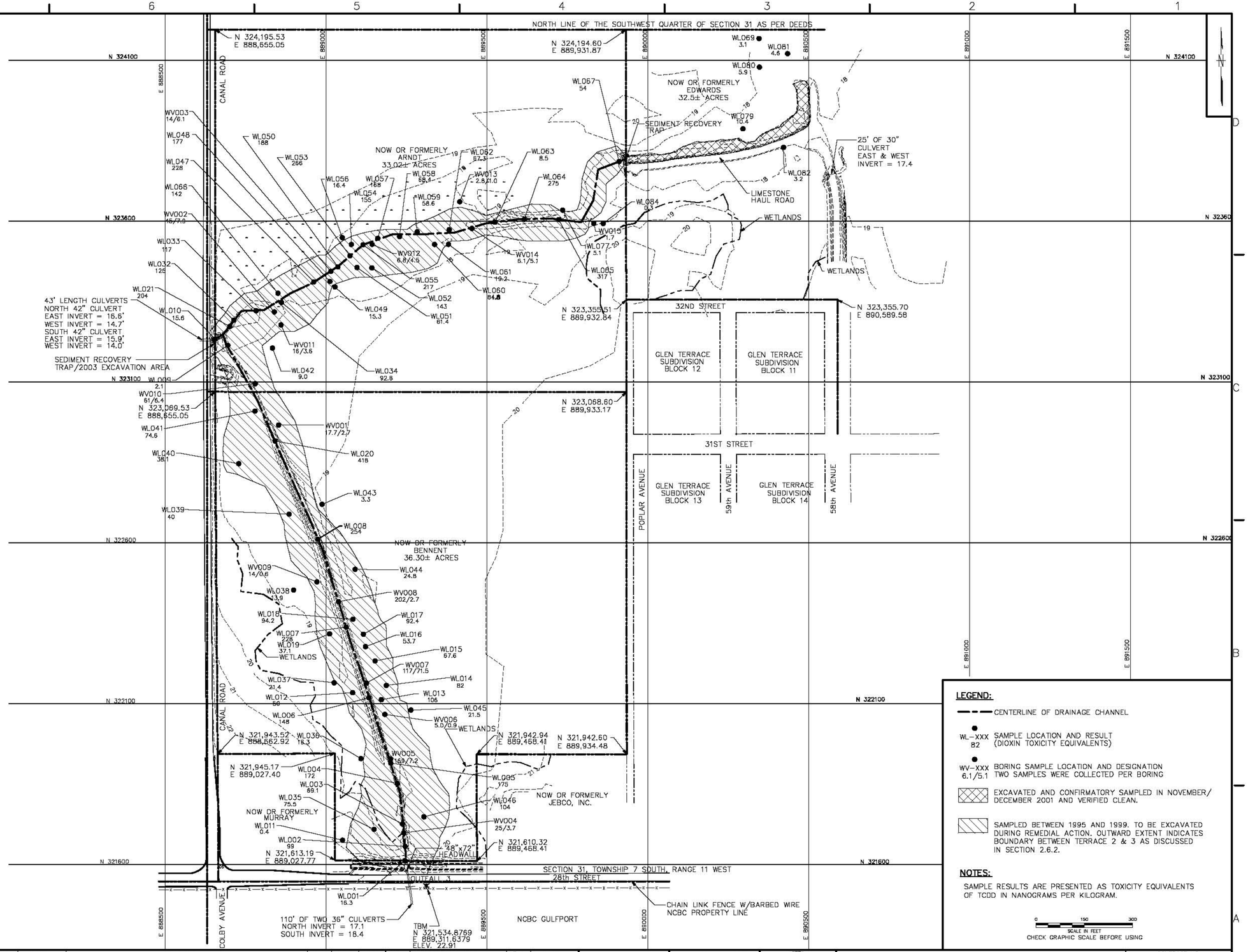
NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 4/24/03
CHECKED BY JJB DATE 5/13/03
COST/SCHED-AREA
SCALE AS NOTED

AREAL EXTENT OF ON-BASE CONTAMINATED MEDIA
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-11
REV. 0

FORM CADD NO. SDIV_B4.DWG - REV 0 - 1/20/98



LEGEND:

- CENTERLINE OF DRAINAGE CHANNEL
- WL-XXX 82 — SAMPLE LOCATION AND RESULT (DIOXIN TOXICITY EQUIVALENTS)
- WV-XXX 6.1/5.1 — BORING SAMPLE LOCATION AND DESIGNATION TWO SAMPLES WERE COLLECTED PER BORING
- EXCAVATED AND CONFIRMATORY SAMPLED IN NOVEMBER/DECEMBER 2001 AND VERIFIED CLEAN.
- SAMPLED BETWEEN 1995 AND 1999. TO BE EXCAVATED DURING REMEDIAL ACTION. OUTWARD EXTENT INDICATES BOUNDARY BETWEEN TERRACE 2 & 3 AS DISCUSSED IN SECTION 2.6.2.

NOTES:

SAMPLE RESULTS ARE PRESENTED AS TOXICITY EQUIVALENTS OF TCDD IN NANOGRAMS PER KILOGRAM.

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

SOURCE: SITE CHARACTERIZATION REPORT, NCBC OFF-BASE AOC, APRIL 2003

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM	DATE 4/25/03
CHECKED BY JJB	DATE 5/13/03
REVISED BY	DATE
SCALE AS NOTED	

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

AREAL EXTENT OF OFF-BASE CONTAMINATION
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
OWNER NO.	
APPROVED BY	DATE
DRAWING NO. FIGURE 2-12	REV. 0

DRAWING NO. FIGURE 2-12 REV. 0

ACAD:7379GF21.dwg 10/15/04 HJB PIT

3.0 PRE-DESIGN INVESTIGATION SUMMARY

TtNUS performed pre-design investigations (PDIs) at Site 8A and the off-base AOC to support the RD effort for Site 8A, contiguous on-base drainage channels, and the associated off-base AOC described in Section 4. The objectives of the PDIs were to establish mixing ratios for the stabilization process, evaluate bearing capacity of stabilized material, verify and identify existing site features and conditions, delineate off-base wetlands, and obtain base topographic and feature mapping. The PDI field activities and results are described below.

3.1 PRE-DESIGN INVESTIGATION FIELD ACTIVITIES

TtNUS and supporting subcontractors conducted the following PDIs in support of the Site 8 RD effort;

- A bench-scale treatability study was conducted in the late summer and fall of 2000.
- A follow-up pilot-scale treatability study was conducted in July and August 2001.
- A wetland specialist delineated the wetlands in the off-base AOC in October 2002.
- Ground surface topography and physical features were surveyed during October and November 2002.

The results of these PDIs are described in the following paragraphs.

3.2 PRE-DESIGN INVESTIGATION RESULTS

3.2.1 Bench-scale Soil/Sediment Treatability Study

A bench-scale treatability study was conducted to determine whether the soil ash, contaminated on-base sediments, and contaminated off-base AOC sediments could be excavated and consolidated into a proportionate mixture of material (henceforth referred to as material blend) that is suitable to support a structural cap, that could be used as a heavy equipment storage area (TtNUS, 2001a). Specifically, the study examined 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 were a minimum California Bearing Ratio (CBR) of 20 and a minimum 28-day unconfined compressive strength (UCS) of 50 pounds per square inch (psi).

Based on information available at the time of the bench-scale study, it was estimated that soil ash comprised 40 percent of the total volume, on-base sediment 40 percent of the total volume, and off-base AOC sediment 20 percent of the total volume (a 2:2:1 ratio). The first tier of bench-scale testing

examined the load-bearing capacity of the material blend mixed in the 2:2:1 ratio and determined that its load-bearing characteristics were unsuitable for H20 loading. A second tier of testing determined 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 improved its load-bearing capacity so that it did satisfy the H20 criterion. Furthermore, the third tier of testing determined that the compaction and load-bearing characteristics of the stabilized material blend are not unduly sensitive to an increase in sediment content, which is the most likely variation in the composition of the material blend to occur under field conditions. Further details of this study are provided in the Bench-Scale Soil/Sediment Treatability Study Report for Site 8 (TtNUS, 2001a).

Since the completion of bench-scale testing, results of a vertical delineation study conducted in the off-base AOC (TtNUS, 2003e) and refined volume estimate calculations (see Appendix B) have determined that the estimated volume of contaminated off-base AOC sediment is approximately 28,800 yd^3 (versus a 13,000 yd^3 estimate prior to the study). However, the results of the third tier of bench-scale testing indicate that this volume increase should not adversely impact the load-bearing characteristics of the stabilized base for the structural cap.

3.2.2 Pilot-scale Soil/Sediment Treatability Study

TtNUS conducted a pilot-scale treatability study during the last half of 2001. The purpose of the pilot-scale study was to determine the feasibility and practicality of implementing the findings of the bench-scale treatability study on a scale representative of actual remedial operations (TtNUS, 2001b). The primary objectives of the pilot-scale study were as follows:

- Determine the most effective methods for excavating and transporting the soil ash, contaminated on-base sediment, and contaminated off-base AOC sediment from their current locations.

- Verify the effectiveness of a mechanical vibrating screen for the removal of oversized particles from the material blend.

- Determine the most effective method of removing excess free water from the sediment excavated from the on-base drainage channels and off-base AOC.

- Determine the most effective method for mixing the soil ash, contaminated on-site sediment, and contaminated off-base AOC sediment into a homogeneous material blend and for mixing the material blend with the required Portland cement to form the stabilized material blend.

- Determine the most effective method of grading the stabilized material blend.

- Verify that the load-bearing capacity and dioxin leachability of the stabilized material blend are within required technical limits.

3.2.2.1 Excavation

To perform the pilot-scale treatability study, material was excavated from the on-base drainage channels, the off-base AOC, and the soil ash piles on Site 8A and transported to a materials handling pad at Site 8A. The following is a summary of the types of material found and the excavation activities performed in each of the areas.

On-base Drainage Channel Sediment - During the bench-scale treatability study, two types of on-base, dioxin-contaminated sediment were observed in the drainage channels. In the upper reaches of the drainage channel 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 channel system, where free-standing water is typically observed year round, additional material consisting of decayed organic matter and settled fines is observed above the fine-grained sand. Both sediment types were excavated during the pilot-scale treatability study. Approximately 276 yd^3 of sandy sediment (unconsolidated material) were excavated from a portion of the Site 8B drainage channels, and approximately 120 yd^3 of sandy sediment with decayed organic matter (unconsolidated material) were excavated from the drainage channels just upgradient from NCBC Outfall 3. Due to standing water in the drainage channel excavations, excavated materials were saturated; therefore, bed liners were used in the dump trucks to prevent material leakage during transport to Site 8A.

Soil Ash - The soil ash stored at Site 8A 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. Because of the proximity of the soil ash piles to the materials handling pad in the pilot-scale treatability study work area at Site 8A, stockpiling the ash on the pad was not required.

Off-base AOC Sediment - The original objectives of the off-base phase of the pilot-scale treatability study were to obtain sufficient off-base sediment for use during the stabilization/landfilling phase of the study and also to remove all dioxin-contaminated sediment from the Edwards property in the off-base AOC. 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. 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 2001 when ground conditions were expected to be drier. For use in the stabilization/landfilling phase of the study, 80 yd^3 of off-base AOC sediment were excavated from a location off Canal Road.

In November 2001, the haul road was constructed by extending 58th Avenue north approximately 450 feet into the Edwards property near the southern branch of Turkey Creek. The haul road was then extended approximately 700 feet along the southern and eastern edges of the contaminated sediment area. The haul road was constructed with a base of cut timber, and clean native soil was used to fill in the voids between the timber (i.e., "corduroy" road). A surface layer of gravel/limestone was then spread and compacted above the soil layer.

Approximately 1,000 yd^3 of off-base AOC sediment were excavated to achieve the objective of removing dioxin-contaminated material from the Edwards property. The off-base AOC sediment is a fine-grained silty clay containing small amounts of vegetative matter (e.g., roots, small twigs, grass). Excavated materials were saturated; therefore, bed liners were used in the dump trucks to prevent material leakage during transport to the Site 8A materials handling pad for storage. Verification sampling was performed on the remediated Edwards property and the bottom of the excavated area contained dioxins at concentrations less than the MDEQ Tier 1 soil/sediment TRG of 4.26 ng/kg for unrestricted (residential) use (TtNUS, 2002).

3.2.2.2 Soil Screening Tests

Soil screening tests were performed to determine 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. Screening equipment was used to perform the screening tests. The screening equipment consisted of 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. During the screening process, the shredder was unable to handle some of the vegetative matter such as tree roots. Therefore, because the vegetative matter only comprised approximately 5 percent of the total volume and consisted of small-sized particles, it was decided that screening and shredding was not a necessary step, and oversized material was removed from the blended material when it was placed in the test pad lifts (TtNUS, 2001b).

3.2.2.3 Free-Water Removal Tests

Free-water removal tests were performed on the excavated off-base AOC sediment. After the excavated sediment was hauled to the materials handling pad, samples were analyzed for moisture content. Three samples were collected at various locations approximately 1 foot above the bottom of the off-base AOC 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 indicate that 24 hours of dewatering reduces the moisture content of the off-base AOC sediment by an average of 6.9 percent (TtNUS, 2001b).

3.2.2.4 Mixing and Spreading Tests

Mixing and spreading tests were conducted to verify that 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 treatability study activities, and two methods of mixing/spreading were used for each of the lifts (TtNUS, 2001b). These methods are described below.

Method 1 - For the first lift (Lift No. 1), the material blend was prepared by placing alternating bucket loads of the material into the dump truck until the truck was full. The material was then hauled to the test pad where a bulldozer was used to mix/spread the material. The resulting material blend loose lift was approximately 11 inches thick, 28 feet wide, and 150 feet in length. Following the placement of the lift, a soil stabilizer (a roto-tiller-type machine) was used to mix the material. After several passes of the soil stabilizer, the material in the lift was visually inspected and was reported to be a homogeneous mix. Portland cement was then added to the lift of material blend using bulldozers to spread the material and the soil stabilizer to mix the material[1]. The completed lift provided a material blend stabilized with 9 percent (by weight) Portland cement (TtNUS, 2001b).

Method 2 - For the second lift (Lift No. 2), the material blend was mixed prior to loading dump trucks for hauling to the test pad. Mixing for Lift No. 2 was performed by placing the appropriate proportions of each of the excavated materials in a pile approximately 40 yd^3 in size within the materials handling pad and using an excavator to mix the soil for approximately 15 to 20 minutes. The material blend was then loaded into dump trucks and hauled to the test pad where it was spread using a bulldozer. The resulting lift was 7 inches thick, 28 feet wide, and 150 feet in length. Portland cement was then added to the lift in the same manner as Lift No. 1. The completed lift provided a material blend stabilized with 5 percent (by weight) Portland cement (TtNUS, 2001b).

Conclusions - After performing the two mixing/spreading procedures, it was determined that the second method of mixing provided easier spreading and a more homogeneous mix. However, the second method also resulted in a slower material hauling rate to the test pad area.

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[1] Phenolphthalein was sprayed along several vertical cross sections made by shovel excavations into 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.

3.2.2.5 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 paragraphs present the compaction and geotechnical test results.

Compaction - Immediately following stabilization with Portland cement, each lift of the stabilized material blend was compacted with a smooth drum vibratory roller to achieve a minimum 90 percent of maximum dry density in accordance with ASTM Method D2922. The density of the compacted stabilized material blend was then field checked with a nuclear density gage in accordance with ASTM Method D698. It was determined that Lift No. 1, with 9 percent Portland cement, required only one pass of the vibratory roller to achieve 90 percent of the maximum dry density and Lift No. 2, with 5 percent Portland cement, required three passes of the vibratory roller to achieve 90 percent of the maximum dry density.

Bearing Tests - CBR tests were performed at four locations on Lift No. 2 in accordance with ASTM Method D4429. These tests were performed 3 days and 7 days after the initial compaction of the stabilized material blend. The results of all of the CBR tests performed on the test pad were well in excess of the minimum CBR requirement of 20. Additionally, the results of the pilot-scale treatability study CBRs were within the range of those observed during the bench-scale treatability study (TtNUS, 2001b).

Conclusions - Both methods used to mix and grade the soil ash and contaminated sediments achieved the compaction and strength requirements necessary to support a structural cap system that would be subjected to AASHTO H20 loading.

3.2.2.6 Dioxin and Leachability Tests

Soil samples were collected during the pilot-scale treatability study to verify that the dioxin contamination in the stabilized material blend is not likely to leach from the test pad lifts. Two samples of the stabilized material blend were collected from Lift No. 1, and two samples were collected from Lift No. 2. Initially, the samples were analyzed for dioxins in accordance with USEPA SW-846 Method 8290. TEQ concentrations of TCDD were calculated in accordance with Interim Report on Data Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks (USEPA, 1989). All TEQ concentrations were less than the MDEQ Tier I restricted TRG soil/sediment dioxin criterion of 38.2 ng/kg. Next, the Synthetic Precipitation Leaching Procedure (SPLP) (USEPA SW-846 Method 1312) was performed on the samples with the two highest TEQ concentrations and the resulting SPLP leachates were analyzed for dioxins. Dioxins were not detected in leachate from one sample and in the other sample, the TEQ concentration in

the leachate was at 0.0016 pg/L. This concentration is less than the USEPA Region III RBC of 0.45 pg/L and the MDEQ groundwater TRG of 30 pg/L. These SPLP leachate results indicate that dioxin contamination would not leach from the stabilized material at concentrations harmful to human health (TtNUS, 2001b). These concentrations also indicated that an implementable layer would not be required below the stabilized material.

Additionally, one water sample (unfiltered) was collected from the sump at the materials handling pad used during the pilot-scale treatability study. The sample was collected to evaluate the potential need for treatment of removed free water that would collect in the materials handling pad during full-scale remediation. The TEQ concentration for this sample was calculated to be 1.2 pg/L. This TEQ concentration is less than the MDEQ groundwater TRG and USEPA MCL of 30 pg/L indicating that water collected from the materials handling pad would not need to be treated before discharging to a stormwater drainage channel (TtNUS, 2001b).

3.2.2.7 Conclusions/Recommendations

The following conclusions and recommendations were drawn from the results of the pilot-scale treatability study (TtNUS, 2001b):

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

- The Pass Road gate (eastern NCBC gate) was used during the pilot-scale treatability study; however, the use of one of the northern entrances during full-scale operations would increase excavation/hauling rates by reducing the round-trip distance by approximately 1.5 miles.

- The use of dump trucks with gasketed tailgates should be considered for material transport during full-scale operations. This action would eliminate material handling problems encountered with the plastic bed liners during pilot-scale material blending activities and would result in an increase in the material-hauling rate.

- 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 materials handling pad with a wheel excavator and then transporting the premixed material to the test pad in dump trucks. Observations indicate that material premixed by the second method was 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 when compared to the first method.

- The soil stabilizer effectively mixed the stabilized material blend at the test pad. After one pass of the soil stabilizer, visual observation of the stabilized material blend and the use of an alkaline indicator (phenolphthalein) indicated a homogenous mixture.

- Pilot-scale treatability 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 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.

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

- Based on CBR results, extensive dewatering of the material blend components would not be required during full-scale operations.

- SPLP leachate results indicated that dioxin contamination in the stabilized material blend would not leach from the stabilized material at concentrations harmful to human health.

- Dioxin analysis conducted on a water sample collected from the materials handling pad sump indicated that water collected from the sump during full-scale operations would not need to be treated before it is discharged to a stormwater drainage channel.

3.2.3 Wetland Delineation

Appendix C presents a delineation of those areas within the off-base AOC that satisfy the definition of wetlands used by the USEPA and the United States Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (33 USC 1344). The USACE and USEPA define wetlands as "those areas that are inundated or saturated at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 230.3 and 33 CFR 328.3). Wetland delineation fieldwork was conducted in October 2002. The delineation followed the routine on-site

methodology outlined in the USACE Wetlands Delineation Manual (1987 Manual) (Environmental Laboratory, 1987) and supplementary USACE guidance (USACE, 1992a).

With few exceptions, areas identified as wetlands according to the 1987 Manual must display evidence of each of the following three parameters indicative of wetland conditions:

- Hydrophytic Vegetation - Defined as the sum total of macrophytic plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

- Hydric Soil - Defined as a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation.

- Wetland Hydrology - Defined as the sum total of wetness characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation (Environmental Laboratory, 1987).

Four wetland boundaries (designated as Boundaries A, B, C, and D) were identified on the off-base AOC (Figure 3-1 of Appendix C). The boundaries enclose a single, contiguous wetland area. The southern part of the wetland, occupying most of the central and western parts of the Bennett property, adjoins a man-made drainage ditch that flows northwestward from Outfall 3 on the northern NCBC perimeter (28th Street). The ditch exits the area addressed by the wetland delineation via a culvert under Canal Road. The northern part of the wetland, occupying most of the western and northeastern part of the Arndt property and western part of the Edwards property, lacks a distinct channel but appears to convey surface flow in an easterly-northeasterly direction.

Boundary A marks the western edge of the wetland on the Bennett property. Boundary B marks the eastern edge of the wetland in the southern part of the Bennett property (and on adjoining areas of another property termed the Jebco Property). Uplands east of Boundary B (on the Jebco Property) support a communication tower and associated guy wires. The majority of the Edwards property west of 58th Avenue and the gravel access road is wetland. Boundary C identifies a very small area of non-wetland at the southern limit of the access road. Boundary D marks the southward extension of wetlands in the southwestern part of the Edwards property and the southeastern part of the Arndt property.

Vegetation: Vegetation in the outer part of the wetland is dominated by a canopy of slash pine (*Pinus elliottii*). Most of the pines are less than 12 inches in diameter at breast height (DBH), but occasional trees exceed 18 inches DBH. Baldcypress (*Taxodium distichum*), sweetbay (*Magnolia virginiana*), and

red maple (*Acer rubrum*) are common throughout the wetland as saplings (most of the baldcypress on the off-base AOC is an ecotype formerly termed pondcypress). The slash pine trees are undergrown by a dense understory of woody broad-leaved evergreen shrubs such as gallberries (*Ilex glabra* and *Ilex coriacea*) and vines such as greenbriers (*Smilax* sp.). Herbaceous groundcover is variable, with some areas virtually lacking groundcover and other areas supporting dense patches of wetland ferns such as chain fern (*Woodwardia areolata*) or wetland forbs such as pitcher plant (*Sarracenia leucophylla*). Poison ivy (*Toxicodendron radicans*) occurs frequently as a groundcover plant and occasionally as a vine supported by trees.

The inner (wetter) part of the wetland supports forest vegetation dominated by a mixture of swamp and bottomland tree species such as baldcypress (or pondcypress), sweetbay, and tupelo (*Nyssa aquatica*). Slash pine occurs only infrequently. Most trees near the man-made drainage ditch crossing the Bennett property are less than 12 inches DBH. Some trees in the wettest part of the Arndt and Edwards properties are more than 18 inches DBH. Baldcypress tend to be more common in the wettest part of the Bennett property, while sweetbay and tupelo tend to be more common in the wettest part of the Arndt and Edwards properties. Understory and groundcover are relatively sparse throughout this inner zone of vegetation.

The uplands adjoining the wetland support slash pine forest containing tree, sapling, and shrub species that are generally indistinguishable from those in the forest in the outer (drier) zone of the wetlands. A canopy of slash pines, generally similar in size and density to that in the wetlands, grows over a dense understory of gallberries and other shrub species. The only perceptible differences between the slash pine forest in the uplands and the wetlands are the absence of baldcypress and certain groundcover species frequent in the wetlands. Because the upland tree cover consists mostly of species that also occur in the wetlands, the position of the delineated boundary relies on changes in soils, hydrology, and groundcover vegetation.

Soils - The *Soil Survey for Harrison County, Mississippi* (SCS, 1975) indicates that the off-base properties are located in an area characterized by loamy and sandy soils on broad flats and floodplains. Soils in the central part of the Bennett property are mapped in the very poorly drained Hyde soil series. Soils in the western part of the Bennett property are mapped in the moderately well drained Harleston soil series. Soils in the southeastern part of the Bennett property are mapped in the poorly drained Plummer soil series, moderately well drained Harleston soil series, and somewhat poorly drained Ocilla soil series. Soils in the northeastern part of the Bennett property, southeastern part of the Arndt property, and southwestern part of the Edwards property are mapped in the poorly drained Plummer soil series. Soils in the remainder of the Arndt and Edwards properties are mapped in the very poorly drained Ponzer soil series and poorly drained Smithton soil series (SCS, 1975).

The soil profiles observed in the field during the wetland delineation generally corroborate the soil survey maps. Shallow soil boring samples collected from the central part of the wetland revealed shallow topsoil more suggestive of the Smithton than the Hyde or Ponzer soil series. Soils below the topsoil were predominantly silt loam (or fine sandy loam) with a grayish matrix color (chroma 1) interrupted with frequent but small mottles of brighter colors (chromas 4 and higher). The matrix color refers to the predominant soil color, and grayer matrix colors are indicative of reduced iron resulting from extended periods of soil saturation. The low matrix chroma qualifies these soils as hydric soils based on the criteria presented in the 1987 Manual. Matrix chromas of 2 with mottling or 1 with or without mottling are typically regarded by the 1987 Manual as potentially indicative of hydric soil. The low matrix chroma in the upper 10 inches of the soil profile is indicative of the "depleted matrix" criterion for a hydric soil (Criterion F3) established by the National Technical Committee for Hydric Soils (NTCHS) (NRCS, 1998).

The soil boring samples taken in the drier part of the wetland (close to the wetland boundary) revealed silt loams or fine sandy loams with grayish matrix colors (chroma 1) generally similar to soils in the inner part of the wetland. The hydric status of these soils is also based on the low chroma matrix color criterion in the 1987 Manual and the depleted matrix criterion established by the NTCHS. The transition from hydric (wetland) soils to upland soils is very gradual throughout the off-base AOC. Matrix chromas remain at 1 until very close to the wetland boundary. Soils at the delineated wetland boundary and just outside of the boundary generally display "polychromatic matrices" (matrices with blocks of differing colors but without the spots and streaks characteristic of mottling) consisting of zones of gray (chromas 1 and 2) and yellow-gray (chromas interim between 2 and 3). Soils dominated by the brighter yellow colors (chroma 3 and higher) characteristic of upland soils do not occur close to the delineated wetland boundary.

Hydrology - All wetlands on the off-base properties are freshwater, nontidal wetlands. Tidal influence from the Gulf of Mexico does not extend to areas north of NCBC Gulfport.

The ditch crossing the central part of the Bennett property contained approximately 3 inches of nearly stagnant water at the time of the wetland delineation (October 2002). Surface flow in the ditch is to the northwest. The ditch was straight and of nearly uniform width. The inner wetlands adjoining the ditch were saturated to the surface and contained shallow pools of 1 to 2 inches of standing water.

Surface flow across the Arndt and Edwards properties is toward the north-northeast toward Turkey Creek, which passes approximately 0.5 mile north of the properties. However, surface flow across the Arndt and Edwards properties does not involve a ditch or other well-defined channel. Instead, a band of deeper wetlands contained a series of small pools of shallow standing water separated by areas of saturated soil

at the time of the wetland delineation (October 2002). However, low watermarks on the buttresses of trees in this area suggest that continuous surface flow does occur episodically.

The outer (drier) zone of the wetlands was saturated to the surface or within 6 to 10 inches of the surface at the time of the wetland delineation. The 1987 Manual treats visual observation of soil saturation within 12 inches of the surface as a primary indicator of wetland hydrology but cautions that the preceding weather conditions must be considered. The region had experienced very heavy rainfall during September and October 2002, with reported cumulative precipitation of 8 to 9 inches in October compared to a normal of 3 to 4 inches and estimated precipitation of 16 to 18 inches in September versus a normal of 4 to 5 inches (NWS, 2002). Based on these above-average rainfalls, soil saturation was considered indicative of wetland hydrological conditions only if the saturation was within 6 to 8 inches below the soil surface.

Classification - The ditch crossing the central part of the Bennett property would be classified as Riverine under the classification system developed by the FWS (Cowardin *et al*., 1979). The Riverine system is defined as all wetlands contained within a channel. The wetlands adjoining the ditch and all of the other wetlands on the properties would be classified as Palustrine Forested (PFO). The Palustrine system consists of nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. The east-northeast surface flow across the Arndt and Edwards properties does not follow a defined channel and thus, the wetlands supporting the flow would be classified as Palustrine rather than Riverine.

Functions and Values - Because the wetland is situated in a relatively flat landscape with little topographic relief and a shallow water table throughout, it is unlikely to play a key role in regulating the recharge or discharge of groundwater. The wetland lacks a large watershed clearly defined by topography and therefore does not likely contribute to the modulation of flood flows. However, activities that partially fill the wetland could cause increased channel flow that does not readily pass through the culvert under Canal Road. Because of the absence of open water adjoining the wetland, the wetland clearly does not play a role in stabilizing shorelines against wave action. However, the vegetation, especially the mature tree roots and dense understory, functions to stabilize the soils in the wetland against surface erosion during high water flows.

The dense vegetation in the wetland likely serves to reduce the velocity of flow discharged from NCBC Gulfport via Outfall 3, thereby trapping at least a portion of any sediments or toxicants contained in the surface flow. Without the dense vegetation in the wetland, the plume of soil contaminated by HO and its by-products might have extended further downgradient (north) toward Turkey Creek. The dense and diverse vegetation and rich soils in the wetland likely contribute substantial quantities of organic carbon,

organically fixed nitrogen and other nutrients, and microbes and other low food chain organisms to downgradient water bodies such as Turkey Creek (production export function).

The forested wetlands on the Bennett and Arndt properties adjoin a large area of forested wetlands to the north providing a contiguous block of several hundred acres of habitat for species favoring swamp habitat. Although some selective logging has recently occurred north of the Arndt property, the block still provides an extensive swath of habitat largely unaffected by roads or agricultural or urban development. Increasing urbanization of the landscape between NCBC Gulfport and Interstate Route 10 to the north has reduced the regional availability of large unfragmented tracts of wetland and upland forest cover that is required by many species of wildlife, especially many species of "forest-interior" songbirds. Although the wetland provides terrestrial habitat, including good amphibian habitat, it provides no substantial aquatic habitat.

The wetland and adjoining uplands have not been developed for recreation and provide few recreational opportunities. They occupy private property that is not open to the public. Because of their urbanizing surroundings, the properties do not appear to offer significant opportunities for hunting, and their value for hunting will likely decrease even more in the future. The wetland does represent a regionally typical example of swamp adjoined by wet pine flatwoods. Such features are common throughout southern Mississippi, but urbanization is making such features increasingly infrequent in the immediate vicinity of NCBC Gulfport. The presence of ditching in the wetland and its history of receiving surface runoff from NCBC Gulfport has compromised the natural integrity of the wetland. The wetland is of some aesthetic value because it provides a visually naturalistic break in the urban development fronting much of 28th Street and Canal Road.

3.2.4 Topographic Survey

TtNUS contracted Land Surveying Inc., professional land surveyors from Gulfport, Mississippi, to complete a topographic and point survey within Site 8A and the off-base AOC north of NCBC in October and November 2002. The ground surface topographic survey covered the limits of Site 8A and the limits of the delineated wetland boundary in the off-base AOC. The surveyor also identified the boundary of the wetlands defined by the wetlands specialist in June 2001. The survey was completed using the North American Vertical Datum of 1988 (NAVD 88) and the Mississippi State Plane Coordinate System, North American Datum of 1983 (NAD 83). The field survey, topography and off-base AOC features are reflected on Design Drawings C-3, C-4, and C-5.

3.3 CONCLUSIONS

The following conclusions were derived from the PDI:

- The material blend should not be consolidated under a structural cap at Site 8A without amendment using a stabilization agent.

- The material blend should be stabilized with 5 to 10 percent by weight of Portland cement prior to placement under the Site 8A structural cap.

- Excavation of sediment in the off-base AOC should not be conducted during the rainy season (typically May to September). Excavation of this material should be performed during 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 bed liners on each round trip would increase the rate of material hauling.

- Use of either pilot-scale treatability study premixing method is acceptable.

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

- Most of the potentially contaminated areas within the off-base AOC (i.e., Bennett, Arndt, and Edwards properties) meet the technical criteria for wetlands established in the 1987 USACE Wetlands Delineation Manual.

- All of the wetlands within the off-base AOC are nontidal, freshwater wetlands regulated as a water of the United States under Section 404 of the Clean Water Act.

- None of the wetlands within the off-base AOC are "coastal wetlands" regulated under the Mississippi Coastal Wetlands Protection Act (Mississippi Code §49-27).

4.0 DESIGN REQUIREMENTS

4.1 DESCRIPTION OF THE SELECTED REMEDY

The Agreed Order stipulated that the Navy and Air Force will manage remediation of the Herbicide Orange Storage Area (Site 8) and associated off-base AOC as a single RA. The remediation will address soil ash at Site 8A, contaminated sediments in on-base drainage channels, and contaminated sediments in the associated off-base AOC. The selected remedy for Site 8A, on-base drainage channels, and associated off-base AOC described in the FFS as Alternative 3 consists of excavation, surface water controls, dewatering, chemical stabilization, on-base landfilling, capping, institutional controls, and monitoring (TtNUS, 2003a).

The Remedial Action Objectives (RAOs) identified in the FFS for Site 8A, on-base drainage channels, and the associated off-base AOC are as follows:

- Protect human health from the carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated surface soil and sediment.

- Protect human health from the carcinogenic risks associated with ingestion of and dermal contact with on-site and off-site groundwater.

- Comply with federal and State ARARs and TBC guidance criteria in accordance with accepted USEPA and MDEQ guidelines.

The PRGs for the soil ash, contaminated on-base sediments, and contaminated off-base AOC sediments are summarized as follows:

1.1.1.1.1.1.1 Area and Medium	PRG for Dioxin (ng/kg)
Site 8 Soil Ash and Sediment	38.2
Non-Site 8 (on-base) Sediment	38.2
Off-base AOC Sediment	38.2

The selected remedy described in the FFS as Alternative 3 consists of excavating approximately 71,000 yd^3 of soil ash and sediment from Site 8A, on-base drainage channels, and the associated off-

base AOC.[1] Sheet piling and pumping would be used to divert surface water from areas of sediment excavation and SRTs would be installed to minimize contaminated sediment migration. Excavated sediment would be dewatered when required through static stockpiling. Following the excavation and dewatering of the contaminated on-base and contaminated off-base AOC sediment, the soil ash, contaminated sediment, incidental soil resulting from overexcavation, and size-reduced vegetative material would be blended proportionally to form a homogeneous mixture (i.e., material blend). The material blend would then be spread in lifts over Site 8A. Each lift would be chemically stabilized with Portland cement. The stabilized material blend would then be covered with a rigid pavement cap designed in accordance with MDEQ regulations and the AASHTO H20 specifications.

Additional components of the selected remedy include institutional controls and monitoring. Institutional controls will consist of restricting access to the Site 8A stabilized material cap system and controlling future land use. Site 8A will continue to be fenced in and posted. Post-removal site controls (PRSCs) will be developed and implemented to prevent residential development and the use of surface water and groundwater. Institutional controls will also include regular inspection, maintenance, and repair of the Site 8A landfill cap system to ensure its continued structural integrity.

Monitoring will consist of regularly collecting and analyzing samples of groundwater from monitoring wells installed downgradient from the Site 8A cap system to verify that no dioxin is leaching from the landfilled material to the groundwater. Sediment sampling in drainage ditches downgradient of the Site 8A cap system will also be conducted. Monitoring will be performed annually for a period of 30 years. Additionally, monitoring wells will be installed in the off-base area north of Outfall 3 and sampled to monitor dioxin concentrations in groundwater. Every 5 years, the status of the site will be formally reviewed and evaluated to determine the continued effectiveness of this alternative.

4.2 PERFORMANCE STANDARDS

The FFS stipulates that the remedy be capable of managing residuals and achieving RAOs within the boundaries of Site 8A and meet all ARARs for Site 8A, the on-base drainage channels, and the associated off-base AOC. The performance standards specific to the activities proposed for this RA are presented in the following sections.

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[1] Based on volume calculation refinements provided in Appendix B, the estimated volume of contaminated media is currently 72,000 yd^3.

4.2.1 Excavation

Soil ash will be excavated and transported to the materials staging area where it will be stored prior to blending with contaminated sediments. The soil ash is currently located in piles on Site 8A and is a product of soil incineration conducted by the USAF in the mid-1980s. Excavation of soil ash will continue until the stabilized soil/native soil subgrade is encountered. Prior to excavating the soil ash, the area of soil ash excavation will be cleared of brush and other vegetation.

Contaminated sediments will be excavated from on-base drainage channels that receive and convey flow from Site 8. Contaminated sediment will also be excavated from the off-base AOC. Prior to excavation of contaminated sediments from on-base drainage channels and the off-base AOC, these areas will be cleared of trees, brush, and other vegetation. The contaminated sediments from these locations will be transported to the materials handling pad where they will be dewatered and stored prior to blending with soil ash. Excavation of contaminated sediments will continue until verification samples indicate that contaminated sediments have been removed or that concentrations of dioxins are less than the PRGs as indicated in the Verification Sampling and Analysis Plan (TtNUS, 2003c). An area may not be excavated until erosion and sediment controls are in place (see Section 4.2.2).

Sediments removed from the erosion and sediment control devices during general maintenance prior to verification that all of the contaminated sediments have been removed will be conservatively handled as contaminated sediment and will be transported to the materials staging area to be blended, stabilized, and placed on Site 8A. Sediments removed from the erosion and sediment control devices can be used as backfill material after verification that contaminated sediment has been removed from the excavation areas.

Excavation will be performed in accordance with Specification Section 02315N, “Excavation and Fill.”

4.2.2 Erosion and Sediment Control

Before excavation activities begin on site, erosion, sediment, and stormwater control devices will be established to prevent impacts to areas adjacent to and downgradient of the excavation limits. The erosion, sediment, and stormwater control devices will be regularly inspected and maintained during excavation and backfilling operations and until vegetation is established. Erosion, sediment, and stormwater control regulations of the Mississippi Commission on Environmental Quality Regulation WPC-1 will be complied with during these activities.

4.2.3 Chemical Stabilization/Capping

Following the excavation of soil ash at Site 8A and contaminated sediments from both on- and off-base locations, a material blend consisting of appropriate portions of soil ash, on-base contaminated sediments, off-base contaminated sediments, incidental soil resulting from overexcavation, and size-reduced vegetative material will be created. This material blend will then be amended using a stabilizing agent. The stabilized material blend will then be transported to the Site 8A placement area where it will be graded, compacted, and capped with 12 inches of rigid pavement. The rigid pavement will be designed in accordance with the AASHTO H20 specifications. The rigid pavement cap will be designed to allow the area to be used for storage of heavy equipment. The graded sideslopes of the cap will not exceed 25 percent (4H:1V), and its top surface slope will be no less than 2 percent and no greater than 5 percent to preclude ponding of stormwater.

Chemical stabilization (blending and stabilizing) will be performed in accordance with Specification Section 02160A, “Solidification/Stabilization of Contaminated Material” and capping will be performed in accordance with Specification Section 02755A, “Roller-Compacted Concrete Pavement.”

4.2.4 Additional Performance Standards

The selected remedy has associated activities that were not specifically identified in the FFS that must be performed in order to satisfy ARARs. The activities and performance standards are presented in the following sections.

Backfilling/Site Restoration

Backfilling of excavations will be performed when the appropriate PRGs are achieved. Backfilling activities will be staged to minimize impacts to the construction sequence. The excavations located within the on-base drainage channels will be backfilled with 6 inches of topsoil to establish final grades. The excavation located in the off-base AOC will be backfilled with common fill to interim grades (i.e., 6 inches below final grades) and then with 6 inches of topsoil to establish final grades. Following backfilling of excavation areas, the areas of disturbance will be restored. The on-base drainage channels will be vegetated using the specified permanent seed mixture. The off-base AOC will be restored by reestablishing the wetlands using the specified planting schedule. Within the limits of Site 8A, the rigid pavement cap will not require restoration (i.e., vegetation); however, the drainage channels located within the footprint of the site will be restored using the specified permanent seed mixture and riprap.

Backfilling will be performed in accordance with Specification Section 02315N, “Excavation and Fill.” Restoration will be performed in accordance with Specification Section 02953, “Mitigated Wetland Area,

Trees, Herbs, and Grasses." The wetlands disturbed during excavation of contaminated sediment from the off-base AOC will require restoration with indigenous wetland species. The restoration of wetlands will be conducted in accordance with the Mississippi Department of Marine Resources' Coastal Zone Consistency Determination and relevant portions of the Clean Water Act (Sections 404 and 401).

Stormwater Retention

Due to the proposed changes in surface topography at Site 8A, the post-construction site conditions are expected to produce heavier stormwater runoff. Based on a Harrison County local ordinance, if post-construction runoff exceeds pre-construction runoff, storage of increased flow is required. The pre- and post-construction runoff volumes must be evaluated in accordance with the Mississippi Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater (USDA, 1994) using a 25-year, 24-hour storm event.

4.3 VARIATIONS FROM PERFORMANCE STANDARDS

A cap plateau grade of not less than 2 percent or more than 5 percent was specified in the FFS to preclude ponding of stormwater. For this BOD, a minimum cap plateau grade of 1 percent will be used. The 1-percent slope on the plateau (storage area) of the cap will allow for storage of shipping containers. At the same time, this slope will prevent ponding of water on the surface of the cap.

Instead of the sheet piling and pumping method presented in the FFS, SRTs, a temporary access road, temporary channels, and diversion pumping will primarily be used to divert surface water from areas of sediment excavation in the off-base AOC. However, sheet piling may be used in the off-base area to prevent migration during removal. Sheet piling and pumping will likely be used for the excavation of sediments from the on-base drainage channels.

Fly ash and/or other reagents may be used in conjunction with Portland cement to stabilize the material blend. A mixture proportioning study was performed during the pilot-scale treatability study. However, since that time, an increase in the total volume of contaminated sediment in the off-base AOC has been estimated due to results of a vertical delineation study in the off-base AOC (TtNUS, 2003e). The Contractor will be required, by specification, to perform a mixture proportioning study using the new volume estimates and to demonstrate that the new material blend will satisfy PRGs, provide a suitable base for the rigid pavement, and optimize use of material(s) and installation procedures.

In lieu of the multi-layer cap system specified in the FFS, the cap system will consist of a single layer of roller-compacted concrete (RCC) designed to handle passenger vehicle, truck, and heavy fork-lift truck loads.

4.4 MATERIAL AND SOILS MANAGEMENT

The RA includes the excavation, stabilization, and placement beneath the Site 8A cap of soil ash, contaminated on-base sediment, and contaminated off-base AOC sediment, and restoration of on-base drainage channels and wetlands disturbed within the off-base AOC. The specific material/soils management requirements for each of these items along with general material/soils management requirements associated with all aspects of the RD are described in the following sections. Table 4-1 summarizes the cut and fill volumes for the activities that comprise the Site 8 RA.

4.4.1 General Material/Soils Management

The general material/soils management requirements associated with this RD are the installation of the erosion, sediment, and stormwater control features and the clearing and grubbing within the limits of disturbance. The erosion, sediment, and stormwater control features include construction entrances/exits, a temporary access road, on-base haul roads, drainage channels, SRTs, and decontamination pads. The locations of these features are shown on Design Drawings C-6 through C-10.

Construction Entrances/Exits

The construction entrances/exits provide ingress and egress to Site 8A, on-base drainage channels, and the off-base AOC. Eight construction entrances/exits will be constructed as shown on Design Drawing C-13. The entrance/exits are to be 12 feet wide, 50 feet long, and 6 inches thick. Therefore, a total of 89 yd^3 of soil will require excavation for the construction of the entrances/exits. Excavated soils generated from the construction of the entrances/exits will be stockpiled for on-site use.

Off-base Temporary Access Road and Diversion Channel

A temporary access road and diversion channel will be constructed through the off-base AOC to provide continuous access for construction equipment and to divert surface water flow from the excavation area. The temporary access road and diversion channel locations are shown on Design Drawing C-8. The temporary access road will be approximately 3,090 feet long with a width of 20 feet and an average fill height above existing grade of 2 feet. The temporary access road will likely be constructed as a “corduroy” road, which consists of felling trees and placing them side-by side and perpendicular to the road alignment to provide adequate subgrade support. A compacted clean soil base will then be placed above the “corduroy” layer followed by a gravel layer. The diversion channel located adjacent to the road will also be approximately 3,090 feet long with an average slope of 0.1 percent.

Approximately 860 yd^3 of soil will be excavated to construct the temporary diversion channel. Soils excavated to construct the diversion channel will be stockpiled and reused for backfill after removal of contaminated sediments is complete.

When the 1,320 feet of temporary access road was constructed on the Edwards property during the pilot-scale treatability study, approximately 3,100 yd^3 of common fill and 580 yd^3 of gravel/limestone were imported from an off-site borrow source. Assuming that construction is similar for the new section of temporary access road, it is estimated that 7,260 yd^3 of common fill and 1,360 yd^3 of aggregate will be required to construct the temporary access road for the off-base AOC. After contaminated sediment removal and wetland restoration activities are complete, 1,940 yd^3 of aggregate from the new and pilot-scale study access roads will be removed and stockpiled on site for future use. In addition, approximately one half of the common fill used to construct the new and pilot-scale study access roads (5,180 yd^3) will be removed and stockpiled on site for future use. Minimal characterization of the common fill and aggregate may be required, depending on the desired future use of the material.

On-base Haul Roads

To access the required reaches of on-base drainage channels, approximately 3,150 feet of haul road will be constructed. The haul roads will be constructed on the ground surface as shown on Design Drawing C-26. Construction of the haul roads will require a 6-inch-deep excavation that is 15 feet wide and 3,150 feet long. The location of the on-base haul roads is provided on Design Drawing C-6. This excavation will result in 875 yd^3 of excavated soil to be stockpiled on site to be used to restore the area after the haul roads are removed. To construct the haul roads, approximately 875 yd^3 of aggregate and 5,250 yd^2 of geotextile will be required.

Decontamination Pad

The decontamination pads shown on Design Drawings C-7 through C-10 will be used to clean haul trucks leaving the site and construction equipment used to haul and excavate soil ash and contaminated sediment. The pad will be constructed as shown on Design Drawing C-13. No earthen cut or fill is required for the construction of the decontamination pads.

Materials Handling Pad

The materials handling pad shown on Design Drawing C-7 will be used to stockpile excavated soil ash, on-base contaminated sediment, off-base contaminated sediment, and miscellaneous soils resulting from overexcavation. The materials handling pad will be constructed as indicated on Design Drawing C-14.

Although no earthen cut is required for the construction of the materials handling pad, 6 inches of aggregate will be required throughout the materials handling pad area, and common fill will be required to construct the berms. It is estimated that 3,390 yd^3 of aggregate and 370 yd^3 of common fill will be required to construct the materials handling pad.

Clearing and Grubbing

Clearing and grubbing will be done within the limits of disturbance identified on Design Drawings C-6 through C-10. Grubbed material from within contaminated sediment areas is addressed below. Clean soil excavated during grubbing activities will be stockpiled for reuse during restoration activities.

4.4.2 Remediation of Soil Ash and Contaminated Sediment

The material/soils management tasks associated with the remediation of soil ash and contaminated sediment include excavating soil ash and contaminated sediment, hauling soil ash and contaminated sediment to Site 8A, stabilization, and constructing a structural cap over the stabilized material. The limits of contaminated sediment presented on Design Drawings C-1 through C-5 were determined based on terrain changes and delineation sampling conducted at Site 8, the on-base drainage channels, and the associated off-base AOC (ABB-ES, 1998a; HLA 1998, 1999a, and 1999c). The locations of the sediment samples collected during the previous investigations are presented on Figures 2-8 through 2-10 and Figure 2-12. Following excavation, the contaminated sediment will be placed within a materials handling pad to allow free liquids to drain from the material before blending with soil ash, incidental soil resulting from overexcavation, and size-reduced vegetative material. Leachate is not anticipated to contain dioxin at concentrations greater than regulatory criteria based on leachate sampling conducted during the pilot-scale study. During stabilization activities, residual leachate will be driven off by the heat of hydration that occurs upon the addition of Portland cement to the material blend. Residual leachate will also incidentally hydrate the Portland cement.

The total in-place volume of soil ash and incidental soil to be excavated at Site 8A is approximately 23,000 yd^3. The total in-place volume of contaminated on-base sediments including incidental soil resulting from overexcavation is 20,200 yd^3. The total in-place volume of contaminated off-base AOC sediments including incidental soil resulting from overexcavation is approximately 27,725 yd^3. Sediment excavation volumes are based on the assumption that confirmation sampling will indicate that the sediment remaining after initial excavation meets the RAOs.

It is anticipated that the water resulting from dewatering operations will require only clarification through an approved sedimentation device (e.g., sediment tank) and will not require further treatment. This assumption is based on the contaminants' tendency to adhere to suspended solids and the results of the

pilot-scale treatability study. The settled solids collected in the bottom of the sediment tank will be periodically removed and blended into the remediation process.

4.4.3 Wetlands Restoration

The excavation of sediment in the off-base AOC will be performed solely in the wetland. The excavated contaminated material volume was addressed in Section 4.4.2, and the material required for wetland restoration was addressed in Section 4.4.1. The extent of restored wetland is presented in Design Drawing C-22.

4.5 STABILIZED MATERIAL BLEND

The material blend will be stabilized[2] such that dioxin contamination does not leach from the material and to provide a base layer capable of supporting the RCC pavement. The Contractor will be required, through specification, to conduct mix design studies and field studies to demonstrate the effectiveness of the final mix design in meeting the specified performance criteria. The stabilized material blend will be placed within a 13-acre area (i.e., Site 8A "footprint") as indicated on Design Drawings C-23 and C-24 and will range in thickness from 0.5 to 5 feet. The material blend will be stabilized to achieve a minimum 90-day compressive strength of 50 psi. A pigment may be added to the top 6 inches of the stabilized material blend to differentiate the stabilized material blend from the overlying RCC pavement in the event that the RCC pavement deteriorates. In addition, the top 6 inches of the stabilized material blend will have a minimum 90-day compressive strength of 500 psi to provide a non-erodable base.

4.6 CAP LIMITS

The stabilized material blend within the limits of Site 8A will be covered with a 12-inch-thick RCC pavement cap. The cap limits will extend over the stabilized material blend as indicated on Design Drawings C-23 and C-24. Because Site 8A was verified clean following the incineration of contaminated soils performed by the USAF in 1987, the RCC cap is only required where the stabilized material blend will be placed.

4.7 CAP DESIGN

The cap consists of a 12-inch-thick RCC pavement selected by the Navy to prevent contact with the underlying stabilized material blend and to provide a surface suitable for equipment and material storage

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[2] The material blend is stabilized chemically; however, in the context of pavement design, the material blend is a "modified" soil because it does not meet the strength criteria for stabilization, which typically requires an unconfined compressive strength of 200 psi and 500 psi for subbase and base courses, respectively (USACE, 1994).

after construction. The integrity of the RCC pavement must be maintained to assure receptors will not come in contact with the underlying stabilized material blend. The design is therefore controlled by the RCC pavement's ability to support structural loads, namely vehicular loading.

4.7.1 Cap Structural Design

The RCC pavement was designed to support anticipated vehicular loads and load repetitions based on the theoretical analysis of Westergaard supplemented by empirical modifications determined from accelerated traffic tests and observations of pavement behavior under actual service conditions (USACE, 1992b). The RCC pavement design is based on no-load transfer at the joints (i.e., all joints and cracks are assumed to be a free-edge condition) (USACE, 1992b). The RCC pavement design is dependent on the anticipated traffic loads (i.e., passenger cars, trucks, and heavy fork-lift trucks), number of load repetitions, soil subgrade strength (i.e., modulus of subgrade reaction), and RCC flexural strength. The heavy fork-lift truck at 120,000 pounds (120 kips) controlled the RCC design. The RCC pavement base and subbase layers (i.e., subgrade) will consist of the stabilized material blend having minimum 90-day compressive strengths of 500 psi and 50 psi, respectively. The RCC pavement design is based on a subgrade with compressive strength of 50 psi. The compressive strength of the top 6 inches of the subgrade (i.e., base layer) is increased to 500 psi to provide a highly erosion-resistant base. A 12-inch-thick RCC pavement with minimum 90-day compressive strength of 2,000 psi is adequate to support passenger car and truck loads with a design index (DI) of 10 absent heavy pneumatic tire loads; however, the RCC pavement would likely be inadequate to support the anticipated heavy fork-lift truck loads. In day compressive strength of the RCC pavement must be a minimum of 4,000 psi. Specifying a 4,000 psi 28-day compressive strength was judged appropriate because it provided an increase of 400,000 load repetitions over the load repetitions that the 3,500-psi compressive strength could withstand and is more appropriate to withstand anticipated wear from heavy fork-lift operations. The RCC pavement calculation is provided in Appendix B.

The specifications reflect the following criteria based on the design calculations:

- Subgrade consists of base and subbase layers (i.e., stabilized material blend). The subbase will have a minimum compressive strength of 50 psi and the base (top 6 inches) will have a minimum compressive strength of 500 psi to provide a highly erosion resistant base.

- RCC pavement will have a minimum 28-day compressive strength of 4,000 psi and be constructed in two lifts with full bonding condition.

- Minimum finished RCC pavement thickness will be 12 inches.

4.7.2 Settlement Analysis

Settlement analysis was performed to estimate the differential settlement impact on the slope of the RCC pavement. The settlement of the shallow sand underlying the site will occur nearly instantaneously during construction as the stabilized material blend and RCC pavement layers are placed. The pavement slope at completion of construction will be 1.00 percent. The estimated long-term differential settlement between the peak of the RCC pavement and the crest of the sideslope will result in a decrease in slope by 0.06 percent for a final slope after settlement of 0.94 percent. Surface water will therefore drain from the RCC pavement surface. The RCC pavement settlement calculation is provided in Appendix B.

4.8 WETLAND MITIGATION

Wetland mitigation measures are an integral element in the RD for Site 8. Mitigation is defined by the Council on Environmental Quality (CEQ) as avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time, and compensating for impacts (40 CFR 1508.20). For mitigation of wetland impacts, the USEPA encourages a sequential approach considering (in order) avoidance measures, minimization measures, and compensatory mitigation measures (USEPA, 1997b). Avoidance of wetland disturbance was considered as part of the FFS. The RD includes best management practices intended to minimize sedimentation of wetlands adjoining soils temporarily exposed by the proposed excavation work. Compensatory restoration of wetlands disturbed by excavation is incorporated into the RD.

4.8.1 Description of Proposed Wetland Impacts

The proposed RA will result in the disturbance of approximately 824,200 square feet (18.9 acres) of wetlands within the off-base AOC. Approximately 523,600 square feet (12.0 acres) of the wetlands will be disturbed by the excavation of contaminated sediment. This acreage includes approximately 24,600 square feet (0.6 acre) of wetlands that were disturbed on the Edwards property during the pilot-scale treatability study and approximately 499,100 square feet (11.5 acres) of wetlands that will be disturbed on the Arndt and Bennett properties during the RA. The affected wetlands are forested wetlands dominated by slash pine, baldcypress, and swamp tupelo. Approximately 66,600 square feet (1.5 acres) of the wetlands will be disturbed by construction of a temporary access road approximately 22 feet in width. The remaining 234,000 square feet (5.4 acres) of wetlands will require forest removal to accommodate work in adjoining areas and to provide trees for use in constructing a temporary access road.

Work within the affected wetlands will commence with clearing and grubbing of forest vegetation. A temporary access road will be constructed as a “corduroy” road, which consists of felling trees and

placing them side-by-side and perpendicular to the road alignment to provide adequate subgrade support. A compacted soil base is then placed above the "corduroy" layer followed by a gravel layer. Approximately 27,700 yd^3 of off-base AOC sediment will then be excavated from the wetland area contained within the Arndt and Bennett properties.

4.8.2 Wetland Mitigation Concept

Wetlands disturbed by excavation will be restored in situ. The excavated wetlands will be restored to the original (existing) grade using clean fill and topsoil, seeded with regionally indigenous wetland herbs, and allowed to develop as emergent wetlands (marshes). The restored areas will simultaneously be planted with regionally indigenous tree seedlings, which will progressively shade out the herbs and ultimately recreate forested wetland vegetation. The soil and gravel will be removed from the temporary access road but the logs, which are biodegradable, will be left in place. Although it will not be possible to seed plants or plant trees on top of the logs, the logs will decay and allow natural wetland vegetation to gradually re-establish. The decaying logs will slowly contribute organic matter to the wetland soils, enhancing the future growth of wetland vegetation. In the meantime, the logs will provide cover and den sites for reptiles and mammals.

Avoidance Measures – The FFS examined several alternatives for remediating the contaminated on- and off-base AOC sediments, including a no action alternative. It concluded that the preferred alternative is the most effective and cost-efficient approach to protecting human health and the environment. Not taking action to remove the contaminated sediments from the wetlands on the off-base AOC will leave the wetland ecosystem indefinitely exposed to dioxins.

Minimization Measures – The RD specifies using best management practices throughout the excavation process to minimize sedimentation of adjoining wetlands outside of the proposed project footprint. These practices include the use of super silt fences on the perimeter of the excavated wetlands and temporary and permanent vegetative stabilization of exposed soils (see Erosion, Sediment, and Stormwater Control Plan). Temporary sediment traps will be installed within the excavated wetlands to reduce the potential for sedimentation of adjoining undisturbed wetlands.

Compensatory Mitigation Measures – Compensatory mitigation will consist of restoring the excavated wetlands using clean fill and topsoil followed by establishing regionally indigenous wetland vegetation. The biodegradable tree trunks used to construct the temporary access road will be left in place to naturally decompose, allowing indigenous wetland vegetation to establish amidst the decaying organic matter. The net result will be no net loss of wetlands. Because it is possible to achieve no net loss through on-site wetland restoration, off-site wetland creation was not considered as a mitigation measure.

4.8.3 Proposed Grading and Hydrology

The excavated wetlands will be filled with clean soil and topsoil to restore its existing elevations. Available information indicates that the wetlands are the result of a seasonally high water table. It is therefore expected that restoration of the existing elevations will effectively restore the original hydrological regime. No water control structures will be installed, and no other effort will be made to artificially manipulate the hydrological regime. Six 30-inch-diameter corrugated metal culverts will be constructed under the access road to allow for unimpeded movement of surface water and to prevent increased ponding in adjoining areas of undisturbed wetlands during construction. The culverts will be removed when the excavation work is completed, but the resulting breaches in the road's base will continue to allow surface flow.

4.8.4 Proposed Topsoil Application

Excavated areas will be backfilled with clean fill soil. The upper 6 inches of fill soil will consist of clean, medium-texture topsoil with a minimum organic matter content of 5 percent and a maximum of 8 percent. The topsoil will be obtained from locations free of invasive plant species. The topsoil will be rolled, disked, and harrowed to create a seedbed. However, small imperfections in the soil surface will be allowed to persist, thereby simulating the irregular micro-topography inherent in most natural wetland soils.

The specifications call for the pH of the topsoil to be between 5.0 and 6.0. This pH range is more acidic than normally specified for topsoils used in revegetation. The natural pH of the plant rooting zone (upper 12 inches) for the Plummer and Hyde soil series prevalent in the subject wetlands is reported to range between 4.5 and 5.5 (SCS, 1975). Many plants indigenous to poorly and very poorly drained wetland soils in the coastal plain of the southeastern United States are adapted to acidic soil conditions and might not as readily colonize higher pH topsoil. However, use of topsoil with a pH of less than 5.0 might retard the growth of some species.

4.8.5 Proposed Revegetation

Following installation of the topsoil, the soil surface in the disturbed wetlands will be hydroseeded with a commercially available wetland seed mixture appropriate for nontidal marshes in the coastal plain of Mississippi. Such mixtures typically consist of seed from indigenous rush (*Juncus* sp.), bulrush (*Scirpus* sp.), and sedge (*Carex* sp.) species intermixed with seed from various indigenous wildflowers. The rushes and bulrushes typically grow rapidly and provide good soil stabilization, while the sedges and wildflowers typically grow slowly and increase the vegetative diversity of the stand and its appeal to wildlife. Seeding will be timed to coincide with periods when the soil surface is saturated but not

inundated. Certain areas that are permanently inundated might require hand planting of appropriate rush and/or bulrush seedlings.

The seeded areas will also be planted with bare-root seedlings of slash pine (*Pinus elliottii*), baldcypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), water oak (*Quercus nigra*), and water hickory (*Carya aquatica*) spaced on staggered 10-foot centers. The first three species are dominant in the existing forest vegetation in the affected wetlands. Slash pine and baldcypress are commonly raised in commercial forest plantations, and all are available as seedlings from commercial suppliers specializing in native plant material. Water oak and water hickory are heavy-seeded tree species common in nontidal swamps in coastal Mississippi but are generally slow to disperse and colonize new areas. Unlike many light-seeded species that can be expected to rapidly colonize the restored wetlands, such heavy-seeded species will not readily colonize unless planted.

The other dominant trees and shrubs in the affected wetlands are not as readily available and will not be planted. However, it is expected that intact wetland vegetation adjoining the restored areas will serve as a seed source that will naturally reintroduce these species. The growing trees will eventually create shaded conditions conducive to the establishment of the other tree and shrub species through natural succession.

Table 4-2 outlines the proposed revegetation of the wetlands on the off-base AOC. Seeding will be performed as soon as verification sampling determines that PRGs have been achieved. Seeding of some areas might be delayed if more than 1 inch of standing surface water is present or if surface soils are dry. Tree seedlings will be planted in early spring while deciduous species are dormant, between February 15 and April 15. Tree planting will be delayed in areas with more than 1 inch of standing water. Tree seedlings, especially those of baldcypress, can be quite exacting with respect to site conditions (Clewell and Lea, 1990; Williston *et al*., 1980). For example, baldcypress seedlings require continuously moist soils but can be killed by submergence for as little as 2 or 3 days (Williston *et al*., 1980).

Plastic tree guards will be installed around each seedling at the time of planting to protect against browsing or other physical damage by wildlife. It is expected that the growth of the seedlings will result in a closed-canopy wetland forest in 30 to 50 years.

4.8.6 Maintenance and Monitoring

The wetland restoration has been designed to minimize the need for maintenance following the initial establishment of wetland vegetation. The wetland seeding will be monitored at least once every 2 weeks until satisfactory germination is achieved. Satisfactory germination will be defined as at least 60 percent ground coverage by the germinated stand, with no bare areas exceeding 100 square feet. Supplemental

seeding (overseeding and/or patch seeding) will be performed as necessary to achieve satisfactory germination. Adjustments in the seed composition, soil amendments, or timing of application will be made as necessary to ensure that supplemental seeding events are successful.

After successful germination is attained, the restored wetlands will be monitored on a regular basis for 5 years or until it is determined that the wetlands are successfully re-established and functioning properly. Planted tree seedlings and germinated herbaceous cover will be inspected for survival, and interim measures will be developed and implemented as necessary to ensure adequate survival. Dead, diseased, or damaged vegetation will be replaced unless it is determined that adequate vegetation that is regionally indigenous has become established through natural succession (i.e., has volunteered). Invasive vegetation such as Phragmites will be killed or removed if found to be inhibiting establishment of desired vegetation.

4.9 EROSION, SEDIMENT, AND STORMWATER MANAGEMENT REQUIREMENTS

4.9.1 Erosion and Sediment Control

An erosion, sediment, and stormwater control plan was prepared and is included in this RD submission. The plan was prepared in accordance with State of Mississippi regulations as set forth in the Mississippi Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater (USDA, 1994). Runoff quality during the RA is addressed via erosion, sediment, and stormwater control devices located around the perimeter of disturbed areas. Refer to the Erosion, Sediment, and Stormwater Control Plan Report for detailed information regarding the planned controls as well as pre- and post-construction runoff calculations.

4.9.2 Stormwater Management

Site 8A will be capped with an RCC pavement that will increase surface water runoff from the site. To convey and store this increased flow, oversized surface water drainage channels will be constructed at the toe of slope or limits of cap to convey surface water runoff from the cap to the existing system of drainage channels. At one location, a Class III reinforced concrete pipe will be placed beneath the stabilized material blend (see Appendix B). In addition, the newly constructed drainage channels will be grass lined with permanent erosion control matting, and portions of the channels will be lined with riprap to reduce flow velocity from the RCC cap as it enters the drainage channels.

To provide additional on-base storage capacity to contain the slight increase in surface water runoff, on-base channels will be overexcavated to allow topsoil placement. This will provide additional flow area in the on-base channels once the contaminated sediment is removed.

The remaining areas within the limits of disturbance (on-base drainage channels and off-base AOC) will be returned to pre-construction conditions. Therefore, these areas will not require permanent stormwater control features.

4.9.3 Floodplain Protection Measures

Although the 100-year floodplain extends to an elevation of 31 feet above seal level around Site 8, it is not anticipated that any additional protection of the floodplain will be required other than the RCC cap covering Site 8A.

4.10 OTHER DESIGN REQUIREMENTS

4.10.1 Utilities

Underground utilities exist near Site 8A along Seventh and Ninth Streets and may exist within the off-base AOC. The Contractor will be obligated through specification to verify all utility locations and adequately protect the utilities before any earth-disturbing activities commence.

4.10.2 Groundwater Monitoring Wells

As part of the RA, three monitoring wells (APT-A-2, APT-A-3, and APT-A-4) within the limits of Site 8A and six temporary wells (WG001, WG002, WG003, WG004, WG005, and WG006) within the off-base AOC will be plugged and abandoned in accordance with the USEPA Region 4 Environmental Investigation Standard Operating Procedures and Quality Assurance Manual (EISOPQAM, 2001). This monitoring well abandonment procedure consists of backfilling the monitoring well with cement-bentonite grout using a tremie pipe to within 5 feet of the existing ground surface. The monitoring well steel casing and riser will then be cut off at a depth of 5 feet below existing grade and the remaining void space backfilled with fill material. The temporary wells, which are constructed similar to well points, will be removed using a backhoe or other excavation type equipment. The abandonment and removal of monitoring wells and temporary wells will be documented.

4.10.3 Maintenance and Repair

Should any cracks appear in the RCC cap, they will be mechanically routed and sealed. Restored wetlands will be monitored, maintained, and repaired as described in Section 4.8.6.

4.11 POST-REMEDIAL ACTION VERIFICATION SAMPLING

Verification sampling will be performed to confirm that RA activities sufficiently achieve the remedial objectives. The Verification Sampling and Analysis Plan (VSAP) for the Site 8 RA specifically:

- Presents the plan to confirm that dioxin-contaminated sediments excavated from the on-base drainage channels and off-base AOC are successfully removed to levels less than the dioxin PRG of 38.2 ng/kg.

- Presents the plan to verify that off-base groundwater does not contain dioxin concentrations greater than 30 pg/L (to be implemented after sediment removal in the off-base AOC is complete).

- Outlines the plan to verify that the subgrade of the materials handling pad to be used during the RA contains dioxin concentrations less than 38.2 ng/kg.

In the event that additional excavation is required, it will be followed by additional verification sampling. Verification activities contained within the VSAP were prepared using the Michigan Department of Environmental Quality guidance document entitled “Verification of Soil Remediation” (Michigan DEQ, 1994). For additional information, refer to the VSAP (TtNUS, 2003c).

4.12 IMPLEMENTATION

The Contractor shall coordinate field work through the Base Environmental and Safety office for specific requirements related to Site 8 and the associated off-base AOC.

TABLE 4-1

MATERIAL/SOILS MANAGEMENT SUMMARY
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

Location/Source	Area (ft^2)	Excavation [1] (yd^3)	Fill [1] (yd^3)	Material Disposition
General (Erosion, Sediment, and Stormwater Control Facilities)				
Construction entrances/exits (8 locations)	4,800	89	89	Stockpile on site for reuse
Materials handling pad	183,060	NA	3,760	Site 8B materials handling pad
Temporary diversion channel	24,720	860	NA	Stockpile on site for reuse
Temporary access road (aggregate)	61,800	NA	1,360	Off-base AOC
Temporary access road (common fill)	61,800	NA	7,260	Off-base AOC
Haul roads	47,250	875	875	Stockpile on site for reuse
Decontamination pads	TBD	NA	NA	Off-base AOC, Site 8A, and Site 8B
Contaminated Media Excavation and Stabilization				
Material currently contained within Site 8A	553,000	ND	NA	Site 8B materials handling pad
Soil ash/incidental native soil	ND	23,068	NA	Site 8B materials handling pad
Site 8B and 8C Sediments from October 2002 excavation (CCI, 2003)	ND	2,600	NA	Site 8B materials handling pad
Edwards property sediment excavation (TtNUS, 2002)	ND	1,030	NA	Site 8B materials handling pad
Site 8A drainage channels	ND	1,198	NA	Site 8B materials handling pad
On-base drainage channels outside boundaries of Sites 8A, 8B, and 8C	ND	16,417	NA	Site 8B materials handling pad
Off-base contaminated sediments	499,050	27,725	NA	Site 8B materials handling pad
Total volume of material blend	NA	72,038	NA	
Site Restoration				
Site 8A (RCC)	473,190	NA	17,526	Limits of cap, Site 8A
Site 8A (high-strength stabilized material blend)	473,190	NA	8,763	Limits of cap, Site 8A
Site 8A (low-strength stabilized material blend)	473,190	NA	63,275	Limits of cap, Site 8A
Site 8A (structural fill)	ND	NA	8,060	Limits of cap, Site 8A
Site 8A (common fill)	79,810	NA	1,478	Site 8A drainage channels
Site 8A (topsoil)	79,810	NA	1,478	Site 8A drainage channels
On-base Drainage Channels (topsoil)	681,142	NA	12,945	On-base drainage channels
Off-base AOC (common fill)	499,050	NA	18,936	Off-base AOC
Off-base AOC (topsoil)	499,050	NA	9,695	Off-base AOC

1 Refer to Material Volume Calculation provided in Appendix B.

ND Not determined
NA Not applicable

RCC = Roller Compacted Concrete
TBD = To Be Determined

TABLE 4-2

PLANT SCHEDULE
OFF-BASE AOC WETLAND RESTORATION
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

Botanical Name	Common Name	Quantity Per Acre	Form	Unit	Size	Notes
Pinus elliotii	Slash Pine	101	Tree	BR	1-year	1. 20% of Trees 2. Space Trees 10' OC
Taxodium Distichum	Baldcypress	100	Tree	BR	1-year	1. 20% of Trees 2. Space Trees 10' OC
Nyssa aquatica	Water Tupelo	101	Tree	BR	1-year	1. 20% of Trees 2. Space Trees 10' OC
Quercus nigra	Water Oak	100	Tree	BR	1-year	1. 1. 20% of Trees 2. Space Trees 10' OC
Carya aquatica	Water Hickory	101	Tree	BR	1-year	1. 20% of Trees 2. Space Trees 10' OC
Wetland-Seed Mixture		50	Herbs	Seed	Pound PLS	Application rate could vary depending on specific seed mixture selected. Use only a mix suited to coastal plain in Mississippi.

BR - bare root
OC - on center (staggered grid)
Lb - pound
PLS - Pure Live Seed

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APPENDIX A

SUBSURFACE INVESTIGATION LOGS

A.1 BORING LOG SHEETS

A.2 GEOTECHNICAL LABORATORY RESULTS

A.3 MONITORING WELL SURVEY DATA

A.1 BORING LOG SHEETS

:LD BORING LOG			BORING NO.: GPT-A-01
;JECT NO.: 8504.30	PROJECT NAME: NCBC H.O. II		PAGE 1 OF 1
.LING CONTRACTOR: Ivey Drilling	DRILLER: E. Fuller	DATE STARTED: 4-12-94	COMPLETED: 4-12-94
'HOD: HSA	AUGER SIZE: 4.25"	OVA: FID	PROTECTION LEVEL: MODIFIED LEVEL D
)UND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: 3.0'	TOTAL DEPTH: 15'
;GED BY: R. Fisher	CHECKED BY: R. Fisher	DATE: 4-12-94	

\MPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. REC.	DESCRIPTION	LAB	FIELD SCREENING FID	FIELD SCREENING UV\IR	MONITORING TIP	MONITORING LEL
	0 - 3	HSA		Dark brown and gray silty clay with some sand, cohesive and dry		0 ppm			
	3 - 5	2,4,3,8	24/8	Gray fine to medium sand with some silt, moist		70 ppm			
	5 - 7	5,10,11,12	24/22	5.0' - 6.5' gray fine to medium sand, wet		70 ppm			
				6.5' - 7.0' dark brown medium sand with some silt, wet		30 ppm			
T-A-01	7 - 9	1,3,4,8	24/16	7.0' - 8.0' dark brown silty sand, wet		20 ppm			
				8.0' - 9.0' dark brown medium sand with some fine sand, wet		10 ppm			
	9 - 11	6,6,7,12	24/18	Dark brown medium sand, fine gravel lens at 10'		0 ppm			
	11 - 13	3,5,14,21	24/18	11.0' - 12.0' dark brown medium sand		0 ppm			
				12.0' - 13.0' fine to medium gray sand, wet		0 ppm			
	13 - 15	2,2,7,9	24/20	Light gray fine sand with some silt, wet		0 ppm			

TITLE: Gulfport HO II	LOG of WELL: GPT-A-01	BORING NO. GPT-A-01
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM		PROJECT NO: 8504-30
CONTRACTOR: Ivey Drilling	DATE STARTED: 04/12/84	COMPLTD: 04/12/84
METHOD: HSA	CASE SIZE: 2"	BORING DIA.: 8.75"	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: FID	TOT DPTH: 15.0FT.	DPTH TO ∇ 3.0 FT.
LOGGED BY: R. Fisher	WELL DEVELOPMENT DATE: 4/18/84	SITE: Site A, Former HO Storage Area

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	
				0	Silty clay, dark brown and gray with some sand, cohesive and dry.		CL	
				70	Sand, fine to medium with some silt, gray, moist.		SM	2,4,3,8
			8"					
5				70	Sand, fine to medium, gray, wet.			5,10,11,12
			22"					
				30	Sand, medium with some silt, dark brown, wet.			
				20	Silty sand, dark brown, wet.			1,3,4,8
			16"	10	Sand, medium with some fine, dark brown, wet.			
				0	Sand, medium, dark brown. Fine gravel lens at 10 ft.			6,6,7,12
10			18"					
				0	Sand, medium, dark brown.			3,5,14,21
			18"		Sand, fine to medium, gray, wet.			
				0	Sand, fine with some silt, light gray, wet.			2,2,7,8
			20"					
15					total depth = 15.0 ft.			
20								

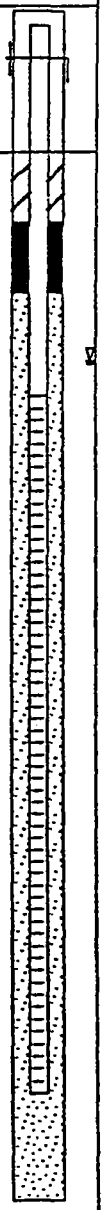

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ABB ENVIRONMENTAL SERVICES, INC.

:LD BORING LOG			BORING NO.: GPT-A-02
JECT NO.: 8504.30	PROJECT NAME: NCBC H.O. II		PAGE 1 OF 1
LLING CONTRACTOR: Ivey Drilling	DRILLER: E. Fuller	DATE STARTED: 4-13-94	COMPLETED: 4-13-94
THOD: HSA	AUGER SIZE: 4.25"	OVA: FID	PROTECTION LEVEL: LEVEL B
OUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL:	TOTAL DEPTH: 14'
GED BY: R. Fisher	CHECKED BY: R. Fisher		DATE: 4-13-94

AMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. REC.	DESCRIPTION	LAB	FIELD SCREENING FID	FIELD SCREENING UV\IR	MONITORING TIP	MONITORING LEL
	0 - 2	HSA		Tan/buff fine to medium sand with little silt, dry		0 ppm			
	2 - 4	3,5,5,6	24/10	Tan/buff fine to medium sand with little silt, wet		3 ppm			
	4 - 6	3,10,11,15	24/18	Tan/buff fine to medium sand with little silt, wet		3 ppm			
	6 - 8	1,1,9,11	24/16	Dark brown fine to medium sand with little silt, wet		2 ppm			
	8 - 10	5,6,7,10	24/20	Dark brown fine to medium sand with little silt, wet		0 ppm			
	10 - 12	1,5,4,7	24/24	Brown medium sand with fine gravel and a trace of cobble, wet		0 ppm			
	12 - 14	2,3,6,11	24/24	Brown medium sand with fine gravel and a trace of cobble, wet		0 ppm			
				Terminate boring at 14' bgs. Redrill with plug for monitoring well.					

TITLE: Gulfport HO II	LOG of WELL: GPT-A-02		BORING NO. GPT-A-02
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			PROJECT NO: 8504-30
CONTRACTOR: Ivey Drilling		DATE STARTED: 04/13/94	COMPLTD: 04/13/94
METHOD: HSA	CASE SIZE: 2"	BORING DIA.: 8.75"	PROTECTION LEVEL: B
TOC ELEV.: NA FT.	MONITOR INST.: FID	TOT DPTH: 14.0FT.	DPTH TO ∇ FT.
LOGGED BY: R. Fisher	WELL DEVELOPMENT DATE: 4/17/94		SITE: Site A, Former HO Storage A

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	
				0	Sand, fine to medium with little silt, tan/buff, dry, fill.		SM	
			10"	3	Sand, fine to medium with little silt, tan/buff, wet.			3,5,5,6
5			18"	3	Sand, fine to medium with little silt, tan/buff, wet.			3,10,11,15
			18"	2	Sand, fine to medium with little silt, dark brown, wet.			1,1,8,11
			20"	0	Sand, fine to medium with little silt, dark brown, wet.			5,6,7,10
10			24"	0	Sand, medium with fine gravel and a trace of cobble, brown, wet.			1,5,4,7
			24"	0	Sand, medium with fine gravel and a trace of cobble, brown, wet.			2,3,8,11
					total depth = 14.0 ft.			
15								
20								

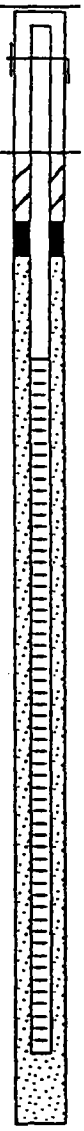

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ABB ENVIRONMENTAL SERVICES, INC.

LD BORING LOG			BORING NO.: GPT-A-03
JECT NO.: 8504.30	PROJECT NAME: NCBC H.O. II		PAGE 1 OF 1
LING CONTRACTOR: Ivey Drilling	DRILLER: E. Fuller	DATE STARTED: 4-14-94	COMPLETED: 4-14-94
HOD: HSA	AUGER SIZE: 4.25"	OVA: FID	PROTECTION LEVEL: LEVEL B
UND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: 3.5'	TOTAL DEPTH: 14'
GED BY: R. Fisher	CHECKED BY: R. Fisher	DATE: 4-14-94	

MPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. REC.	DESCRIPTION	LAB	FIELD SCREENING FID	FIELD SCREENING UV\IR	MONITORING TIP	MONITORING LEL
	0 - 3	HSA		Silt with same sand, cohesive, moist		5 ppm			
	3 - 8	HSA		Fine to medium sand, light brown with some silt, moist to wet		60 ppm max.			
	8 - 14	HSA		Fine to medium sand, light brown with some silt, wet		10 ppm			

TITLE: Gulfport HO II	LOG of WELL: GPT-A-03	BORING NO. GPT-A-03
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM		PROJECT NO: 8504-30
CONTRACTOR: Ivey Drilling	DATE STARTED: 04/14/94	COMPLTD: 04/14/94
METHOD: HSA	CASE SIZE: 2" / BORING DIA.: 8.75"	PROTECTION LEVEL: B
TOC ELEV.: NA FT.	MONITOR INST.: FID / TOT DPTH: 14.0FT.	DPTH TO ∇ FT.
LOGGED BY: R. Fisher	WELL DEVELOPMENT DATE: 4/16/94	SITE: Site A, Former HO Storage Ar

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS
				5	Silt, with some sand, cohesive, moist.		SM
				80 max	Sand, fine to medium with some silt, light brown, moist to wet.		
5							
				10	Sand, fine to medium with some silt, light brown, wet.		
10							
					total depth = 14.0 ft.		
15							
20							

ELD BORING LOG			BORING NO.: GPT-A-04
OJECT NO.: 8504.30	PROJECT NAME: NCBC H.O. II		PAGE 1 OF 1
ILLING CONTRACTOR: Ivey Drilling	DRILLER: E. Fuller	DATE STARTED: 4-14-94	COMPLETED: 4-14-94
THOD: HSA	AUGER SIZE: 4.25"	OVA: FID	PROTECTION LEVEL: LEVEL B
OUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: 3.5'	TOTAL DEPTH: 13'
GGED BY: R. Fisher	CHECKED BY: R. Fisher	DATE: 4-14-94	

AMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 2			Light brown silty sand, fill		0 ppm			
	2 - 13			Gray medium sand with fine sand and little silt		50 ppm at 8' bgs			
				Terminate boring at 13'					

TITLE: Gulfport HO II		LOG of WELL: GPT-A-04	BORING NO. GPT-A-04
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			PROJECT NO: 8504-30
CONTRACTOR: Ivey Drilling		DATE STARTED: 04/14/94	COMPLTD: 04/14/94
METHOD: HSA	CASE SIZE: 2"	BORING DIA.: 8.75"	PROTECTION LEVEL: B
TOC ELEV.: NA FT.	MONITOR INST.: FID	TOT DPTH: 13.0FT.	DPTH TO ∇ FT.
LOGGED BY: R. Fisher	WELL DEVELOPMENT DATE: 4/18/94		SITE: Site A, Former HO Storage

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS
				0	Silty sand, light brown, fill		SM
					Sand, medium with fine, little silt, gray.		
5							
				50			
10							
					total depth = 13.0 ft.		
15							
20							

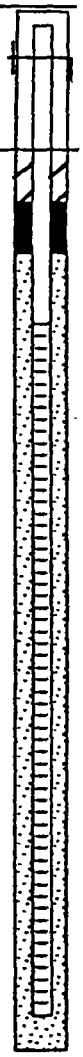

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ABB ENVIRONMENTAL SERVICES, INC.

Boring No.: GPT-08-05	Date Drilled: 2/2/99
Logged By: D. Carigan/R. Fields	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Depth 25 Ft.
Ground Elevation 31.99' msl	

Depth (ft)		Sample Despcription	USCS Symbol	Graphic Log
	0-1'	Fill material, brown/orange silty sand	SM	
2	1-3'	Medium brown, fine- to medium-grained sand, some silt	SM	
4	3-5'	Medium gray grading to orange/tan, fine- to medium-grained sand with some silt	SM	
6	5-6'	Very light tan, medium to fine sand with small amount of silt	SM	
	6-7'	Light tan, medium to fine sand with some silt	SP	
8	7-8'	Medium gray/tan, medium to fine sand with some silt	SP	
10	8-12'	Medium brown/dark dray, medium to fine sand with some silt	SP	
12				
14	12-14'	Dark brown, medium to fine sand with some silt	SP	
16	14-16'	Dark brown grading to medium brown/gray, medium to fine sand, some fine gravel	SP	
	16-17'	Light brown, fine to medium sand with some silt, hydrated	SW	
18	17-23'	Light gray/brown grading to medium gray, fine to medium sand, silt, some fine gravel	GW	
20				
22				
24	23-25'	Fell back into hole		
26				
28				
30				

Boring No.: GPT-08-06	Date Drilled: 2/2/99
Logged By: D. Carigan/R. Fields	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Depth 26 Ft.
Ground Elevation 31.81' bgs	

Depth (ft)	Sample Despcription	USCS Symbol	Graphic Log
2	0-3.5' Fill material, orange, fine to medium silty sand with some clay	SM/SC	
4	3.5-6' Gray, fine to medium silty sand with debris, wood, gravel	SM	
6			
8	6-8' Tan/gray, fine to medium sand with some silt	SM	
10	8-16' Dark brown, fine to medium sand with some silt	SP	
12			
14			
16			
18	16-21' Medium/dark brown, fine to medium sand with some silt, fine gravel	SM	
20			
22	21-22' Medium brown, fine to medium sand with some gravel	SM	
	22-23' Medium gray, fine to medium clayey sand with silt	CL	
24	23-24' Medium/dark gray, fine to medium sand, some gravel, 4-inch band of clay	SP	
26	24-26' Medium gray soft clay with some fine sand and silt	CL	
28			
30			

Boring No.: GPT-08-07	Date Drilled: 2/2/99
Logged By: D. Carigan/R. Fields	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Depth 26 Ft.
Ground Elevation 31.86' msl	

Depth (ft)	Sample Despcription	USCS Symbol	Graphic Log
	0-1.5' Fill material, brown, fine to medium silty sand, fine gravel	SP	
2	1.5-2.5' Fill material, orange, medium to fine sand, coarse and fine gravel	SM	
4	2.5-4' Medium gray, fine to medium silty sand	SM	
6	4-6' Very light gray, fine to medium sand	SP	
	6-7' Light tan, fine to medium sand with some silt	SM	
8	7-9' Medium/light tan, fine to medium sand with some silt	SP	
10	9-17.5' Dark brown, fine to medium sand with some silt, fine gravel	SM	
12			
14			
16			
18	17.5-20' Medium to dark brown, fine to medium grained silty sand	SM	
20			
22	20-23' Light brown grading to medium brown then to tan, fine to medium sand with some silt	SM	
24	23-25' Light gray, fine to medium sand, gravel, with a 4-inch band of clay	SM/SC	
26	25-26' Medium gray clay	CH	
28			
30			

Boring No.: GPT-08-08	Date Drilled: 2/2/99
Logged By: D. Carigan/R. Fields	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Depth 26 Ft.
Ground Elevation 31.72' msl	

Depth (ft)		Sample Despcription	USCS Symbol	Graphic Log
2	0-2'	Fill material, mixed browns, oranges, and grays. Fine to medium sand with silt	SM	
4	2-3'	Dark brown, fine to medium sand	SM	
	3-3.5'	Black, organic-rich, fine sand, silt, some clay	SM/PT	
6	3.5-6'	Dark gray, silty clay with fine sand	SC	
8	6-10'	Brown grading to light gray, fine to medium sand	SM	
10				
12	10-14.5'	Medium gray grading to gray/tan then back to medium gray, fine to medium sand	SM	
14				
16	14'5-16'	Same as above with some fine to medium gravel	SM	
18	16-22'	Light gray, medium to fine sand with some fine gravel	SM	
20				
22	22-24'	Medium/dark gray, fine to medium sand, silt	SM	
24				
26	24-26'	Same as above with small amounts of clay	SM/SC	
28				
30				

Boring No.: GPT-08-09	Date Drilled: 2/4/99
Logged By: D. Carigan	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Depth 15 Ft.
Ground Elevation 28.00' msl	

Depth (ft)	Sample Despcription	USCS Symbol	Graphic Log
	0-0.25' Fill material, medium brown, fine gravel	SM	
2	0.25-4' Medium brown with pockets of orange, fine sand with silt	SM	
4			
	4-8' Medium to light gray, medium to fine sand with silt	SM	
6			
8			
	8-15' Medium to light gray, medium to fine sand, silt	SM	
10			
12			
14			
16			
18			
20			

Boring No.: GPT-08-10	Date Drilled: 2/4/99
Logged By: D. Carigan	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Depth 46 Ft.
Ground Elevation 28.22' msl	

Depth (ft)		Sample Despcription	USCS Symbol	Graphic Log
	0-0.5'	Fill material, brown medium to fine sand, silt, fine to medium gravel	SP	
2	0.5-2.5'	Dark brown, fine to medium sand, silt, some clay particles	SM	
4	2.5-6'	Gray/tan grading to light gray, fine to medium sand, silt. Slight odor at 5' - possible sulfur or methane	SM	
6				
8	6-10.5'	Medium brown, fine to medium sand, silt, fine to medium gravel	SM	
10				
12	10.5-16'	Light gray, medium to fine sand, silt, fine gravel	SP	
14				
16				
18	16-21.5'	Medium gray, fine to medium sand with some silt, some fine gravel, and occasional medium gravel	SM	
20				
22	21.5-26'	Medium gray, fine to medium sand, silt	SM	
24				
26				
28	26-29'	Dark gray, silt with fine sand, some clay particles	SM/SC	
30	29-29.5'	Dark gray, silty clay, medium plasticity	CL	
32	29.5-36'	Dark gray clay with silt, high plasticity	CH	
34				
36				
	36-37'	Dark gray silty clay with medium plasticity, wood fragments	CL	
38	37-38'	Dark gray, medium to fine sand with silt and some clay, wood fragments	SM/SC	
40	38-40'	Dark gray clay, stiff, low plasticity, silt and fine sand, wood fragments	CL	
42	40-42'	Dark gray, dense, stiff clay with silt, fine sand, wood fragments	CL	
44	42-46'	Medium gray, very stiff sandy clay	CL	
46				
48				
50				

Boring No.:	GPT-08-11	Date Drilled: 2/2/99 - 2/4/99	
Logged By:	D. Carigan/R. Fields	Checked By:	
Contractor:	Alliance	Rig:	Sonic
Method:	Rotasonic	Completion Depth	186 Ft.
Ground Elevation:	28.42' msl		

Depth (ft)		Sample Despcription	USCS Symbol	Graphic Log
	0-1'	Fill material, dark gray/brown, fine to medium silty sand	SM	
2	1-3'	Gray, fine to medium sand, some clay	SM	
4	3-6'	Medium gray grading to light gray, fine to medium sand, pieces of wood, debris, fine gravel, odor - possibly sulfur or methane	SP	
6				
8	6-16'	Medium gray, fine to medium sand, fine to medium gravel	SM	
10				
12				
14				
16				
18	16-19'	Light gray, fine to medium sand with small to medium sub- to well-rounded gravel	SM	
20	19-26'	Dark gray, silty clay, grading into sandy clay, shell particles from 19-23'	CL	
22				
24				
26				
28	26-28'	Dark gray, fine to medium silty sand with small shell fragments	CL	
30	28-32'	Dark gray silty clay, some small shell fragments, grading into higher density and elasticity. Around 31' grades back into silty clay with some wood fragments	CL	
32				
34	32-36'	Dark gray, fine to medium silty sand with some clay particles	SM/SC	
36				
38	36-38'	Dark gray, soft, silty clay	CL	
	38-44'	Dark gray clay, very stiff, some wood fragments	CL	

40				
42				
44				
46	44-49'	Medium gray, silty clay, very stiff	CL	
48				
50	49-53'	Brown/gray marbled with orange, clay, very stiff	CL	
52				
54	53-56'	Brown/gray clay, very stiff	CL	
56				
58	56-66'	Light gray grading into green/gray clay, very stiff, very small amount of silt	CL	
60				
62				
64				
66				
68	66-76'	Green/gray clay, very stiff, trace amount of silt	CL	
70				
72				
74				
76				
78	76-86'	Green/gray clay, very stiff, trace amount of silt	CL	
80				
82				
84				
86				
88	86-96'	Same as above except at 94-95' there were some rock fragments	CL	

90				
92				
94				
96				
98	96-106'	Green/gray clay, very stiff, trace amount of silt	CL	
100				
102				
104				
106				
108	106-116'	Medium gray grading to green/gray silt and some clay, very stiff, low moisture brittle, very dense	CL	
110				
112				
114				
116				
118	116-126'	Medium gray, dense silt with some clay particles, higher moisture than above section	CL	
120				
122				
124				
126				
	126-127.5'	Medium/light gray, silty clay, low to moderate moisture content, medium plasticity	CL	
128	127.5-129.5'	Medium gray clay, silt	CL	
130	129.5-136'	Medium gray with some gray/brown, grading to medium gray, fine to medium sand, some silt	SM	
132				
134				
136				
138	136-141.5'	Dark gray, fine to medium sand with small particles of green sandy clay. At 137.5-138.5' there are wood fragments	SM	
140				

142	141.5-143'	Dark gray sand, fine to medium with some silt	SM	
144	143-144.5'	Dark gray, dense, silty sand with green clay	SC	
146	144.5-146'	Dark gray silty clay, low plasticity, dense, stiff	CL	
148	146-152'	Medium gray, very stiff clay, low moisture	CL	
150				
152				
154	152-154'	Medium/light gray, stiff clay, low moisture but slightly higher than that above	CL	
156	154-164'	Medium gray, very stiff clay, low moisture	CL	
158				
160				
162				
164				
	164-164.5'	Medium gray silty sand	SM	
166	164.5-166'	Medium gray, very stiff clay, low moisture	CL	
168	166-186'	Medium/dark gray, fine sand with some silt	SM	
170				
172				
174				
176				
178				
180				
182				
184				
186				
188				
190				

Boring No.: GPT-08-12	Date Drilled: 2/6/99
Logged By: D. Carigan	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Depth 15 Ft.
Ground Elevation 31.14' msl	

Depth (ft)		Sample Despcription	USCS Symbol	Graphic Log
	0-1'	Fill material, medium brown, medium to fine sand, silt, fine gravel	SM	
2	1-4.5'	Medium brown with some orange, fine to medium sand, silt	SM	
4				
6	4.5-9'	Light brown grading to medium/light brown, medium to fine sand, silt	SM	
8				
10	9-15'	Dark brown, fine to medium sand, silt, fine to medium sub-rounded gravel	SM	
12				
14				
16				
18				
20				

Boring No.: GPT-08-13	Date Drilled: 2/5/99
Logged By: R. Fields	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Dept 37 Ft.
Ground Elevation 30.96' msl	

Depth (ft)	Sample Despcription	USCS Symbol	Graphic Log
	0-1' Fill material with fine gravel, brown fine to medium silty sand	GW	
2	1-2' Brown/orange, fine to medium silty sand	SM	
	2-7' Brown, fine to medium sand	SP	
4			
6			
8	7-13' Tan/buff, fine to medium sand	SP	
10			
12			
14	13-17' Brown, fine to medium sand	SP	
16			
18	17-22' Brown, fine to medium grained sand	SP	
20			
22			
	22-24' Light brown, fine to medium grained sand	SP	
24			
	24-29' Light gray, fine, silty sand	SM	
26			
28			
30	29-35' Gray, fine silty sand	SM	
32			
34			
36	35-37' Gray, silty clay	CL	
38			
40			

Boring No.: GPT-08-14	Date Drilled: 2/2/99
Logged By: R. Fisher/D. Carigan	Checked By:
Contractor: Alliance	Rig: Sonic
Method: Rotasonic	Completion Depth 26 Ft.
Ground Elevation 31.76' msl	

Depth (ft)	Sample Despcription	USCS Symbol	Graphic Log
	0-1.5' Tan, fine sand, some silt, 1/2' of organic	SM	
2	1.5-5.5' Gray, fine sand, trace silt. Coarser and lighter with depth.	SM	
4			
6	5.5-7' Dark gray, silty sand	SM	
8	7-10' Gray, silty sand, high organic content, coarse gravel at 7-8'	SM	
10			
12	10-15' Gray/brown, silty sand, with organic righ zones and trace gravel at 12-13' and 14-14.5'	SM	
14			
16	15-17' Brown, medium to fine sand with some silt	SM	
18	17-23' Tan, silty sand	SM	
20			
22			
24	23-26' Gray clay with some fine sand	CH	
26			
28			
30			

Project: NCBC Gulfport Site 8A

Site ID: GB-1 Project No: 44236 0254062

Comp. Date: 12/9/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 3.1 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	83	3, 4, 5		Loose fine SAND, mottled light gray and orange, some silt, low moisture	SM
2						
4						
	2	100	10, 11, 13		Medium dense, fine SAND, grading from light yellow-brown to light gray to yellow-tan, little to some silt, moist	SP/SM
6						
8						
	3	80	3, 4, 4		Top 0.5' Loose fine SAND, yellow-tan, little to some silt Bottom 0.7' Loose fine SAND, dark brown, trace fine angular gravel, trace medium sand, wet	SP/SM SP
10						
12						
14	4	100	7, 7, 14		Medium dense fine SAND, grades from light tan to light orange to light brown, few fine angular gravel, moist	SP
					Bottom of boring	
16						
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8A

Site ID: GB-2 Project No: 44236 0254062

Comp. Date: 12/9/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 16 ft. bgs Depth To Water: 2.55 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	60	3, 3, 4		Top 0.3' Loose fine SAND, mottled medium gray, yellow-orange and black, trace silt, slightly moist Bottom 0.9' Medium dense fine SAND, medium gray, trace silt, moist	SP
2	2	60	8, 9, 9, 10		Medium dense fine SAND, light gray, moist	SP
4	3	86	5, 6, 6, 10		Top 0.4' Same as above Next 0.5' Medium brown Next 0.4' Dark brown, odor	SP
6	4	100	5, 6, 6, 7		Medium dense fine SAND, medium/dark brown, trace silt, few fine gravel, moist	SP
8	5	100	2, 4, 6, 5		Same as above with trace fine sub-angular to sub-rounded gravel, wet	SP
10	6	100	2, 2, 7, 7		Loose fine SAND, medium/dark brown, trace to no silt, few fine gravel, wet, slight odor	SP
12	7	100	4, 4, 7, 9		Medium dense fine SAND, dark brown grading to medium brown, sand grains getting finer with depth, wet, slight odor	SP
14	8	100	2, 4, 8, 9		Continuation of above: grades to medium/light brown, very fine SAND	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates

Project: NCBC Gulfport Site 8A

Site ID: GB-4 Project No: 44236 0254062

Comp. Date: 12/9/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 3.8 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	93	8, 9, 8		Medium dense fine SAND, mottled light gray, tan and orange, some silt, slightly moist	SM
2						
4						
	2	80	6, 6, 7		Medium dense fine SAND, grading from light brown to dark brown. Dark brown sand is silty and has an odor	SW SM
6						
8						
	3	100	5, 9, 9		Medium dense fine SAND, dark brown, few fine sub-rounded gravel, trace to no silt, odor	SP
10						
12						
14	4	NR	8, 6, 9		Medium dense very fine SAND, dark brown, moist to wet, odor	SP
					Bottom of boring	
16						
18						
20						

NR = Not reported

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8Annex

Site ID: GB-5 | Project No: 44236 0254062

Comp. Date: 12/8/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 16 ft. bgs | Depth To Water: 3.5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	100	9, 5, 4		Loose fine SAND, mottled medium yellow-brown and light brown, little silt, slightly moist	SP
2	2	75	7, 8, 13, 15		Top 0.4' Medium dense fine SAND, tan, moist Next 0.9' Fine SAND, pinkish-gray, some silt, moist	SP
4	3	77	9, 13, 16, 23		Continuation of above	SP
6	4	100	9, 12, 13, 10		6.0 - 6.3' Continuation of above with fine gravel 6.3 - 8.0' Medium dense fine SAND, medium/dark brown, some silt, moist, odor	SP SM
8	5	100	5, 6, 8, 10		Medium dense fine SILTY SAND, medium/dark brown, trace fine gravel, wet, odor	SM
10	6	100	1, 2, 5, 7		Same as above	SM
12	7	100	11, 15, 15, 17		Medium dense fine SILTY SAND, medium/dark brown, trace to no silt, wet, odor. Trace fine sub-rounded gravel in bottom 0.5'	SP
14	8	100	7, 8, 11, 14		Medium dense fine SILTY SAND, medium/dark brown, trace to no silt, trace fine sub-rounded gravel, wet, odor	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates

Project: NCBC Gulfport Site 8Annex

Site ID: GB-6 Project No: 44236 0254062

Comp. Date: 12/8/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 4.7 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	87	13, 3, 2		Top 0.5' Loose fine SAND, brown-orange, some silt, trace fine rounded to sub-angular gravel, dry Next 0.9' Seashell material, white, purple and blue, dry Next 0.4' Soft silt mixed with shell material, black, sticky, moist	SM M L
2						
4	2	93	1, 2, 3		Soft SILT, medium gray, some fine sand, sticky, moist	ML
6						
8						
10	3	100	8, 11, 14, 18		Medium dense fine to medium SAND, light gray/tan, fine rounded gravel, very moist	SW
12						
14	4	NR	6, 6, 12		Medium dense, fine SAND, medium gray, moist	SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8Annex

Site ID: GB-7 Project No: 44236 0254062

Comp. Date: 12/8/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 4.5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	87	24, 13, 11		Medium dense, fine SAND, mottled brown-orange, black and medium brown, little silt, slightly moist	SP
2						
4	2	80	6, 4, 5		Loose, fine SAND, light/medium gray, trace to little silt, moist, odor	SP
6						
8						
10	3	100	7, 8, 10		Medium dense, fine SAND, dark brown, trace silt, few fine rounded gravel, moist to wet, odor	SP
12						
14	4	100	7, 9, 16		Medium dense, fine SAND, trace medium sand, trace fine gravel, moist to wet, odor	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8A

Site ID: GB-8 Project No: 44236 0254062

Comp. Date: 12/9/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 16 ft. bgs Depth To Water: 3.4 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	60	6, 5, 5, 4		Top 0.9' Loose fine SAND, mottled light gray and yellow brown, some silt, slightly moist Bottom 0.3' Loose fine SAND, light gray, trace silt, slightly moist	SM
2	2	80	3, 4, 5, 8		Top 0.9' Medium dense fine SILTY SAND, mottled brown-orange and light gray, slightly moist Bottom 0.7' Fine SAND, light gray, slightly moist	SM SP
4	3	68	4, 5, 9, 10		Medium dense fine SAND, light gray, slightly moist	SP
6	4	70	6, 8, 10, 11		Medium dense fine SAND, dark brown and medium/dark brown, trace silt, trace fine rounded gravel, moist	SP
8	5	95	4, 7, 8, 14		Top 0.3' Medium dense fine SAND, medium brown Bottom 1.6' Medium dense fine SAND, dark brown, some silt, some fine sub-rounded to rounded gravel, moist	SP SM
10	6	100	3, 9, 11, 14		Medium dense fine SAND, dark brown, trace silt, some fine rounded gravel, moist. No gravel in bottom 0.4'	SP
12	7	100	7, 14, 18, 22		Medium dense fine SAND, dark brown, few fine gravel, trace coarse sand, moist	SP
14	8	NR	7, 10, 14, 19		Dense fine SAND, dark brown, moist	SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8A

Site ID: GB-9 | Project No: 44236 0254062

Comp. Date: 12/9/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 15 ft. bgs | Depth To Water: 2.65 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	100	5, 4, 4		Loose fine SAND, yellow and tan, trace silt, moist	SP
2						
4						
	2	NR	4, 5, 6		Medium dense fine SAND, light brown and black, moist	SP
6						
8						
10	3	NR	8, 7, 13		Medium dense fine SAND, dark brown, trace fine rounded gravel, trace to no silt, moist to wet, odor. Contains 0.1' band of orange plastic silt at top of sample	SP
12						
14	4	NR	2, 5, 7		Medium dense fine SAND, dark brown, moist, odor	SP
					Bottom of boring	
16						
18						
20						

NR = not reported

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8A

Site ID: GB-10 Project No: 44236 0254062

Comp. Date: 12/10/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 2.8 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	100	3, 3, 4		Loose, fine SAND, trace to some silt, slightly moist, medium brown from 0.0 - 0.7', yellow-tan from 0.7 - 1.5'	SP
2						
4						
	2	80	9, 11, 10		Medium dense, fine SAND, medium gray, trace to no silt, moist	SP
6						
8						
10	3	100	7, 9, 12		Medium dense, fine SAND, dark brown, few fine angular gravel, moist to wet, odor	SP
12						
14	4	100	6, 14, 16		Medium dense, fine SAND, grading from medium to light brown, moist to wet, odor in brown sand	SP
					Bottom of boring	
16						
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8A

Site ID: GB-11 Project No: 44236 0254062

Comp. Date: 12/10/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 3.8 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	93	9, 6, 8		Medium dense fine SAND, trace to no silt, slightly moist, top 0.6' light brown, bottom 0.8' tan	SP
2						
4						
	2	73	5, 4, 3		Loose fine SAND, light brown, trace patches of dark gray silty material, moist	SP
6						
8						
10	3	100	9, 7, 10		Medium dense fine SAND, trace to no silt, moist to wet, odor, 9.0 - 9.3' light brown, 9.3 - 10.5' dark brown	SP
12						
14	4	100	8, 13, 15		Medium dense fine SAND, dark brown, trace to no silt, moist	SP
					Bottom of boring	
16						
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8A

Site ID: GB-12 Project No: 44236 0254062

Comp. Date: 12/9/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 3.7 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	100	2, 2, 2		Top 0.8' Loose fine SILTY SAND, medium brown, slightly moist Bottom 0.7' Loose fine SAND, medium brown, moist	SM SP
2						
4	2	NR	7, 7, 9		Medium dense fine SAND, grading from yellow-tan to tan to light brown, moist	SP
6						
8						
10	3	80	7, 7, 8		Medium dense fine SAND, dark brown, trace silt, few fine angular gravel, wet	SP
12						
14	4	NR	7, 9, 12		Medium dense fine SAND, medium/dark brown grading to medium brown, trace fine gravel in top 0.1', moist	SP
					Bottom of boring	
16						
18						
20						

NR = Not reported

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8A

Site ID: GB-13 | Project No: 44236 0254062

Comp. Date: 12/9/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 15 ft. bgs | Depth To Water: 3.3 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	48	1, 3, 3		Top 0.4' Loose ASH, dry Bottom 0.3' Loose fine SAND, yellow-tan, some silt, moist	SM
2						
4	2	80	9, 7, 10		Medium dense fine SAND, grading from tan to pinkish light brown, little silt, moist	SP
6						
8						
10	3	100	7, 9, 13		Medium dense fine SILTY SAND, dark brown	SM
12						
14	4	NR	9, 10, 13		Medium dense to dense fine SAND, dark brown, trace silt, moist	SP
					Bottom of boring	
16						
18						
20						

NR = Not reported

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8Annex

Site ID: GB-14 | Project No: 44236 0254062

Comp. Date: 12/8/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 15 ft. bgs | Depth To Water: 5.4 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	100	11, 5, 4		0.0 - 1.2' Loose fine SAND, mottled light gray, light brown-orange and dark gray, trace silt, slightly moist	SP
					1.2 - 1.5' Loose fine SILTY SAND, black	SM
2						
4	2	67	2, 5, 5		Loose to medium dense fine SAND, light gray ranging to medium gray, some silt, moist	SM
6					↑ Note: One of these had a small ~0.1' band containing >50% fine gravel ↓	
8						
10	3	100	3, 4, 5		Loose fine SAND, grading from dark to medium brown, little to some silt, moist to wet, odor	SP
12						
14	4	100	9, 11, 14		13.5 - 14.7' Medium dense fine SAND, light/medium brown, trace to some fine sub-rounded gravel	SP
					14.7 - 15.0' Same with silt	SM
16					Bottom of boring	
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8Annex

Site ID: GB-15 Project No: 44236 0254062

Comp. Date: 12/8/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 4.4 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	60	10, 5, 3		Medium stiff SILT, medium gray to dark brown/gray, trace to little fine sand, trace pinkish rock material, trace wood fragments	ML
2						
4						
	2	60	6, 6, 9		Top portion of sample is a large chunk of wood. Medium dense fine SILTY SAND, medium gray, moist, odor	SM
6						
8						
10	3	100	9, 12, 13		Medium dense fine SAND, dark brown, trace silt, odor	SP
12						
14	4	100	6, 8, 14		Medium dense, fine SAND, medium/dark brown, trace coarse sand, trace wood, moist	SP
					Bottom of boring	
16						
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8B

Site ID: GB-16 | Project No: 44236 0254062

Comp. Date: 12/6/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 16 ft. bgs | Depth To Water: 4.0 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	85	10, 7, 5, 7		Top 0.7' Medium dense medium SAND, medium brown, dry Next 1.0' Medium dense medium SAND, trace to some clay, slightly moist	SP
2	2	82	4, 6, 7, 18		Top 1.0' Medium dense fine CLAYEY SAND Next 0.7' Loose fine SAND, light gray, moist	SC SP
4	3	65	10, 12, 12, 16		Loose fine SAND, light gray, moist	SP
6	4	88	6, 12, 13, 11		Top 1.1' Medium dense medium SAND, light gray, trace black debris and fine sub-angular gravel, wet Next 0.7' Medium dense fine SAND, black, some silt, trace sub-angular gravel	SP SM
8	5	85	3, 3, 1, 5		Top 0.35' Loose fine SAND, light gray, some silt, wet Next 1.4' Very loose SAND, black, trace silt, trace fine sub-rounded gravel, very wet	SM SP
10	6	95	2, 5, 12, 15		Medium dense fine SILTY SAND, very dark brown, trace fine rounded gravel, little to some medium grained light gray sand mixed throughout, very wet	SM
12	7	100	NR		12.0 - 12.9' Continuation of above 12.9 - 14.0' Medium dense fine SILTY SAND, very dark brown, wet	SM
14	8	100	3, 5, 11, 12		14.0 - 14.6' Medium dense fine to medium SAND, very dark brown, trace sub-rounded gravel, wet 14.6 - 16.0' Medium dense fine SAND, dark brown, some fine sub-angular gravel	SW SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8B

Site ID: GB-17 Project No: 44236 0254062

Comp. Date: 12/7/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 3.5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	87	12, 6, 7		Top 0.6' Dense fine SANDY SILT, light gray/tan Next 0.7' Medium dense, same as above	ML
2						
4						
	2	73	4, 5, 7		Medium dense fine SAND, wet	SP
6						
8						
10	3	100	7, 7, 9		Medium dense fine SILTY SAND, dark brown, little fine rounded gravel, trace coarse sand, wet	SM
12						
14	4	100	4, 6, 6		Same as above	SM
					Bottom of boring	
16						
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8B

Site ID: GB-19 | Project No: 44236 0254062

Comp. Date: 12/7/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 15 ft. bgs | Depth To Water: 5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	90	9, 7, 5		Top 0.35' Stiff CLAYEY SILT, mottled medium brown, tan and black, low moisture	ML
					Bottom 1.0' Medium dense fine SILTY SAND, light gray/tan, low moisture	SM
2						
4						
	2	93	6, 7, 8		Top 0.3' Medium dense fine SILTY SAND, medium orange-brown, low moisture	SM
					Next 0.4' Medium dense fine SAND, light gray, moist	SP
					Next 0.7' Medium dense fine SILTY SAND, black/dark brown, wet, odor	SM
6						
8						
	3	100	8, 10, 10		Medium dense fine SILTY SAND, some fine gravel, wet, odor	SM
10						
12						
14	4	100	7, 8, 9		Loose fine SILTY SAND, dark brown, trace fine sub-rounded gravel, wet, odor	SM
					Bottom of boring	
16						
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8B

Site ID: GB-21 | Project No: 44236 0254062

Comp. Date: 12/7/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 16 ft. bgs | Depth To Water: 4 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	100	16, 8, 7, 7		0.0 - 1.7' Stiff SILT, light gray mottled with some orange and brown, trace clay, dry 1.7 - 2.0' Medium dense fine SILTY SAND, light gray, slightly moist	ML SM
2	2	80	3, 6, 6, 8		Medium dense fine SILTY SAND, light gray, trace clay, slightly moist, moisture and grain size increase with depth	SM
4	3	95	3, 7, 9, 11		Top 1.0' Medium dense fine SAND, medium and dark brown, some silt, trace medium sand, trace clay, very moist Bottom 0.9' Medium dense fine SAND, light tan, wet	SM
6	4	100	7, 12, 14, 18		Medium dense fine SAND, light tan, grading to medium sand in bottom 0.3', wet	SW
8	5	100	4, 8, 12, 21		8.0 - 8.9' Medium dense fine SILTY SAND, medium gray 8.9 - 10.0' Medium dense fine SILTY SAND, dark brown, odor	SM
10	6	100	2, 7, 9, 12		10.0 - 11.0' Medium dense fine SAND, medium brown, wet 11.0 - 12.0' Medium dense fine SILTY SAND, dark brown, wet	SP SM
12	7	100	7, 12, 13, 27		12.0 - 12.9' Medium dense fine SAND, medium brown, little fine rounded gravel, moist 12.9 - 14.0' Medium dense fine SANDY SILT, medium/dark brown, moist	SP ML
14	8	100	10, 19, 24, 24		14.0 - 15.2' Medium dense fine SAND, little fine rounded gravel, moist 15.2 - 16.0' Medium dense fine SANDY SILT, dark brown, moist, odor	SP ML
16					Bottom of boring	
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8B

Site ID: GB-22 Project No: 44236 0254062

Comp. Date: 12/7/99 Logged By: Deven Carigan

Contractor: Pensacola Testing Driller: Matt Howard

Drill Method: 6" OD HSA Rig Type: Diedrich 25

Total Depth: 15 ft. bgs Depth To Water: 4.0 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	100	11, 6, 5		0.0 - 0.7' Medium dense fine SILTY SAND, medium gray, slightly moist 0.7 - 1.5' Medium dense fine CLAYEY SAND, light gray and light brown	ML SC
2						
4	2	87	8, 7, 8		Medium dense fine SAND, medium tan/gray, trace silt, moist	SP
6						
8						
10	3	100	4, 5, 4		Loose fine SILTY SAND, dark and medium brown, little fine rounded gravel, wet	SM
12						
14	4	73	7, 8, 10		Medium dense fine to medium SILTY SAND, medium brown, moist	SM
16					Bottom of boring	
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8B

Site ID: GB-23 | Project No: 44236 0254062

Comp. Date: 12/7/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 15 ft. bgs | Depth To Water: 3.85 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	100	13, 10, 10		0.0 - 0.9' Stiff fine SANDY SILT, medium brown 0.9 - 1.5' Medium dense fine SAND, some silt, slightly moist	ML SM
2						
4	2	93	7, 7, 8		Top 0.6' Loose fine SAND, tan, trace silt, trace fine sub-rounded gravel Bottom 0.8' Medium dense fine SAND, medium brown, wet	SP
6						
8						
10	3	87	9, 9, 10		Medium dense fine SAND, medium tan, little fine sub-rounded gravel, moist to wet	SP
12						
14	4	80	4, 3, 4		Loose fine to coarse SAND, tan, little fine sub-rounded to sub-angular gravel	SW
16					Bottom of boring	
18						
20						

Harding Lawson Associates

Project: NCBC Gulfport Site 8B

Site ID: GB-25 | Project No: 44236 0254062

Comp. Date: 12/7/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 15 ft. bgs | Depth To Water: 3.85 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	93	16, 10, 8		Top 1.3' Stiff SILT, medium gray, some fine sand, little clay, slightly moist Bottom 0.1' Fine SILTY SAND	ML SM
2						
4	2	73	14, 17, 16		Medium dense fine SAND, grading from tan to light brown to medium brown, trace silt	SP
6						
8						
10	3	100	9, 7, 6		Medium dense fine SILTY SAND, dark brown, trace fine gravel and coarse sand, moist	SM
12						
14	4	100	8, 7, 9		13.5 - 14.5' Medium dense fine SAND, medium brown, little fine sub-rounded gravel 14.5 - 15.0' Fine SAND, dark brown, trace fine gravel	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8B

Site ID: GB-26 | Project No: 44236 0254062

Comp. Date: 12/8/99 | Logged By: Deven Carigan

Contractor: Pensacola Testing | Driller: Matt Howard

Drill Method: 6" OD HSA | Rig Type: Diedrich 25

Total Depth: 15 ft. bgs | Depth To Water: 4.5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
	1	93	12, 10, 8		0.0 - 0.9' Dense fine SAND, dark gray, trace silt, low moisture 0.9 - 1.5' Medium dense fine SAND, mottled light gray and orange-brown, trace silt, low moisture	SP
2						
4	2	100	12, 6, 4		4.5 - 4.7' Loose fine SAND, medium brown, dry 4.7 - 5.7' Medium dense fine SAND, pinkish gray, moist 5.7 - 6.0' Medium dense fine SAND, black, little silt, moist	SP
6						
8						
10	3	100	10, 6, 7		9.0 - 9.3' Medium dense fine SILTY SAND, dark brown, moist 9.3 - 9.7' Dense fine SILTY SAND, dark brown, moist 9.7 - 10.5' Medium dense fine SAND, medium/dark brown, little silt, trace fine sub-rounded gravel, moist to wet	SM SP
12						
14	4	100	4, 5, 8		Medium dense fine SAND, medium brown, trace to little fine gravel, trace coarse sand, trace silt, moist to wet	SW
16					Bottom of boring	
18						
20						

Harding Lawson Associates

A.2 GEOTECHNICAL LABORATORY RESULTS

Soils Analysis

Boring GPT-A-1
7' to 9' bgs

ΓICLE SIZE ANALYSIS
I D-422

ıt Name:	ABB	Sample I.D.:	37881001
ı. Desc. :	ABB/GULFPORT	Client Sample I.D.:	GP1-A-1
Number:	LRD01000.XY.GP	Date Analyzed:	05/06/94
ıttention:	Ms. P. Baxter		

INITIAL SAMPLE MASS	Units		HYGROSCOPIC MOISTURE CONTENT	Units	
; Dry Sample	g	50.00	Can No.	--	[ ]
ture Cont	%	0.00	Gross Wet Mass	g	50.00
Dry Mass	g	50.00 (M)	Gross Dry Mass	g	50.00
#10 sieve	%	100.00 (B)	Moisture Mass	g	0.00
; of total sample represented			Tare Mass	g	0.00
mass used in hydrometer test			Dry Soil Mass	g	50.00
= (M/B) x 100 =		50.00 g	Moisture Content	%	0.00

ometer No.: 87026 Type: 152H
ersing Agent: Sodium Hexametaphosphate
unt Used: 50 ml

Specific Gravity: 2.65

Material Retained On 75 um Sieve After Washing

D ve	Gross Mass	Tare Mass	Net Mass Indiv.	Retained Accumulative	Percent Retained Individual	Percent Retained Accumulative	STD Sieve	Accum. Percent Passing
20#	430.03	428.75	1.3	--	2.6	2.6	0.850mm	97.4
40#	401.59	395.05	6.5	7.8	13.1	15.6	0.425mm	84.4
80#	370.31	337.15	33.2	41.0	66.3	82.0	0.180mm	18.0
100#	361.04	357.60	3.4	44.4	6.9	88.8	0.150mm	11.2
200#	369.53	367.91	1.6	46.0	3.2	92.1	0.075mm	7.9
200#	360.30	360.22	0.1	46.1	0.2	92.2	<0.075mm	7.8

Day	Reading Time Hr	Min	Elapsed Time (min)	Hydrom Reading	Temp °C	Corr. Hydrom Reading	Particle Diam. (mm)	Pct Soil Susp.
5	7	09	0	--	21.2	--	--	--
5	7	10	0.67	11.0	21.2	5.7	0.0626	11.4
5	7	40	30	9.0	21.2	3.7	0.0095	7.4
5	8	10	60	8.5	21.1	3.2	0.0067	6.4
5	11	10	240	8.0	21.0	2.7	0.0034	5.4
5	3	10	480	7.5	21.0	2.2	0.0024	4.4
6	7	10	1440	7.0	21.1	1.7	0.0014	3.4

Approved By: Fred Bickell
Fred Bickell
Inorganics Supervisor

Date: 5/6/94

MS_SiteA.TM1
mlv.11.94

Report of Analytical Results
INORGANICS

Date Collected: 04/12/94
Date Received: 04/15/94
Sample Matrix: Soil
Sample Description:

Client Sample ID: GP1-A-1
Lab ReferenceNum: RD-37881
Lab Sample ID: RD-37881-001

CATEGORY NAME Analytical Parameter	Result	Units	Reporting Level	Date of Analysis	Analytical Method(s)
GENERAL					
Moisture	12.7	%		04/28/94	ASTM D2216
DEMAND AND GENERAL ORGANIC					
Total Organic Carbon	1390	mg/Kg	5.0	04/26/94	EPA415.2
Total Petroleum Hydrocarbons	< 1.9	mg/Kg	1.9	05/02/94	S3550/9071/418.1

Fred Bichel 5/6/94
Approved By

(701)

Quality Analytical Laboratories (QAL), Inc. -- Redding

000004

MS_SiteA.TM1
mlv.11.94

RSS/6/94

Soils Analysis

Boring GPT-A-2
12' to 14' bgs

ITICLE SIZE ANALYSIS
M D-422

ent Name:	ABB	Sample I.D.:	37881002
oj. Desc. :	ABB/GULFPORT	Client Sample I.D.:	GP1-A-2
. Number:	LRD01000.XY.GP	Date Analyzed:	05/06/94
Attention:	Ms. P. Baxter		

INITIAL SAMPLE MASS	Units		HYGROSCOPIC MOISTURE CONTENT	Units	
s Dry Sample	g	50.00	Can No.	--	[ ]
sture Cont	%	0.00	Gross Wet Mass	g	50.00
. Dry Mass	g	50.00 (M)	Gross Dry Mass	g	50.00
s #10 sieve	%	100.00 (B)	Moisture Mass	g	0.00
s of total sample represented			Tare Mass	g	0.00
mass used in hydrometer test			Dry Soil Mass	g	50.00
= (M/B) x 100 =		50.00 g	Moisture Content	%	0.00

rometer No.: 87026 Type: 152H
ersing Agent: Sodium Hexametaphosphate
ount Used: 50 ml

Specific Gravity: 2.65

Material Retained On 75 um Sieve After Washing

D ve #	Gross Mass	Tare Mass	Net Mass Indiv.	Retained Accumulative	Percent Retained Individual	Percent Retained Accumulative	STD Sieve	Accum. Percent Passing
20#	429.93	428.77	1.2	--	2.3	2.3	0.850mm	97.7
40#	404.08	395.02	9.1	10.2	18.1	20.4	0.425mm	79.6
80#	372.98	337.12	35.9	46.1	71.7	92.2	0.180mm	7.8
100#	359.84	357.53	2.3	48.4	4.6	96.8	0.150mm	3.2
200#	368.70	367.90	0.8	49.2	1.6	98.4	0.075mm	1.6
4200#	360.24	360.21	0.0	49.2	0.1	98.4	<0.075mm	1.6

Reading Time Day	Hr	Min	Elapsed Time (min)	Hydrom Reading	Temp °C	Corr. Hydrom Reading	Particle Diam. (mm)	Pct Soil Susp.
5	7	11	0	--	21.2	--	--	--
5	7	12	0.67	8.5	21.2	3.2	0.0635	6.4
5	7	42	30	7.5	21.2	2.2	0.0095	4.4
5	8	12	60	7.0	21.1	1.7	0.0068	3.4
5	11	12	240	6.5	21.0	1.2	0.0034	2.4
5	3	12	480	6.5	21.0	1.2	0.0024	2.4
6	7	12	1440	6.5	21.1	1.2	0.0014	2.4

Approved By: Fred Bickell
Fred Bickell
Inorganics Supervisor

Date: 5/6/94

MS_SiteA.TM1
mlv.11.94

Report of Analytical Results
INORGANICS

Date Collected: 04/13/94
Date Received: 04/15/94
Sample Matrix: Soil
Sample Description:

Client Sample ID: GP1-A-2
Lab ReferenceNum: RD-37881
Lab Sample ID: RD-37881-002

CATEGORY NAME Analytical Parameter	Result	Units	Reporting Level	Date of Analysis	Analytical Method(s)
GENERAL					
Moisture	15.7	%		04/28/94	ASTM D2216
DEMAND AND GENERAL ORGANIC					
Total Organic Carbon	1090	mg/Kg	5.0	04/26/94	EPA415.2
Total Petroleum Hydrocarbons	< 2.0	mg/Kg	2.0	05/02/94	S3550/9071/418.1

Fred Bickell 5/6/94
Approved By

(701)

Quality Analytical Laboratories (QAL), Inc. -- Redding

MS_SiteA.TM1
mlv.11.94

000005
ROJ 5/6/94

NSACOLA TESTING LABORATORIES, INC.
217 East Brent Lane, Pensacola, FL 32503
PHONE (850)477-5100 FAX (850) 477-1310

No.	Client No.	PO No.	Report No.	Date	Page
-132	–		20960	12/24/99	1 of 4

PORT OF: CALIFORNIA BEARING RATIO (CBR) TESTING (ASTM D1883)

For: Harding Lawson Associates
1400 Centerpoint Boulevard, #158
Knoxville, TN 37932

Dates of Service: 12/20 to 12/24/99
Technicians: B.H. & R.B.

Attn:

ject: NCBC
Gulfport, MS

Sample Identification: Boring GB-9

Sampled by: PTL / M.Howard

Date Delivered to Lab: 12/10/99

ıple I.D. - Brown Sand

l Test Results:

MOISTURE CONTENT, % BY DRY WT.	DRY DENSITY, PCF	% OF MAXIMUM DRY DENSITY (ASTM D698)	CBR @ 0.1" PENETRATION	CBR @ 0.2" PENETRATION
12.5	102.8	97.9	6.8	7.5
12.5	103.7	98.8	9.8	11.1
12.5	105.0	100.0	13.2	13.7

harge Used: 10 lbs.

dition of sample at penetration: Soaked

ng performed in general accordance with ASTM D1883.

By: Pttla Wheeler

PENSACOLA TESTING LABORATORIES, INC.

217 East Brent Lane, Pensacola, FL
PHONE (850) 477-5100, FAX (850) 47

Job Number	Client Number	P.O. Number	Report Number	Date	Pag
99-132	–		20960	12/20/99	2 of

REPORT OF: PROCTOR DENSITY OF SOIL

For: Harding Lawson Associates
1400 Centerpoint Boulevard, #158
Knoxville, TN 37932

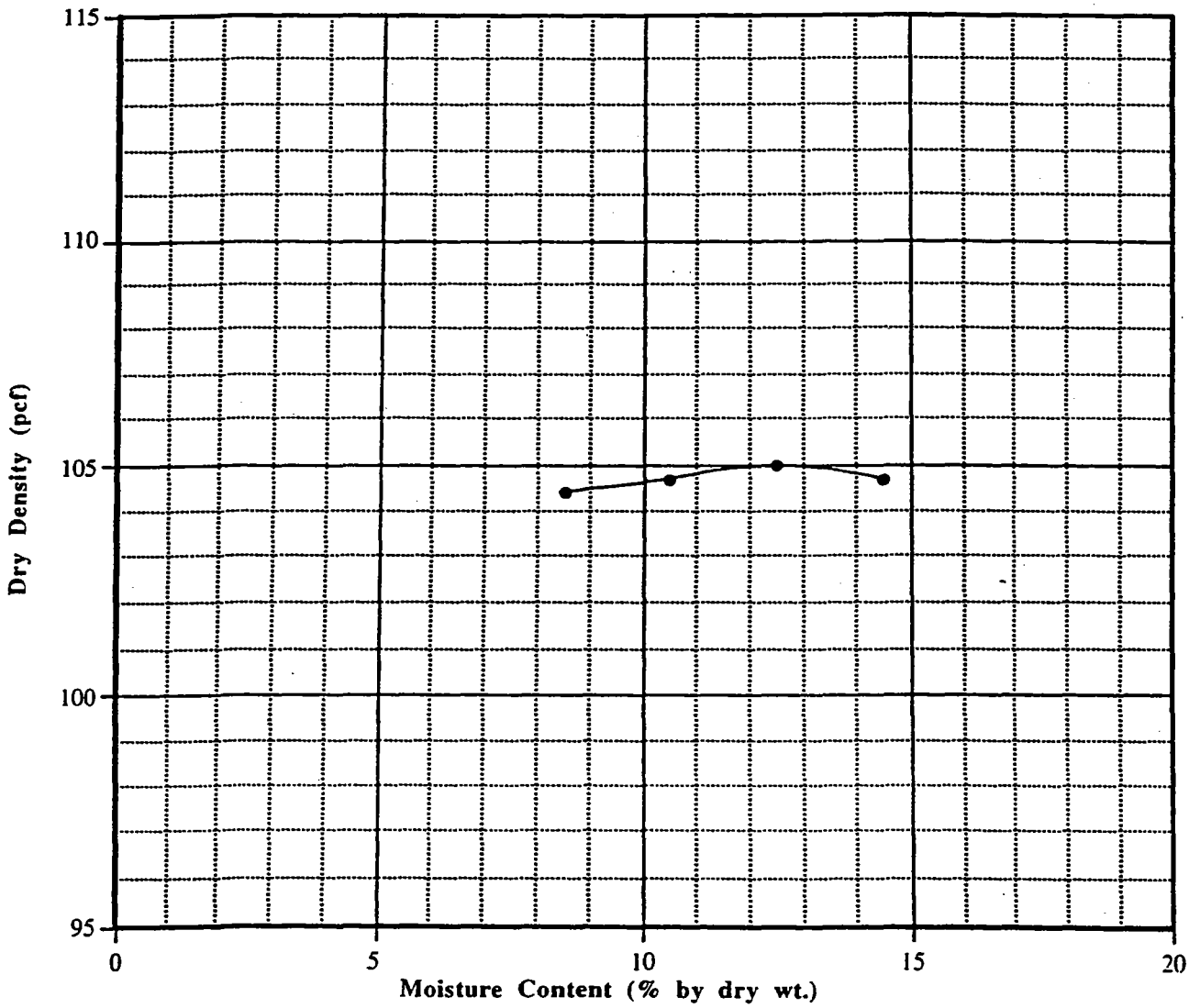
cc:

Att:

Project: NCBC Gulfport, MS	Sampled/Deliv. By: PTL - M.H.	Date: 12/10/
Sampled From: Boring GB-9	Pit Name: ---	Pit No: ---
Pit Location: ---	% Passing #200 Screen:	Soil Classification:
Soil Descript. & Color: Brown Sand	Applicable Specs: ASTM D1883	

Comments:

Maximum Density (Dry): 105.0 Lbs. Ft^3 @ An Optimum Moisture Of: 12.6 %



Reports To:

Reviewed By PAW

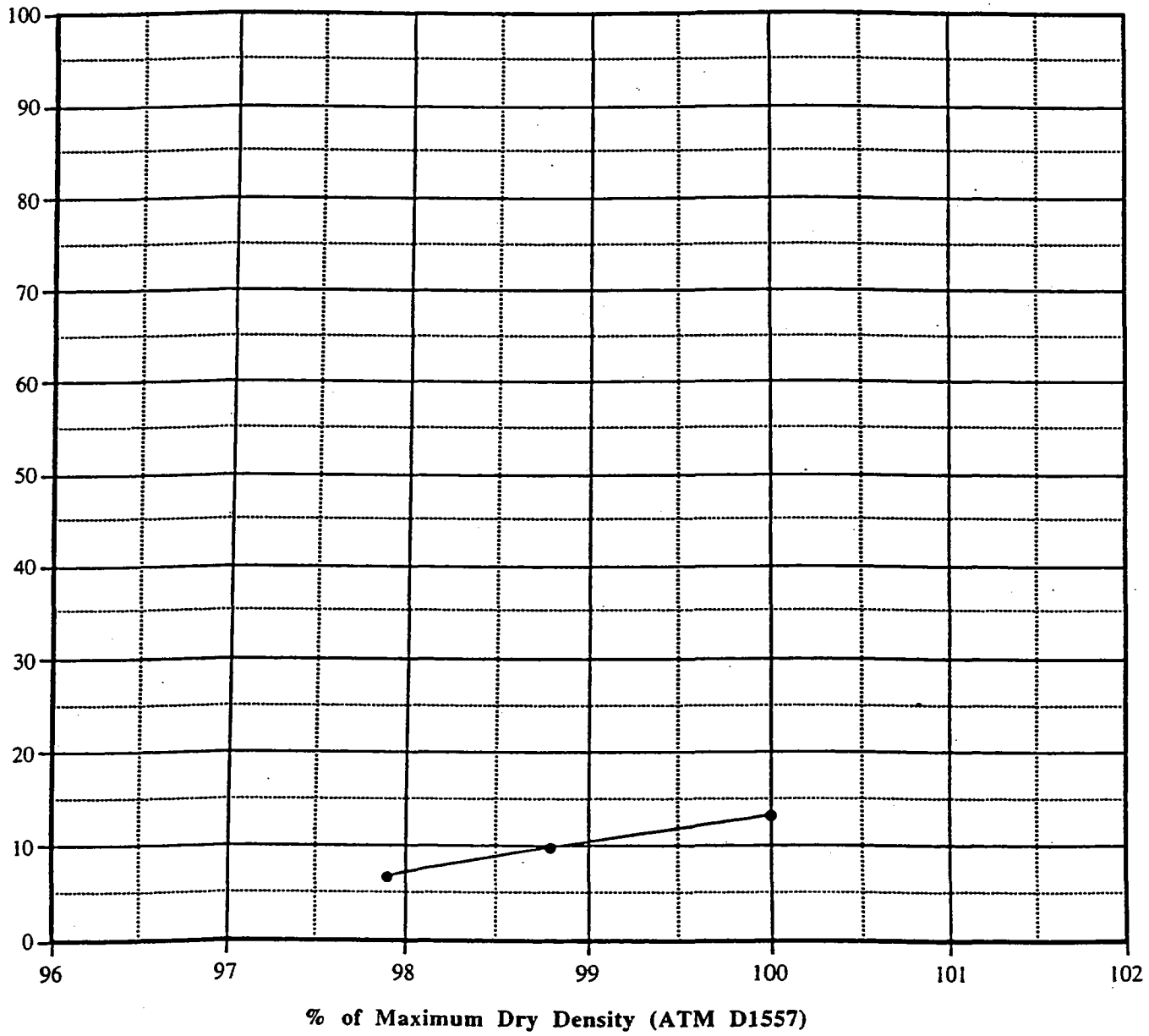
By: Patricia A Wheeler

NSACOLA TESTING LABORATORIES, INC.
217 East Brent Lane, Pensacola, FL 32503
PHONE (850) 477-5100, FAX (850) 477-1310

ob No.	Client No.	P.O. No.	Report No.	Date	Page
99-132	–		20960	12/31/99	3 of 4

EPORT OF: CALIFORNIA BEARING RATIO (CBR) TESTING (ASTM D1883)

For: Harding Lawson Associates
Project: NCBC, Gulfport, MS

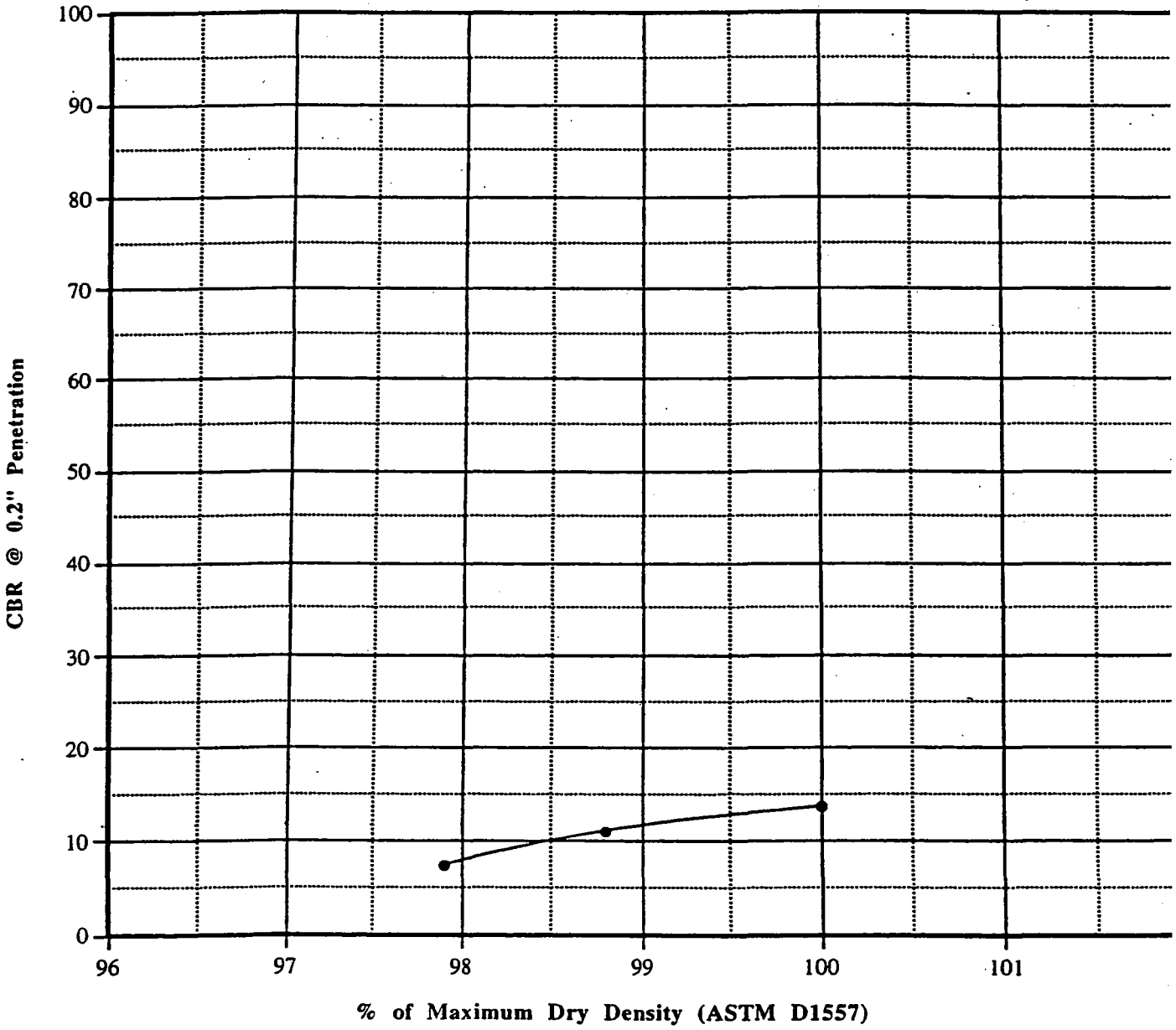


PENSACOLA TESTING LABORATORIES, INC.
217 East Brent Lane, Pensacola, Fl
PHONE (850) 477-5100. FAX (850)

Job No.	Client No.	P.O. No.	Report No.	Date	Page
99-132	–		20960	12/31/99	4 of 4

REPORT OF: CALIFORNIA BEARING RATIO (CBR) TESTING (ASTM D1883)

For: Harding Lawson Associates
Project: NCBC, Gulfport, MS



ISACOLA TESTING LABORATORIES INC.,
217 East Brent Lane,Pensacola,FL 32503
PHONE 850/477-5100, FAX 850/477-1310

REPORT OF: Soil Classification Analyses

e No.	Job No.	PO No:	Report No	Date	Page
)-132	-	-	78774-1	Dec 22, 1999	1 of 31

ect: NCBC Gulfport

For Harding Lawson Associates
1400 Centerpoint Blvd., #158
Knoxville, TN 37932
Att:

Samples Submitted by Client: ☐	Samples Taken By PTL: ☒	Submit/Taken,Date: 12/6-12/10/99

LL, PL, PI & Sieve Analysis % Passing (By Wt.)

>#	Sample I.D.	LL	PL	PI	#10	#20	#40	#80	#200	Class
	LIGHT BROWN SILTY SAND	19	16	3	100	99.7	95.0	24.2	18.2	SM
	TAN POORLY GRADED SAND			NP	100	99.1	86.0	4.8	2.1	SP
	TAN POORLY GRADED SAND			NP	99.9	99.8	86.7	7.3	2.9	SP
	BROWN POORLY GRADED SAND			NP	98.0	94.4	77.2	10.5	2.7	SP
	BROWN POORLY GRADED SAND			NP	94.1	90.1	78.6	13.3	2.2	SP
	TAN AND BROWN POORLY GRADED SAND			NP	99.0	91.7	57.4	6.8	2.5	SP
	TAN POORLY GRADED SAND			NP	98.9	97.6	75.8	5.1	2.3	SP
	BLACK ASH			NP	86.1	80.6	67.6	19.5	12.9	**
	BLACK ASH			NP	94.7	90.9	76.0	15.7	10.2	**
	BROWN SILTY SAND	25	24	1	96.6	92.6	77.1	16.9	13.7	SM*
	BROWN SILTY SAND	52	30	22	95.7	94.2	88.6	37.8	31.7	SM*
	BROWN LEAN CLAY	47	25	22	99.6	99.5	99.4	98.0	95.6	CL*
	LIGHT BROWN SILTY SAND			NP	99.1	96.1	81.3	27.3	16.9	SM*
	BROWN SILTY SAND	17	15	2	99.6	99.0	95.0	33.9	22.2	SM*
	BROWN SILTY SAND	17	15	2	99.9	99.2	81.4	32.9	27.0	SM*
	BROWN SILTY CLAYEY SAND	27	20	7	99.9	99.7	97.0	48.2	27.4	SC-SM*
	BROWN GREY SILTY CLAYEY SAND	25	20	5	99.9	99.7	98.9	83.8	31.8	SC-SM*
	DARK BROWN ELASTIC SILT WITH SAND	61	35	26	98.7	96.9	95.3	92.6	77.8	MH*
	BROWN SILT WITH SAND	48	29	19	99.8	99.5	98.8	93.2	70.3	ML*
	DARK BROWN SANDY ELASTIC SILT	75	38	37	99.3	97.0	93.3	85.7	65.6	MH*

:d By: RRC, PW, BH, TD

nts
Samples were washed over #200 sieve.
*Wood particles, small roots and other organics were visually evident.
**Based on sample identification (ASH) and appearance, it is not certain that a Unified Soil Classification is appropriate for the material tested.
NP: Non-Plastic

ts To: 1 - Harding Lawson Associates

By

PENSACOLA TESTING LABORATORIES INC.,
217 East Brent Lane, Pensacola, FL 3250
PHONE 850/477-5100, FAX 850/477-1310

REPORT OF: Soil Classification Analyses

File No.	Job No.	PO No:	Report No	Date	Page
99-132	-	-	78774-1	Dec 22, 1999	2 of 3

Project: NCBC Gulfport

For Harding Lawson Associates
1400 Centerpoint Blvd., #158
Knoxville, TN 37932
Att:

Samples Submitted by Client: ☐	Samples Taken By PTL: ☒	Submit/Taken,Date: 12/6-12/10/99

LL, PL, PI & Sieve Analysis % Passing (By Wt.)

Samp#	Sample I.D.	LL	PL	PI	#10	#20	#40	#80	#200	Class
GS-12	LIGHT BROWN SILTY SAND	21	18	3	100	99.8	99.2	88.3	44.2	SM
GS-13	DARK BROWN ELASTIC SILT	95	52	43	97.3	94.0	91.0	87.5	73.7	MH*
GS-14	DARK BROWN SILTY SAND	39	26	13	98.2	94.7	89.7	67.1	27.0	SM*
GS-15	DARK BROWN SANDY SILT	49	28	21	99.9	99.6	98.4	88.7	63.0	ML*
GS-16	DARK BROWN SANDY ELASTIC SILT	62	33	29	99.8	99.7	98.2	86.2	68.2	MH*
GS-17	BROWN GREY SILTY SAND	20	18	2	99.2	98.2	95.9	58.1	26.3	SM*
GS-18	BROWN SILTY SAND	27	22	5	99.8	99.3	66.0	45.6	22.6	SM*
GS-19	BROWN SANDY ELASTIC SILT	94	44	50	93.8	77.4	66.7	64.0	61.9	MH*
GS-20	BROWN CLAYEY SAND	33	20	13	99.9	99.4	97.8	82.1	35.8	SC*

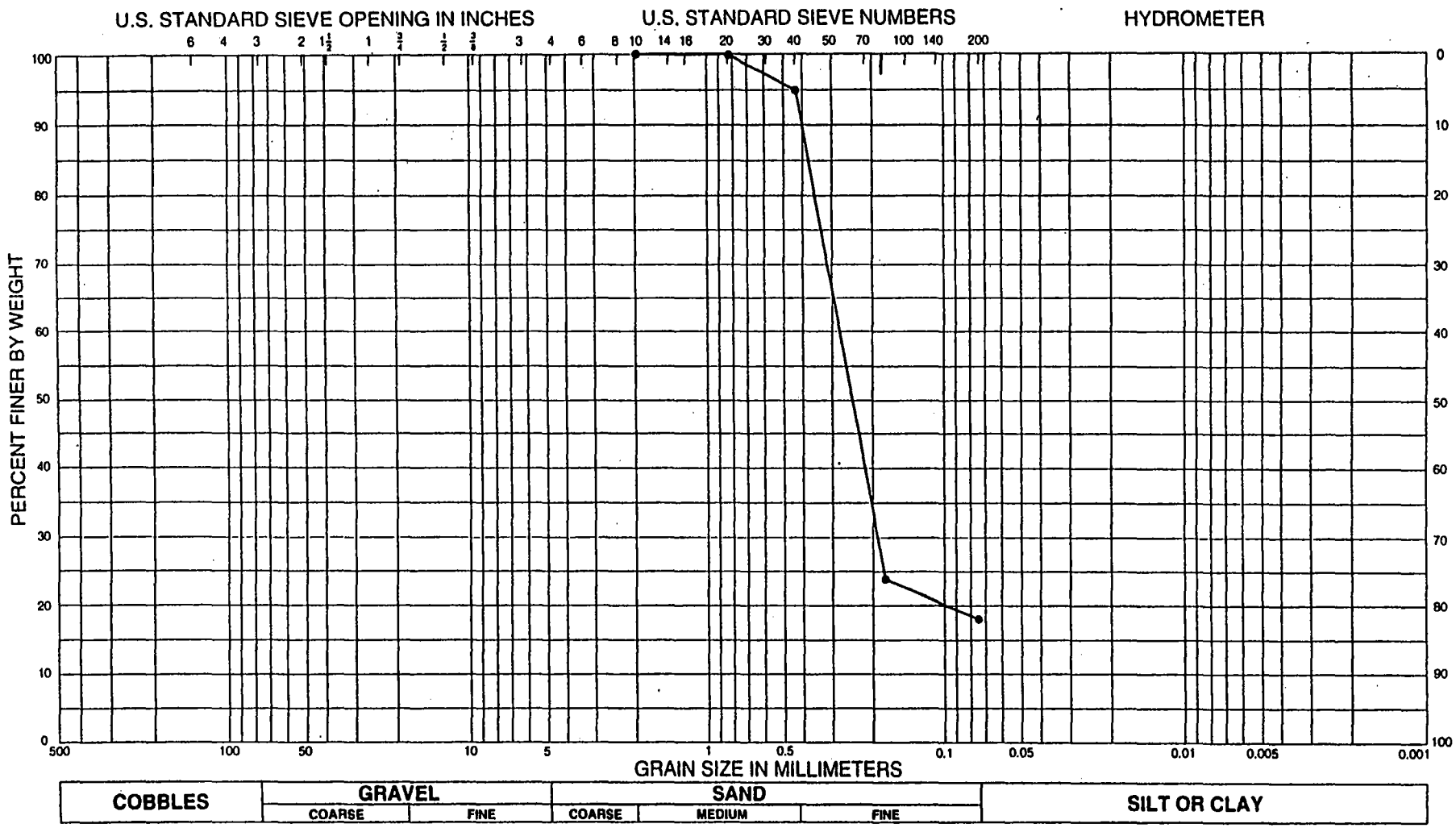
Tested By: RRC, PW, BH, TD

Comments
Samples were washed over #200 sieve.
*Wood particles, small roots and other organics were visually evident.
**Based on sample identification (ASH) and appearance, it is not certain that a Unified Soil Classification is appropriate for the material tested.

Reports To: 1 - Harding Lawson Associates

By Pttla Whelan

Report No.	Report Date:	Client No.	Page
78774-1	12/22/99	99-132	3 of 31



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GB-1	0 - 1.5'	Light Brown Silty Sand (SM)	--	19	16	3
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

PENSACOLA TESTING LABORATORIES, INC.

217 E. Brent Lane, Pensacola, FL 32503
Phone (850) 477-5100, Fax (850) 477-1310

Report No.	Report Date:	Client No.	Page
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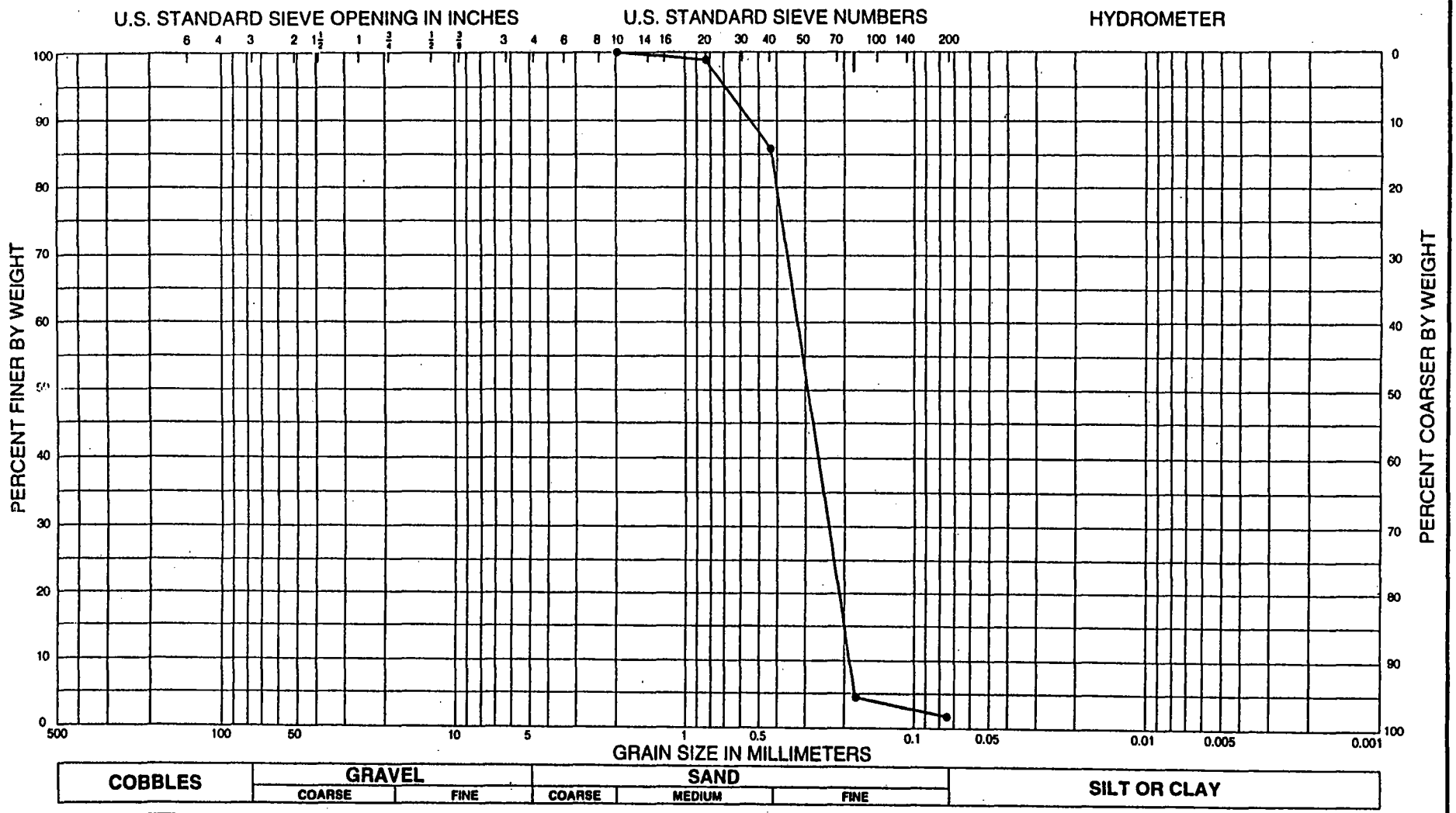

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GB-8	2' - 4'	Tan Poorly Graded Sand (SP)	--	--	--	NP
		NP: Non-Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Report No.	Report Date:	Client No.	Page
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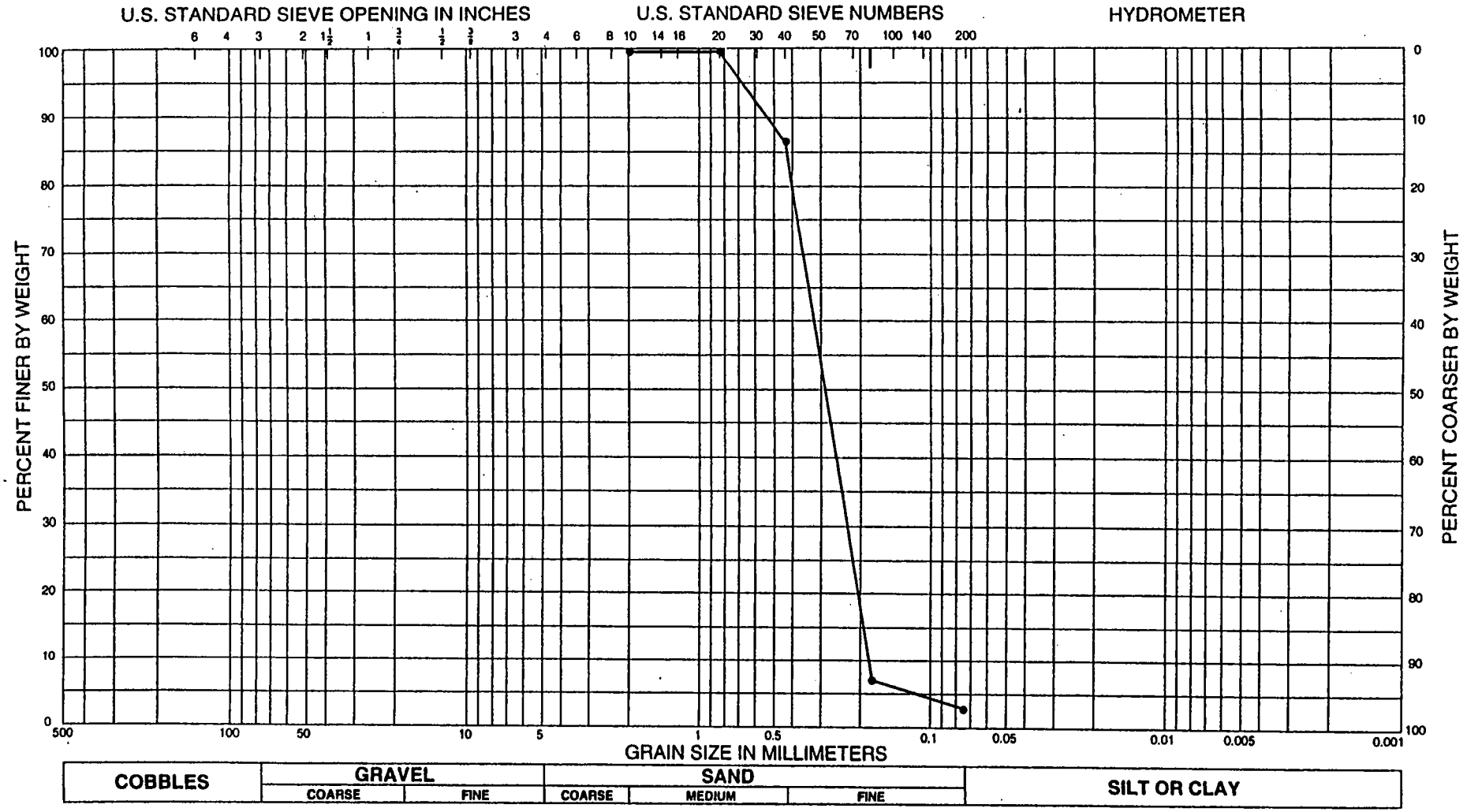

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GB-12	4.5'-6'	Tan Poorly Graded Sand (SP)	--	--	--	NP
		NP: Non-Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

PENSACOLA TESTING LABORATORIES, INC.

217 E. Brent Lane, Pensacola, FL 32503
Phone (850) 477-5100, Fax (850) 477-1310

Report No.	Report Date:	Client No.	Page
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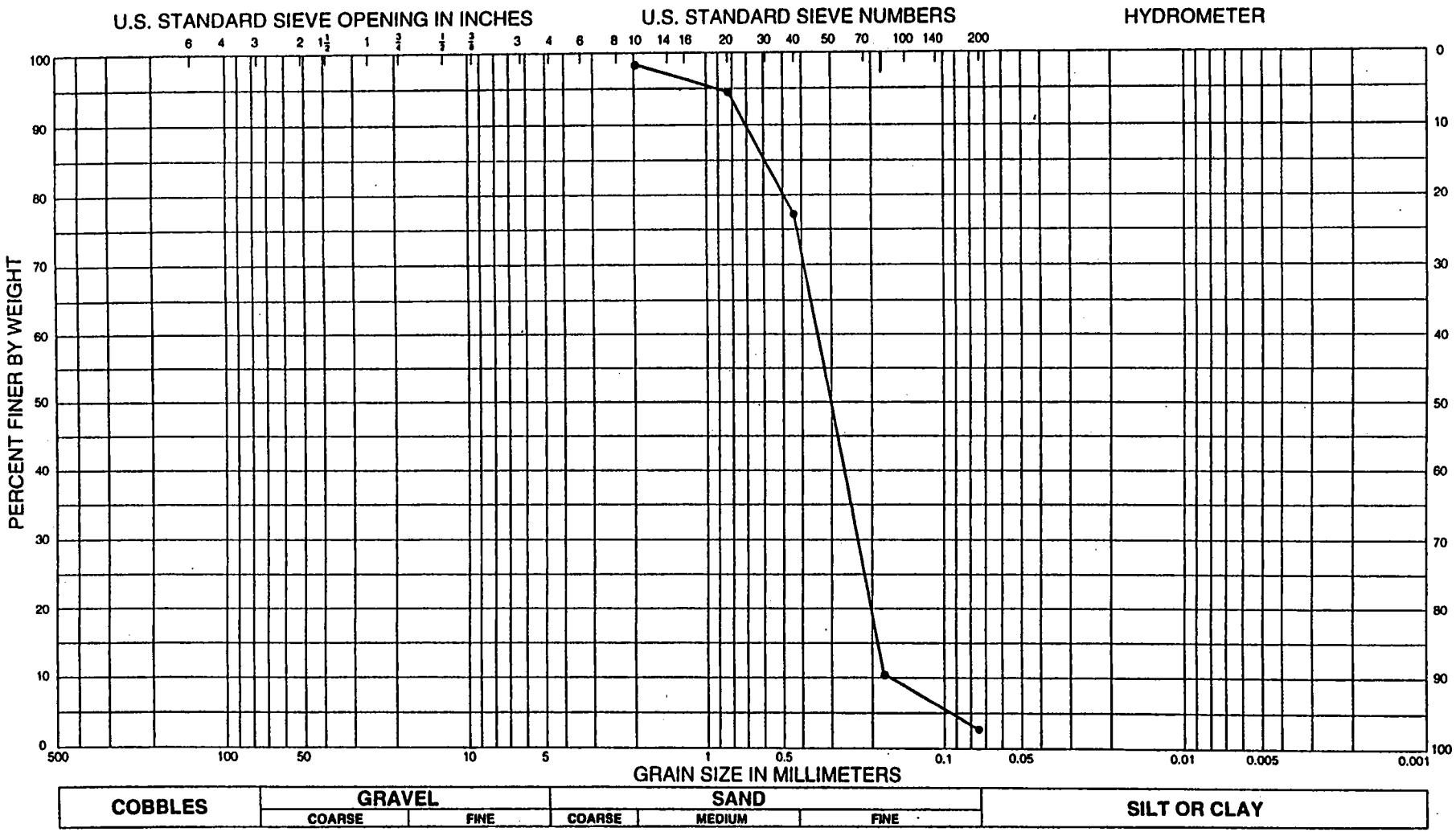

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GB-13	13.5'-15'	Brown Poorly Graded Sand (SP)	--	--	--	NP
		NP: Non-Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Phone (850) 477-5100, Fax (850) 477-1310

Report No.	Report Date:	Client No.	Page
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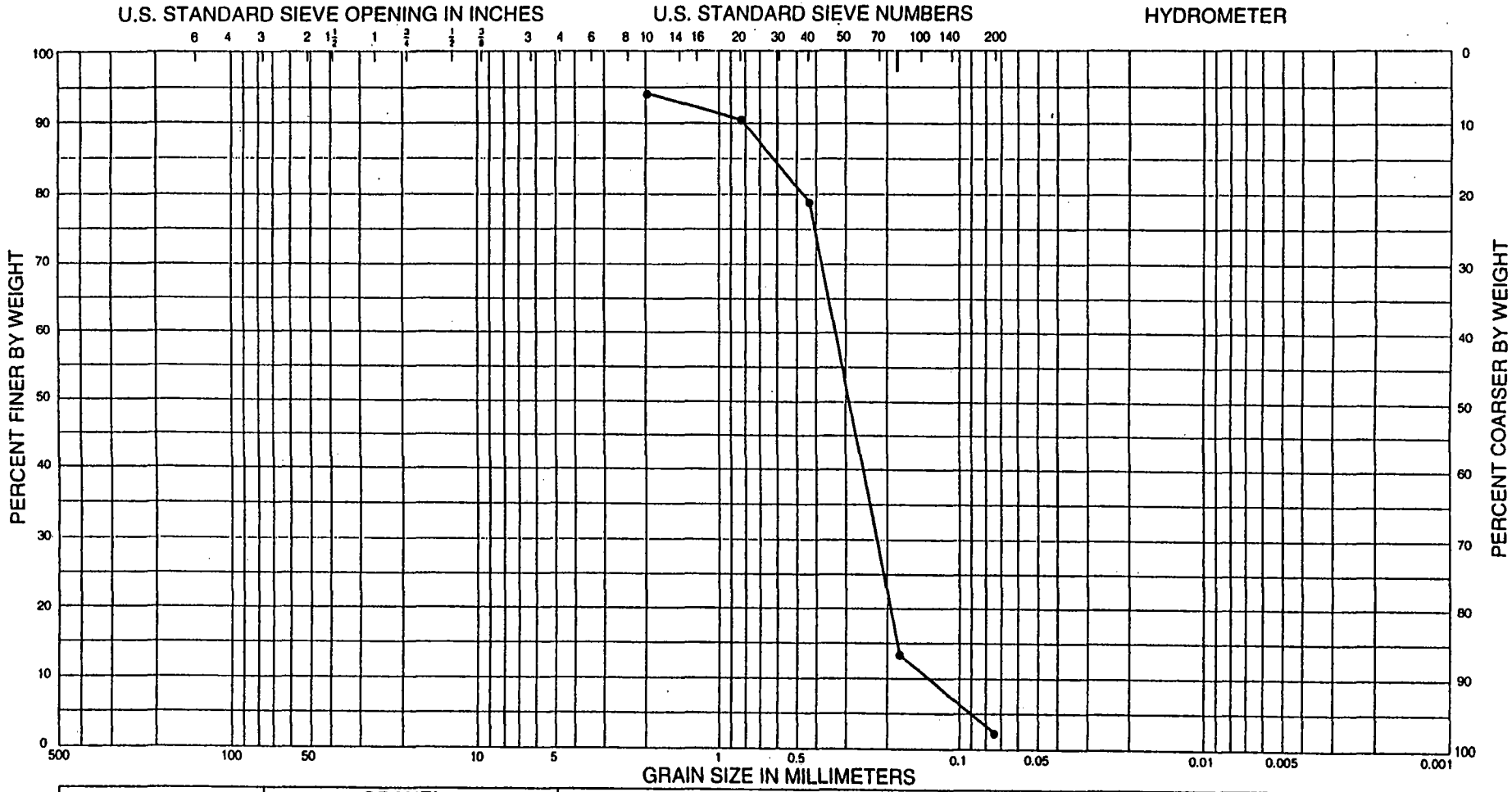

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GB-8	10' - 12'	Brown Poorly Graded Sand (SP)	--	--	--	NP
		NP: Non-Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

PENSACOLA TESTING LABORATORIES, INC.

217 E. Brent Lane, Pensacola, FL 32503
Phone (850) 477-5100, Fax (850) 477-1310

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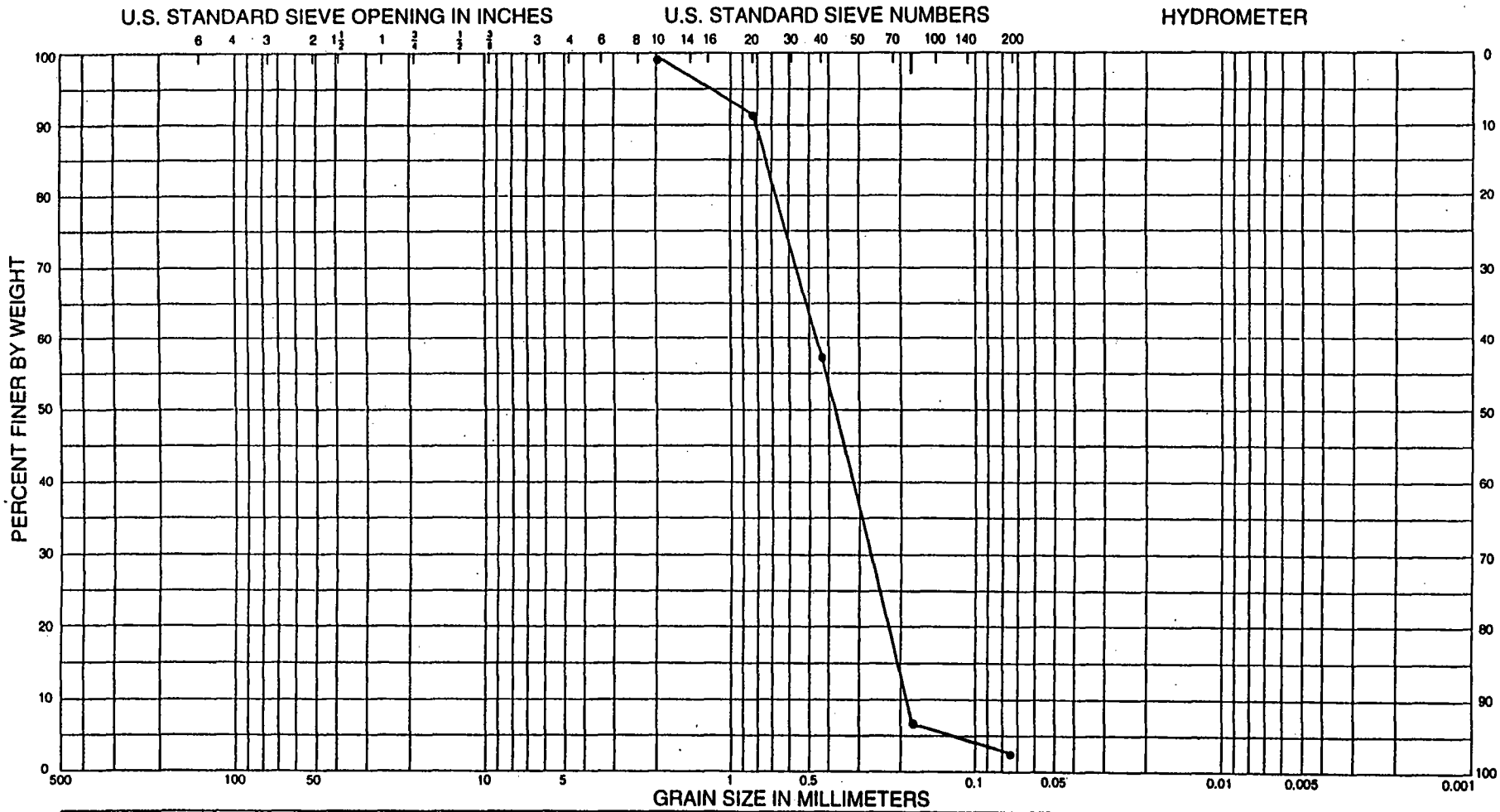

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GB-16	8' - 10'	Tan and Brown Poorly Graded Sand (SP)	--	--	--	NP
		NP: Non-Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

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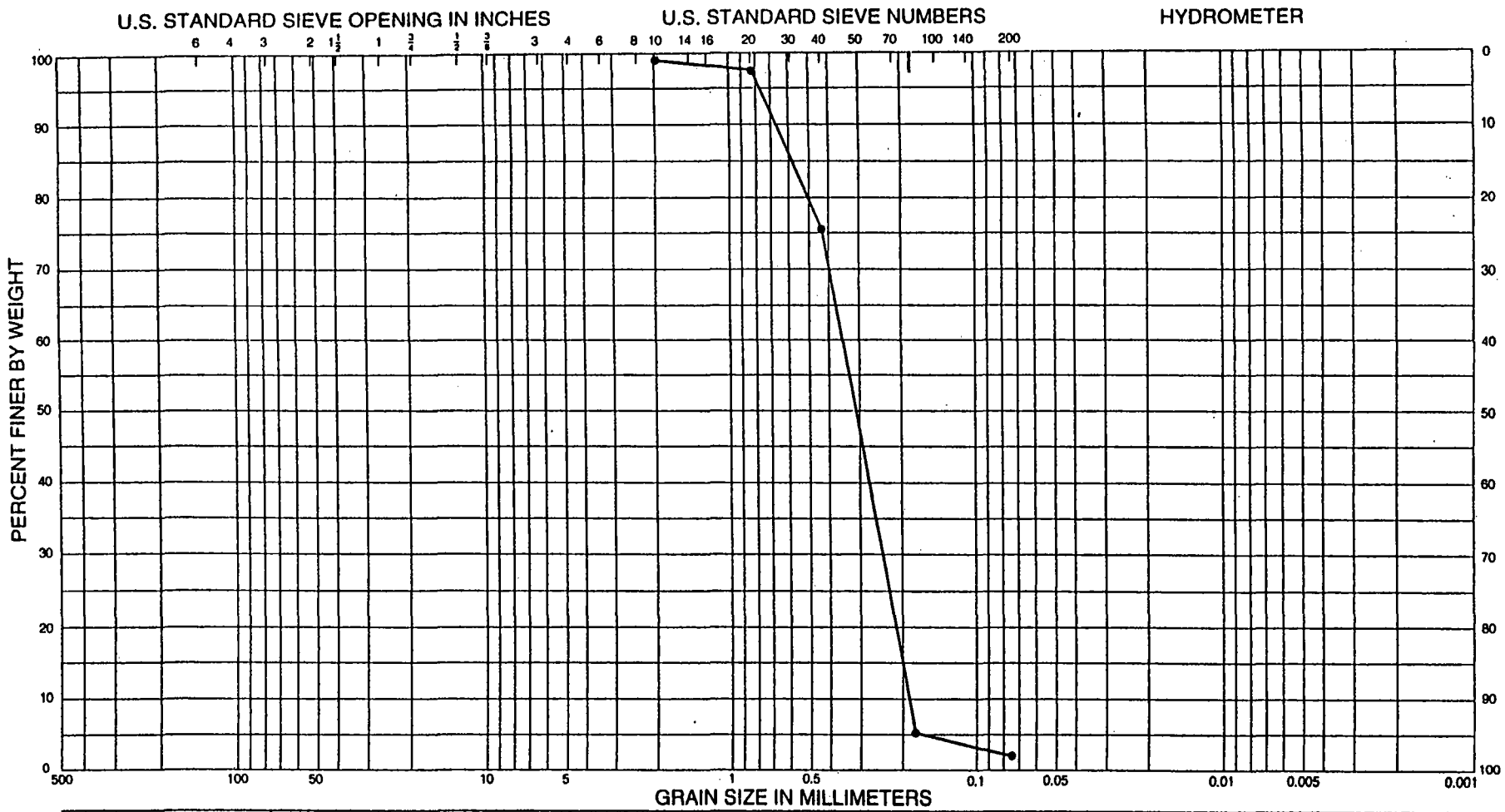

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GB-21	6' - 8'	Tan Poorly Graded Sand (SP)	--	--	--	NP
		NP: Non-Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

PENSACOLA TESTING LABORATORIES, INC.

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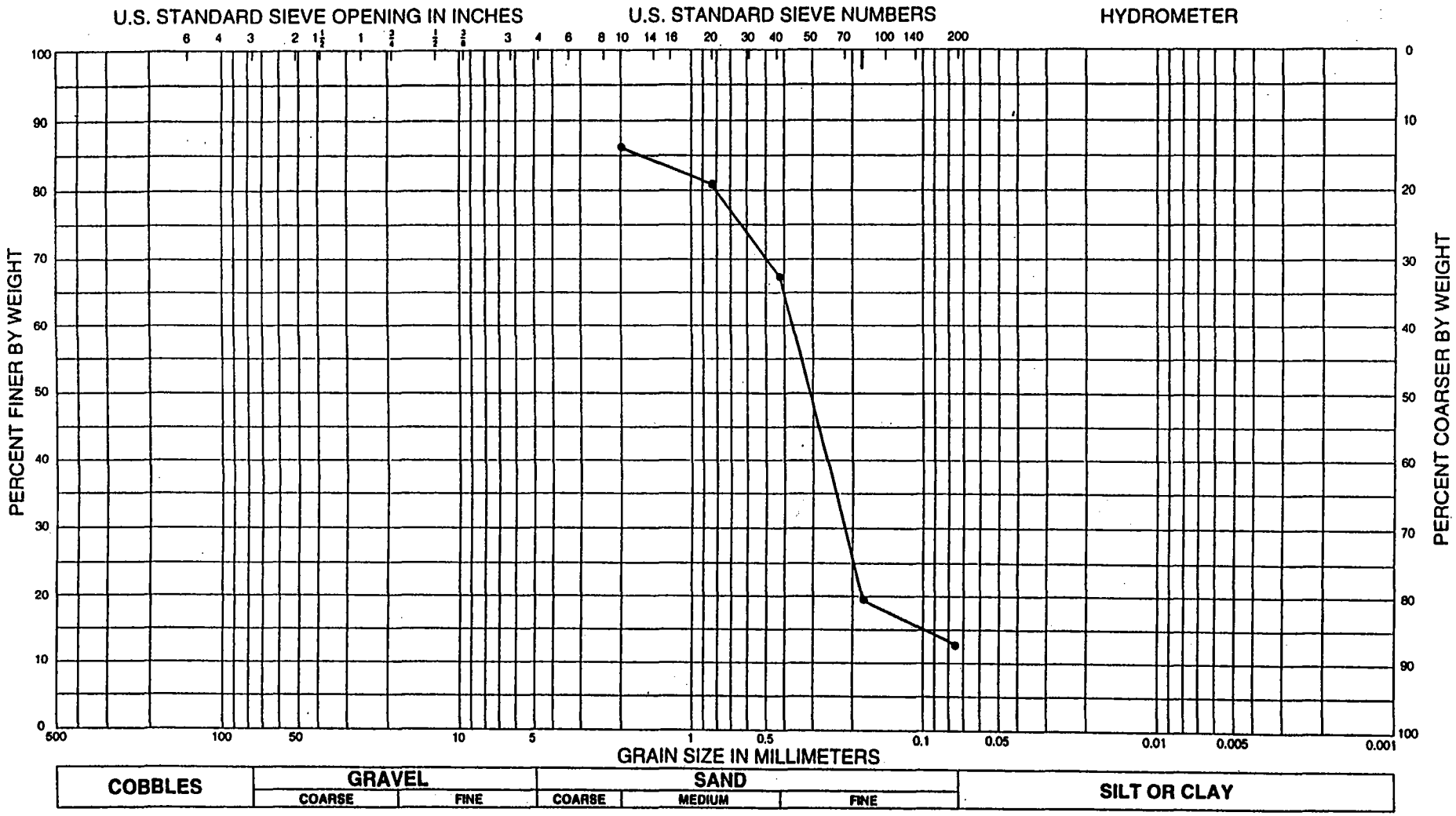

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
ASH-1	--	Black Ash	--	--	--	NP
		NP: Non- Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Phone (850) 477-5100, Fax (850) 477-1310

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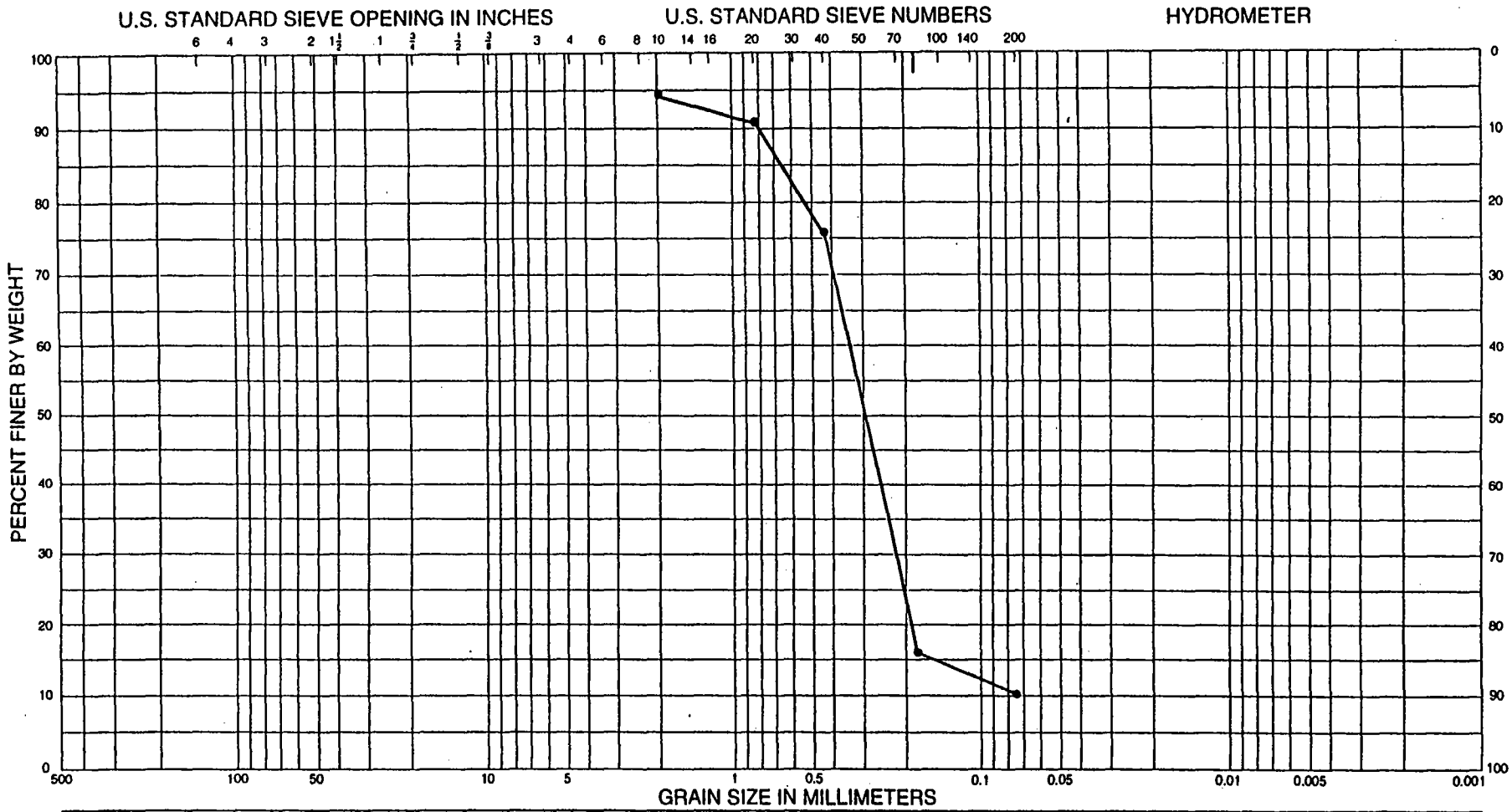

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
ASH-2	--	Black Ash	--	--	--	NP
		NP: Non-Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

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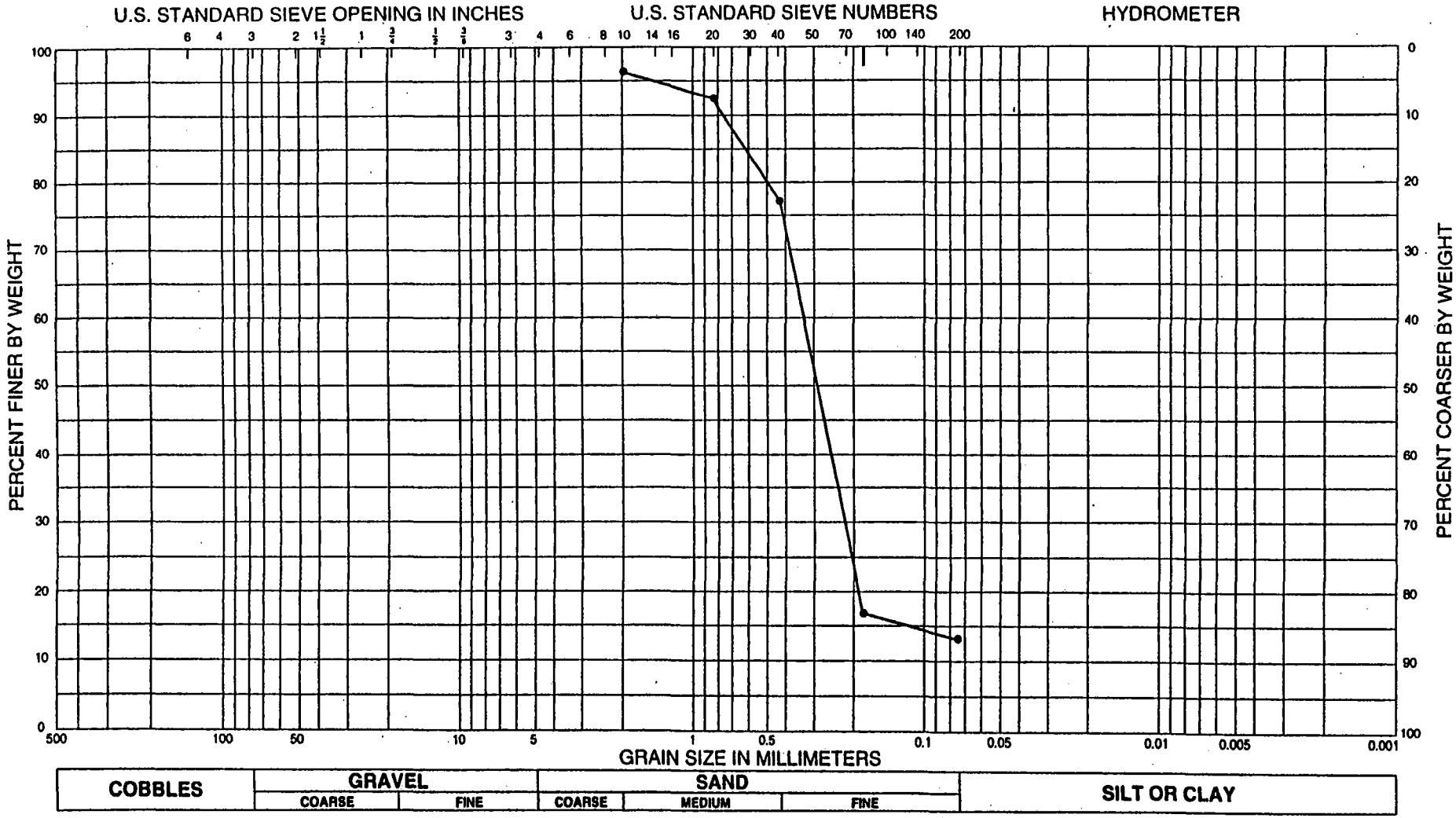

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-1	--	Brown Silty Sand (SM)	--	25	24	1
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

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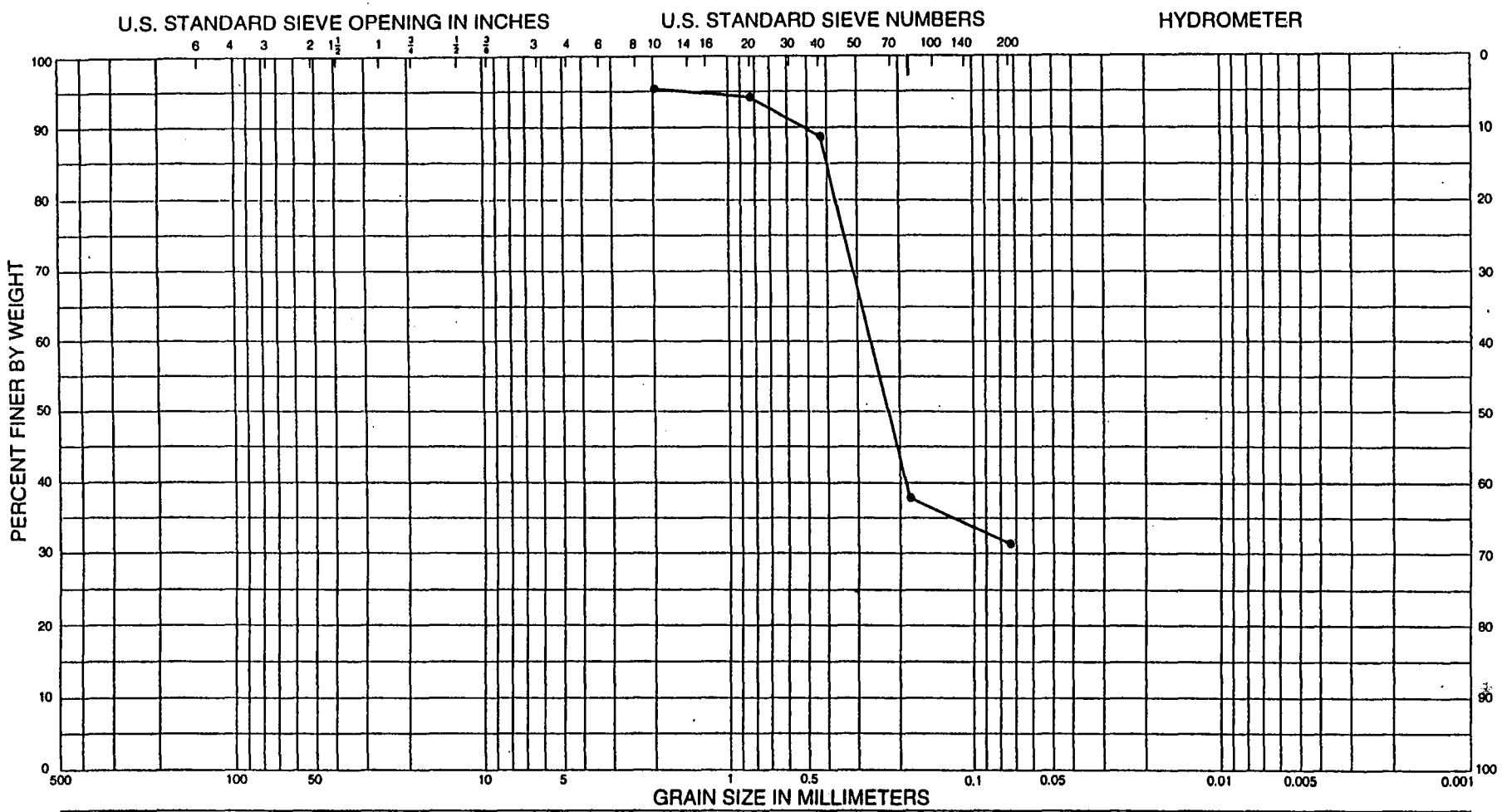

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-2	--	Brown Silty Sand (SM)	--	52	30	22
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

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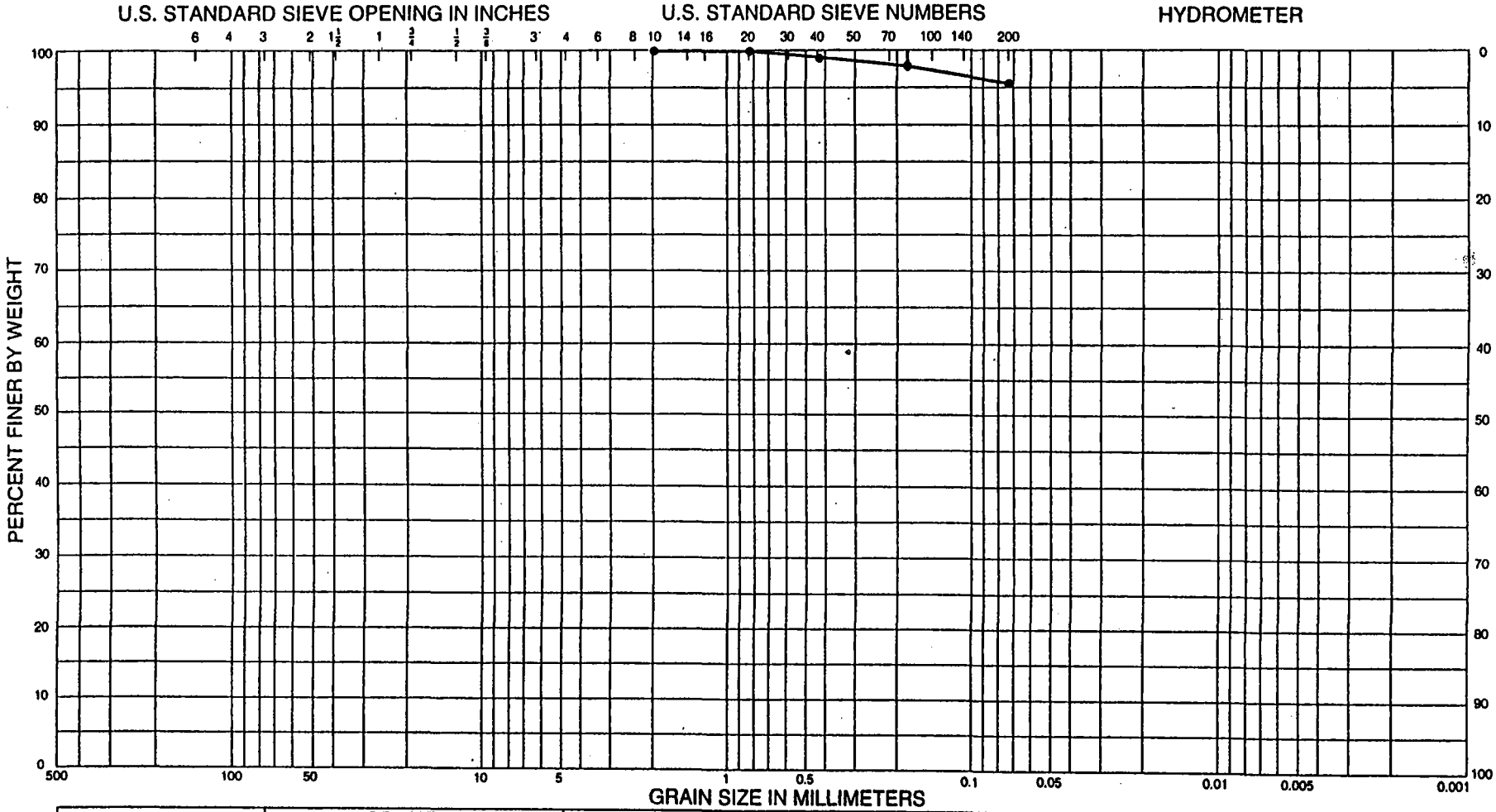

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-3	--	Brown Lean Clay (CL)	--	47	25	22
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

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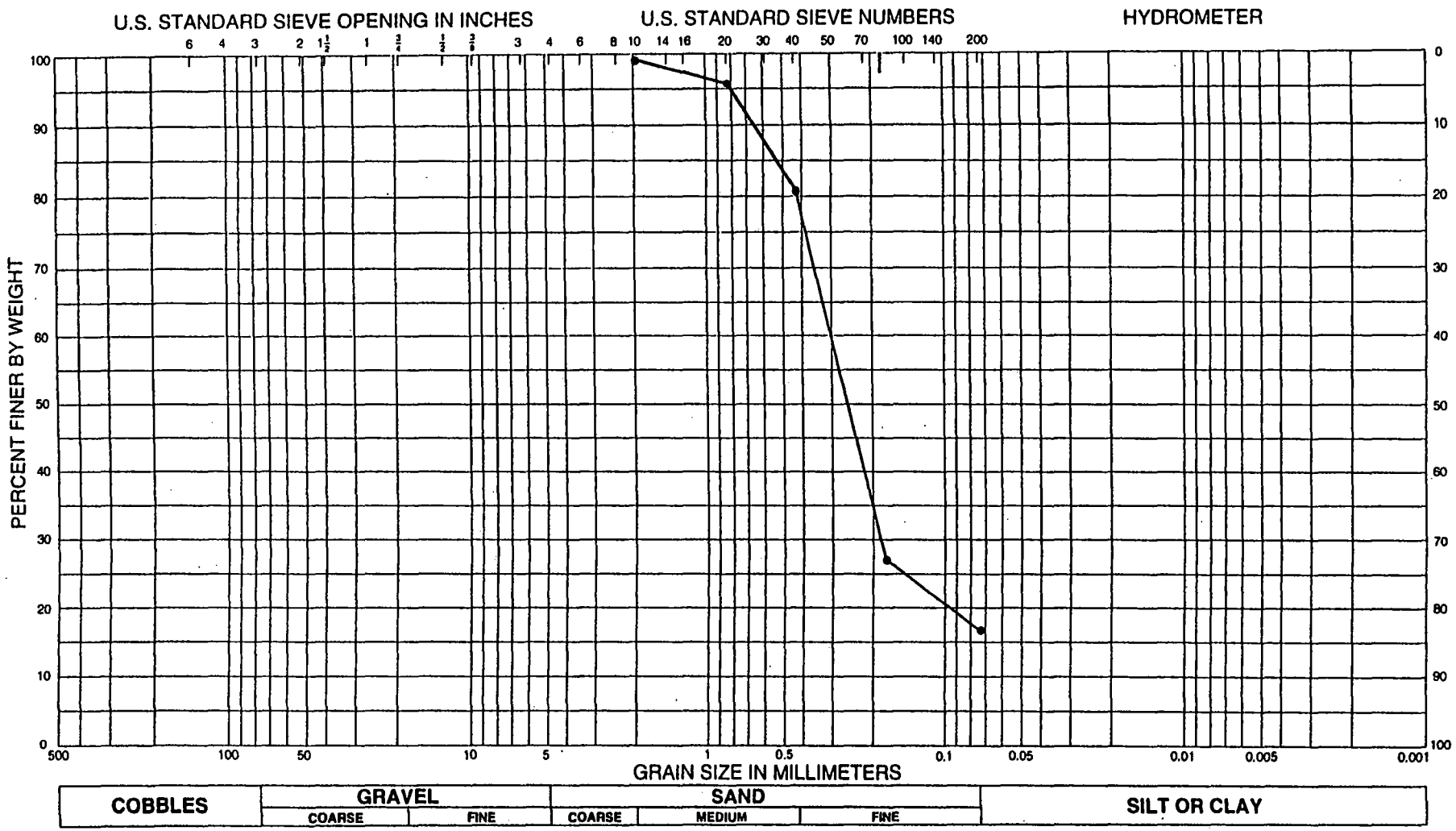

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-4	--	Light Brown Silty Sand (SM)	--	--	--	NP
		NP: Non-Plastic				
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

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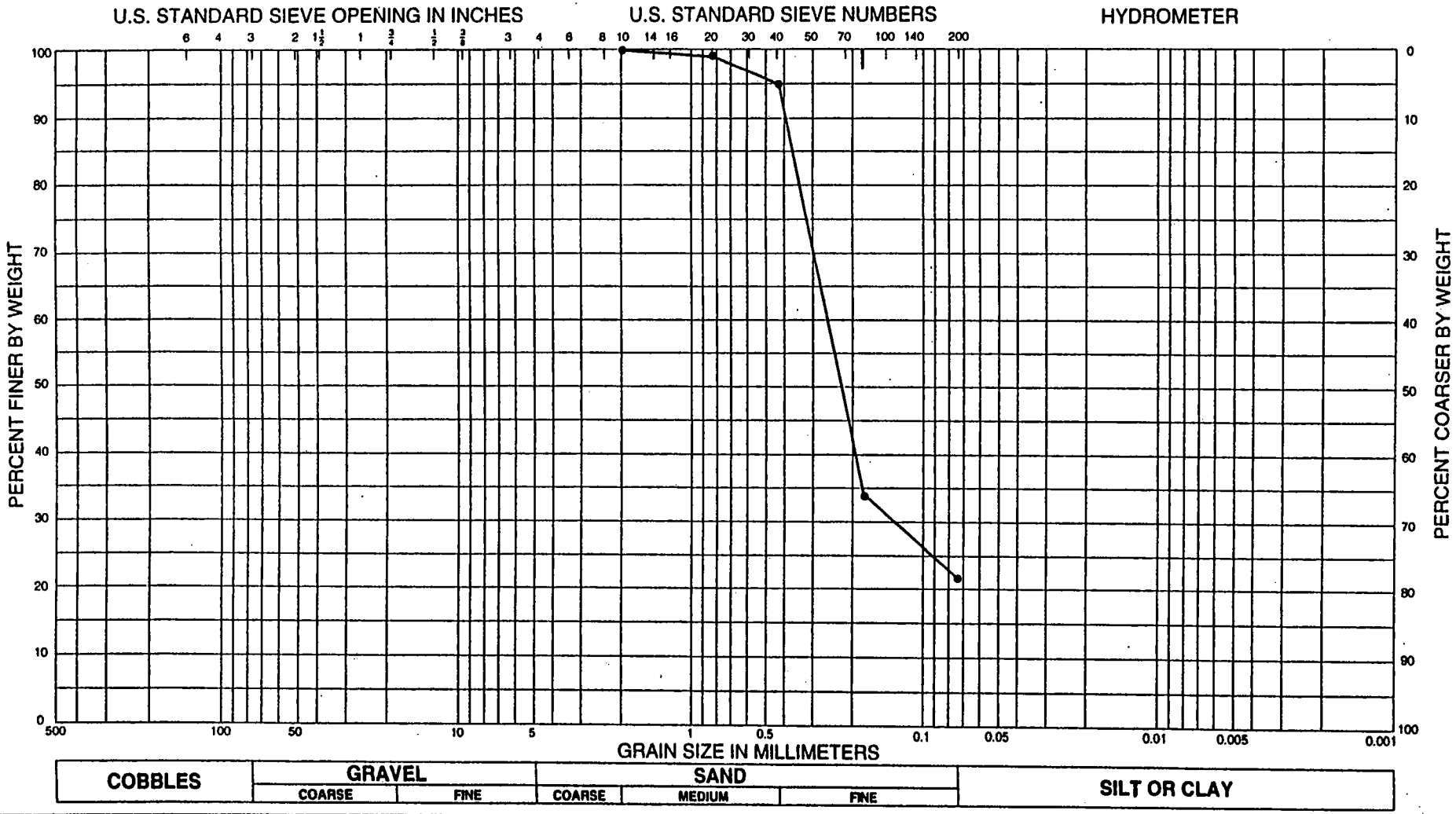

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-5	--	Brown Silty Sand (SM)	--	17	15	2
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

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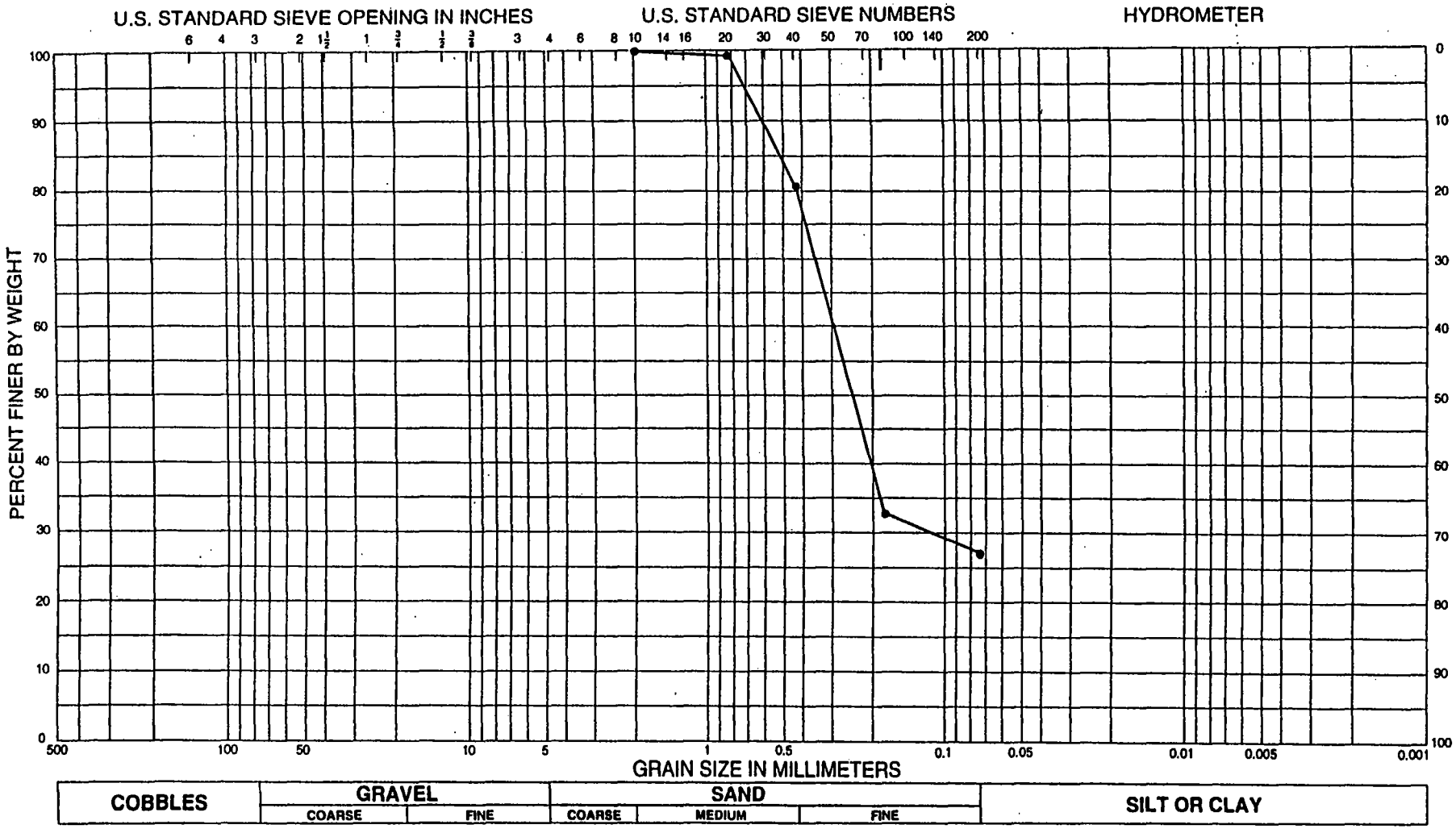

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-6	--	Brown Silty Sand (SM)	--	17	15	2
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

PENSACOLA TESTING LABORATORIES, INC.

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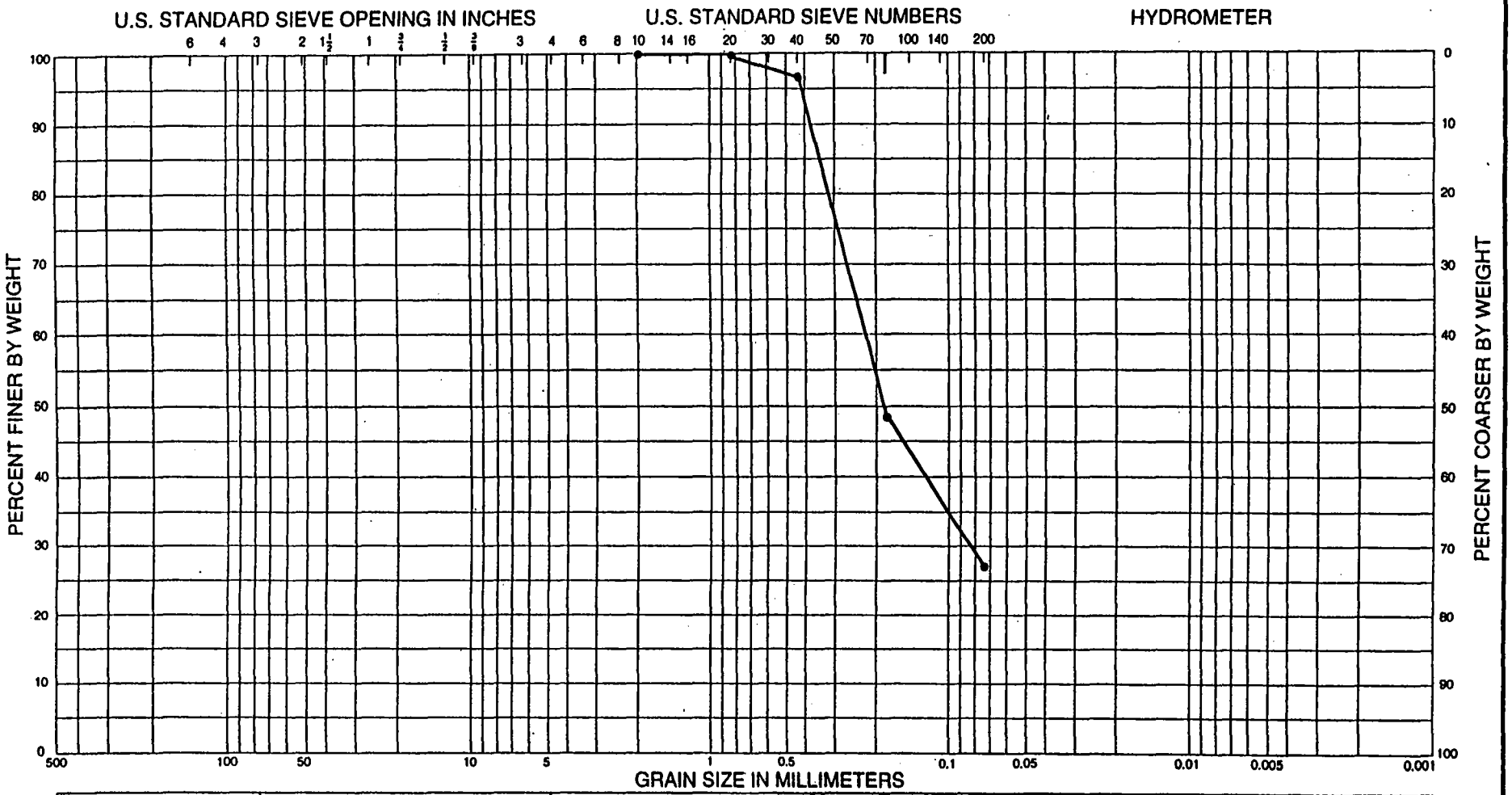

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-7	--	Brown Silty Clayey Sand (SC-SM)	--	27	20	7
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

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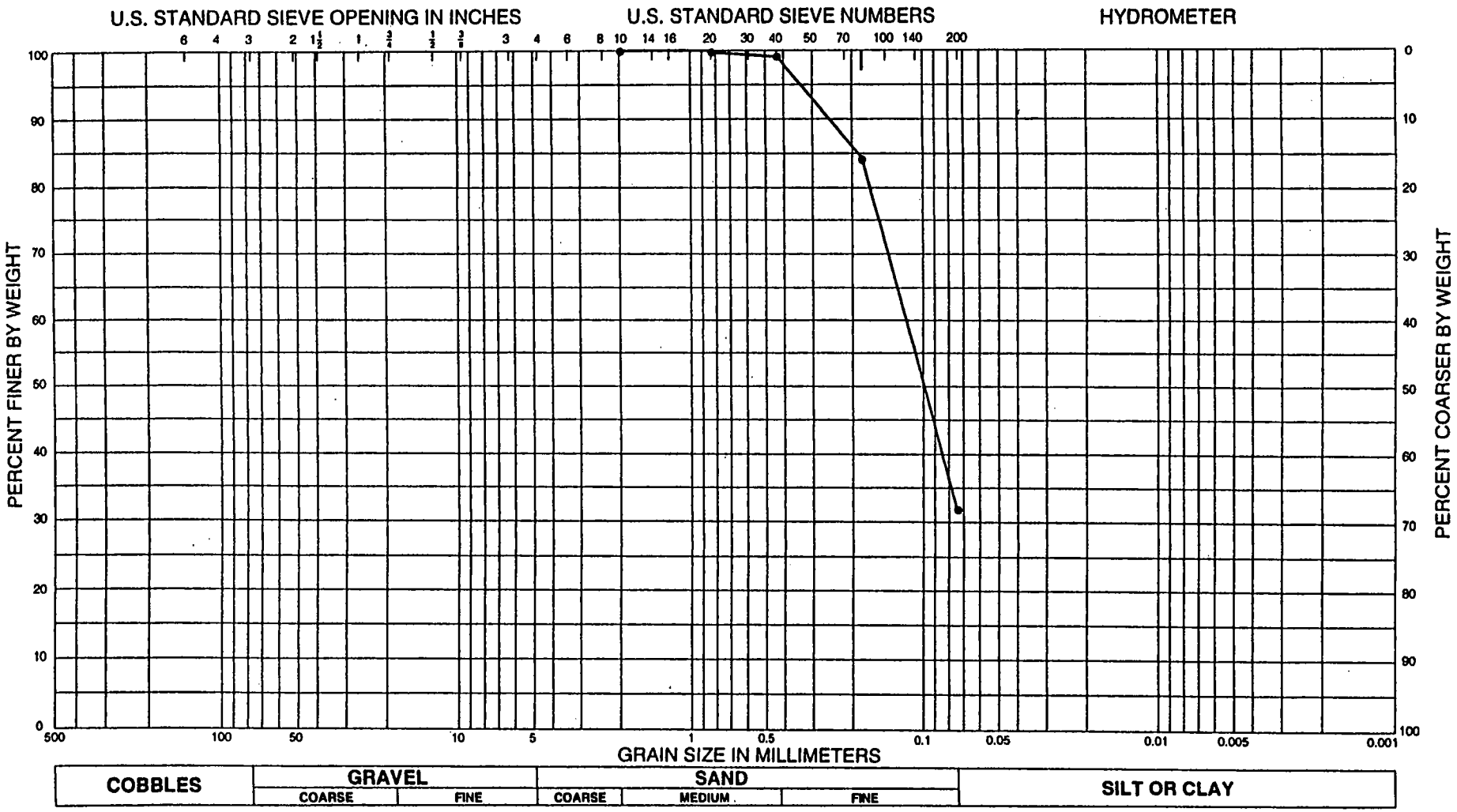

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-8	--	Brown Grey Silty Clayey Sand (SC-SM)	--	25	20	5
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

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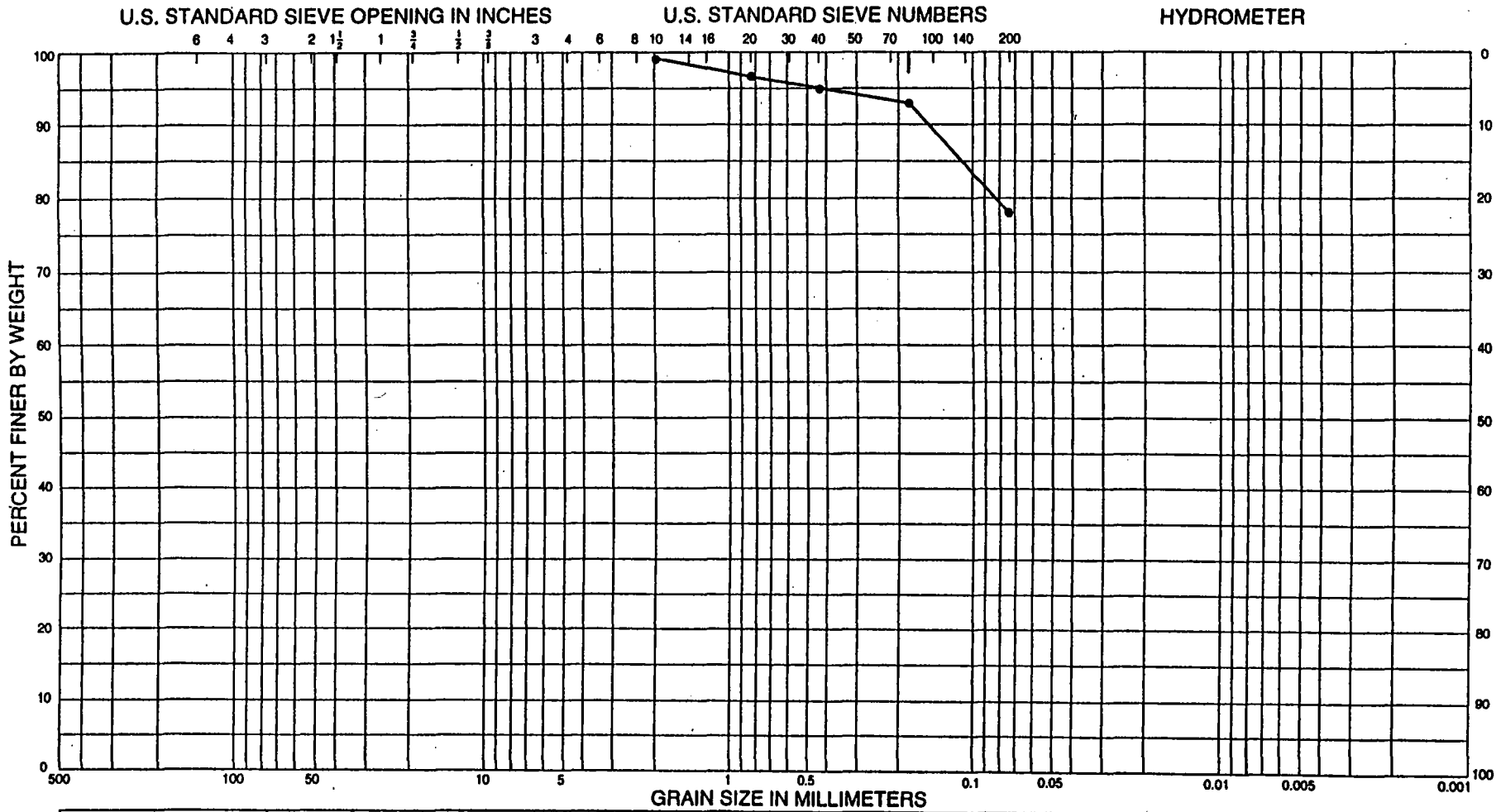

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-9	--	Dark Brown Elastic Silt with Sand (MH)	--	61	35	26
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

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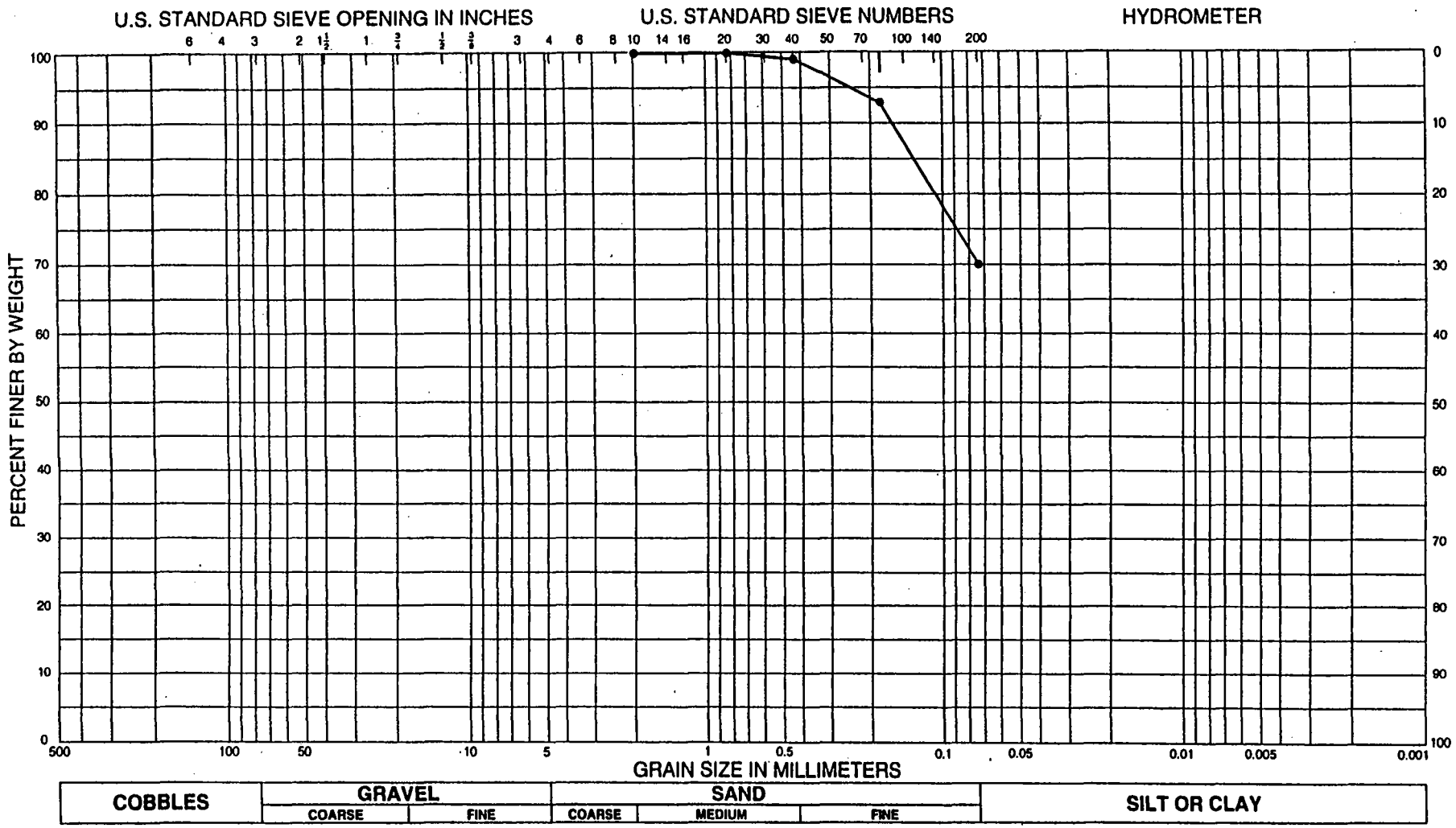

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-10	--	Brown Silt with Sand (ML)	--	48	29	19
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

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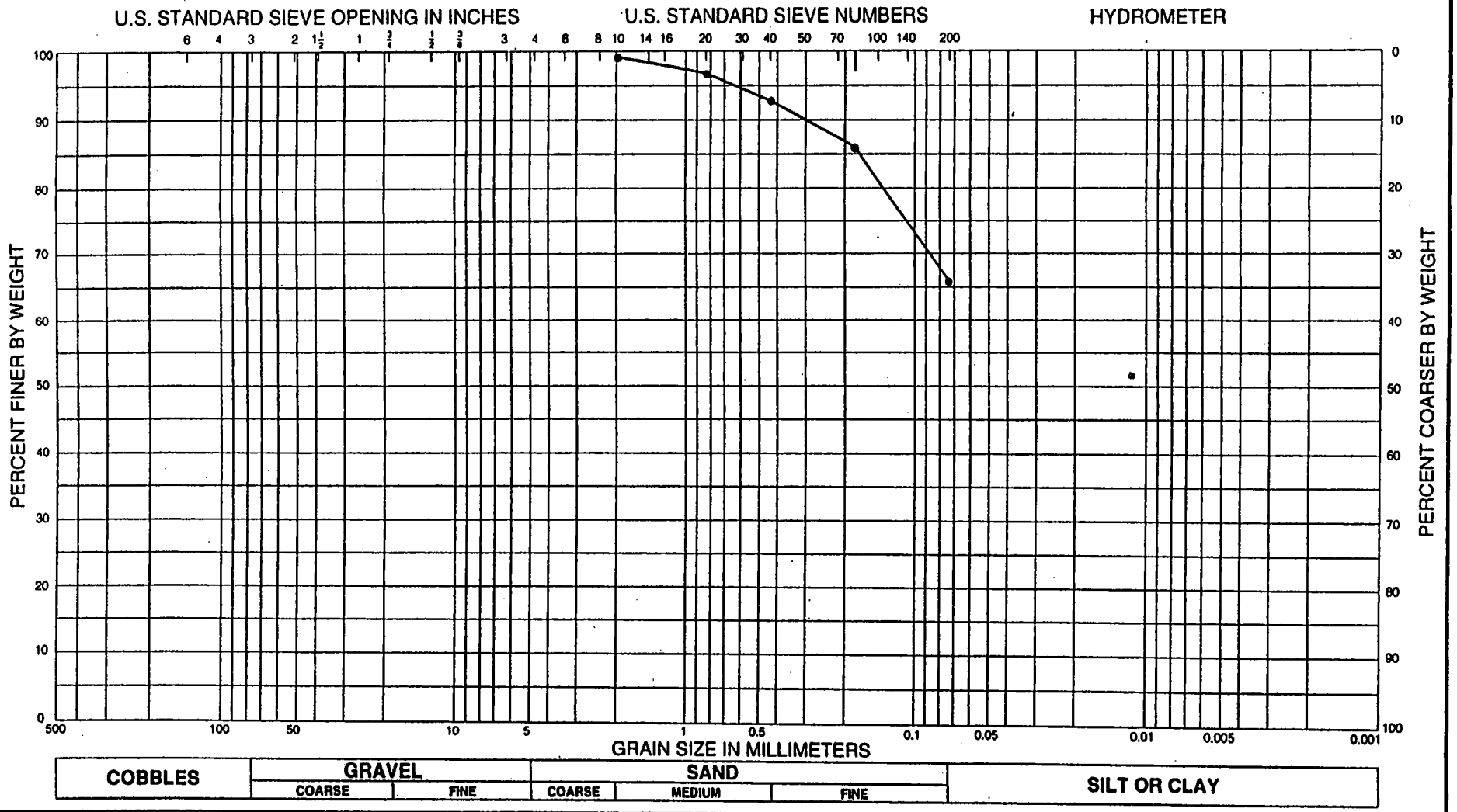

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-11	--	Dark Brown Sandy Elastic Silt (MH)	--	75	38	37
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

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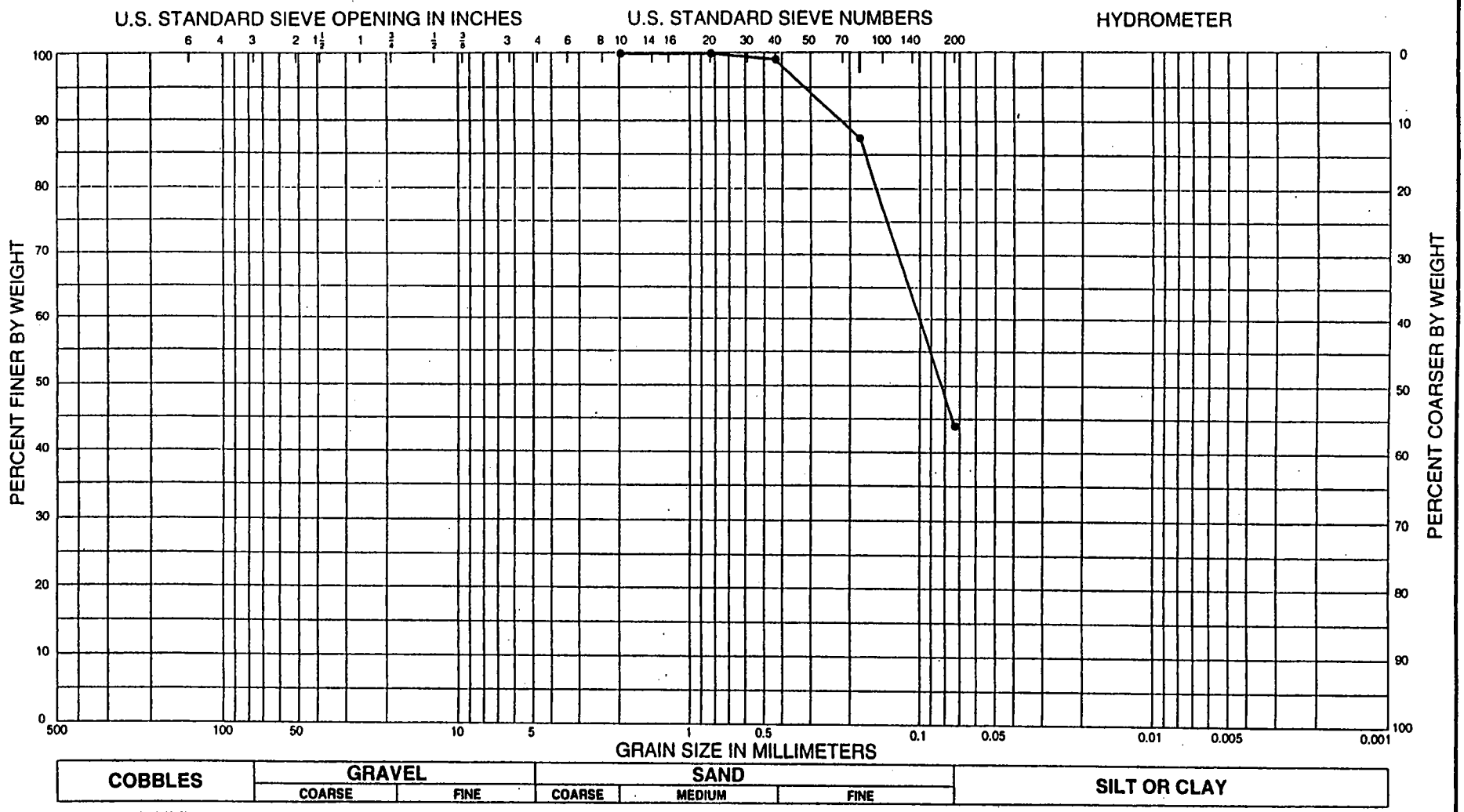

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-12	--	Light Brown Silty Sand (SM)	--	21	18	3
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

PENSACOLA TESTING LABORATORIES, INC.

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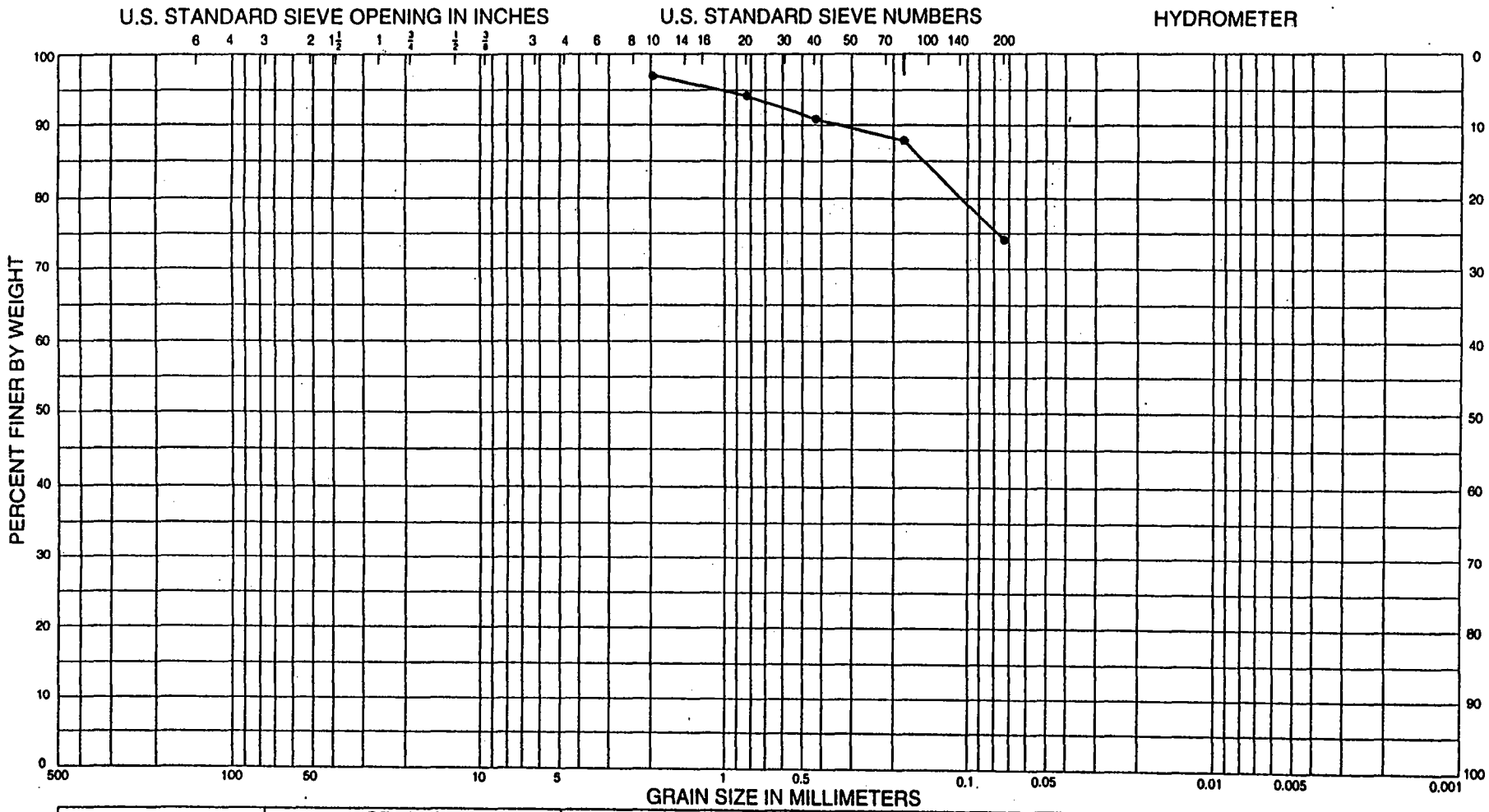

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-13	--	Dark Brown Elastic Silt (MH)	--	95	52	43
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

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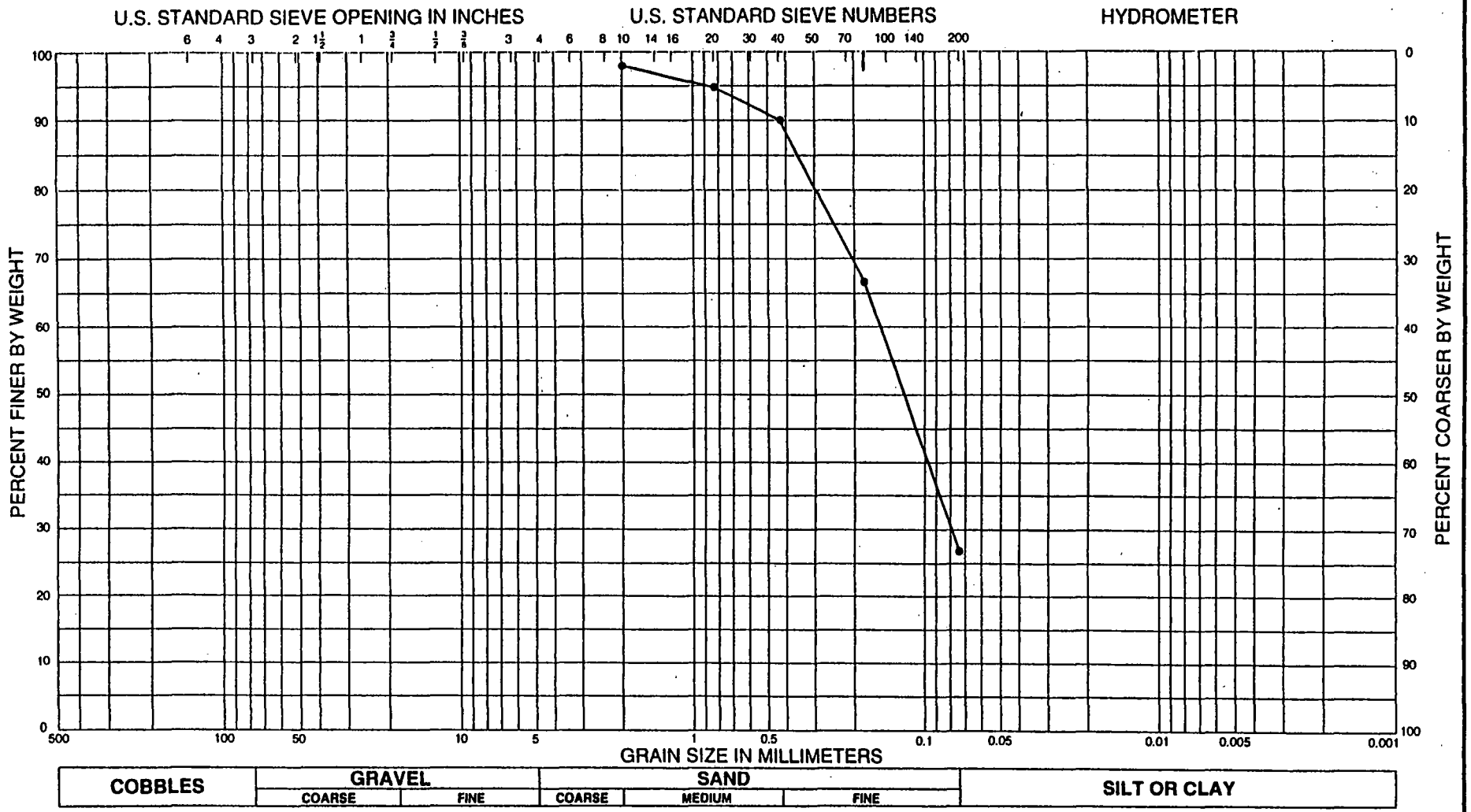

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-14	--	Dark Brown Silty Sand (SM)	--	39	26	13
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

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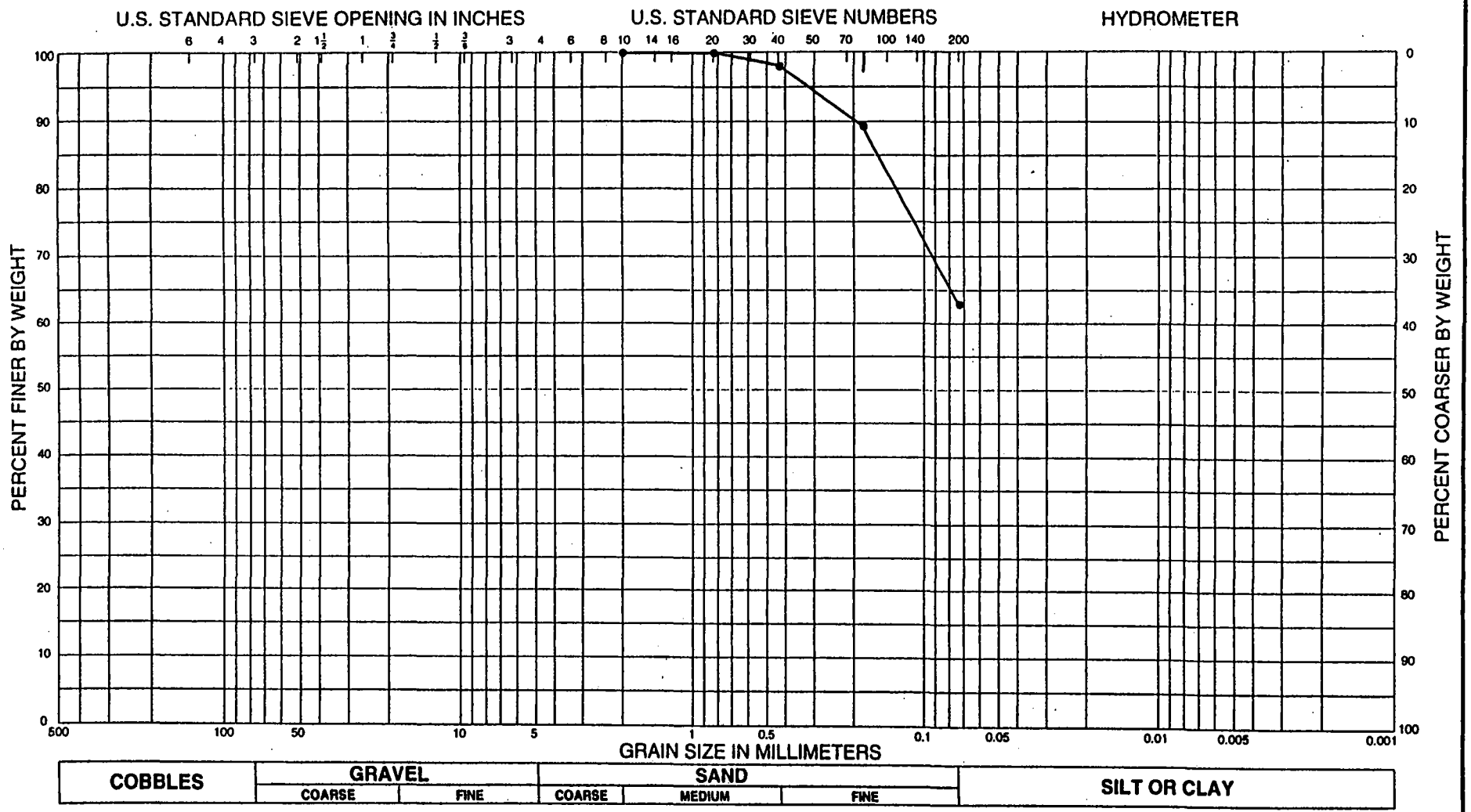

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-15	--	Dark Brown Sandy Silt (ML)	--	49	28	21
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

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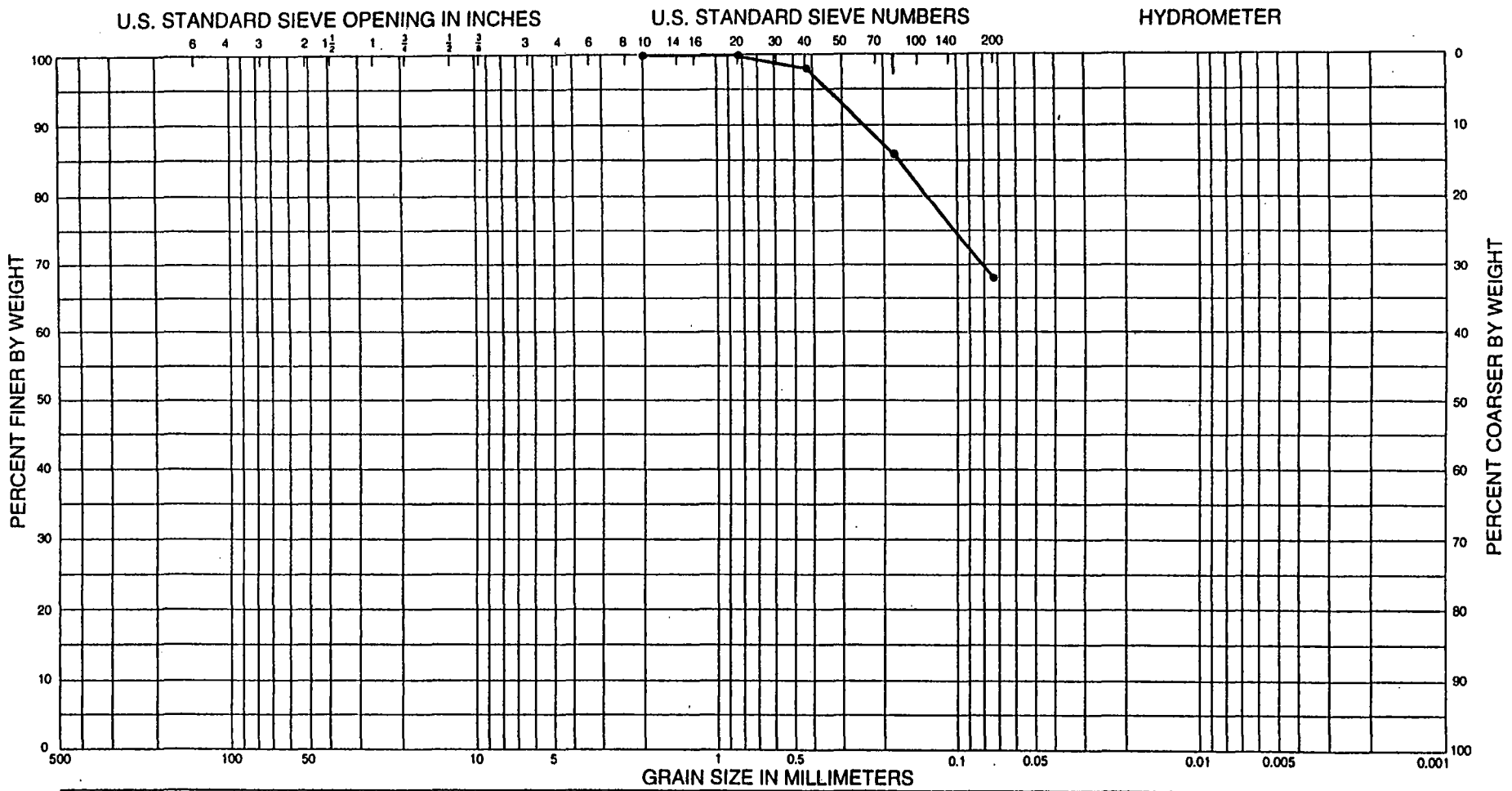

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-16	--	Dark Brown Sandy Elastic Silt (MH)	--	62	33	29
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

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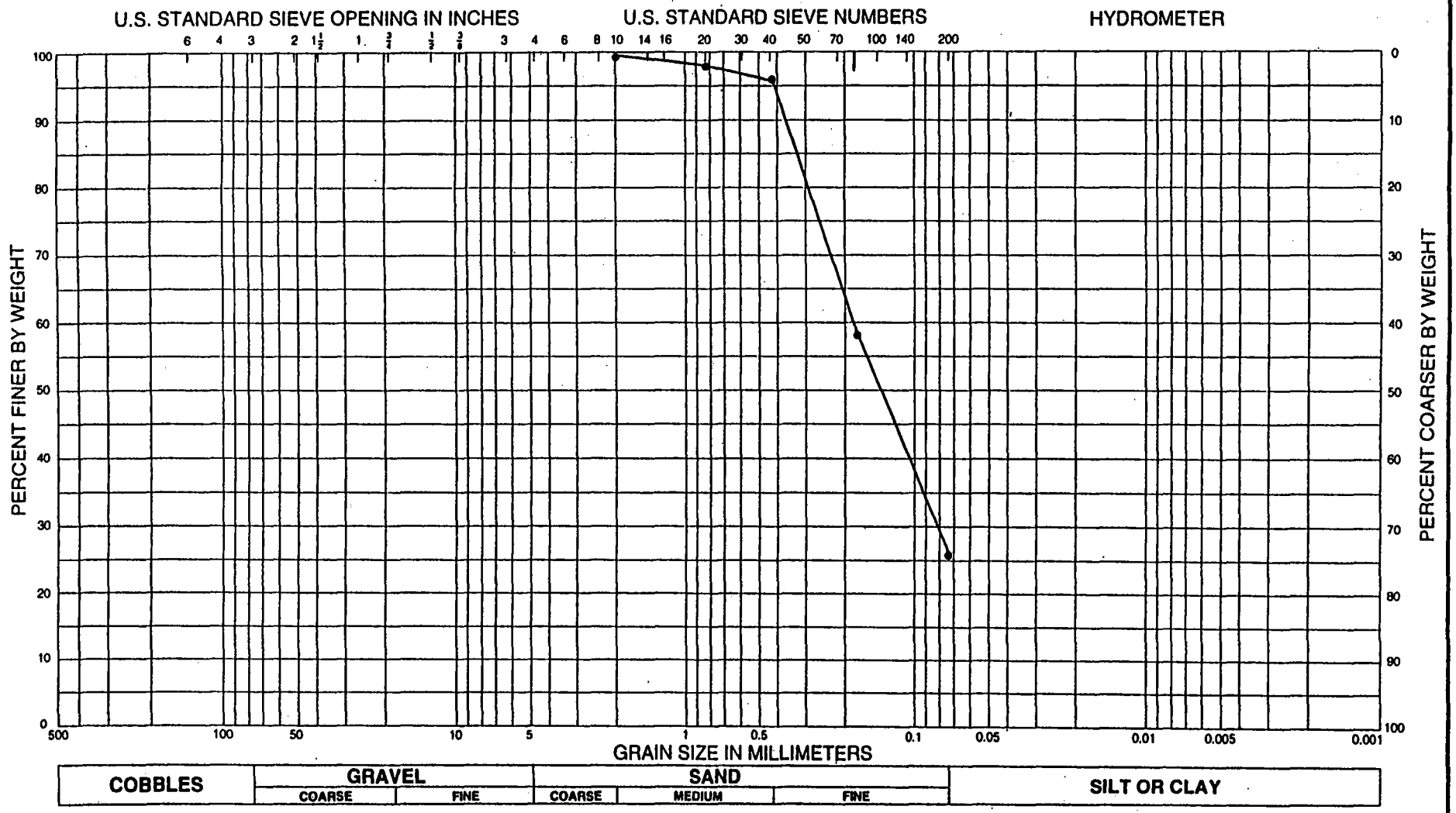

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-17	--	Brown Grey Silty Sand (SM)	--	20	18	2
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

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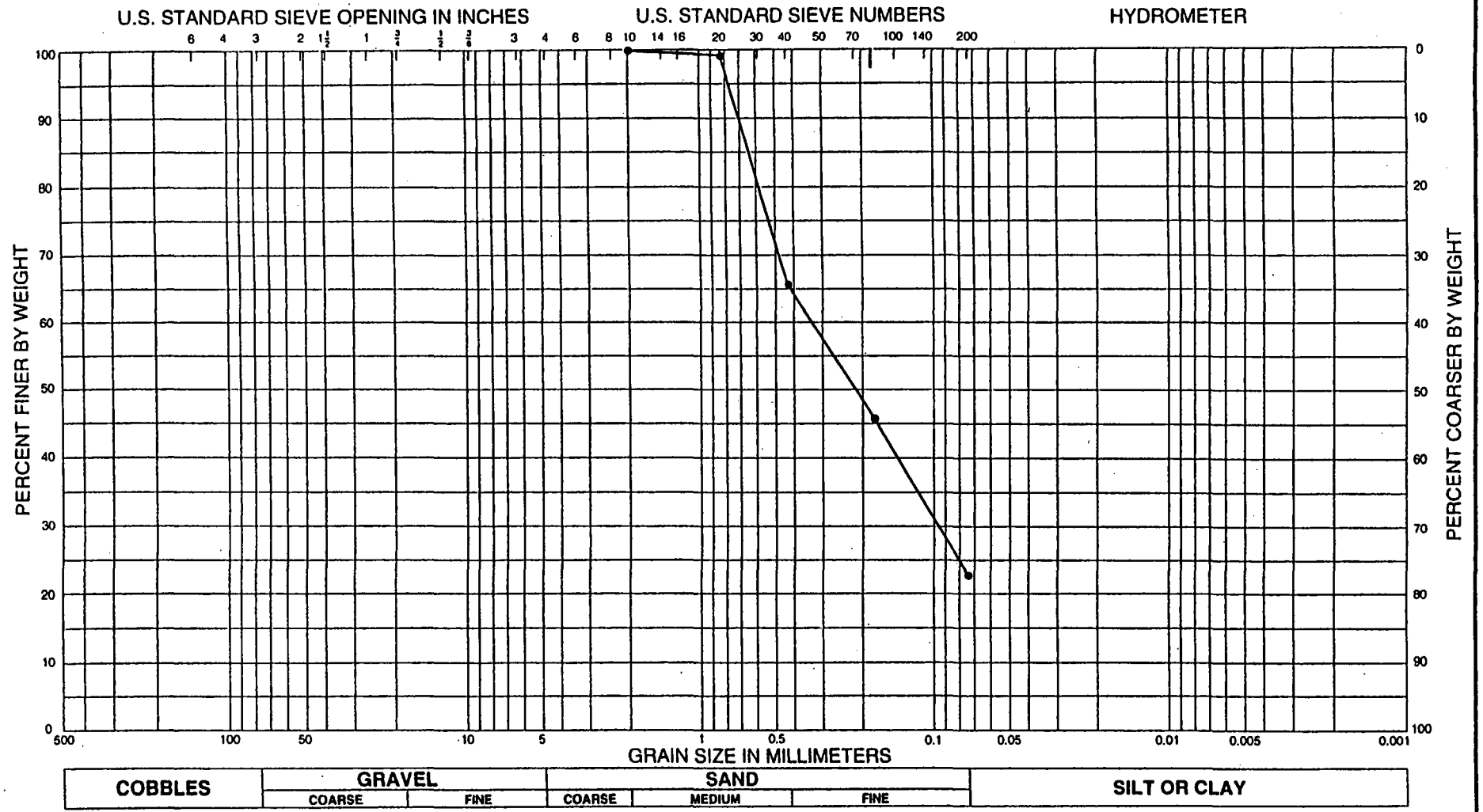

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-18	--	Brown Silty Sand (SM)	--	27	22	5
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

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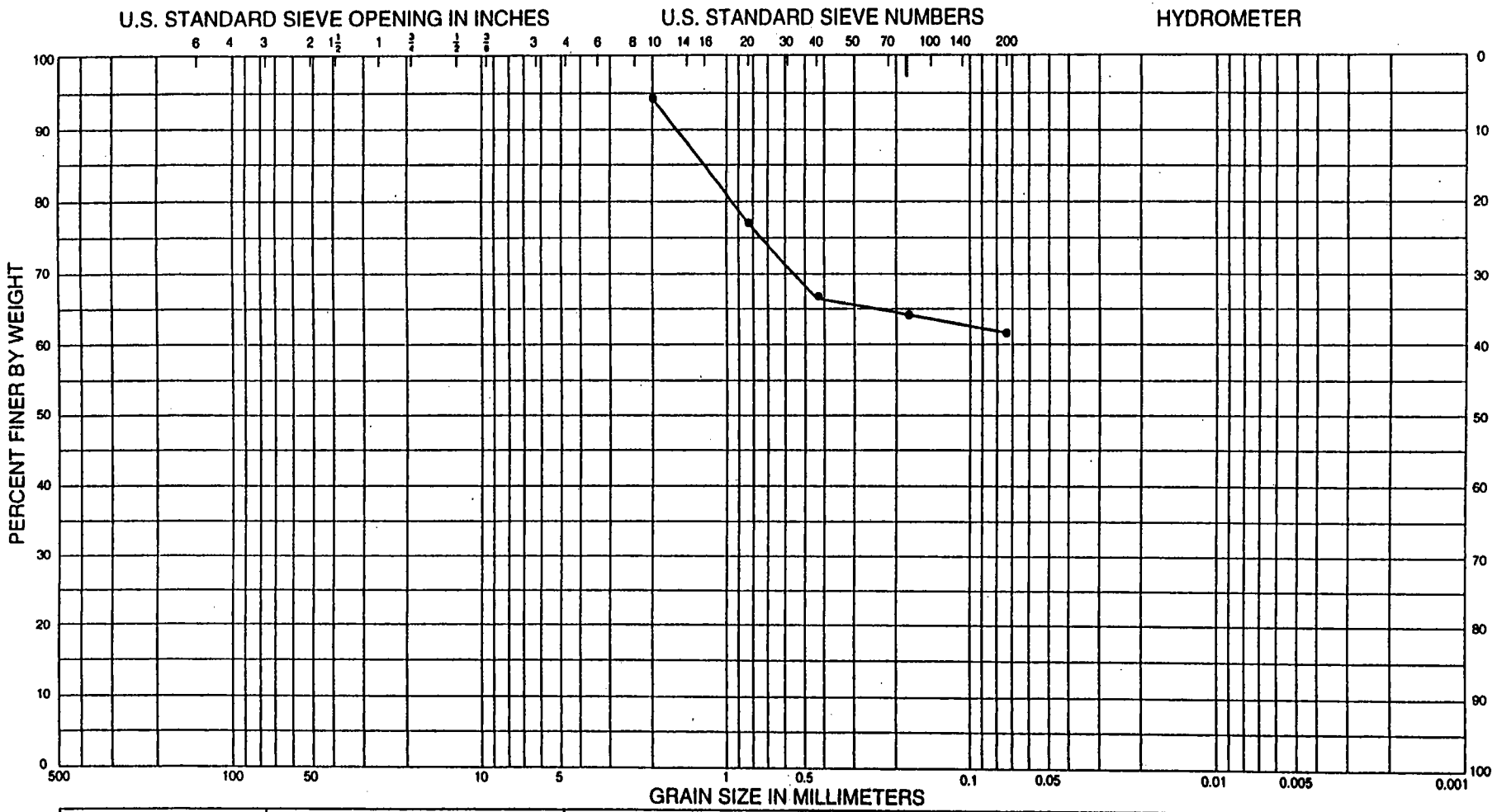

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-19	--	Brown Sandy Elastic Silt (MH)	--	94	44	50
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

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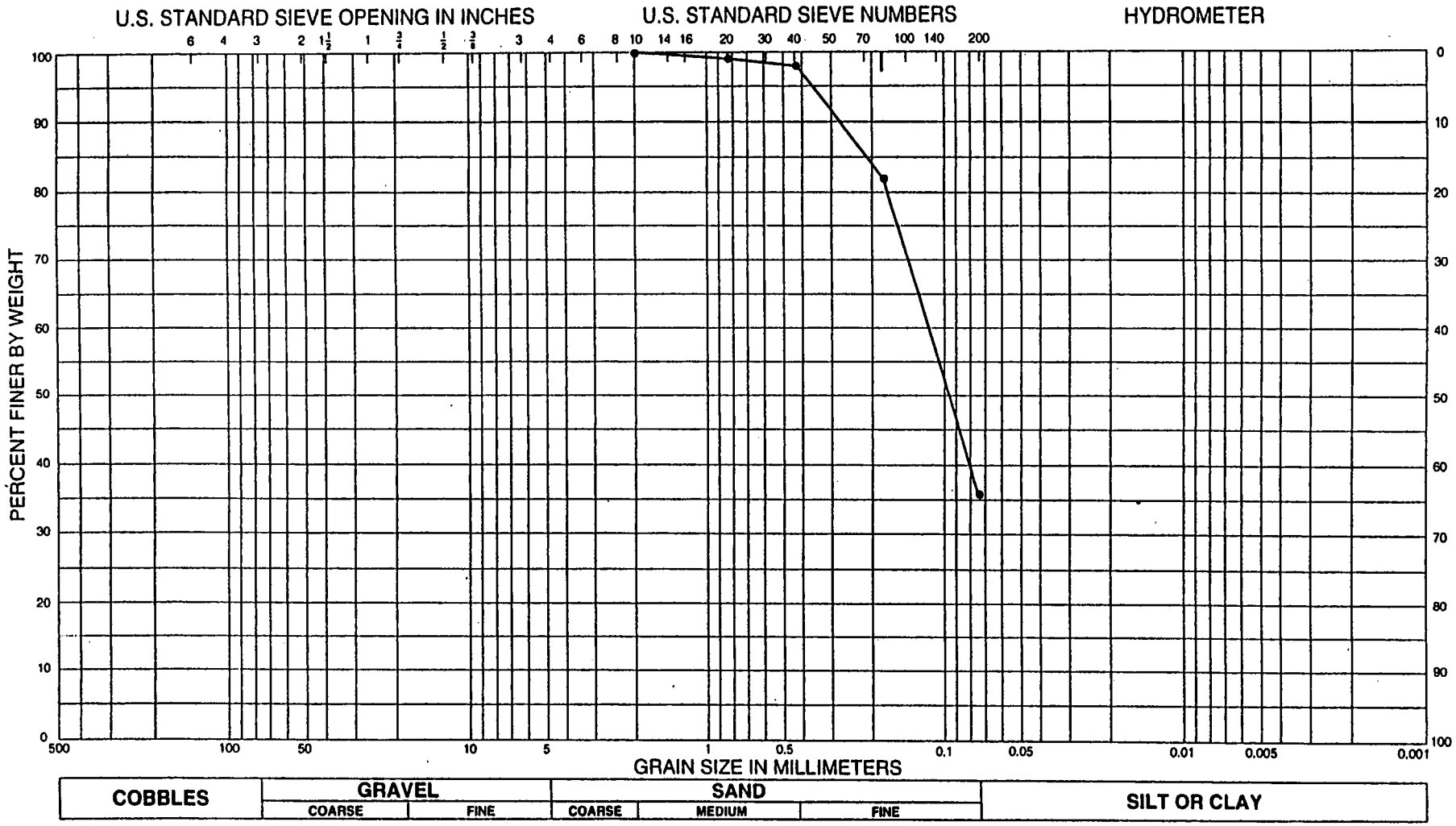


Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GS-20	--	Brown Clayey Sand (SC)	--	33	20	13
		Sample was washed over #200 sieve.				

Project: NCBC Gulfport

For: Harding Lawson Associates

Attn.: Penny Baxter

Boring Number:

Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

A.3 MONITORING WELL SURVEY DATA

Table 2-4
Monitoring Well Survey

Technical Memorandum No. 1
Site A, Former Herbicide Orange Storage Area
Groundwater Sampling Event No. 1
Naval Construction Battalion Center
Gulfport, Mississippi

Well No.	Horizontal Coordinates[1] North	Horizontal Coordinates[1] East	TOC Elevation (msl)
GPT-A-1	259946.44	410564.84	32.20
GPT-A-2	259040.74	409587.93	31.59
GPT-A-3	259393.81	409662.64	33.71
GPT-A-4	259662.96	409940.39	33.69

[1] U.S. Geological Survey, North American Datum, 1927.

Notes: TOC = top of casing.
msl = mean sea level.

Table C-1
Well Survey Data
Groundwater Monitoring Report
Naval Construction Batallion Center
Gulfport, MS

Site ID	Easting	Northing	Ground Elev (ft-MSL)	SI (ft bgs)	Screened Elev (ft-MSL)	Depth of Boring (ft)	Zone	Comment
GPT-08-05	894797.46	319157.32	31.99	15 - 25	6.99 - 16.99	25	Shallow	Downgradient
GPT-08-06	895225.41	319826.93	31.81	15.5 - 25.5	6.31 - 16.31	25.5	Shallow	Downgradient
GPT-08-07	895739.26	320439.77	31.86	15.5 - 25.5	6.36 - 16.36	25.5	Shallow	Downgradient
GPT-08-08	894486.29	320751.08	31.72	16 - 26	5.72 - 15.72	26	Shallow	Downgradient
GPT-08-09	893472.05	320020.01	28.00	5 - 15	13.00 - 23.00	15	Shallow	Downgradient
GPT-08-10	893480.04	320027.46	28.22	21 - 31	-(2.78) - 7.22	31	Intermediate	Downgradient
GPT-08-11	893489.00	320036.08	28.42	135 - 145	-(116.58 - 106.58)	145	Deep	Downgradient
GPT-08-12	893197.76	319388.04	31.14	5 - 15	16.14 - 26.14	15	Shallow	Downgradient
GPT-08-13	893190.08	319380.57	30.96	25 - 35	-(4.04) - 5.96	35	Intermediate	Downgradient
GPT-08-14	893448.33	319089.53	31.76	15 - 25	6.76 - 16.76	27	Shallow	Cross-gradient

NOTES:
Survey coordinates reported in NAD 83
SI = Screened Interval
ft-MSL = feet above mean sea level
bgs = below ground surface

APPENDIX B

CALCULATIONS

B.1 MATERIAL VOLUME CALCULATION

B.2 ROLLER-COMPACTED CONCRETE CALCULATION

B.3 REINFORCED CONCRETE PIPE CALCULATION

B.4 SETTLEMENT ANALYSIS CALCULATION

B.5 CLASS III ROLLER-COMPACTED CONCRETE CULVERT EVALUATION

B.1 MATERIAL VOLUME CALCULATION

CLIENT: NCBC GULFPORT		JOB NUMBER: 7379-NX0-140-150	
SUBJECT: SITE 8 REMEDIAL DESIGN MATERIAL VOLUMES			
BASED ON: Design Drawings		DRAWING NUMBER:	
BY: JLM Date: 5-12-03	CHECKED BY: TNS Date: 5/13/03	APPROVED BY:	DATE:

OBJECTIVE:

1) Determine the volume of on-base drainage channel sediment with the limits of Site 8A to be excavated for stabilization purposes.

2) Determine the volume of structural fill required to restore the drainage channels located on Site 8A.

3) Determine the volume of topsoil required to restore the drainage channels located on Sites 8B and 8C that were excavated by CH2MHILL Contractors Inc. (CCI) in 2002.

4) Determine the volume of on-base drainage channel sediment requiring excavation and consolidation.

5) Determine the volume of topsoil required to restore the on-base drainage channels.

6) Determine the total volume of on-base drainage channel sediment to be stabilized during the Remedial Action.

7) Determine the average area per foot of common fill and aggregate used to construct the Pilot-Scale temporary site access road in 2001.

8) Using information from Pilot-Scale activities, determine the volume of common fill and aggregate required to construct the remainder of the temporary site access road in the off-base area of contamination.

9) Determine the volume of soil to be excavated to construct the temporary diversion channel in the off-base area of contamination.

10) Determine the volume of sediment to be excavated from the off-base area of contamination.

11) Determine the volume of common fill and topsoil required to restore the off-base area of contamination.

12) Determine the volume of common fill and topsoil required to restore the off-base area of contamination that was previously excavated by TtNUS in 2001.

APPROACH:

For the drainage channels located on Site 8A:

1) Using field measurements taken in August 2000, determine the volume of Site 8A drainage channel sediment requiring excavation and consolidation.

2) Determine the volume of structural fill required to restore the Site 8A drainage channels assuming that the drainage channels will be filled to existing grade.

CLIENT: NCBC GULFPORT			JOB NUMBER: 7379-NX0-140-150
SUBJECT: SITE 8 REMEDIAL DESIGN MATERIAL VOLUMES			
BASED ON: Design Drawings			DRAWING NUMBER:
BY: JLM Date: 5-12-03	CHECKED BY: TNA Date: 5/13/03		APPROVED BY: DATE:

For the drainage channels located on Sites 8B and 8C:

1) Determine the average width of the drainage channels located on Sites 8B and 8C that were previously excavated.

2) Assuming a V-shaped drainage channel and a topsoil depth of 6 inches, calculate the volume of topsoil required to restore the drainage channels located on Sites 8B and 8C.

For the on-base drainage channels outside the boundaries of Sites 8A, 8B, and 8C:

1) Using field measurements taken in August 2000, determine the volume of on-base drainage channel sediment requiring excavation and consolidation.

2) Determine the volume of topsoil required to restore the on-base drainage channels assuming a topsoil depth of 6 inches.

For the off-base area of contamination to be excavated:

1) Using invoices from Pilot-Scale activities conducted in 2001, calculate the average area of common fill and aggregate used per foot of temporary site access road.

2) Based on the average area per foot of common fill and aggregate used for Pilot-Scale activities, calculate the volume of common fill and aggregate required for the remainder of the temporary site access road in the off-base area of contamination.

3) Using a typical cross section, determine the volume of soil requiring excavation to construct the temporary diversion channel.

4) Determine the volume of sediment to be excavated from the off-base area of contamination. Assume an excavation depth of 18 inches.

5) Determine the volume of common fill and topsoil required to restored the off-base area of contamination assuming a common fill depth of 12 inches and a topsoil depth of 6 inches.

6) Determine the volume of common fill and topsoil required to restored the off-base area of contamination that was previously excavated by TtNUS in 2001. Assume a common fill depth of 6 inches and a topsoil depth of 6 inches.

REFERENCES:

1) Report titled "Technical Memorandum, Summary of Dioxin Removal Activities and Results, Site 8, Naval Construction Battalion Center, Gulfport, Mississippi, January 2003" prepared by CH2MHILL for the Naval Facilities Engineering Command, Southern Division"

CLIENT: NCBC GULFPORT			JOB NUMBER: 7379-NX0-140-150
SUBJECT: SITE 8 REMEDIAL DESIGN MATERIAL VOLUMES			
BASED ON: Design Drawings			DRAWING NUMBER:
BY: JLM Date: 5-12-03	CHECKED BY: TNN Date: 5/13/03		APPROVED BY: DATE:

2) Calculation titled "Volume of Contaminated On-Base Sediment Calculation" located in Appendix A of the report titled "Focused Feasibility Study, Site 8 Herbicide Orange Storage Area, Naval Construction Battalion Center, Gulfport, Mississippi, March 2003" prepared by Tetra Tech NUS, Inc. for the Naval Facilities Engineering Command, Southern Division"

3) Design Drawings titled "Existing Conditions Plan (Sheet 5 of 5), 60% Remedial Design Submission, Site 8 Herbicide Orange Storage Area, Naval Construction Naval Construction Battalion Center, Gulfport, Mississippi, April 2003" prepared by Tetra Tech NUS, Inc. for the Naval Facilities Engineering Command, Southern Division"

CALCULATIONS:

Drainage Channels on Site 8A

In August 2000, measurements of the Site 8A drainage channels were taken (Reference 2). The measurements included drainage channel width and vertical depth from top of bank to top of sediment (Figure 1, Page 8 of 13). Based on those measurements, the drainage channels were broken up into segments (Figure 2, Page 9 of 13) . Using the measurements collected in August 2000 and Figure 1 (Page 8 of 13), the excavation volume of Site 8A drainage channel sediments has been calculated as follows:

Volume of Excavation = Total Area x Length (L)

Using the measurements collected in August 2000 and Figure 3 (Page 10 of 13), the volume of structural fill required to restore the Site 8A drainage channels is as follows:

Volume of Structural Fill = Area of Structural Fill x Length (L)

Stream Segment	Width (W) (ft)	Vertical Depth from Top of Bank to Top of Sediment (t) (ft)	Sediment Excavation Thickness (d) (ft)	Segment Length (L) (ft)	Volume of Excavation (cf)	Excavation Volume (cy)	Area of Structural Fill (sf)	Volume of Structural Fill (cy)
2	11	3	2	225	2,700	100	30	250
3	14	3	3	350	8,400	311	48	622
4	10	2	3	200	3,000	111	25	185
5	9	3	4	920	7,360	273	14	477
6	22	4	2	240	7,680	284	96	853
C	13	3	2	200	3,200	119	40	296

Volume of Site 8A Drainage Channel Sediment To Be Excavated = 1,198 cy

Volume of Structural Fill Required for Site 8A Drainage Channels = 2,684 cy

CLIENT: NCBC GULFPORT		JOB NUMBER: 7379-NX0-140-150
SUBJECT: SITE 8 REMEDIAL DESIGN MATERIAL VOLUMES		
BASED ON: Design Drawings		DRAWING NUMBER:
BY: JLM Date: 5-12-03	CHECKED BY: FNS Date: 5/13/03	APPROVED BY: DATE:

Drainage Channels on Sites 8B and 8C

According to the CH2MHILL Report (Reference 1):

Length of Drainage Channels Excavated = 3,800 ft
Volume of Sediment Excavated = 2,600 cy
Excavation Depth = 2 ft

Using the first sketch on Figure 4 (Page 11 of 13):
Average Area of Drainage Channels = Volume / Length = 18.5 sf
Average Width of Drainage Channels (W) = Area / Depth = 9.2 ft

Using the second sketch on Figure 4 (Page 11 of 13):
Depth of Channel (D) = W / 2 = 4.6 ft
Width of One Side of Channel (T) = SQRT(D^2 + $[W/2]^2$) = 6.5 ft

Assume 6 inches of Topsoil
Volume of Topsoil Required = Area x Length = 2 Sides x T x 6 inches x Length = 919 cy

On-Base Drainage Channels

In August 2000, measurements of the on-base drainage channels were taken (Reference 2). The measurements included drainage channel width and vertical depth from top of bank to top of sediment (Figure 1, Page 8 of 13). Based on those measurements, the drainage channels were broken up into segments (Figure 2, Page 9 of 13). Using the measurements collected in August 2000 and Figure 1 (Page 8 of 13), the excavation volume of on-base drainage channel sediments has been calculated as follows:

Volume of Excavation = Total Area x Length (L)

Assuming a topsoil depth of 6 inches, using the measurements collected in August 2000 and Figure 5 (Page 12 of 13), the volume of topsoil required to restore the on-base drainage channels is as follows:

Volume of Topsoil = Area of Topsoil x Length (L)

Stream Segment	Width (W) (ft)	Vertical Depth from Top of Bank to Top of Sediment (t) (ft)	Sediment Excavation Thickness (d) (ft)	Segment Length (L) (ft)	Volume of Excavation (cf)	Excavation Volume (cy)	Area of Topsoil (sf)	Volume of Topsoil (cy)
7	16	4	2	690	13,800	511	16	409
8	13	3	2	1065	17,040	631	13	496
9	16	5	2	240	4,320	160	13	119
10	22	5.5	2	890	25,810	956	24	795
11	22	5	2	405	12,150	450	25	381
12	30	5	3	2100	138,600	5,133	53	4108
13	24	5	3	420	20,160	747	35	542

CLIENT: NCBC GULFPORT		JOB NUMBER: 7379-NX0-140-150
SUBJECT: SITE 8 REMEDIAL DESIGN MATERIAL VOLUMES		
BASED ON: Design Drawings		DRAWING NUMBER:
BY: JLM Date: 5-12-03	CHECKED BY: TNS Date: 5/13/03	APPROVED BY: DATE:

Stream Segment	Width (W) (ft)	Vertical Depth from Top of Bank to Top of Sediment (t) (ft)	Sediment Excavation Thickness (d) (ft)	Segment Length (L) (ft)	Volume of Excavation (cf)	Excavation Volume (cy)	Area of Topsoil (sf)	Volume of Topsoil (cy)
14	22	5	3	555	23,310	863	29	592
15	21	6	4	990	43,560	1,613	18	647
16	24	5	3	2070	99,360	3,680	35	2669
17	11	2	3	745	13,410	497	10	264
G	23	3	2	550	19,800	733	33	663
K	11	2	2	540	7,560	280	11	223
18 & 19(1)					4,389	163		119

1 Underground channel segment. Volume assumed to be 1% of the total volume.

Volume of On-Base Drainage Channel Sediment To Be Excavated = 16,417 cy

Volume of Topsoil Required for On-Base Drainage Channels = 12,026 cy

Off-base Area of Contamination

Pilot-Scale Temporary Site Access Road

From Figure 6 (Page 13 of 13)
Length of Pilot-Scale Temporary Site Access Road = 1,075 ft

From Pilot-Scale Invoices
Volume of Common Fill Used = 3,100 cy
Volume of Aggregate Used = 580 cy

Average Area Per Foot of Common Fill Used = Common Fill Volume / Length = 2.88 sf
Average Area Per Foot of Aggregate Used = Aggregate Volume / Length = 0.54 sf

Temporary Site Access Road

From Figure 6 (Page 13 of 13)
Length of Temporary Site Access Road = 3,045 ft

Volume of Common Fill Required = Average Area of Common Fill x Length = 8,781 cy
Volume of Aggregate Required = Average Area of Aggregate x Length = 1,643 cy

CLIENT: NCBC GULFPORT			JOB NUMBER: 7379-NX0-140-150
SUBJECT: SITE 8 REMEDIAL DESIGN MATERIAL VOLUMES			
BASED ON: Design Drawings			DRAWING NUMBER:
BY: JLM Date: 5-12-03	CHECKED BY: TWS 5/13/03 Date:		APPROVED BY: DATE:

Temporary Diversion Channel

From Figure 6 (Page 13 of 13):
Length of Channel = 3,090 ft

From Design Drawing C-3 (Reference 3):
Bottom Width of Channel = 2 ft
Depth of Channel = 1.5 ft
Sideslopes =(X Horizontal:1 Vertical) = 2

Area of Excavated Soil = Area of Sides + Area of Middle = 7.5 sf
Volume of Excavated Soil = Area x Length = 858 cy

Area of Contamination

Using Figure 6 (Page 13 of 13)
Off-base Area of Contamination = 499,051 sf

Excavation Depth = 1.5 ft

Volume of Off-base Area of Contamination Sediment = Area x Depth = 27,725 cy
Volume of Common Fill = Area x 12 inches = 18,483 cy
Volume of Topsoil = Area x 6 inches = 9,242 cy

Area of Contamination Previously Excavated

Using Figure 6 (Page 13 of 13)
Off-base Area of Contamination Previously Excavated = 24,441 sf

Excavation Depth = 1.133 ft

Volume of Off-base Area of Contamination Sediment = Area x Depth = 1,026 cy
Volume of Common Fill = Area x 6 inches = 453 cy
Volume of Topsoil = Area x 6 inches = 453 cy

CLIENT: NCBC GULFPORT		JOB NUMBER: 7379-NX0-140-150
SUBJECT: SITE 8 REMEDIAL DESIGN MATERIAL VOLUMES		
BASED ON: Design Drawings		DRAWING NUMBER:
BY: JLM Date: 5-12-03	CHECKED BY: TNA Date: 5/13/03	APPROVED BY: DATE:

SUMMARY OF RESULTS:

Area	Volume of Excavation (cy)	Volume of Topsoil (cy)	Volume of Common Fill (cy)	Volume of Aggregate (cy)	Volume of Structural Fill (cy)
Site 8A Drainage Channels	1,198	--	--	--	2,684
Sites 8B and 8C Drainage Channels[1]	2,600	919	--	--	--
On-Base Drainage Channels (Outside Boundary of Sites 8A, 8B, and 8C)	16,417	12,026	--	--	--
Temporary Site Access Road	--	--	8,781	1,643	--
Temporary Diversion Channel	858	--	--	--	--
Off-base Area of Contamination	27,725	9,242	18,483		
Off-base Area of Contamination Previously Excavated[2]	1,026	453	453		

[1] Volume of excavation taken from Reference 1. Excavated prior to Remedial Action by CCI in 2002.

[2] Excavated prior to Remedial Action by TtNUS in 2001.

Total Volume of On-base Drainage Channel Sediments To Be Stabilized = 20,215 cy

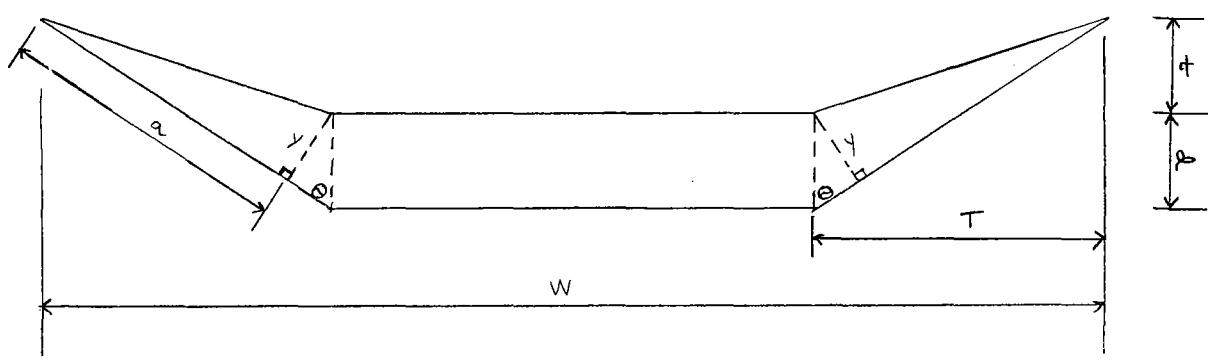
CLIENT	JOB NUMBER
NCBC GULFPORT	
SUBJECT: SITE 8 MATERIAL VOLUMES CALCULATION	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
JLM	5/13/03		

FIGURE 1

SITE 8A AND ON-BASE DRAINAGE CHANNELS

EXCAVATION VOLUME



$\sin\theta = \frac{y}{d}$ $\quad y = d\sin\theta$ $\quad \theta = 45°$ (1H:1V) $\quad y = d\sin 45°$

$a = \sqrt{T^2 + (t+d)^2}$ $\quad T = t+d$ (1H:1V)

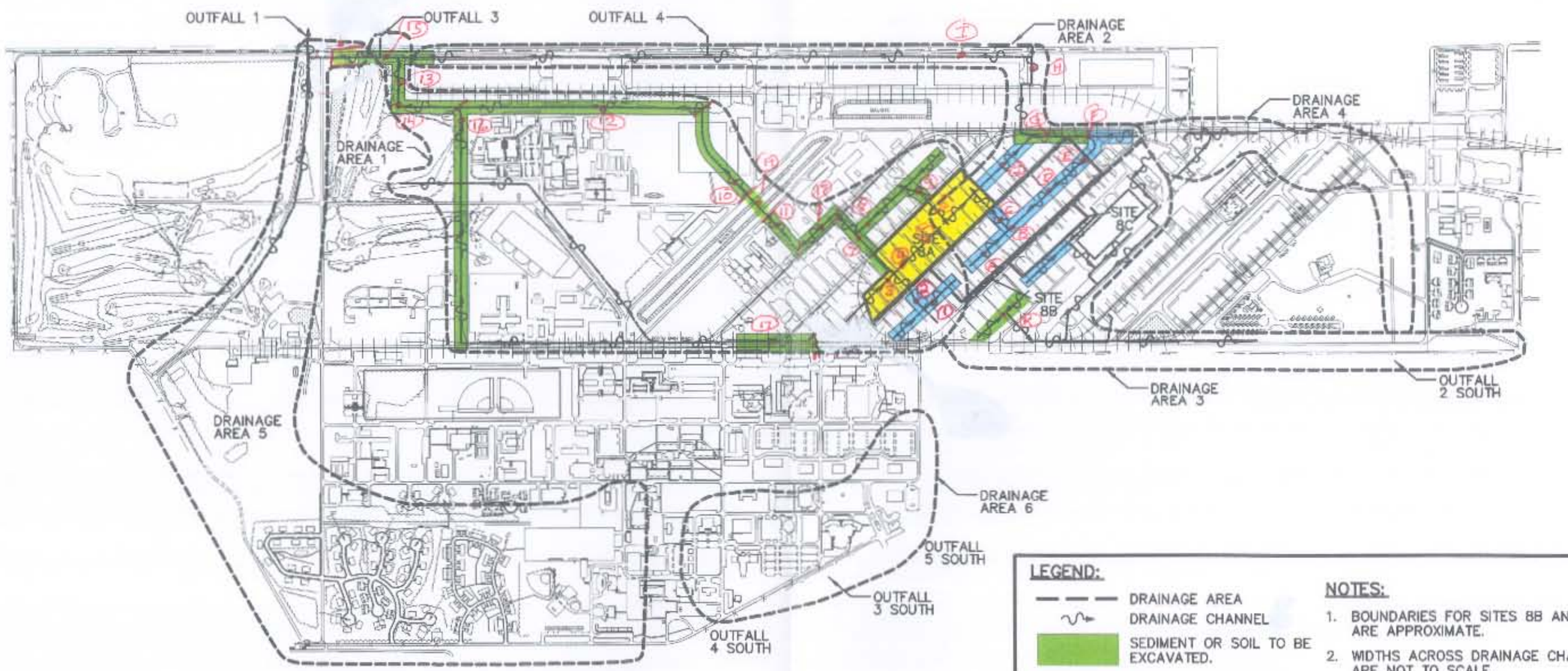
$= \sqrt{(t+d)^2 + (t+d)^2} = \sqrt{2(t+d)^2}$

AREA (2 SIDES) $= 2 \times \frac{1}{2} ay = ay = \sqrt{2(t+d)^2}\,(d\sin 45°)$

TOTAL AREA = AREA (2 SIDES) + MIDDLE $= \sqrt{2(t+d)^2}\,(d\sin 45°) + (W-2T)d$

$= \sqrt{2(t+d)^2}\,(d\sin 45°) + [W - 2(t+d)]\,d$

ACAD: 7379GP22.dwg 04/25/03 DM PIT



LEGEND:

- DRAINAGE AREA
- DRAINAGE CHANNEL
- SEDIMENT OR SOIL TO BE EXCAVATED.
- AREA TO BE USED FOR STAGING AND STORAGE AREA (SITE 8A)
- SEDIMENT OR SOIL EXCAVATED (CH2MHILL, 2002)

NOTES:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.
2. WIDTHS ACROSS DRAINAGE CHANNELS ARE NOT TO SCALE.

0 1000 2000
SCALE IN FEET

SOURCE: NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT MS., JUNE 2001

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 4/24/03
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

AREAL EXTENT OF ON-BASE CONTAMINATED MEDIA
SITE 8 BASIS OF DESIGN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2
REV. 0

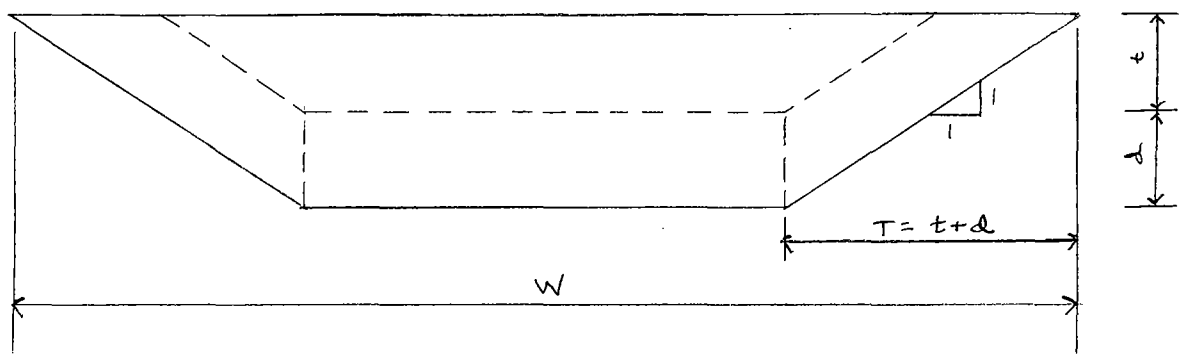
FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

CLIENT		JOB NUMBER	
NCBC GULFPORT			
SUBJECT: SITE 8 MATERIAL VOLUMES CALCULATION			
BASED ON		DRAWING NUMBER	
BY: JLM	CHECKED BY: [illegible] 5/13/03	APPROVED BY	DATE

FIGURE 3

SITE 8A DRAINAGE CHANNELS

STRUCTURAL FILL VOLUME



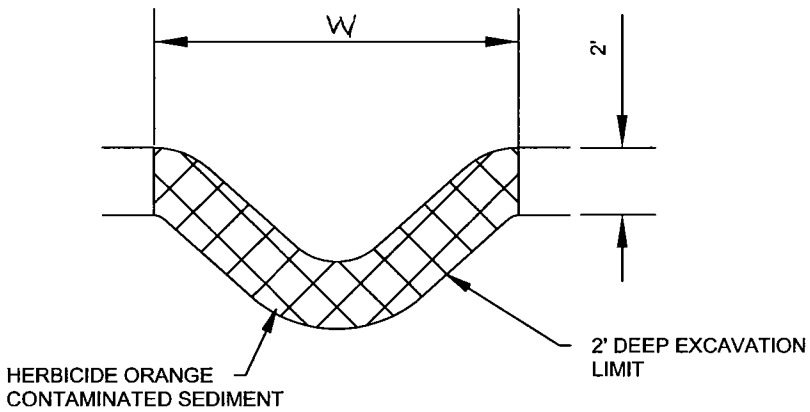
$$\text{AREA (2 SIDES)} = 2 \times \tfrac{1}{2}(T)(t+d) = (t+d)(t+d)$$

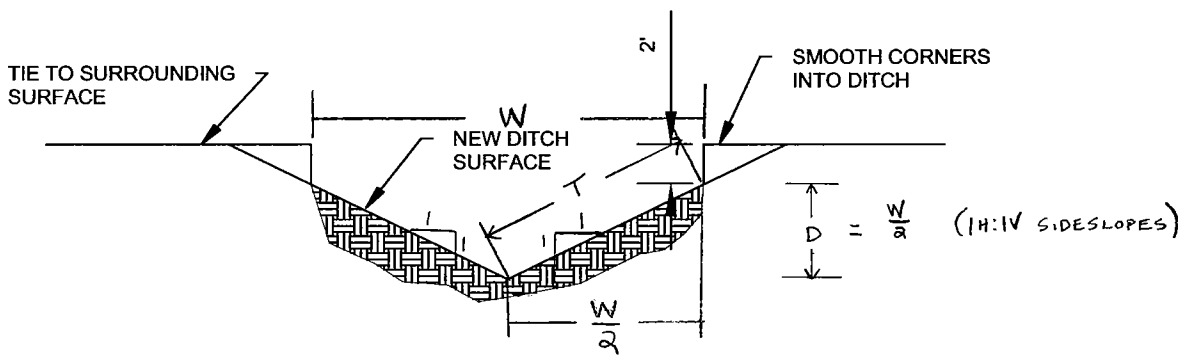
$$\begin{aligned}\text{TOTAL AREA} &= \text{AREA (2 SIDES)} + \text{MIDDLE} \\ &= (t+d)(t+d) + (W - 2T)(t+d) \\ &= (t+d)(t+d) + [W - 2(t+d)](t+d)\end{aligned}$$

FIGURE 4

SITES 8B AND 8C

DRAINAGE CHANNELS





$$T = \sqrt{D^2 + \left(\frac{W}{2}\right)^2}$$

AREA OF TOPSOIL = (T)(6 inches) x 2 SIDES

☒ AVERAGE AREA OF DRAINAGE CHANNELS (EXCAVATED)

TYPICAL SECTION OF DITCH EXCAVATION
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MS

REFERENCE 1

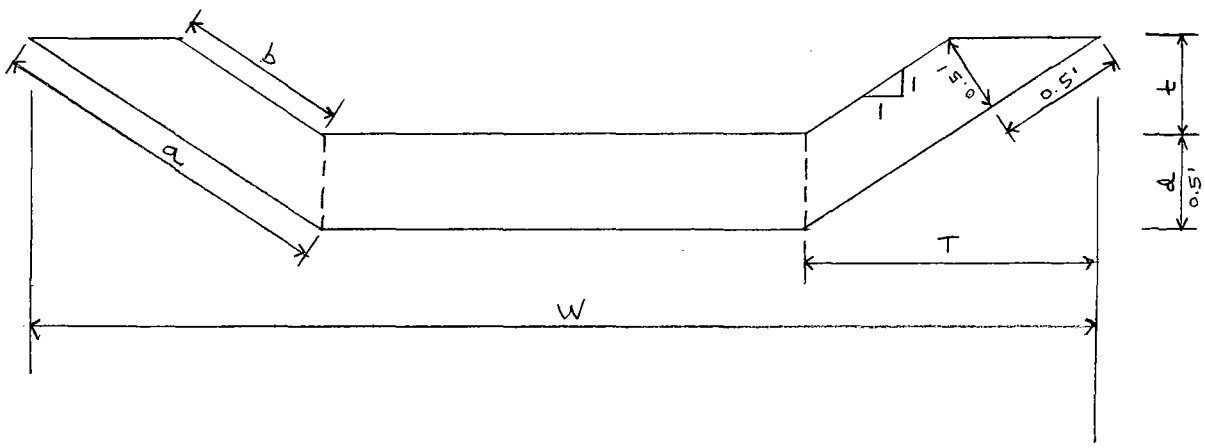
CH2MHILL

CLIENT		JOB NUMBER	
NCBC GULFPORT			
SUBJECT			
SITE 8 MATERIAL VOLUMES CALCULATION			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE
JLM	5/13/03		

FIGURE 5

ON-BASE DRAINAGE CHANNELS

TOPSOIL VOLUME



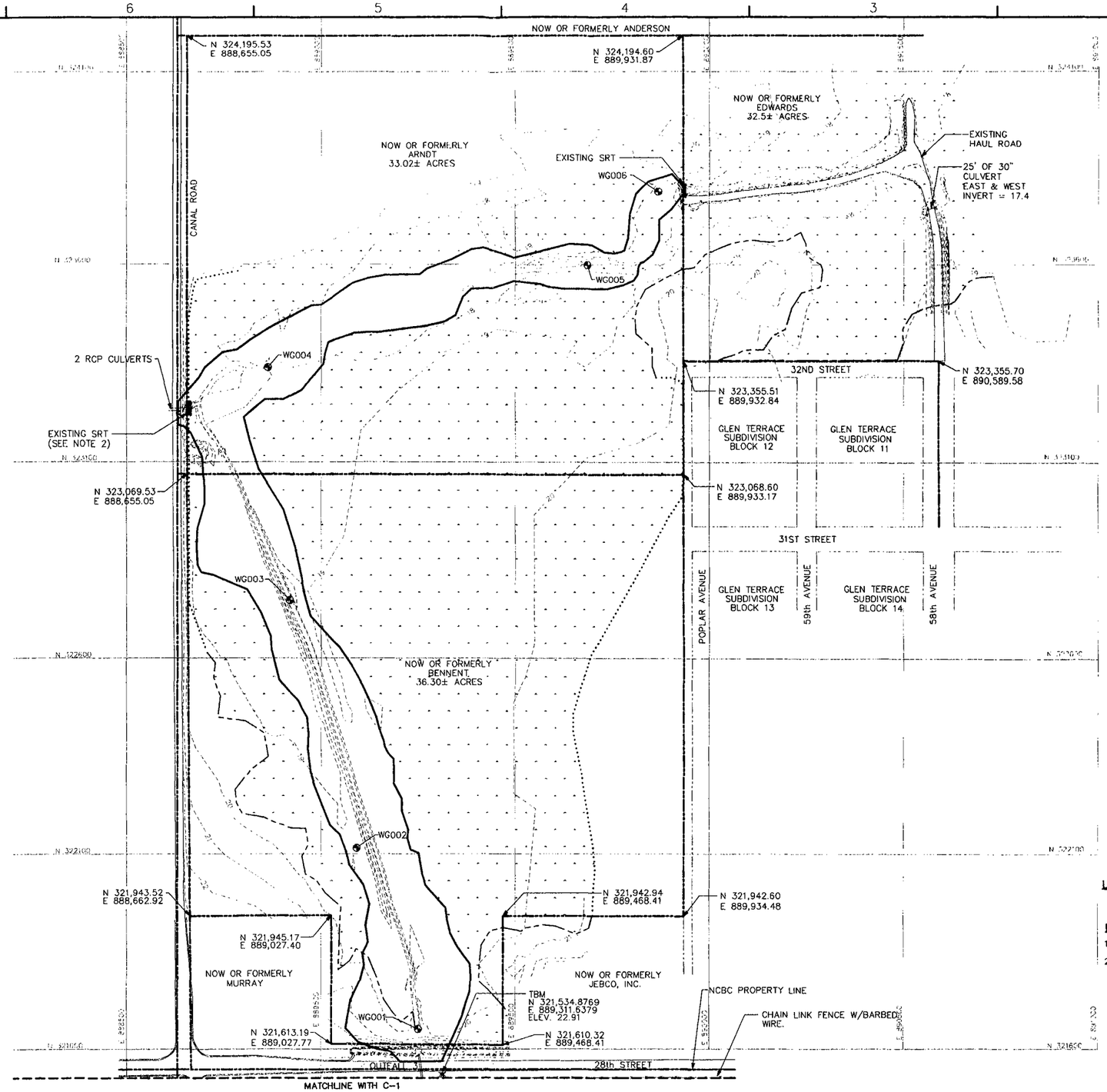
$b = a - 2(0.5') = a - 1$

$$\text{AREA (2 SIDES)} = 2\left(\frac{a+b}{2}\right)(0.5') = 2\left[\frac{a+(a-1)}{2}\right](0.5') = 0.5(2a-1)$$

$$\begin{aligned}\text{TOTAL AREA} &= \text{AREA (2 SIDES)} + \text{MIDDLE} \\ &= 0.5(2a-1) + (W-2T)\,d \\ &= 0.5(2a-1) + [W-2(t+d)]\,d\end{aligned}$$

Page 13 of 13

DRAWING NO. C-3 REV. 0



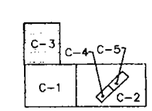
LEGEND:

SEE DRAWING NO. T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING NO. T-2 FOR GENERAL NOTES.

2.) IN APRIL 2002, TTNUS EXCAVATED APPROXIMATELY 30 CUBIC YARDS OF SEDIMENT ADJACENT TO CULVERTS UNDERLYING CANAL ROAD. THE SEDIMENT WAS TRANSPORTED TO SITE 8A AND STORED WITHIN THE MATERIALS HANDLING PAD USED DURING THE 2001 PILOT-SCALE TREATABILITY STUDY. AN SRT WAS CONSTRUCTED AT THE EASTERNMOST EXTENT OF THE EXCAVATION.



DRAWING KEY

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY MF DATE 11/22/02
CHECKED BY TWS DATE 5/12/03
REVISED BY DATE
SCALE AS NOTED

Off-base EXISTING CONDITIONS PLAN (SHEET 3 OF 5)
60% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
OWNER NO.
APPROVED BY DATE
DRAWING NO. ~~C-3~~ Figure 6
REV. 0

ACAD: 7379C413.dwg 05/29/03 HLB PIT

B.2 ROLLER-COMPACTED CONCRETE CALCULATION

Load Capacity Analysis
Roller Compacted Concrete Pavement
Site 8 – Herbicide Orange Storage Area
NCBC Gulfport
Gulfport, Mississippi

By: RCM 02/6/03
Chk'd By: NJB 5/28/03

TtNUS Project No. N7379
CTO 0272
Contract No. N62467-94-D-0888

PROBLEM STATEMENT:

Determine the acceptable loads and load repetitions for the roller compacted concrete (RCC) pavement selected for use as the cap at Site 8 – Herbicide Orange Storage Area (Site 8).

REFERENCES:

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20. Yoder, E. J. and Witczak, M. W., Principles of Pavement Design (Second Edition), John Wiley & Sons, Inc., New York, 1975.

21. Communications with A. G. Peltz LLC, Birmingham, AL, March 2003.

22. Piggott, R. W., 1999. "Roller Compacted Concrete Pavements – A Study of Long Term Performance" (RP366), Portland Cement Association.

23. Communications with Dr. David Luhr, Portland Cement Association, May 2003.

APPROACH / ASSUMPTIONS:

The Navy selected 12-inch thick RCC pavement as the cap for Site 8.

The rationale for plain (unreinforced) concrete pavement thickness design is applicable to RCC pavement (p. 17-1, ref. 7). Critical assumptions for RCC pavement design used herein are as follows:

- The assumption of 25% load transfer at joints in open storage areas constructed of plain concrete is not valid for RCC thickness design; RCC thickness design is therefore based on no load transfer at the joints, i.e. assuming all joint/cracks to be a free edge condition (p. 17-1, ref. 7).
- All plain (unreinforced) concrete pavements are uniform in cross-sectional thickness, namely thickened edges are not normally required since the design is for free edge condition (p. 12-1, ref. 7).
- Plain (unreinforced) concrete pavement design on a "modified" soil foundation assumes the layer is unbound using the k-value measured on top of the "modified" soil layer (refer to "Modulus of Subgrade Reaction of Base Layer" below for definition of "modified" and "stabilized").

The design procedure cited in USACE technical manual TM 5-822-5 (ref. 7) will be used to determine the acceptable passenger car and truck loads for the Navy selected 12-inch thick RCC pavement. The traffic load evaluation procedure is as follows:

- determine modulus of subgrade reaction, k for base layer based on review of references and Pilot-Scale field test results
- estimate RCC flexural strength based on 28-day compressive strength
- determine road or street classification
- determine RCC thickness required to support various design indexes using Figure 12-1 (sheet 19)
- compare RCC thickness required to support design index versus Navy selected 12-inch thickness
- if RCC thickness required to support design index is less than 12-inches then the 12-inch thick RCC pavement may be used for the vehicle types defined by the design index; conversely if the RCC thickness required to support design index is greater than 12-inches then the 12-inch thick RCC pavement should not be used for the vehicle types defined by the design index otherwise unacceptable damage may occur.

Evaluation parameters are derived in the sections below. Results are presented on sheet 20.

The working stress design procedure cited in USACE technical manual TM 5-809-12 (ref. 4) will be used to determine the acceptable heavy vehicle loads and load repetitions for the Navy selected 12-inch thick RCC pavement. The traffic load evaluation procedure is as follows:

- determine modulus of subgrade reaction, k for base layer based on review of references and Pilot-Scale field test results
- estimate RCC flexural strength based on 28-day compressive strength
- determine reasonable axle load for anticipated operations on RCC pavement surface
- determine RCC pavement thickness required to support load repetitions using Figure 5-2 (sheet 15)
- compare RCC thickness required to support axle load for given load repetitions and compare to the Navy selected 12-inch thickness

Evaluation parameters are derived in the section below. Results are presented on sheet 20.

The 12-inch thick RCC pavement must be constructed in two lifts due to limitations of the paving and compaction equipment. The first lift will have a maximum uncompacted thickness of 10-inches and maximum compacted thickness of 8-inches. The second lift will have a minimum uncompacted thickness of 5-inches and minimum compacted thickness of 4-inches.

The following should be noted regarding lift thickness:

- German-developed RCC equipment can place and compact RCC lifts up to 9-1/2-inches thick with an additional reduction of approximately ½-inch with subsequent compaction yielding a compacted lift of approximately 9-inches. (ref. 21)
- For a RCC pavement with a total thickness of 12-inches, two lifts of equal thickness (6-inches and 6-inches) are recommended if there is delamination between lifts because a 4-inch thick upper lift would develop higher tensile stresses than a 6-inch thick upper lift. (ref. 23)

The 12-inch thick RCC pavement will be constructed in two lifts due to the limitations of placement and compaction equipment and the requirement to achieve acceptable grades, smoothness, and compaction (p. 17-1, ref. 7). The type of bond achieved between the lifts is a function of the construction sequence and timing and governs the thickness design. The three types of bonding conditions are full, partial, and no bond.

Full bond conditions between the two RCC pavement lifts is assumed. Assuming full bond conditions allows analysis as if a monolithic slab were used with no consideration for the joint between lifts in the thickness design. Full bond may be assumed provided adjacent RCC lifts are placed and compacted within 1 hour of each other, or if a thin grout is placed between the upper and lower lifts. (p. 17-1, ref. 7) A thin layer of grout (i.e., "mortar bedding" per the project specifications) with compressive strength 50% greater at all ages than the associated RCC pavement will be used if lifts are not placed within time constraints provided in specifications.

SOLUTION:

Modulus of Subgrade Reaction of Base Layer

The modulus of subgrade reaction, k of the base layer supporting the RCC (i.e., modified material blend or "stabilized" material blend) may be derived using CBR test results.

For concrete pavement design the USACE defines a "stabilized base course layer" as having a minimum compressive strength of 500 pounds per square inch (psi), a "subbase course, select material, or subgrade" as having a minimum compressive strength of 200 psi with both layers having acceptable durability (p. 4-4, ref. 9). A "modified soil" is one that shows improvement in its construction characteristics but which does not show a sufficient increase in strength to qualify it as a "stabilized soil".

The RCC pavement subbase layer will consist of a Portland cement (or other reagent) "modified soil" with a specified minimum CBR of 50 and minimum unconfined compressive strength of 50 psi. [The compressive strength of the top 6-inches of the stabilized material blend (i.e., base layer) is 500 psi (refer to "Miscellaneous, Drainage Layer" below); however, RCC pavement design is based on a base layer with compressive strength of 50 psi]. The following should be noted regarding CBR:

- minimum CBR of 30 is required by SOUTHDIV guidance (Section 5, p. 5, ref. 17);
- k-value corresponding to a CBR of 30 is approximately 340 psi/inch or pci (sheet 11; page 4 of 8, ref. 16);
- a minimum CBR of 20 was specified in the Pilot-Scale study with field test results at 7-days for 0.1- and 0.2-inch deflection averaging 94 (range of 49 to 186 and standard deviation of 42) for the material blend containing 5% Portland cement (ref. 19); and
- k-value corresponding to the Pilot-Scale average CBR of 94 is greater than 700 pci (sheet 11; page 4 of 8, ref. 16).

The maximum allowable design k-value for soil is 500 pci (p. 4-1, ref. 4; p. 4-5, ref. 9; Section 5 p. 4, ref. 17). A k-value of 500 pci will be used for the RCC pavement design and a sensitivity analysis performed using a k-value of 340 pci. The k-value of 500 pci used corresponds to a CBR of 50, however field testing during Pilot-Scale testing demonstrated that the base layer achieved an average CBR of 82 (std. dev. = 39.2) at 3-days and 94 (std. dev. = 41.8) at 7-days.

The majority of the RCC paved area will be underlain by a significant thickness of the "modified" soil with a specified minimum CBR of 50 and minimum unconfined compressive strength of 50 psi; however the thickness of the "modified soil" is reduced at the perimeter of the RCC paved area (refer to remedial design drawings). Therefore the minimum base layer thickness is estimated based on the effective k-value at the surface of the base layer. For a k-value of 500 pci, the relationship between layer thickness and k-value at the surface of the base is essentially constant for values of approximately 12-inches or more (sheet 12; p. 9-3, ref. 7); the minimum thickness of the combined "stabilized" base and "modified" subbase is therefore set at 12-inches. Note that the compressive strength of the top 6-inches of the stabilized material blend (i.e., base layer) is increased to 500 psi to provide a highly erosion resistant base (refer to "Miscellaneous, Drainage Layer" below), the actual k-value will therefore be greater than 500 pci.

Concrete Compressive Strength and Modulus of Rupture (Flexural Strength)

The concrete modulus of rupture, MR (i.e., flexural strength) may be estimated by its approximate relationship with compressive strength as follows (p. 259, ref. 20):

$$MR = K \times (f'_c)^{0.5}$$

where K = constant between 8 and 10
(ref. 16 suggests a range between 9.4 and 10.8)
f'_c = concrete compressive strength, psi

Common RCC mixtures may produce compressive strengths ranging from 1,000 psi to over 4,000 psi at 1 year. Most RCC projects have used mixtures producing an average compressive

strength between 2,000 and 3,000 psi at 90-days to 1-year age. (p. 4-2, ref. 13) Common RCC mixtures for pavements and storage areas may produce compressive strengths ranging from 3,600 psi to 6,500 psi at 28 days. (sheet 13 derived from ref. 22 & ref. 23, respectively) Most RCC projects have used mixtures producing an average compressive strength between 2,000 and 3,000 psi at 90-days to 1-year age. (p. 4-2, ref. 13) Note that the compressive strength specified for plain concrete and RCC pavements is typically at 28- and 90-days, respectively. The USACE typically uses the 90-day period for RCC due to the longer duration of significant strength gain in RCC pavements due to routine use of fly ash/pozzolan which replaces a portion of the Portland cement whereas the PCA uses the 28-day period; the 28-day compressive strength will be used herein.

RCC pavements normally have a minimum compressive strength of 2,000 psi at 1 year for durability reasons (p. 1-20, ref. 8). [The PCA has stated that compressive strengths ranging from 4,500 to 6,500 psi at 28 days are normally used. With the wear expected on the pavement surface due to fork-lift operations and in consideration of the PCA having little experience with lesser compressive strengths (i.e., 3,500 psi) in such applications, the higher strengths are recommended. (ref. 23)].

RCC compressive strengths at 28-days can range from about 3,500 to over 5,000 psi and flexural strengths from about 500 to over 700 psi. (ref. 16) An RCC vendor has indicated that compressive strengths of 5,000 psi have been achieved routinely over the past year. (ref. 21)

Based on review of the references cited above, and considering typical compressive strengths and potential use of the RCC pavement at Site 8, a minimum 28-day compressive strength of 4,000 psi should be used. Compressive strengths between 2,000 and 6,000 psi will be evaluated for illustrative purposes.

if $f'_c = 2{,}000$ psi ...
$MR = 8 \text{ to } 10 \times (2{,}000 \text{ psi})^{0.5}$
MR = 358 to 447 psi use 400 psi

Similarly for ...

f'_c (psi)	MR Range (psi)	MR Used (psi)
2,500	400 to 500	450
3,000	438 to 548	500
3,500	473 to 592	550
4,000	505 to 632	600
5,000	565 to 707	650
6,000	620 to 775	700

Passenger Car and Truck Loads

The RCC pavement will likely be subjected to loading from several vehicle types (i.e., passenger cars, single axle trucks, etc.) or "Groups". A mixture of vehicle "Groups" is defined into "Categories" due to the varying percentages of each vehicular "Group". Vehicle "Group" and "Category" definitions are provided on sheet 14.

The road and street classification used to determine the Design Index (DI) is "E" because the cap will be a vehicular parking area. (p. 3-7, ref. 5).

The adequacy of the 12-inch thick RCC pavement to support various traffic "Categories" will be evaluated.

Design Index

The design index, DI is used to design pavements not subjected to heavy loads and is therefore used herein only for evaluation of the 12-inch thick RCC pavement to support passenger vehicle and truck loads.

Heavy Vehicular Loads

Three general types of military vehicles are used for determining slab thickness for floors subject to heavy loads: fork-lift trucks, other pneumatic and solid tired vehicles, and tracked vehicles (p. 2-1, ref. 4). The type of vehicle, traffic volume by vehicle type, wheel loads, and average daily volume of traffic (ADV) are used to determine slab thickness. The following design loads are assumed for the purposes of this calculation:

fork-lift truck – NCBC typically handles 20-foot military-owned demountable containers (MILVANs) that weigh 3,500 pounds empty and have a 41,300 pound cargo capacity for a total weight of 44,800 pounds (44.8 kips or 22.4 tons) (ref. 10 and 12). The principal Container- or Materials-Handling Equipment (CHE or MHE) used is the fork-lift truck. A Category VI fork-lift truck has a maximum axle load of 43 to 120 kips and a maximum load capacity of 20 to 52 kips. A Hyster H620B front-end loading fork-lift truck can handle 50,000 pound containers (maximum 62,000 pound payload) and has a gross vehicle weight of 140,710 pounds. The weight carried by the drive axle of a fork-lift truck is normally 87 to 94 percent of the total gross weight of the loaded vehicle (ref. 4). The maximum axle load is therefore approximately 90% or 126.6 kips. The Hyster H620B is no longer manufactured but may still be in use.

The Hyster H550F, H620F, and H650F are currently manufactured and can handle MILVANs. These fork-lifts trucks have the following load characteristics:

Hyster Model No.	Rated Capacity (kips)	Total Approx. Weight (kips)	Static Axle Loading (front/rear in kips)	Comments
H550F	55	72.3	113.1 / 14.1	
H620F	62	87.8	133.1 / 16.7	Load > Category VI
H650F	65	86.5	136.2 / 15.4	Load > Category VI

The Hyster H620F and H650F fork-lift trucks exceed the maximum load capacity for a Category VI fork-lift truck and are therefore not used as the design load.

The 12-inch thick RCC pavement will therefore be evaluated to determine if it can handle a Category VI fork-lift truck with an axle load of 120 kips. (p. 3-1, ref. 4)

Note that the USACE recommends that most modern MHE have the capability of stacking fully loaded 40-foot containers (67,200 pounds) three high; however, only two-high stacking is recommended due to the additional weight and maintenance of pavement surfaces. The USACE also states that empty containers should not be stacked over three high unless wind screening is provided. (ref. 3). Container dead loading, not evaluated herein, should be based on fully loaded 20-foot containers stacked two-high.

pneumatic and solid tired vehicles – The required slab thickness for pavements subjected to fork-lift trucks having axle loads greater than 25 kips are not significantly affected by vehicles having axle loads less than 25 kips (i.e., trucks, cars, buses, and small fork-lift trucks). These light loads are therefore ignored in determining requirements for pavements carrying axle loads greater than 25 kips (Category VI)(p. 5-1, ref. 4)

tracked vehicles – A Caterpillar D6 or D7 dozer is assumed to be the representative tracked vehicle load. The weight ranges for D6 and D7 dozers varies from approximately 32 kips to 44 kips and 46 kips to 58 kips, respectively (ref. 2). The D6 and D7 dozers are categorized as Category II tracked vehicles with a maximum gross weight of 40 to 60 kips. Categories for tracked vehicles may be substituted for the same category for fork-lift trucks (p. 3-1, ref. 4). Tracked vehicles are therefore not specifically evaluated herein.

Note that the minimum cast-in-place concrete compressive strengths for floors subjected to pneumatic tired traffic and abrasive traffic such as steel wheels are 4,000 and 5,000 psi, respectively (p. 4-3, ref. 4). The surface of reinforced concrete pavements subjected to wear, abrasion, and impact loads are typically protected by providing a hardened (e.g., Master Builder's "Anvil-Top"), armored (e.g., steel plate, rails), or absorptive (e.g., wood) surface.

Service Life

The USACE recommends a service life of 25-years for highways (ref. 5). SOUTHDIV guidance recommends a minimum design life of 20 years (Section 5, p. 5, ref. 17). A service life of 25 years is therefore used.

Traffic Volume

Traffic volume is calculated based on the assumed average daily volume (ADV) of traffic. For example, the traffic volume over the 25-year service life for 1 operation per day, 7 days per week is...

V = ADV x 7 days/week x 52 weeks/year x 25 years
V = 1 pass/day x 7 days/week x 52 weeks/year x 25 years
V = 9,100 passes

The pavement design for the pavement subjected to heavy loads utilizes Figure 5-2 (sheet 15) which includes only traffic volumes of 10,000, 50,000, 100,000, 500,000, etc. The table presented on sheet 20 therefore presents only the traffic volume over the service life with corresponding ADV presented to the nearest 0.1.

Design Air Freezing Index

The design air freezing index for Gulfport is less than 50 (sheet 16, ref. 15).

An approach to determine if a drainage layer is required for frost protection beneath the roller compacted concrete pavement is "If the combined thickness, in inches, of pavement and contiguous bound base courses is less than 0.09 multiplied by the design air freezing index (this calculation limits the design freezing index at the bottom of the bound base to about 20 degree-days), not less than 4 inches of free-draining material shall be placed directly beneath the lower layer of bound base or, if there is no bound base, directly beneath the pavement slab or surface course." (p. 18-15, ref. 7)

t_{RCC} = 12 inches > 0.09 x 50 design freezing index = 4.5 inches
therefore conclude free-draining layer is not required for frost protection

The effects of frost on the RCC pavement will be negligible due to the location of the site. The durability of the RCC pavement will be acceptable provided the compressive strength is at least 2,000 psi (refer to "Concrete Compressive Strength..." above).

Results

For a base layer with modulus of subgrade reaction of 500 pci based on a CBR of 50:

The 12-inch thick RCC pavement with 28-day minimum compressive strength of 2,000 psi is adequate to support passenger car and truck loads with a DI = 10 absent heavy pneumatic tire loads (see row 1 of sheet 20). Heavy pneumatic tire loads would likely damage the RCC pavement with relatively few load repetitions.

The 2,000 psi compressive strength would be inadequate to support heavy pneumatic tire loads, in particular a 120k fork-lift truck load, using only a 12-inch thickness (see row 7 of sheet 20). For the 120k fork-lift truck a minimum compressive strength of 3,000 psi at 28-days would withstand over 10,000 load repetitions (1.1 ADV) over the 25-year service life (see row 9 of sheet 20).

For the 120k fork-lift truck a minimum compressive strength of 3,500 psi at 28-days would withstand over 100,000 load repetitions (5.5 ADV) over the 25-year service life (see row 13 of sheet 20).

For the 120k fork-lift truck a minimum compressive strength of 4,000 psi at 28-days would withstand over 500,000 load repetitions (55 ADV) over the 25-year service life (see row 14 of sheet 20).

For a base layer with modulus of subgrade reaction of 340 pci based on a CBR of 30 (k sensitivity analysis):

The 12-inch thick RCC pavement with 28-day minimum compressive strength of 2,000 psi or 3,000 psi is adequate to support passenger car and truck loads with a DI = 10 absent heavy pneumatic tire loads (see rows 19 and 20 of sheet 20). Heavy pneumatic tire loads would likely damage the RCC pavement with relatively few load repetitions.

For the 120k fork-lift truck a minimum 3,500 psi compressive strength at 28-days would not withstand 10,000 load repetitions (1.1 ADV) over the 25-year service life (see row 22 of sheet 20).

For the 120k fork-lift truck a minimum 4,000 psi compressive strength at 28-days would withstand 10,000 load repetitions (1.1 ADV) over the 25-year service life (see row 23 of sheet 20).

For RCC pavement thicknesses less than 12-inches (thickness sensitivity analysis) refer to rows 15 through 18 on sheet 20. Based on communications with a RCC pavement vendor (ref. 21) the 12-inch thick RCC pavement is preferred (refer to "Miscellaneous" below).

Miscellaneous

Drainage Layer

Pumping of pavements, where pumping is defined as the ejection of water and subgrade (or base) material through joints or cracks or at the pavement edge caused by deflection of the slab after the free water has accumulated under the slab, is addressed primarily by "...use of either (1) a free-draining base with adequate drainage outlets or (2) use of a highly erosion-resistant base." (pp. 340 – 341, ref. 20). Resistance to the erosive action of water can be provided by stabilizing the base with asphalt or cement (p. 374, ref. 20). To address pumping with a cement-treated base, Yoder and Witczak recommend a compressive strength of 400 to 750 psi at 28 days (pp. 372 and 373, ref. 20). Therefore, it is judged that the top 6 inches of the stabilized contaminated material blend be prepared as a stabilized base course layer, i.e., with a required unconfined compressive strength of 500 psi at 90 days.

Edge Joints

Thickened edge joints are not required since the design is based on free edge stresses (refer to "Approach / Assumptions" above). However, at the limits of the RCC pavement, wheels loadings may track the edge of the pavement; a thickened edge should therefore be used (p. 5-19, ref. 4). Thickened edges typically consist of a 125% increase in the pavement design thickness at the edge of the pavement tapering from the free-edge thickness to the design thickness at a distance of 5 feet from the longitudinal edge (p. 5-21, ref. 4).

Pozzolan

Partial replacement of Portland cement with pozzolan (e.g. fly ash) in concrete mixtures will increase workability, improve surface finish, reduce the water/cement ratio, decrease heat of hydration, increase long-term strength, decrease drying shrinkage, and decrease the permeability. The Portland cement and fly ash proportions should be determined via project specific mix design to assure that the strength and rate of strength gain are acceptable and meet project requirements. Fly ash material cost is less than Portland cement. Use of pozzolan is therefore recommended, although not necessary to obtain required RCC strength.

If the RCC is batched <u>without</u> pozzolan the Portland cement content required to increase the 90-day compressive strength from 3,000 to 3,500 psi is approximately 19% [((315 - 265)/265) x 100] and the Portland cement content required to increase the 90-day compressive strength from 3,000 to 4,000 psi is approximately 38% [((365 - 265)/265) x 100] (sheet 17; Figure 3-2, ref. 13). If the RCC is batched <u>with</u> pozzolan (30-50% pozzolan replacement by volume of equivalent cement) the cementitous content (cement plus pozzolan) required to increase the 90-day compressive strength from 3,000 to 3,500 psi is approximately 11% [((305 - 275)/275) x 100] and the cementitous content required to increase the 90-day compressive strength from 3,000 to 4,000 psi is approximately 23% [((340 - 275)/275) x 100] (sheet 18; Figure 3-1, ref. 13).

Similarly if the RCC is batched <u>without</u> pozzolan the Portland cement content required to increase the 28-day compressive strength from 3,000 to 4,000 psi is approximately 41% [((500 - 355)/355) x 100] (sheet 17; Figure 3-2, ref. 13). If the RCC is batched <u>with</u> pozzolan the cementitous content required to increase the 28-day compressive strength from 3,000 to 4,000 psi is approximately 26% [((480 - 380)/380) x 100] (sheet 18; Figure 3-1, ref. 13). Note that RCC batched with 500 pounds per cubic yard (pcy) Portland cement would achieve a 90-day compressive strength of approximately 5,500 psi and RCC batched with 480 pcy cementitous content would achieve a 90-day compressive strength of approximately 5,900 psi.

Note that the Portland cement and fly ash proportions should be determined via project specific mix design to assure that the strength and rate of strength gain are acceptable and meet project requirements.

RCC Cost

Based on communications with an RCC vendor (ref. 21) the 12-inch thick RCC pavement with 3,500 psi compressive strength would be preferred to support the heavier loads over an 8-inch thick RCC pavement with higher strength. The unit cost for 12-inch thick RCC pavement with 2,000 or 3,500 psi compressive strength is approximately $29/yd^2. (ref. 21)

CONCLUSIONS/RECOMMENDATIONS:

A pavement adequate to support passenger car and truck loads with a DI = 10 and heavy fork-lift (120k loaded) or similar should be a 12-inch thick RCC pavement with a 28-day compressive strength of 4,000 psi. [Based on review of rows 9 through 13 (sheet 20) the increase in compressive strength from 3,000 psi to 4,000 psi increases the allowable 120k load repetitions from 10,000 to 500,000.]

The RCC pavement specifications should be developed considering all of the references cited. Specification criteria stated or assumed herein include the following:

- subbase layer ("modified" blend of soil ash and sediment) minimum unconfined compressive strength of 50 psi at 90-days, minimum thickness of 6 inches
- base layer ("stabilized" blend of soil ash and sediment) (top 6-inches) minimum unconfined compressive strength of 500 psi at 90-days, minimum thickness of 6 inches.
- a layer or surface treatment may be placed between the "modified" blend of soil ash and sediment layer and the RCC pavement and not have a bearing on the conclusions drawn herein. (A layer or surface treatment is not proposed. If a layer is added to the profile it should be at least as strong as the "modified" blend of soil ash and sediment.)
- Portland cement used as cementitous material for RCC pavement
- pozzolan (i.e., fly ash) recommended for RCC pavement but not required
- compressive strength of RCC pavement $\geq$ 4,000 psi at 28 days
- modulus of rupture of RCC pavement $\geq$ 600 psi at 28 days
- finished thickness of RCC pavement $\geq$ 12-inches
- thickened edge consisting of an increase in the pavement design thickness of 25% (i.e., 15-inches) at the edge with the increase in thickness occurring uniformly over a minimum distance of 5-feet
- RCC pavement constructed in two lifts
  - compacted lower lift thickness of 8-inches for RCC with 12-inch total thickness, or 6-inches if two equal lifts are used
  - compacted upper lift thickness = 33% of total thickness (4 inches) for RCC with 12-inch total thickness, or 6-inches if two equal lifts are used
  - full bonding condition
  - use mortar bedding with compressive strength 50% greater at all ages than the associated RCC pavement if lifts are not placed within time constraints provided in specifications

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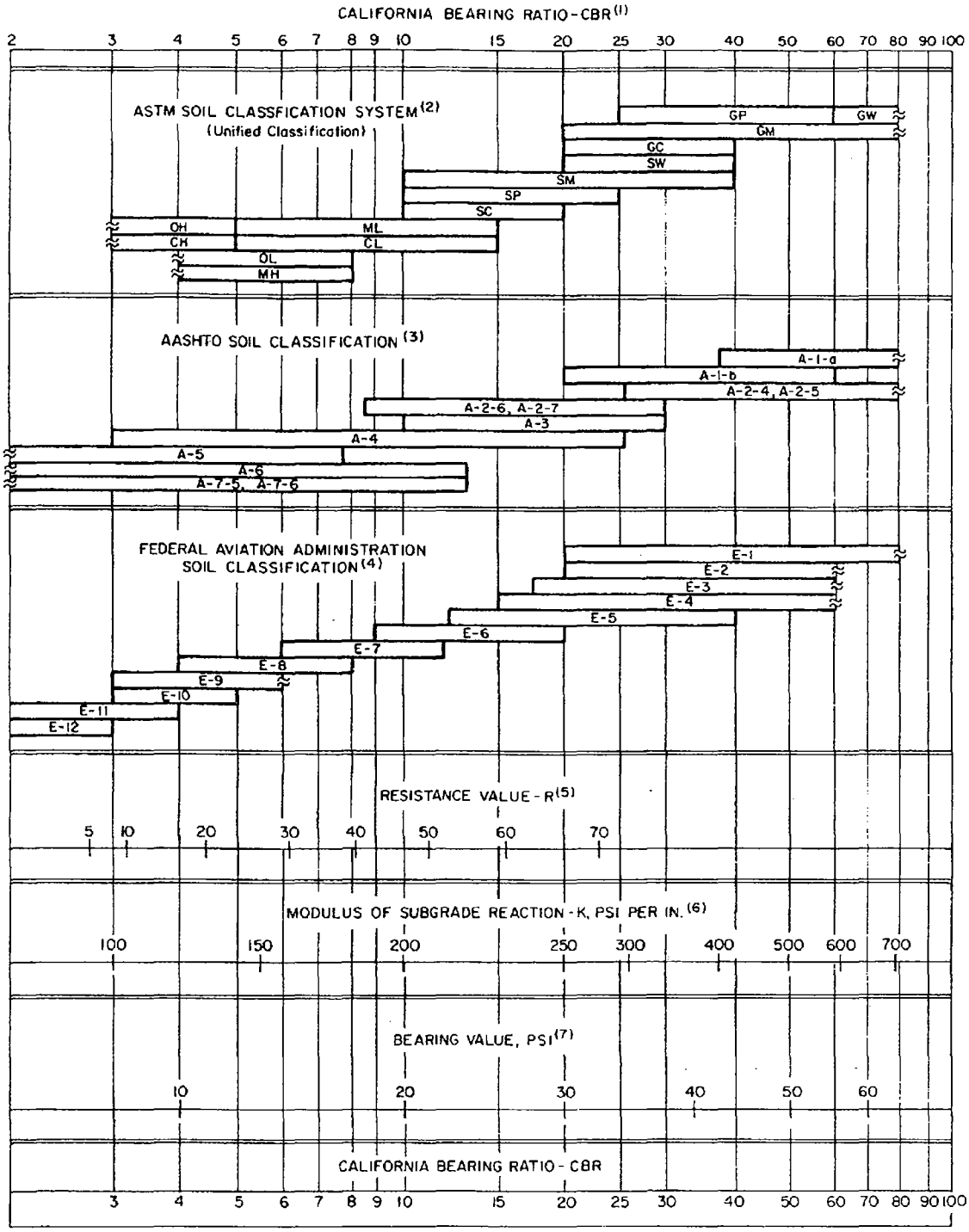

(1) For the basic idea, see O. J. Porter, "Foundations for Flexible Pavements," Highway Research Board *Proceedings of the Twenty-second Annual Meeting*, 1942, Vol. 22, pages 100-136.
(2) ASTM Designation D2487.
(3) "Classification of Highway Subgrade Materials," Highway Research Board *Proceedings of the Twenty-fifth Annual Meeting*, 1945, Vol. 25, pages 376-392.
(4) *Airport Paving*, U.S. Department of Commerce, Federal Aviation Agency, May 1948, pages 11-16. Estimated using values given in FAA *Design Manual for Airport Pavements*.(Formerly used FAA Classification; Unified Classification now used.)
(5) C. E. Warnes, "Correlation Between *R* Value and *k* Value," unpublished report, Portland Cement Association, Rocky Mountain-Northwest Region, October 1971 (best-fit correlation with correction for saturation).
(6) See T. A. Middlebrooks and G. E. Bertram, "Soil Tests for Design of Runway Pavements," Highway Research Board *Proceedings of the Twenty-second Annual Meeting*, 1942, Vol. 22, page 152.
(7) See item (6), page 184.

Fig. 2. Approximate interrelationships of soil classifications and bearing values.

Reference: PCA

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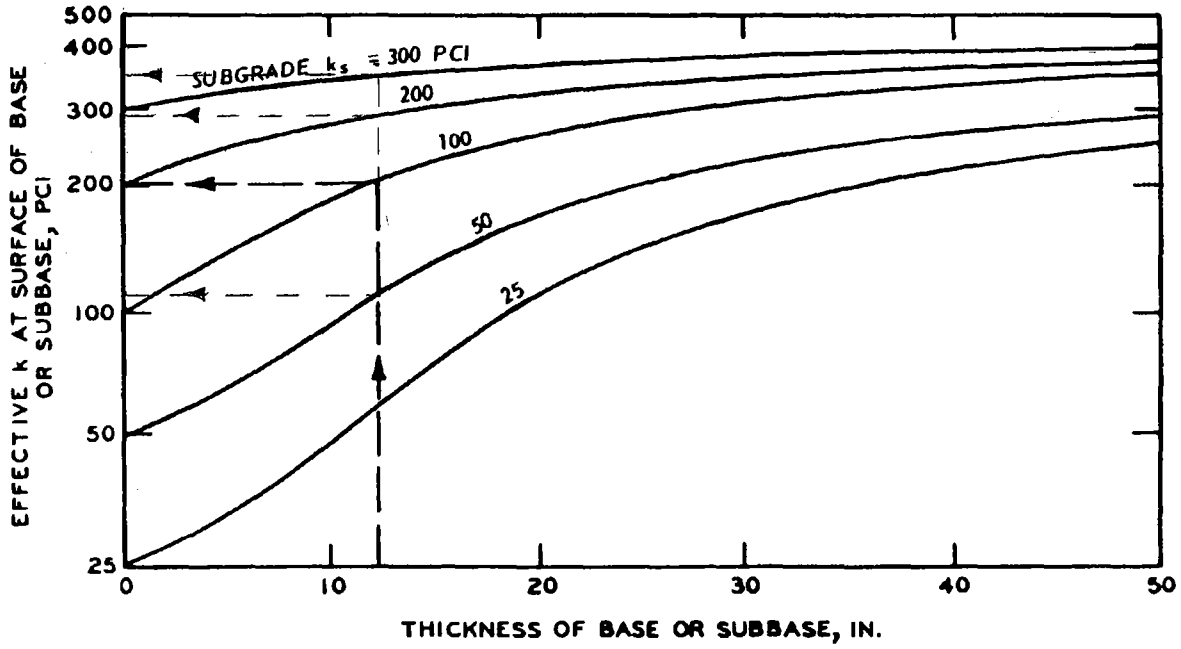

Figure 9-1. Effect of Base-Course Thickness on Modulus of Soil Reaction.

for k_s of approx. 300 pci or greater the k_s, k' relationship is essentially equal for $t = 12''$ or greater

i.e. for $t = 12''$ ...

k_s	k'	% increase
50	105	210
100	200	200
200	290	145
300	355	118 (approaching unity)
500	~500 based on trend of curves	

Reference: p. 9-3
TM 5-822-5

Project	Location	Use	Loads	Yr(s) Const.	Base Descr.	Max. Agg. (in)	Lifts [No./ Thickness (in)]	Total Thickness (in)	Portland Cement (pcy)	Fly Ash (pcy)	Comp. Str. (psi) / Age	Flex. Str. (psi) / Age
TERMINALS												
Burlington Northern Santa Fe Railroad	Denver, CO	Containers	Straddle crane, one side load est. 55k	1986	24-inch pit run gravel base	0.75	2 / 9 + 6	15 & 20				
Massachusetts Port Authority Terminal	Boston, MA	Containers		1986/87	8-inch compacted granular base	0.75	3 / 6 + 6 + 6 & 3 / 9 + 4.5 + 4.5	18	1: 600 2&3: 500	1: 120 2&3: 100	4,900 @ 28 (C)	700 @ 28 (S)
Central Freight Lines	Austin, TX			1987	12-inch lime stabilized clay	0.75		7 storage & 8 travel	250	250	3,625 @ NP (A)	600 @ NP (C)
STORAGE												
Fort Lewis	Fort Lewis, WA	Equip. Parking	mobile rocket launch vehicles	1985				8.5	450	150	3,600 @ 28 (C)	600 @ 28 (S)
Fort Drum	Fort Drum, NY	Equip. Parking		1988	8-inch granular	0.75	1 / 10	10	413	137	4,900 @ 28 (C) / 5,625 – 8,100 @ 14 (C)	700 @ 28 (S) / 750 – 900 @ 14 (A)
Alberta Pacific Forest Industries	Athabaska, Alberta, Canada	Wood chip storage		1992/93	Unstabilized clay	0.75	1 / 6 + 4	10 (12 @ edges)	465	125	3,915 @ 28 (A)	625 @ 28 (C)

NP – Not Provided
(A) – actual value
(S) – specified value
(C) – calculated value using relationship $MR = K \times (f'_c)^{0.5}$ using K = 10

Source: Piggott, R. W., 1999. "Roller Compacted Concrete Pavements – A study of Long Term Performance" (RP366), Portland Cement Association. (ref. 22)

Group 1. Passenger cars, panel trucks, and pickup trucks
Group 2. Two-axle trucks
Group 3. Three-, four-, and five-axle trucks

Maximum Vehicle Gross Weight, Pounds

Category	Tracked Vehicles	Forklift Trucks
V	60,000	15,000
VI	90,000	25,000
VII	130,000	(*)

* Forklift trucks exceeding 25,000-pounds gross weight are treated in TM 5-809-12/AFM 88-3, Chap. 15.

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Category I. Traffic composed primarily of passenger cars, panel and pickup trucks (group 1 vehicles), but containing not more than 1 percent two-axle trucks (group 2 vehicles).

Category II. Traffic composed primarily of passenger cars, panel and pickup trucks (group 1 vehicles), but may contain as much as 10 percent two-axle trucks (group 2 vehicles). No trucks having three or more axles (group 3 vehicles) are permitted in this category.

Category III. Traffic containing as much as 15 percent trucks, but with not more than 1 percent of the total traffic composed of trucks having three or more axles (group 3 vehicles).

Category IV. Traffic containing as much as 25 percent trucks, but with not more than 10 percent of the total traffic composed of trucks having three or more axles group 3 vehicles).

Category IVA. Traffic containing more than 25 percent trucks.

Table 3-1. Pavement Design Index

Traffic Category	Pavement Design Index for Road or Street Classification					
	A	B	C	D	E	F
I	2	2	2	1	1	1
II	3	2	2	2	2	1
III	4	4	4	3	3	2
IV	5	5	5	4	4	3
IVA	6	6	6	5	5	4
V (60-kilopound (kip) track-laying vehicles or 15 kip forklifts)	7	7	7	7	7	(*)
500/day	6	6	6	6	6	(*)
200/day	6	6	6	6	6	(*)
100/day	6	6	6	6	6	6
40/day	6	6	6	5	5	5
10/day	5	5	5	5	5	5
4/day	5	5	5	5	4	4
1/day	5	5	5	4	4	4
VI (90-kip track-laying vehicles or 25 kip forklifts)						
200/day	9	9	9	9	9	(*)
100/day	8	8	8	8	8	8
40/day	7	7	7	7	7	7
10/day	6	6	6	6	6	6
4/day	6	6	6	6	6	6
1/day	5	5	5	5	5	5
1/week	5	5	5	4	4	4
VII (120-kip track laying vehicles):						
100/day	10	10	10	10	10	10
40/day	9	9	9	9	9	9
10/day	8	8	8	8	8	8
4/day	7	7	7	7	7	7
1/day	6	6	6	6	6	6
1/week	5	5	5	5	5	5

* Traffic limited to 100 vehicles per day.

Reference: pp. 3-1 & 3-2
TM 5-822-5

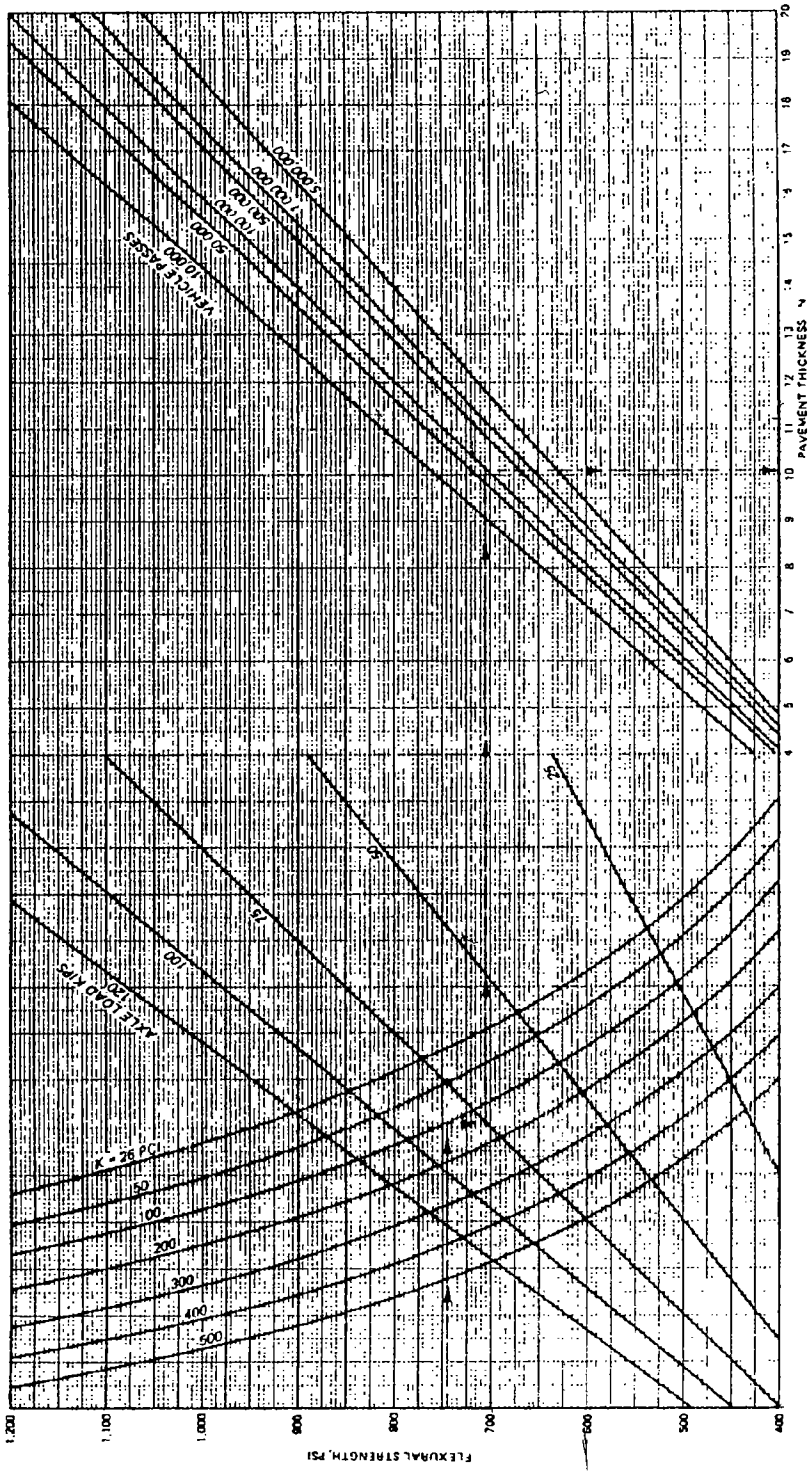
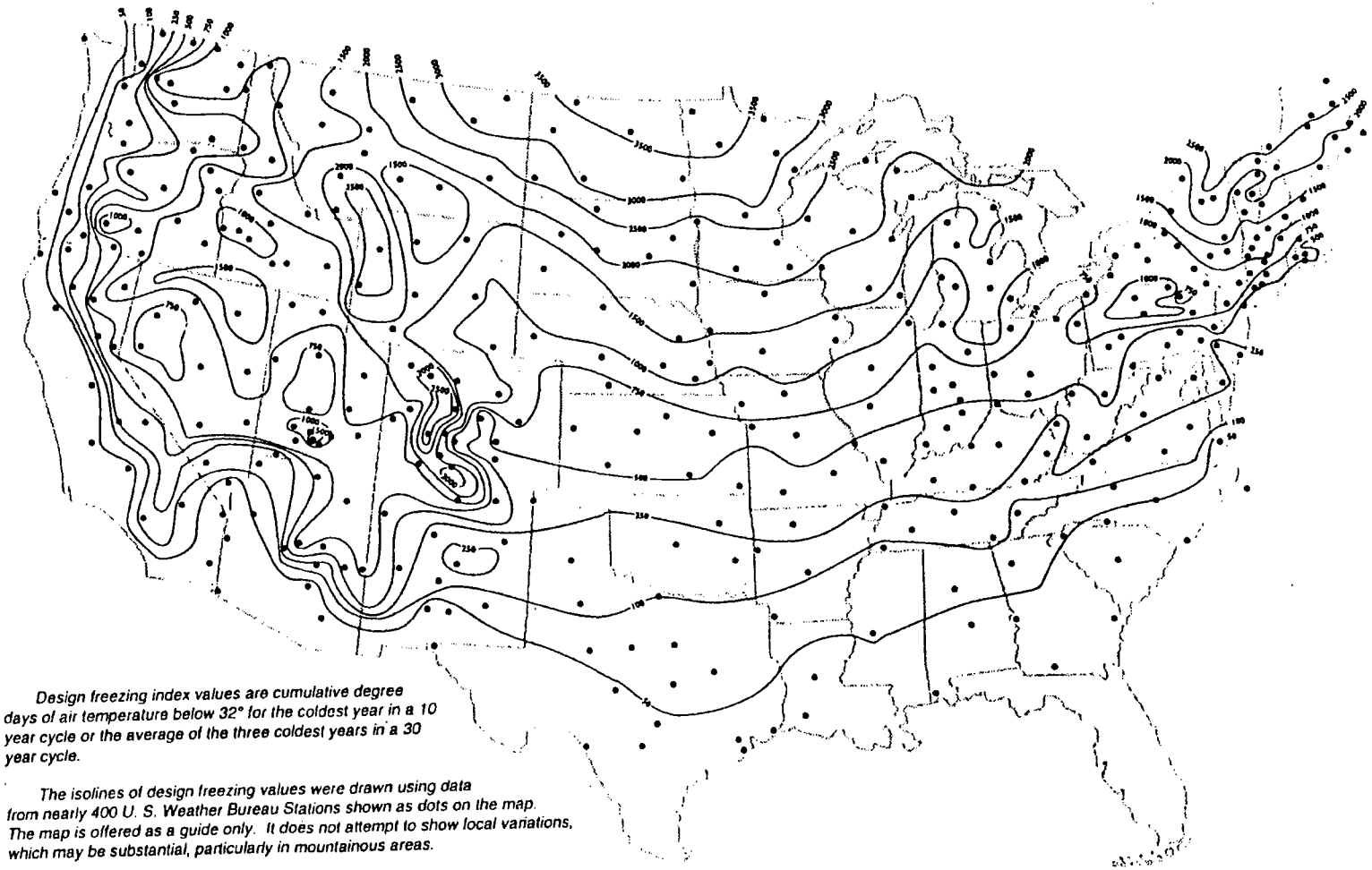


Figure 5-2. Design curves for concrete floor slabs for heavy forklifts.

Reference: p. 5-3
TM 5-809-12



Design freezing index values are cumulative degree days of air temperature below 32° for the coldest year in a 10 year cycle or the average of the three coldest years in a 30 year cycle.

The isolines of design freezing values were drawn using data from nearly 400 U. S. Weather Bureau Stations shown as dots on the map. The map is offered as a guide only. It does not attempt to show local variations, which may be substantial, particularly in mountainous areas.

The actual design freezing index used should be computed for the specific project using temperature data from station nearest site. See text.

FIGURE 2-5. DISTRIBUTION OF DESIGN AIR FREEZING INDEXES IN THE CONTINENTAL U.S.

Reference: P. 17 FAA

16/20

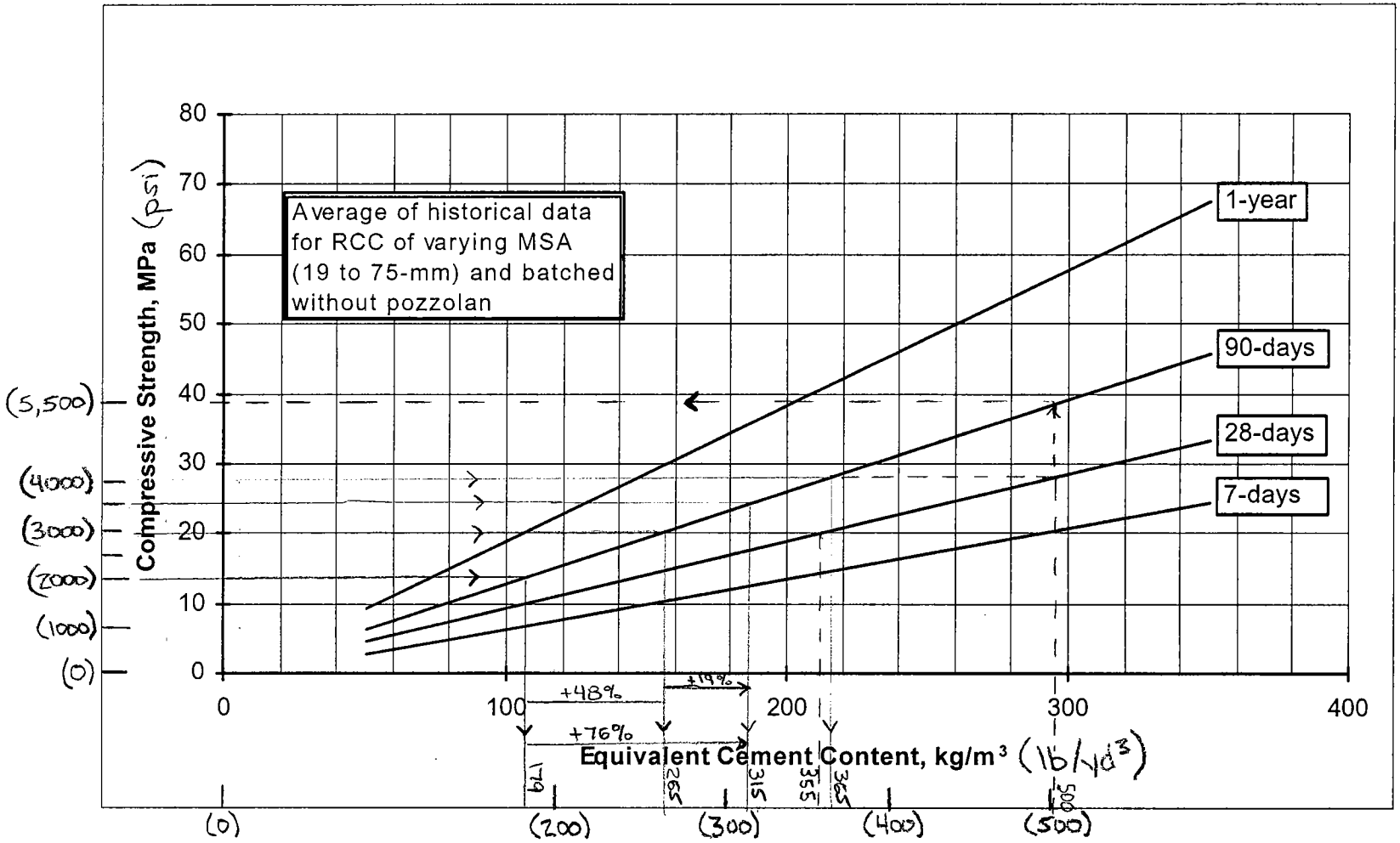


Figure 3-2. Equivalent cement content versus compressive strength; average historical data for RCC batched without pozzolan

Reference: p. 3-3
EM 1110-2-2006

17/20

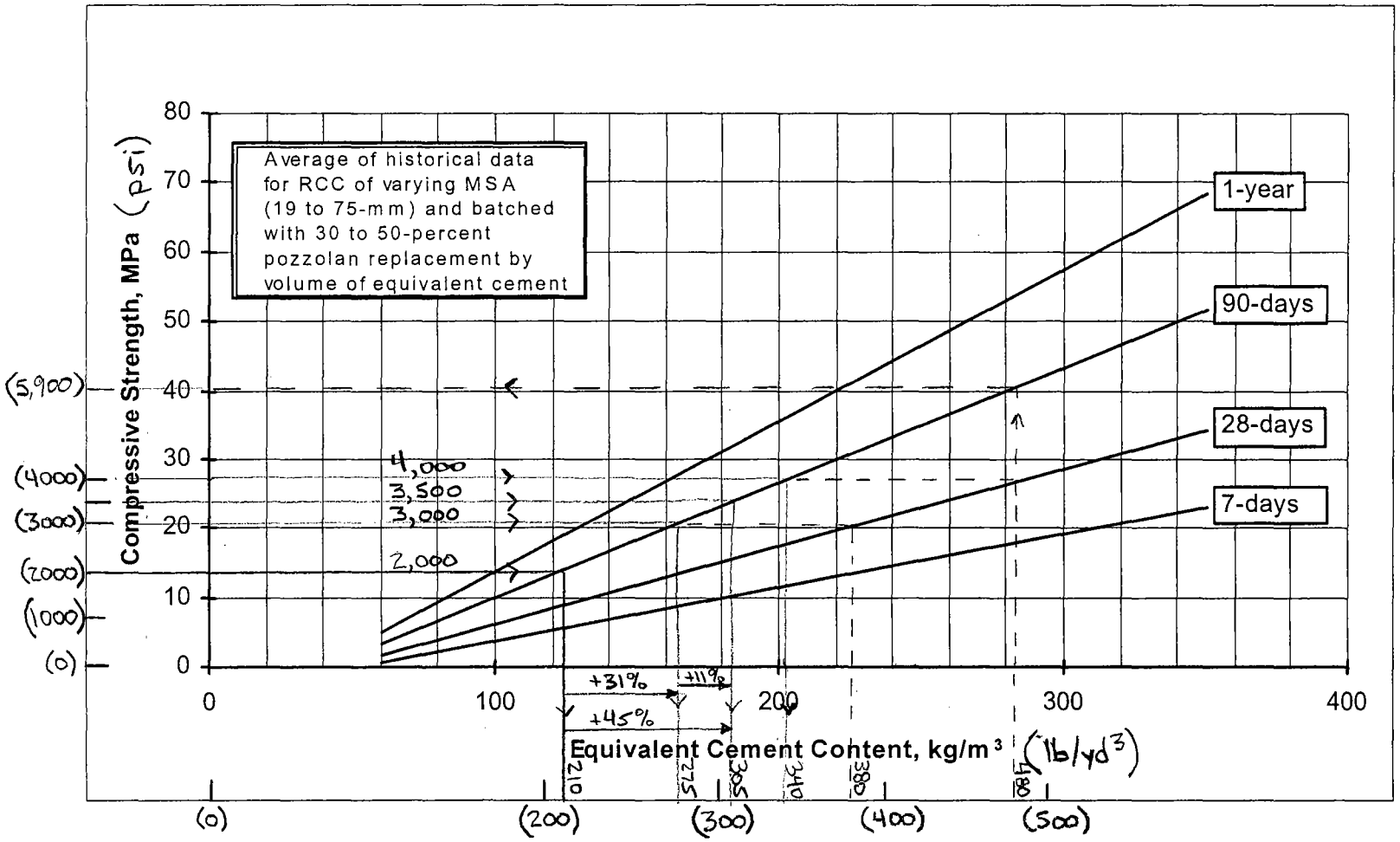


Figure 3-1. Equivalent cement content versus compressive strength; average historical data for RCC batched with pozzolan

Conversion: $1\ kPa \times \left(\frac{2.54\ cm}{in}\right)^2 \left(\frac{144\ in^2}{ft^2}\right)\left(\frac{2.2046\ lb}{kg}\right) / 98.07 \Rightarrow psf$

$psf / 144 \Rightarrow psi$

$MPa = 1{,}000\ kPa$

Reference: p. 3-2
EM 1110-2-2006

18/20

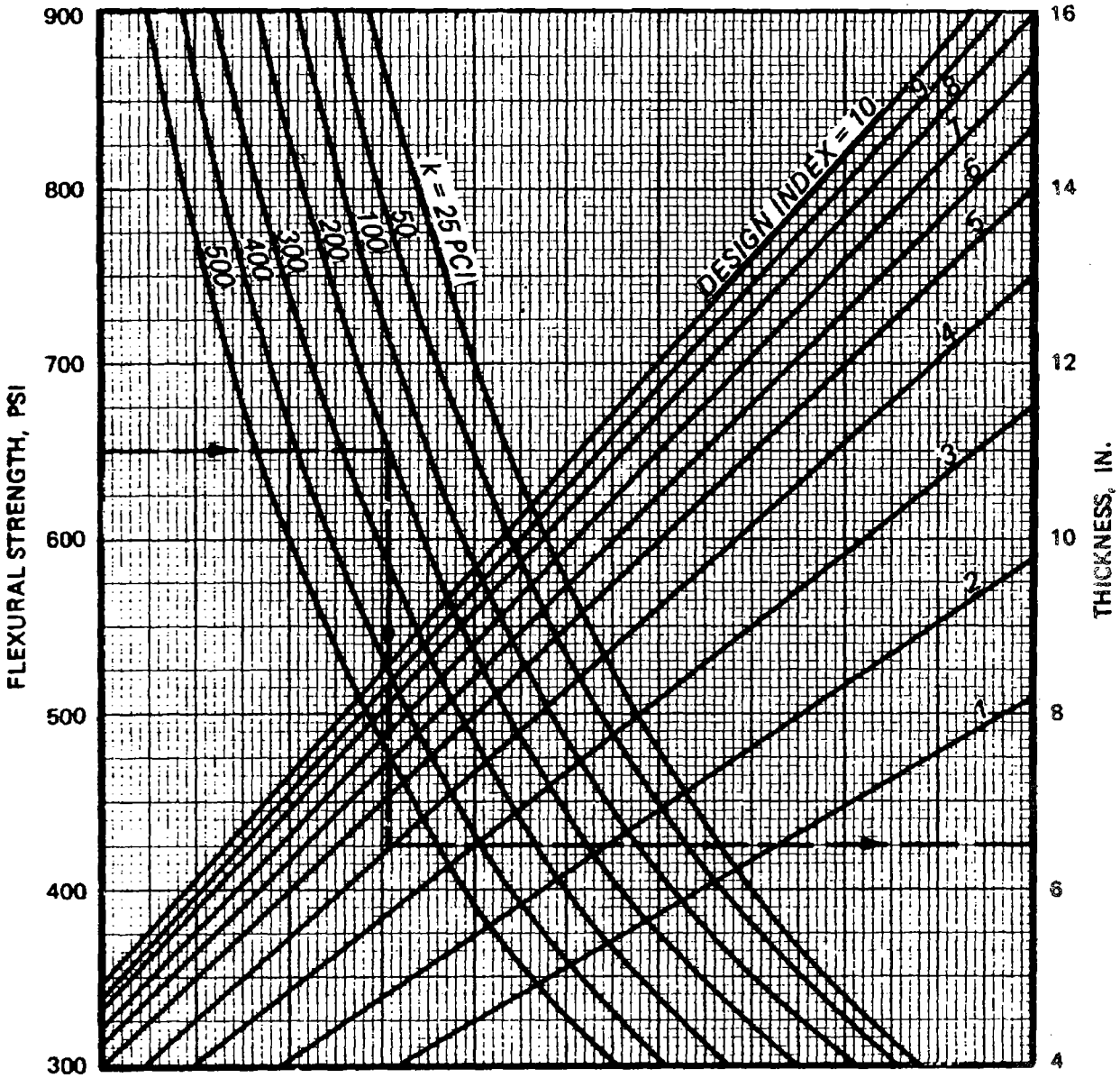


Figure 12-1. Design Curves for Plain Concrete Roads and Streets, and RCCP.

Reference: p. 12-2

TM 5-822-5

LOAD CAPACITY ANALYSIS
ROLLER COMPACTED CONCRETE
REMEDIAL DESIGN
SITE 8 - HO STORAGE AREA
NCBC GULFPORT, GULFPORT, MISSISSIPPI

Row	Design Figure	Design Thickness (in)	California Bearing Ratio (CBR)	Modulus of Subgrade Reaction, k (psi/in or pci)	RCC Compressive Strength @ 90 days (psi)	RCC Flexural Strength @ 90 days, MR (psi)	Design Index, DI	Axle Load (kips)	Service Life Volume (Passes), V	Average Daily Volume, ADV	Thickness (min) from Design Figure (in)	Thickness (min) from Design Figure (rounded up) (in)	Comments
Modulus of subgrade reaction, k = 500 psi/in (pci) based on Pilot Study results...													
							Pneumatic Tire Loads (Categories I through VII) (e.g., passenger vehicle and truck)						
(1)	12-1	12	50	500	2,000	400	10	NA	NA	NA (1)	9.5	9.5	t = 12" adequate for DI=10
(2)	12-1	12	50	500	2,000	400	≤ 9	NA	NA	NA (1)	≤ 9.3	≤ 9.5	t = 12" adequate for all DI's
(3)	12-1	12	50	500	3,000	500	10	NA	NA	NA (1)	8.3	8.5	t = 12" adequate for DI=10
(4)	12-1	12	50	500	3,000	500	≤ 9	NA	NA	NA (1)	≤ 8.1	≤ 8.5	t = 12" adequate for all DI's
(5)	12-1	12	50	500	4,000	600	10	NA	NA	NA (1)	7.3	7.5	t = 12" adequate for DI=10
(6)	12-1	12	50	500	4,000	600	≤ 9	NA	NA	NA (1)	≤ 7.1	≤ 7.5	t = 12" adequate for all DI's
							Heavy Fork-lift Truck Loads (Categories NA)						
(7)	5-2	12	50	500	2,000	400	NA	120	10,000	1.1	13.5	13.5	inadequate thickness
(8)	5-2	12	50	500	2,500	450	NA	120	10,000	1.1	12.5	12.5	inadequate thickness
(9)	5-2	12	50	500	3,000	500	NA	120	10,000	1.1	11.6	12	adequate thickness
(10)	5-2	12	50	500	3,000	500	NA	120	50,000	5.5	12.4	12.5	inadequate thickness
(11)	5-2	12	50	500	3,500	550	NA	120	10,000	1.1	10.8	12	adequate thickness
(12)	5-2	12	50	500	3,500	550	NA	120	50,000	5.5	11.6	12	adequate thickness
(13)	5-2	12	50	500	3,500	550	NA	120	100,000	11.0	12.0	12	adequate thickness
(14)	5-2	12	50	500	4,000	600	NA	120	500,000	54.9	12.0	12	adequate thickness
(15)	5-2	8	50	500	5,000	650	NA	120	100,000	11.0	9.4	9.5	inadequate thickness
(16)	5-2	9.5	50	500	5,000	650	NA	120	100,000	11.0	9.4	9.5	adequate thickness
(17)	5-2	8	50	500	6,000	700	NA	120	100,000	11.0	8.9	9	inadequate thickness
(18)	5-2	9	50	500	6,000	700	NA	120	100,000	11.0	8.9	9	adequate thickness
Modulus of subgrade reaction, k = 340 psi/in (pci) based on specified CBR = 30...													
							Pneumatic Tire Loads (Categories I through VII)						
(19)	12-1	12	30	340	2,000	400	10	NA	NA	NA (1)	10.6	11	t = 12" adequate for DI=10
(20)	12-1	12	30	340	3,000	500	10	NA	NA	NA (1)	9.2	9.5	t = 12" adequate for DI=10
							Heavy Fork-lift Truck Loads (Categories NA)						
(21)	5-2	12	30	340	3,000	500	NA	120	10,000	1.1	13.1	13.5	inadequate thickness
(22)	5-2	12	30	340	3,500	550	NA	120	10,000	1.1	12.3	12.5	inadequate thickness
(23)	5-2	12	30	340	4,000	600	NA	120	10,000	1.1	11.5	12	adequate thickness

Notes

1. Refer to sheet 10 for ADV limits for Categories V, VI, and VII.

B.3 REINFORCED CONCRETE PIPE CALCULATION

CLIENT:	**NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI**		JOB **7379** **CTO 0272**
SUBJECT:	**CONCRETE PIPE DESIGN 100% DESIGN**		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: Date: 9/29/04	APPROVED BY: Date:

Objective: To determine the thickness and concrete strength of the reinforced concrete pipe (RCP) which is to be placed beneath the proposed roller compacted concrete (RCC) pavement.

References:

1. American Concrete Pipe Association, 1998, Concrete Pipe Design Manual, Irving, Texas, 12th Printing, August.
2. American Concrete Pipe Association, 1998, Concrete Pipe Handbook, Irving, Texas, 5th Printing, February.
3. Hyster, H440-700F/FS Lift Truck Technical Guide, H550F Lift Truck Specifications
4. Goodyear, Load and Inflation Table, Tire 14.00 x 24, 28 ply.

Given: The pipe will be an 24" diameter culvert, NW invert El. 26.5, SE invert El. 26.9, say El. 26.7 at max fill height (sheet 11).

Existing ground surface elevation is between El. 27 and El. 28. Say El 27.5

Assumptions: Maximum elevation of dead load over the pipe is El. 36.8 (sheet 11). Dead load consists of:

12" thick layer of RCC
12" densely compacted backfill
6" Base course (stabilized material blend)
remainder: Subbase (stabilized material blend)

Assume it is possible and practical to excavate into existing ground surface.

Stabilized Material Blend placement will start at El 30.

Maximum Live Load = loaded forklift (also check out construction loads - paving machine, etc.)

Assume the installation condition is a Negative Projecting Embankment - common fill placed on existing ground to 1' higher than top of pipe, then trench excavated with shaped subgrade 2" below bottom of pipe, 2" fine granular fill placed, culvert is placed in a trench, then densely compacted backfill placed to top of trench.

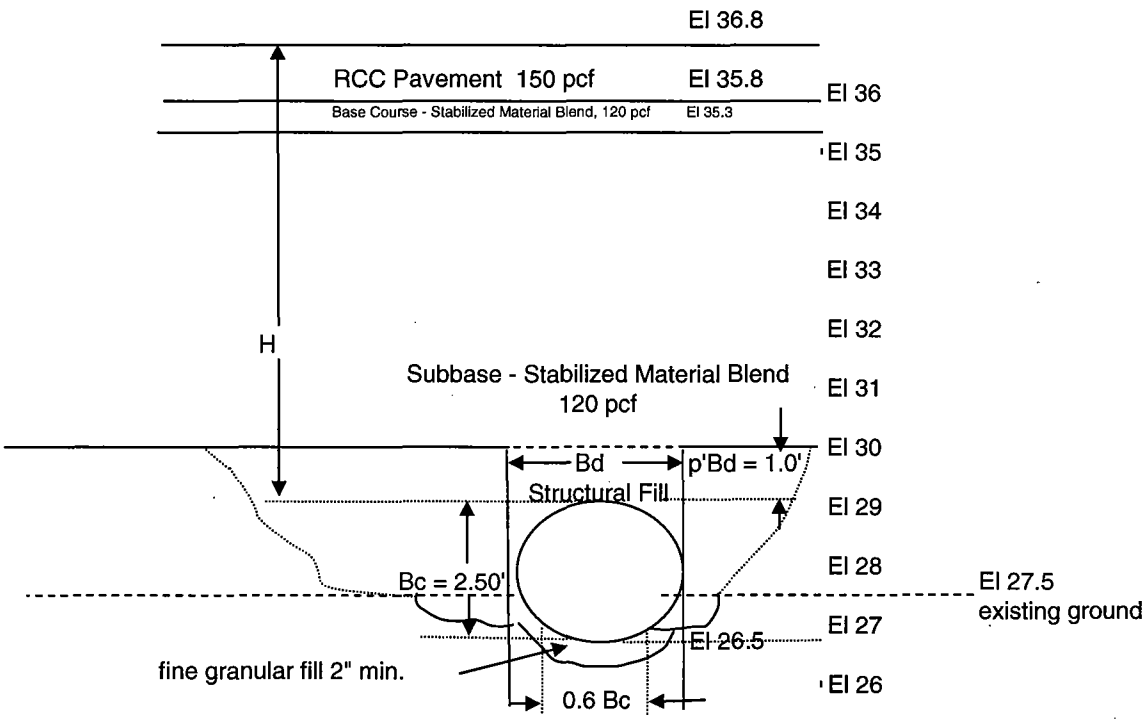
Find: Find the required pipe strength in terms of 0.01 inch crack D-load and ASTM RCP pipe class.

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB	7379	CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN				
BASED ON:			DRAWING NUMBER: C-23		
BY: Date:	NJB 09/29/04	CHECKED BY: Date: 9/29/04	APPROVED BY: Date:		

Solution:

For 24" pipe, Bc = 2.50' (Table 45, ref 1, sheet 12)

Pipe thickness = (2.50-2.00)/2 = 0.25'



El of top of pipe = 26.5 + 2.5 = 29.0

Max. height of fill + pavement over pipe = 36.8 - 29.0 = 7.8 ft = H

Trial 1 **Determine Pipe Strength needed under maximum fill height and HS 20 live load**

1. Determine Earth Load W_E

Negative projecting embankment condition

Say B_d = trench width = 5'

Given $p'B_d$ = 1'

Then $p' = p'B_d/B_d$ = 1' / 5' = 0.2

Settlement ratio r_{sd} (table 43, ref 1, sheet 12) is -0.1 for p' = 0.5, say r_{sd} = -0.05 for p'=0.2

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB 7379 CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: TMS Date: 9/29/04	APPROVED BY: Date:

From Figure 183, for r_{sd} = 0 (ref 1, sheet 13), for 10 ft height of fill (least shown on graph), for 5' wide trench, for 100 pcf fill, fill load = 4500 pounds per linear foot.
From Figure 184, for rsd = -0.1 (ref 1, sheet 13), for 10 ft height of fill (least shown on graph), for 5' wide trench, for 100 pcf fill, fill load = 4000 pounds per linear foot.

Use average load, or (4500 + 4000) / 2 = 4250
For 120 pcf backfill, fill load = 4250 x 1.2 = 5100 pounds per linear foot = W_E

2. Determine Live Load W_L

Height of fill is 7.8 ft.
From Table 45 (ref 1, sheet 12), highway load is 290 pounds per linear foot = W_L.

3. Select Bedding
Assume Class B bedding.

4. Determine bedding factor (Bf)

$$B_{fv} = (B_{fe}-B_{ft}) x \left[\frac{B_d - (B_c + 1.0)}{B_{dt} - (B_c + 1.0)}\right] + B_{ft}$$ ref 1, p. 42

B_c = outside horizontal span of pipe, feet

B_d = trench width at top of pipe, feet

B_{dt} = transition width at top of pipe, feet

B_{fe} = bedding factor, embankment

B_{ft} = fixed bedding factor, trench

B_{fv} = variable bedding factor, trench

Step 1. From Figure 227 (ref 1, sheet 14), use B_{ft} = 1.9 for shaped subgrade with granular foundation

Step 2. Trench width is 5 ft. = B_d

Step 3. From Table 20A (ref 1, sheet 15), for sand & gravel backfill, transition width B_{dt} is 4' 10" or 4.83'

Step 4. H/B_c = 7.8/2.5 = 3.12
From Table 43 (ref 1, sheet 12), the r_{sd} for ordinary soils is +0.5 to +0.8. Assume +0.5. For granular Class B bedding p=0.5, then $r_{sd}p$ = 0.5 x 0.5 = 0.25

Step 5. From Table 62.1 (ref 1, sheet 16), for H/B_c = 3.12, p = 0.5, $r_{sd}p$ = 0.25, and Class B bedding, B_{fe} = 2.20

Step 6. Filling in the equation, the trench variable bedding factor is:

$$B_{fv} = (2.2-1.9) x \left[\frac{5 - (2.5 + 1.0)}{4.83-(2.5+1.0)}\right] + 1.9$$

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB 7379 CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: SNA Date: 9/29/04	APPROVED BY: Date:

B_{fv} = 2.24

Apply safety factor of 1.0 based on the 0.01-inch crack. (ref 1, p. 51)

$$D_{0.01} = \frac{W_L + W_E}{B_{fv} \times D} \times FS$$ ref 1, pp. 45 & 51

D = pipe inside diameter = 2'

$$D_{0.01} = \frac{290 + 5100}{2.24 \times 2} \times 1.0$$

= 1204 pounds per linear foot per foot of inside diameter

Trial 2 **Determine pipe strength needed for loaded forklift**

1. Determine Live Load W_L from loaded forklift

Design pipe strength for a loaded Hyster 550F lift truck (fork lift)

1a. Determine length of contact area of each tire (dimensions from sheets 17, 18, & 19)

Axle loading, front: 113,130 lb (ref 3)
Axles loading, rear: 14,100 lb (ref 3)
Pneumatic tires
Tire size: 14.00 x 24 - 28 ply, front and rear (ref 3)

Maximum tire pressure at 10 mph: 110 psi (ref 4, sheet 20)

Load per front tire = 113,130 lb / 4 tires = 28,282.50 lb per tire

$$\frac{\text{load}}{\text{pressure}} = \frac{28{,}282.50 \text{ lb}}{110 \text{ psi}} = 257.11 \text{ sq. inches}$$

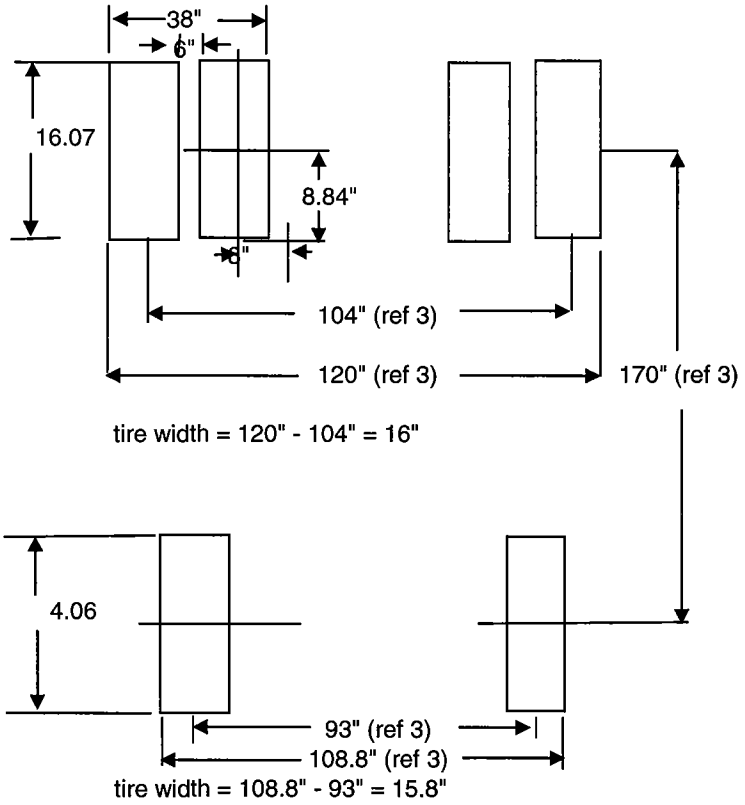
$$\frac{\text{tire contact area}}{\text{tire width}} = \frac{257.11}{16} = 16.07 \text{ inches tire length}$$

Load per steering tire = 14,100 lb / 2 tires = 7,050.00 lb per tire

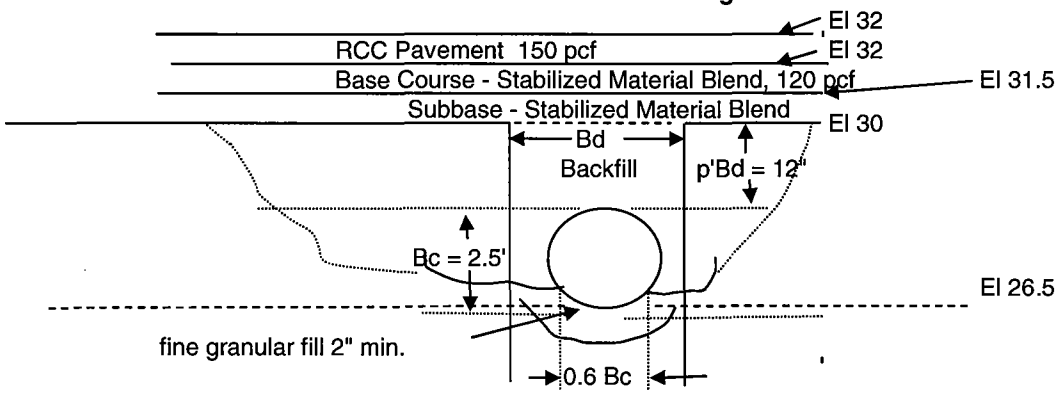
$$\frac{\text{load}}{\text{pressure}} = \frac{7{,}050.00 \text{ lb}}{110 \text{ psi}} = 64.09 \text{ sq. inches}$$

$$\frac{\text{tire contact area}}{\text{tire width}} = \frac{64.09}{15.8} = 4.06 \text{ inches in length}$$

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB 7379 CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: TMM Date: 9/29/04	APPROVED BY: Date:



1b. Determine minimum cover with forklift loading



Cover = 12" backfill + 6" minimum subbase + 6" base course + 12" RCC = 3' minimum cover prior to loaded forklift

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB 7379 CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: TMS Date: 9/29/04	APPROVED BY: Date:

For AASHTO live loads, single dual wheel load surface contact area is 0.83 ft x 1.67 ft
=' 1.37 sf

At depth H, load is distributed over area (0.83+1.75H) x (1.67 + 1.75H) (p. 34-35, ref 1, sheet 21)

Find average pressure intensity

$w_L = (P*I_f)/A_{LL}$ (p. 35, ref 1, sheet 21)

where

w_L = average pressure intensity, psf

P = total applied surface wheel load, pounds

A_{LL} = distributed live load area, sf

I_f = impacted factor At 3 ft of cover I_f = 1.0 (ref 1, pg 35)

For loaded forklift: P = 28,282.5 x 2 = 56,565 lb

A_{LL} = (tire length + 1.75H) x (dual wheel width) x 1.75H) (ref 2, pp. 4-39 - 4-41)

A_{LL} = (16.07"/12 + 1.75H) x (38"/12 + 1.75H) = (16.07/12 + 1.75*3) x (38/12 + 1.75*3)

A_{LL}= 55.5 sf

w_L = (56,565 x 1.0) / 55.5 = 1020.0 psf

Find total live load

$W_T = w_L L S_L$

S_L = lessor of the outside horizontal span of pipe or width of A_{LL} transverse to longitudinal axis of pipe, feet = 2.5 ft

L = length of A_{LL} parallel to longitudinal axis of pipe, ft = 16.07"/12 + 1.75*3

L = 6.6 ft

W_T = 1020 psf x 6.6' x 2.5' = 16,829 pounds

Find live load on pipe

$W_L = W_T$ / Le (ref 1, p. 36)

W_L = live load on pipe, pounds per linear foot

Le = effective supporting length of pipe (length 3/4 diameter down from top of pipe), feet

Le = L + 1.75(3*Bc/4) where Bc = outside diameter of pipe

Le = 6.6 + 1.75(3*2.5/4) = 9.9 ft

W_L = 16,829/9.9 = 1703 pounds per linear foot

Find earth load W_E on pipe

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB 7379 CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: [illegible] Date: 9/29/04	APPROVED BY: Date:

W_E for 10 ft of cover was 5100 lb/lf, so for 3' of cover use 5100 x 3'/10' = 1530 lb/lf

Determine D-Load

$$D_{0.01} = \frac{W_L + W_E}{B_{fv} \times D} \times FS$$ ref 1, pp. 45 & 51

D = pipe inside diameter = 2'

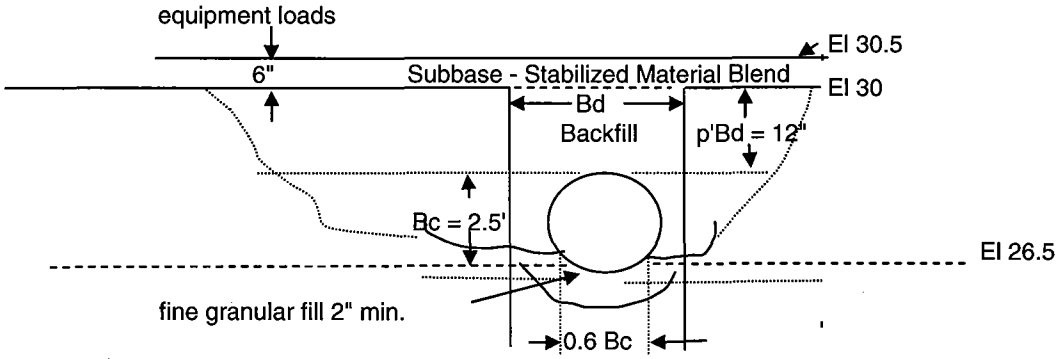
$$D_{0.01} = \frac{1703 + 1530}{2.24 \times 2} \times 1.0$$

= 722 pounds per linear foot per foot of inside diameter

Trial 3: **Determine pipe strength required for compaction of stabilized material blend during**

1c. Determine minimum cover prior to compaction equipment loading

Cover = 12" backfill + 6" minimum subbase = 18" minimum cover prior to heavy compaction equipment loads



Find average pressure intensity

$w_L = (P^*I_f)/A_{LL}$ (p. 4-42, ref 2)

where

w_L = average pressure intensity, psf

P = total applied surface wheel load, pounds

A_{LL} = distributed live load area, sf

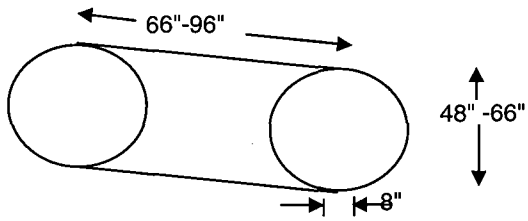
I_f = impacted factor At 1.5 ft of cover I_f = 1.2 (pg 35, ref 1)

For vibratory roller: Double drum vibratory rollers with an average operating weight per drum of at least 150 pounds per lineal inch of drum. The roller drum shall be 48 to 66 inches in diameter and 66 to 96 inches in width.

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB 7379 CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: TMB Date: 9/29/04	APPROVED BY: Date:

For rubber-tired roller: 50 to 90 psi tire pressure, with a total load of 3000 to 4500 pounds per wheel. 2 axles with at least 3 wheels per axle

For vibratory roller: Roller contact length is unknown. As the compacted material becomes denser and stiffer, the roller will sink in less and ride on a smaller area. Try roller contact length of 8 inches.



Assume roller width is 96 inches

A_{LL} = (8"/12 + 1.75H) x (96"/12 + 1.75H) = (8/12 + 1.75*1.5) x (96/12 + 1.75*1.5)

A_{LL}= 35 sf

w_L = 150 lb/in/8 in = 18.8 psi = 2700 psf

Find total live load

$W_T = w_L L S_L$

S_L = lessor of the outside horizontal span of pipe or width of A_{LL} transverse to longitudinal axis of pipe, feet = 2.5 ft

L = length of A_{LL} parallel to longitudinal axis of pipe, ft = 8/12 + 1.75*1.5

L = 3.3 ft

W_T = 2700 psf x 3.3' x 2.5' = 22,219 pounds

Find live load on pipe

$W_L = W_T$ / Le

W_L = live load on pipe, pounds per linear foot

Le = effective supporting length of pipe (length 3/4 diameter down from top of pipe), feet

Le = L + 1.75(3*Bc/4) where Bc = outside diameter of pipe

Le = 3.3 + 1.75(3*2.5/4) = 6.57 ft

W_L = 22,219 / 6.57 = 3,380 pounds per linear foot

Find earth load W_E on pipe

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB 7379 CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: TMB Date: 9/29/04	APPROVED BY: Date:

W_E for 10 ft of cover was 5100 lb/lf, so for 1.5' of cover use 5100 x 1.5'/10' = 765 lb/lf

Determine D-Load

$$D_{0.01} = \frac{W_L + W_E}{B_f \times D} \times FS$$

$$= \frac{3{,}380 + 765}{2.24 \times 2} \times 1.0$$

= 926 pounds per linear foot per foot of inside diameter

Trial 4: What if roller contact length is 12"?

Assume roller width is 96 inches

A_{LL} = (1 + 1.75H) x (96"/12 + 1.75H) = (1 + 1.75*1.5) x (96/12 + 1.75*1.5)

A_{LL}= 39 sf

w_L = 150 lb/in/12 in = 12.5 psi = 1800 psf

Find total live load

$W_T = w_L L S_L$

S_L = lessor of the outside horizontal span of pipe or width of A_{LL} transverse to longitudinal axis of

L = length of A_{LL} parallel to longitudinal axis of pipe, ft = 1' + 1.75*1.5

L = 3.6 ft

W_T = 1800 psf x 3.6' x 2.5' = 16,313 pounds

Find live load on pipe

$W_L = W_T$ / Le

W_L = live load on pipe, pounds per linear foot

Le = effective supporting length of pipe (length 3/4 diameter down from top of pipe), feet

Le = L + 1.75(3*Bc/4) where Bc = outside diameter of pipe

Le = 3.6 + 1.75(3*2.5/4) = 6.9 ft

W_L = 16,313 / 6.9 = 2,362 pounds per linear foot

Find earth load W_E on pipe

W_E for 10 ft of cover was 5100 lb/lf, so for 1.5' of cover use 5100 x 1.5'/10' = 765 lb/lf

CLIENT:	NCBC GULPORT, SITE 8A GULFPORT, MISSISSIPPI		JOB 7379 CTO 0272
SUBJECT:	CONCRETE PIPE DESIGN 100% DESIGN		
BASED ON:			DRAWING NUMBER: C-23
BY: Date:	NJB 09/29/04	CHECKED BY: TWJ Date: 9/29/04	APPROVED BY: Date:

Determine D-Load

$$D_{0.01} = \frac{W_L + W_E}{B_{fv} \times D} \times FS$$

$$= \frac{2{,}362 + 765}{2.24 \times 2} \times 1.0$$

= 699 pounds per linear foot per foot of inside diameter

Results:

Trial	Case	W_L (lb/lf)	W_E (lb/lf)	$D_{0.01}$ (lb/lf/ft)
1	Max fill, HS 20 live load	290	5100	1204
2	Min cover, loaded forklift	1703	1530	722
3	Min cover, compaction roller 8" contact	3,380	765	926
4	Min cover, compaction roller 12" contact	2,362	765	699

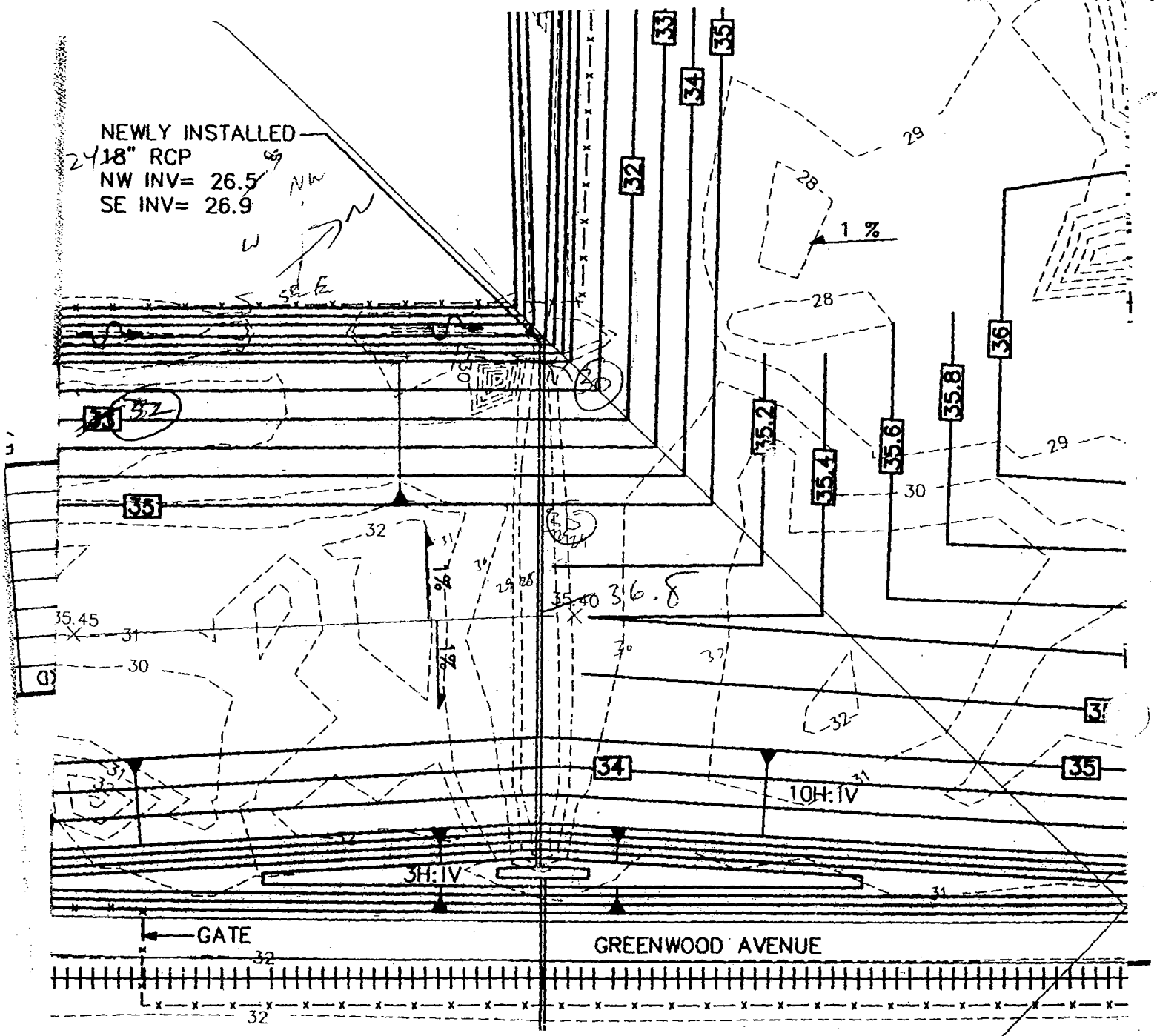
Worst case: Trial 1, Max fill, $D_{0.01}$ = 1204 pounds per lineal foot

Recommendation: A pipe which would withstand a minium three-edge bearing test load for the 0.01-inch crack of 1204 pounds per linear foot per foot of inside diameter would be required to withstand 7.8 foot of cover and AASHTO HS 20 highway loads.

Compare D-Load to ASTM C76 reinforced concrete pipe strength test requirements (sheets 22, 23, & 24)

This would require a Class III reinforced concrete pipe (D-load to produce 0.01-in crack - 1350 pounds per linear foot per foot of diameter)

Use Class III reinforced concrete pipe.



NCRETE
ADING RAMP

TABLE 43

DESIGN VALUES OF SETTLEMENT RATIO

Installation and Foundation Condition	Settlement Ratio r_{sd} Usual Range	Settlement Ratio r_{sd} Design Value
Positive Projecting	0.0 to +1.0	
Rock or Unyielding Soil	+1.0	+1.0
*Ordinary Soil	+0.5 to +0.8	+0.7
Yielding Soil	0.0 to +0.5	+0.3
Zero Projecting		0.0
Negative Projecting	−1.0 to 0.0	
p′ = 0.5		−0.1
p′ = 1.0		−0.3
p′ = 1.5		−0.5
p′ = 2.0		−1.0
Induced Trench	−2.0 to 0.0	
p′ = 0.5		−0.5
p′ = 1.0		−0.7
p′ = 1.5		−1.0
p′ = 2.0		−2.0

**The value of the settlement ratio depends on the degree of compaction of the fill material adjacent to the sides of the pipe. With good construction methods resulting in proper compaction of bedding and sidefill materials, a settlement ratio design value of +0.5 is recommended.*

TABLE 44

DESIGN VALUES OF COEFFICIENT OF COHESION

Type of Soil	Values of c
Clay	
Soft	40
Medium	250
Hard	1000
Sand	
Loose Dry	0
Silty	100
Dense	300
Top Soil	
Saturated	[illegible]

12

TABLE 45

HIGHWAY LOADS ON CIRCULAR PIPE

POUNDS PER LINEAR FOOT

PIPE SIZE D IN INCHES	B_c (ft.)	HEIGHT OF FILL H ABOVE TOP OF PIPE IN FEET 0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	PIPE SIZE D IN INCHES
12	1.33	3780	2080	1470	1080	760	550	450	380	290	230	190	160	130	12
15	1.63	4240	2360	1740	1280	900	660	540	450	350	280	230	190	160	15
18	1.92	4110	2610	1970	1460	1030	750	620	520	400	320	260	220	190	18
21	2.21	3920	2820	2190	1620	1150	840	690	580	450	360	300	250	210	21
24	2.50	4100	3010	2400	1780	1270	930	760	640	500	400	330	280	240	24
27	2.79	3880	2940	2590	1930	1380	1010	830	700	560	440	360	300	260	27
30	3.08	3620	2830	2770	2070	1480	1080	890	750	590	480	390	330	280	30
33	3.38	3390	2930	2950	2200	1580	1160	960	810	630	510	420	360	300	33
36	3.67	3190	2810	2930	2330	1670	1230	1020	860	670	550	450	380	330	36
39	3.96	3010	2670	2850	2440	1760	1290	1070	910	710	580	480	410	350	39
42	4.25	2860	2550	2770	2560	1840	1360	1130	950	750	610	510	430	370	42
48	4.83	2590	2330	2620	2480	1990	1470	1230	1040	820	670	560	470	410	48
54	5.42	2360	2150	2490	2360	2050	1580	1320	1120	890	730	610	520	440	54
60	6.00	2170	1990	2450	2250	1960	1680	1400	1190	950	780	650	560	480	60
66	6.58	2010	1850	2520	2160	1880	1640	1480	1260	1010	830	700	590	510	66
72	7.17	1870	1730	2580	2190	1810	1570	1510	1330	1060	880	740	630	540	72
78	7.75	1750	1630	2630	2240	1770	1520	1460	1390	1110	920	780	660	570	78
84	8.33	1650	1540	2730	2290	1810	1460	1410	1360	1160	960	810	690	600	84
90	8.92	1550	1460	2530	2330	1850	1470	1360	1310	1210	1000	850	720	630	90
96	9.50	1470	1380	2410	2290	1880	1500	1330	1270	1250	1040	880	750	650	96
102	10.08	1390	1320	2300	2190	1910	1530	1350	1240	1290	1070	910	780	680	102
108	10.67	1320	1260	2200	2090	1830	1560	1380	1230	1330	1110	940	810	700	108
114	11.25	1260	1200	2110	2010	1760	1540	1410	1260	1362	1140	970	830	730	114
120	11.83	1210	1150	2020	1930	1700	1480	1420	1280	1400	1170	990	860	750	120
126	12.42	1160	1100	1940	1860	1640	1430	1380	1300	1430	1200	1020	880	770	126
132	13.00	1110	1060	1870	1800	1580	1380	1330	1290	1460	1220	1040	900	790	132
138	13.58	1070	1020	1800	1730	1530	1340	1290	1250	1490	1250	1070	920	810	138
144	14.17	1020	980	1740	1670	1480	1300	1250	1210	1470	1280	1090	940	830	144

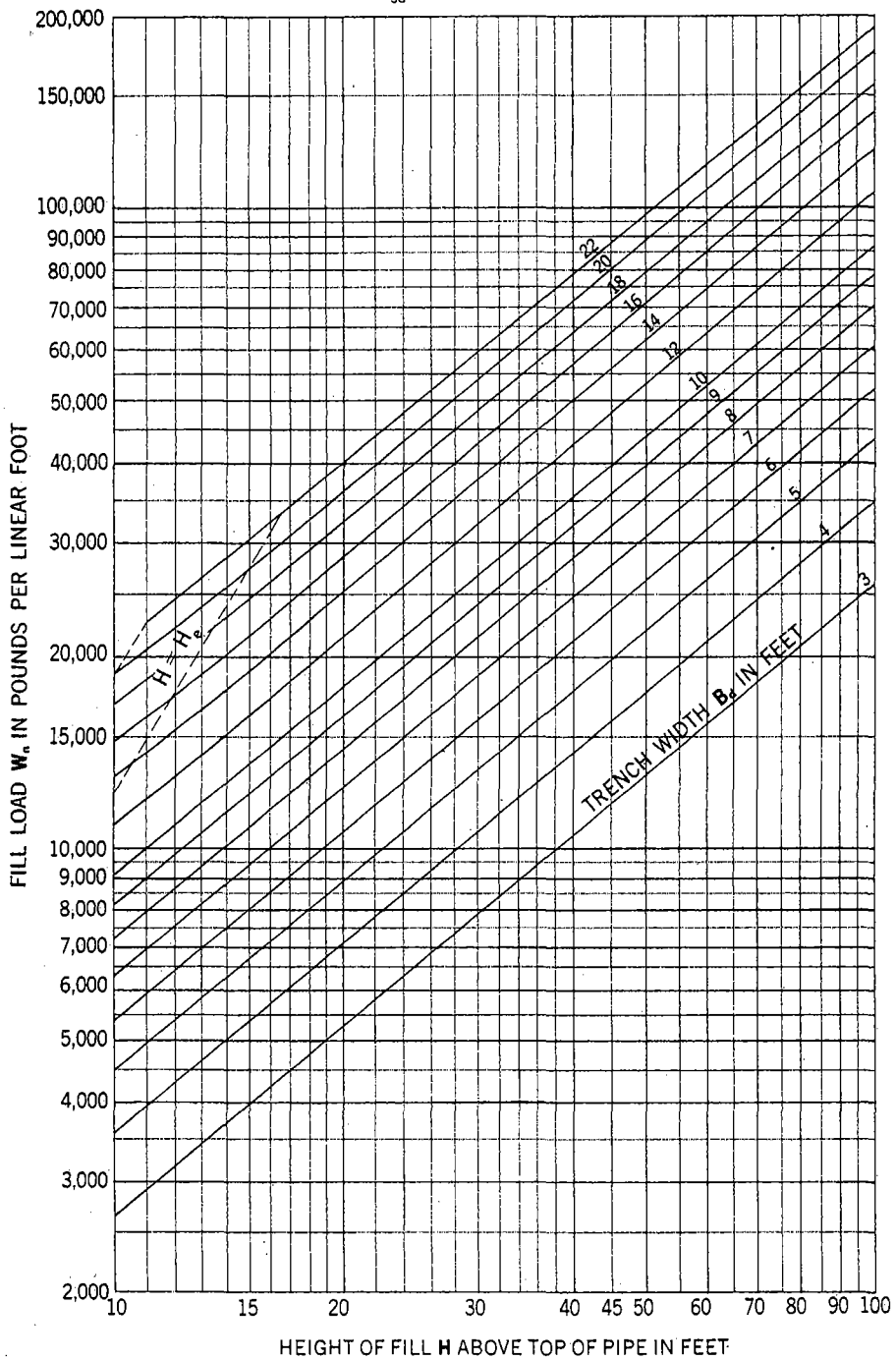
DATA:
1. Unsurfaced roadway.
2. Loads—AASHTO HS 20, two 16,000 lb. dual-tired wheels, 4 ft. on centers, or alternate loading, four 12,000 lb. dual-tired wheels, 4 ft. on centers with impact included.

NOTES:
1. Interpolate for intermediate pipe sizes and/or fill heights.

FIGURE 183

EMBANKMENT FILL LOADS ON CIRCULAR PIPE

NEGATIVE PROJECTING $p' = 0.5$ $r_{sd} = 0$ **100** POUNDS PER CUBIC FOOT FILL

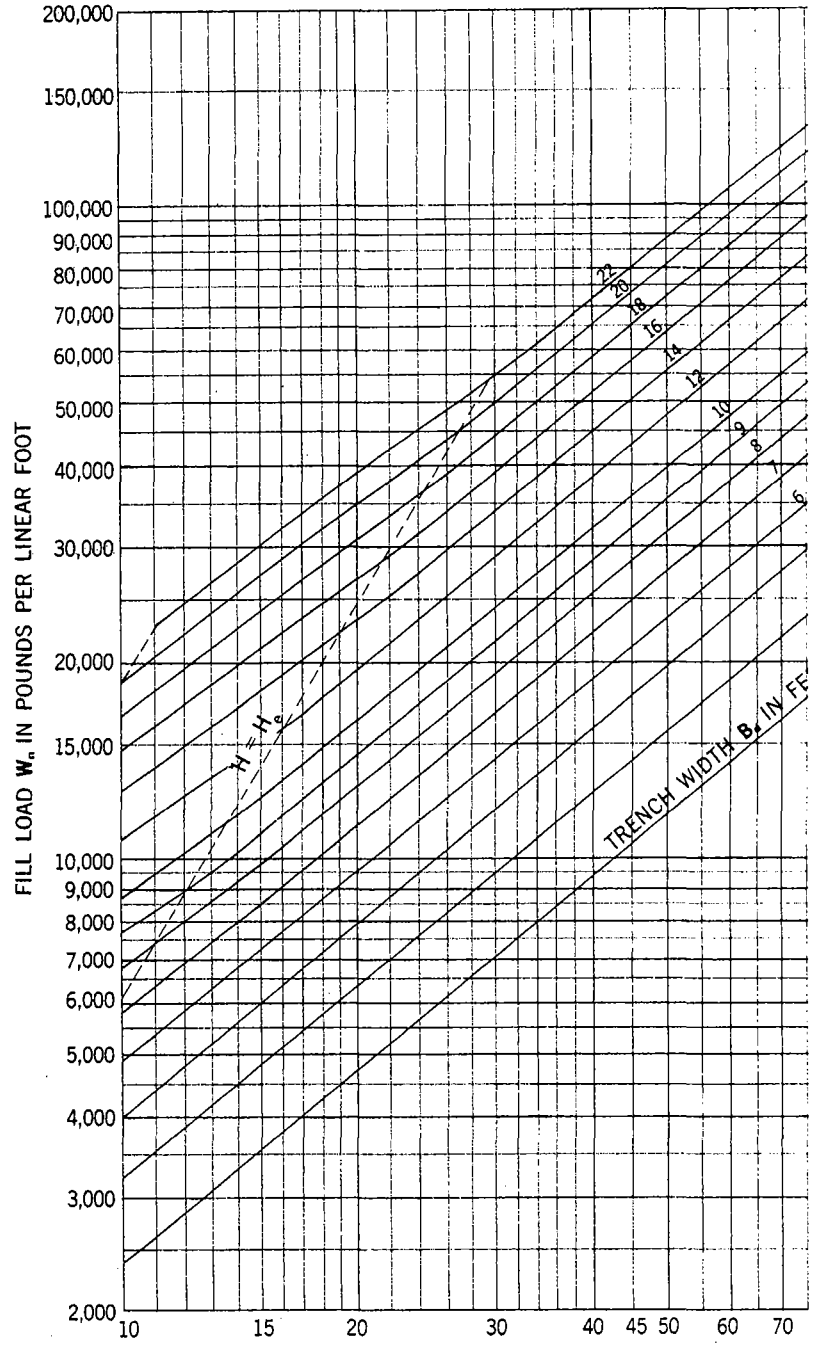


For fill weighing 110 pounds per cubic foot, increase loads 10%; for 120 pounds increase 20%, etc.

FIGURE 184

EMBANKMENT FILL LOADS ON CIRCULAR PIPE

NEGATIVE PROJECTING $p' = 0.5$ $r_{sd} = -0.1$ **100** POUNDS PER CUBIC F



For fill weighing 110 pounds per cubic foot, increase loads 10%; for 120 pounds increase 2

Interpolate for intermediate trench widths.

FIGURE 227

TRENCH BEDDINGS
CIRCULAR PIPE

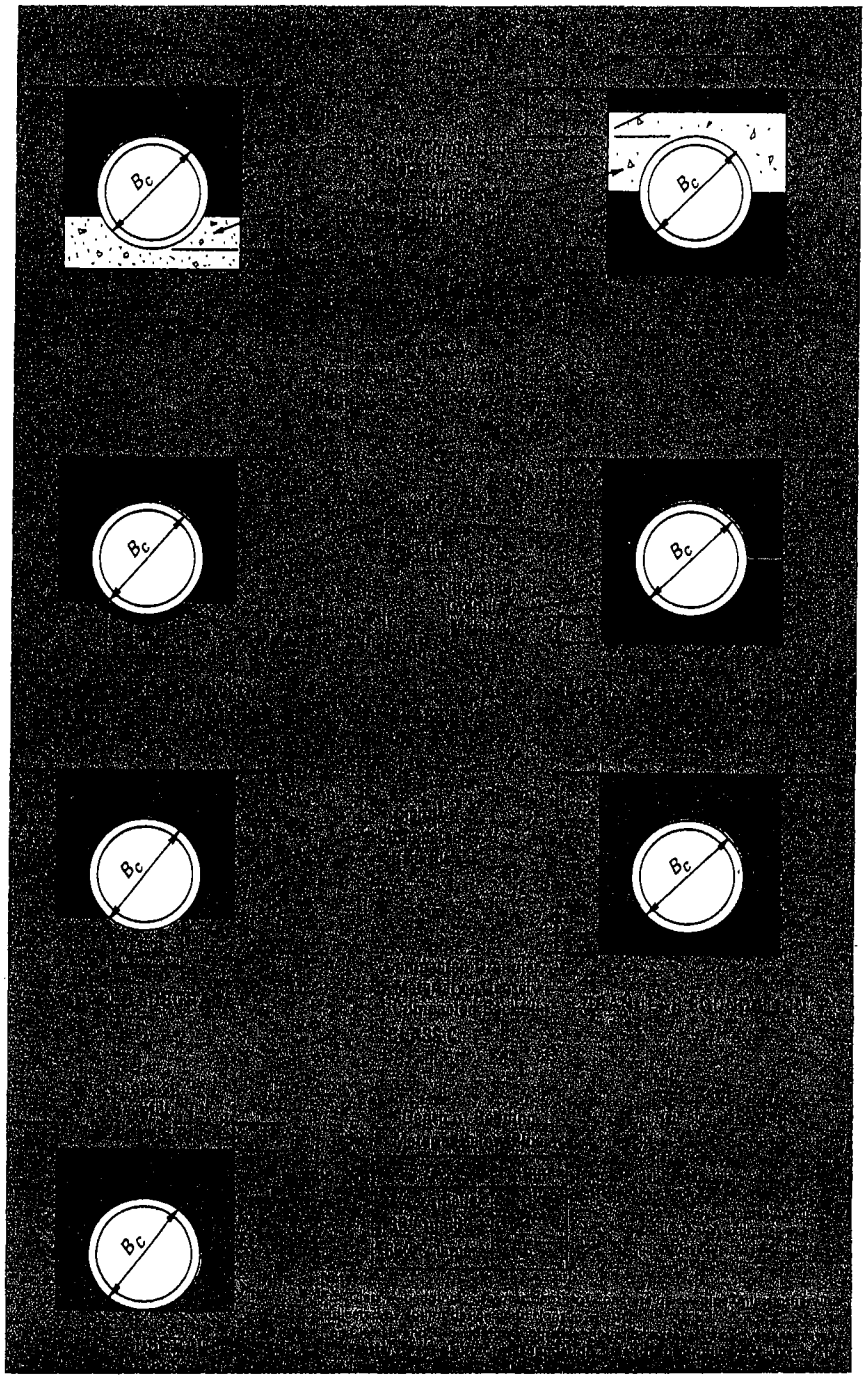


FIGURE 228

TRENCH BEDDINGS

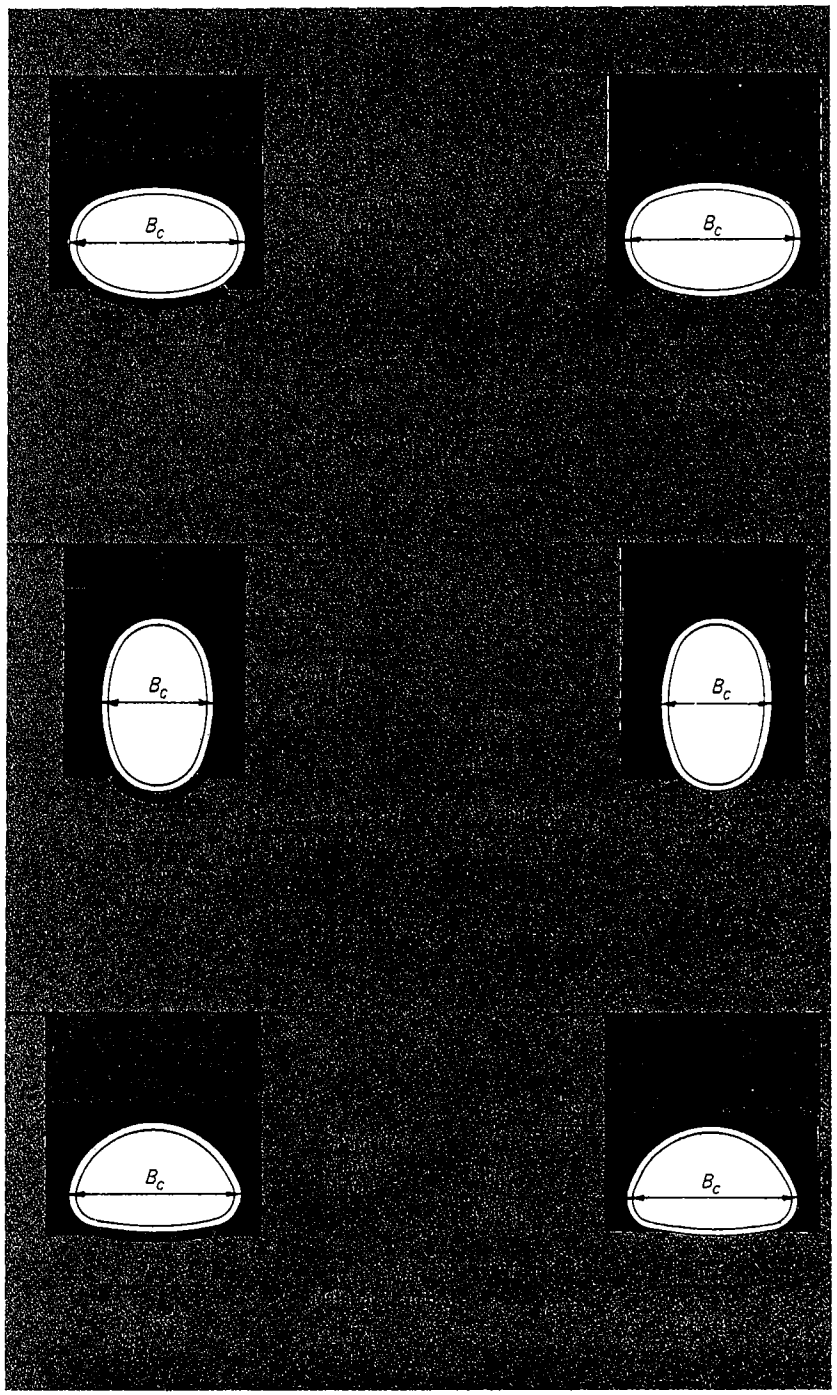


TABLE 20

BACKFILL LOADS ON CIRCULAR PIPE IN TRENCH INSTALLATION

24" 24"

*100 POUNDS PER CUBIC FOOT BACKFILL MATERIAL — LOADS IN POUNDS PER LINEAR FOOT

A SAND AND GRAVEL Kμ'—0.165

HEIGHT OF BACKFILL H ABOVE TOP OF PIPE, FEET	TRENCH WIDTH AT TOP OF PIPE 3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	▲TRANSITION WIDTH
5	1395	1638	**1819**								4'- 4"
6	1603	1892	**2199**								4'- 6"
7	1793	2127	2463	**2576**							4'- 8"
8	1966	2342	2723	**2954**							4'-10"
9	2123	2540	2964	**3331**							4'-11"
10	2266	2723	3189	**3705**							5'- 0"
11	2396	2891	3397	3910	**4081**						5'- 2"
12	2514	3046	3591	4144	**4456**						5'- 3"
13	2622	3189	3771	4363	**4836**						5'- 5"
14	2720	3320	3938	4568	**5209**						5'- 6"
15	2809	3441	4093	4760	5439	**5580**					5'- 7"
16	2890	3553	4238	4940	5656	**5955**					5'- 8"
17	2964	3655	4372	5108	5861	**6330**					5'-10"
18	3032	3750	4497	5266	6053	**6708**					5'-11"
19	3093	3837	4613	5413	6234	**7082**					6'- 0"
20	3148	3917	4720	5552	6405	7277	**7454**				6'- 1"
21	3199	3991	4820	5681	6566	7472	**7842**				6'- 2"
22	3245	4058	4913	5802	6717	7656	**8217**				6'- 4"
23	3287	4121	5000	5915	6860	7830	**8598**				6'- 5"
24	3325	4179	5080	6021	6994	7994	**8965**				6'- 6"
25	3360	4232	5155	6120	7121	8150	9204	**9341**			6'- 7"
26	3392	4280	5224	6213	7240	8298	9382	**9704**			6'- 8"
27	3421	4325	5289	6300	7352	8438	9552	**10080**			6'- 9"
28	3447	4367	5349	6382	7458	8570	7913	**10450**			6'-10"
29	3471	4405	5404	6458	7557	8695	9866	**10840**			6'-11"
30	3492	4440	5456	6529	7651	8814	10010	**11220**			7'- 0"
31	3512	4472	5504	6596	7739	8926	10150	11400	**11580**		7'- 1"
32	3530	4502	5549	6659	7822	9032	10280	11560	**11990**		7'- 2"
33	3546	4529	5590	6717	7901	9132	10400	11710	**12330**		7'- 3"
34	3561	4555	5629	6772	7974	9227	10520	11860	**12720**		7'- 4"
35	3575	4578	5665	6823	8044	9317	10640	12000	**13090**		7'- 5"
36	3587	4599	5698	6871	8109	9402	10740	12130	**13450**		7'- 6"
37	3598	4619	5729	6916	8181	9483	10850	12250	13700	**13860**	7'- 7"
38	3608	4637	5758	6958	8229	9559	10940	12370	13840	**14210**	7'- 8"
39	3618	4654	5784	6998	8283	9631	11040	12490	13980	**14610**	7'- 8"
40	3626	4669	5809	7035	8335	9700	11120	12600	14110	**14970**	7'- 9"

B SATURATED TOP SOIL Kμ'—0.150

HEIGHT OF BACKFILL H ABOVE TOP OF PIPE, FEET	TRENCH WIDTH AT TOP OF PIPE 3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	▲TRANSITION WIDTH
5	1423	1667	**1819**								4'- 4"
6	1641	1932	**2199**								4'- 5"
7	1842	2178	2517	**2576**							4'- 7"
8	2026	2406	2790	**2954**							4'- 8"
9	2195	2617	3045	**3331**							4'-10"
10	2350	2814	3284	**3705**							4'-11"
11	2492	2996	3507	4026	**4081**						5'- 1"
12	2623	3164	3717	4277	**4456**						5'- 2"
13	2743	3321	3912	4513	**4836**						5'- 3"
14	2853	3466	4095	4735	**5209**						5'- 4"
15	2954	3601	4266	4945	**5580**						5'- 6"
16	3047	3726	4426	5142	5870	**5955**					5'- 7"
17	3132	3843	4576	5328	6094	**6330**					5'- 8"
18	3210	3950	4716	5503	6305	**6708**					5'- 9"
19	3282	4050	4848	5668	6506	**7082**					5'-10"
20	3347	4143	4970	5823	6696	**7454**					5'-11"
21	3408	4229	5085	5969	6876	**7842**					6'- 0"
22	3463	4309	5192	6107	7046	8005	**8217**				6'- 1"
23	3514	4383	5293	6236	7207	8200	**8598**				6'- 2"
24	3561	4451	5387	6358	7360	8385	**8965**				6'- 3"
25	3604	4515	5475	6473	7504	8561	**9341**				6'- 4"
26	3643	4574	5557	6582	7641	8729	**9704**				6'- 5"
27	3679	4629	5634	6684	7771	8889	**10080**				6'- 6"
28	3712	4680	5706	6780	7893	9040	10220	**10450**			6'- 7"
29	3743	4727	5773	6870	8010	9185	10390	**10840**			6'- 8"
30	3771	4771	5836	6955	8120	9322	10560	**11220**			6'- 9"
31	3796	4811	5895	7036	8224	9453	10720	**11580**			6'-10"
32	3820	4849	5950	7111	8323	9577	10870	**11990**			6'-11"
33	3842	4884	6002	7182	8416	9695	11010	**12330**			7'- 0"
34	3861	4916	6050	7249	8505	9807	11150	12530	**12720**		7'- 1"
35	3880	4946	6095	7312	8588	9914	11280	12690	**13090**		7'- 2"
36	3896	4974	6137	7372	8668	10020	11410	12840	**13450**		7'- 3"
37	3912	5000	6177	7428	8743	10110	11530	12990	**13860**		7'- 3"
38	3926	5024	6214	7480	8814	10200	11640	13130	**14210**		7'- 4"
39	3939	5047	6248	7530	8881	10290	11760	13260	**14610**		7'- 5"
40	3950	5067	6280	7577	8945	10380	11860	13390	**14970**		7'- 6"

C ORDINARY CLAY Kμ'—0.130

HEIGHT OF BACKFILL H ABOVE TOP OF PIPE, FEET	TRENCH WIDTH AT TOP OF PIPE 3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	▲TRANSITION WIDTH
5	1461	1707	**1819**								4'- 3"
6	1694	1987	**2199**								4'- 4"
7	1910	2249	**2576**								4'- 6"
8	2110	2495	2882	**2954**							4'- 7"
9	2297	2725	3158	**3331**							4'- 8"
10	2470	2941	3418	**3705**							4'-10"
11	2630	3143	3663	**4081**							4'-11"
12	2779	3332	3894	**4456**							5'- 0"
13	2917	3510	4113	4724	**4836**						5'- 1"
14	3046	3676	4319	4972	**5209**						5'- 2"
15	3165	3832	4514	5207	**5580**						5'- 3"
16	3276	3978	4698	5430	**5955**						5'- 4"
17	3378	4115	4871	5643	**6330**						5'- 5"
18	3474	4243	5035	5844	**6708**						5'- 6"
19	3562	4364	5190	6035	6895	**7082**					5'- 7"
20	3645	4476	5336	6216	7114	**7455**					5'- 8"
21	3721	4582	5473	6388	7323	**7842**					5'- 9"
22	3792	4681	5603	6552	7522	**8217**					5'-10"
23	3858	4773	5726	6707	7712	**8598**					5'-11"
24	3919	4860	5842	6855	7893	**8965**					6'- 0"
25	3975	4942	5951	6994	8066	9159	**9341**				6'- 1"
26	4028	5018	6054	7127	8230	9358	**9704**				6'- 2"
27	4077	5089	6151	7253	8387	9548	**10080**				6'- 3"
28	4122	5156	6243	7373	8537	9731	**10450**				6'- 4"
29	4165	5219	6330	7486	8680	9905	**10840**				6'- 4"
30	4204	5278	6412	7594	8817	10070	**11220**				6'- 5"
31	4240	5333	6489	7697	8947	10230	**11580**				6'- 6"
32	4274	5385	6562	7794	9071	10380	11730	**11990**			6'- 7"
33	4305	5433	6631	7886	9189	10530	11910	**12330**			6'- 8"
34	4334	5478	6696	7974	9302	10670	12080	**12720**			6'- 9"
35	4361	5521	6757	8057	9410	10810	12240	**13090**			6'- 9"
36	4386	5561	6815	8136	9513	10940	12400	**13450**			6'-10"
37	4409	5598	6870	8211	9610	11060	12550	**13860**			6'-11"
38	4431	5633	6921	8282	9704	11180	12700	**14210**			7'- 0"
39	4451	5666	6970	8350	9793	11290	12840	14420	**14610**		7'- 1"

D SATURATED CLAY Kμ'—0.110

HEIGHT OF BACKFILL H ABOVE TOP OF PIPE, FEET	TRENCH WIDTH AT TOP OF PIPE 3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	▲TRANSITION WIDTH
5	1501	1748	**1819**								4'- 2"
6	1749	2044	**2199**								4'- 3"
7	1982	2323	**2576**								4'- 4"
8	2200	2588	**2954**								4'- 5"
9	2405	2839	**3331**								4'- 7"
10	2598	3076	3559	**3705**							4'- 8"
11	2779	3301	3828	**4081**							4'- 9"
12	2949	3513	4085	**4456**							4'-10"
13	3108	3714	4329	**4836**							4'-11"
14	3258	3905	4562	**5209**							5'- 0"
15	3399	4085	4783	5490	**5580**						5'- 1"
16	3531	4256	4994	5743	**5955**						5'- 2"
17	3655	4417	5195	5985	**6330**						5'- 3"
18	3772	4570	5386	6216	**6708**						5'- 3"
19	3881	4714	5568	6438	**7082**						5'- 4"
20	3984	4851	5742	6650	**7454**						5'- 5"
21	4080	4981	5907	6853	**7842**						5'- 6"
22	4171	5104	6064	7047	8046	**8217**					5'- 7"
23	4256	5220	6214	7233	8270	**8598**					5'- 8"
24	4336	5329	6357	7410	8485	**8965**					5'- 9"
25	4411	5433	6493	7581	8691	**9341**					5'- 9"
26	4481	5532	6622	7743	8889	**9704**					5'-10"
27	4548	5625	6745	7899	9080	**10080**					5'-11"
28	4610	5713	6863	8048	9263	**10450**					6'- 0"
29	4668	5797	6974	8191	9439	10710	**10840**				6'- 1"
30	4723	5876	7081	8328	9608	10920	**11220**				6'- 1"
31	4774	5950	7182	8458	9770	11110	**11580**				6'- 2"
32	4823	6021	7278	8583	9926	11300	**11990**				6'- 3"
33	4868	6088	7370	8703	10080	11480	**12330**				6'- 4"
34	4911	6151	7458	8817	10220	11660	**12720**				6'- 4"
35	4951	6211	7541	8927	10360	11830	**13090**				6'- 5"
36	4988	6268	7620	9032	10490	11990	**13450**				6'- 6"
37	5024	6322	7696	9132	10620	12150	13720	**13860**			6'- 7"
38	5057	6373	7768	9228	10740	12300	13900	**14210**			6'- 7"
39	5088	6421	7836	9320	10860	12450	14070	**14610**			6'- 8"

TABLE 62.1

BEDDING FACTORS FOR CIRCULAR PIPE
POSITIVE PROJECTING EMBANKMENT INSTALLATIONS

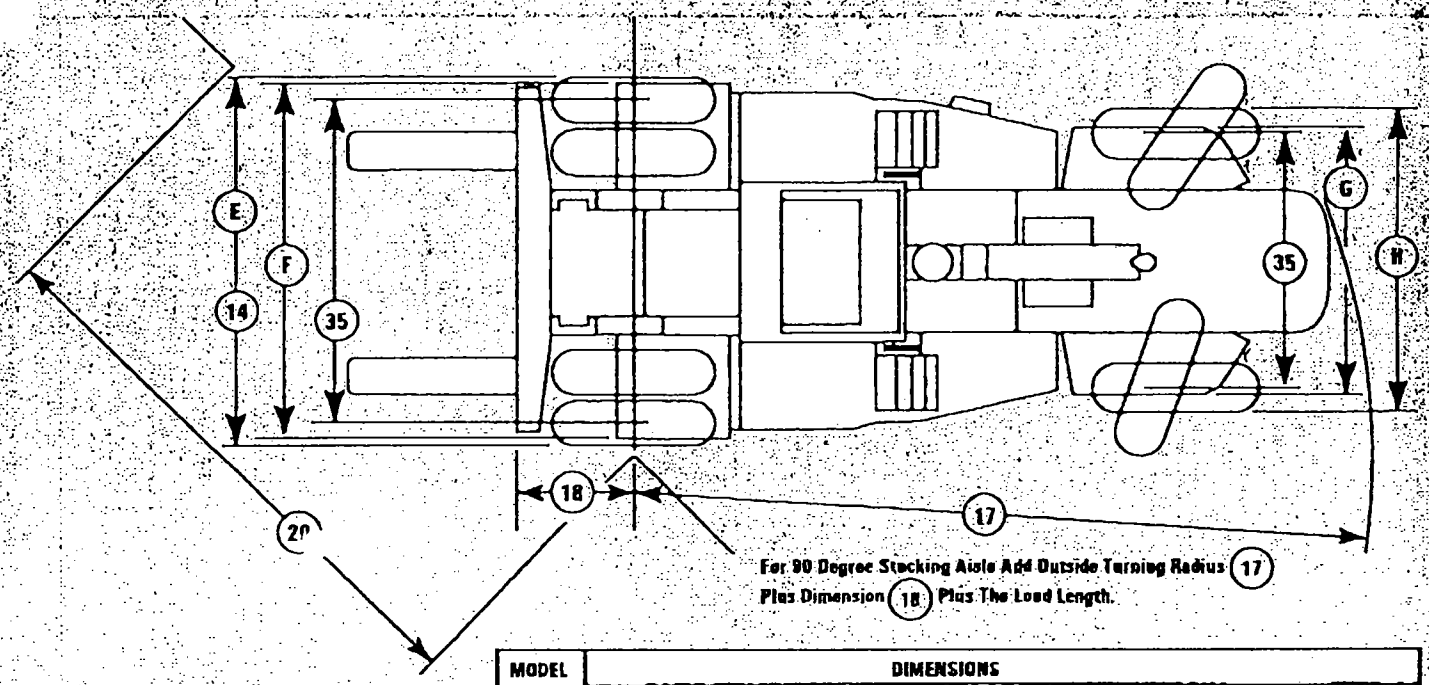
$\frac{H}{B_c}$	CLASS A BEDDING					CLASS B BEDDING				
	p = 0.9									
	$r_{sd}p = 0$	0.1	0.3	0.5	1.0	$r_{sd}p = 0$	0.1	0.3	0.5	1.0
0.5	5.09	5.09	5.09	5.09	5.09	2.92	2.92	2.92	2.92	2.92
1.0	5.09	5.09	5.09	5.09	5.09	2.92	2.92	2.92	2.92	2.92
1.5	5.09	4.83	4.47	4.47	4.47	2.92	2.83	2.71	2.71	2.71
2.0	5.09	4.49	4.35	4.19	4.19	2.92	2.77	2.67	2.61	2.61
3.0	5.09	4.50	4.21	4.06	3.88	2.92	2.72	2.62	2.56	2.50
5.0	4.97	4.37	4.11	3.97	3.81	2.88	2.67	2.58	2.52	2.46
10.0	4.82	4.28	4.04	3.90	3.76	2.83	2.64	2.55	2.50	2.44
15.0	4.77	4.25	4.01	3.88	3.74	2.81	2.63	2.54	2.49	2.43
	p = 0.7									
	$r_{sd}p = 0$	0.1	0.3	0.5	1.0	$r_{sd}p = 0$	0.1	0.3	0.5	1.0
0.5	6.03	6.03	6.03	6.03	6.03	2.80	2.80	2.80	2.80	2.87
1.0	5.61	4.79	4.79	4.79	4.79	2.73	2.58	2.58	2.58	2.58
1.5	5.17	4.46	4.19	4.19	4.19	2.65	2.50	2.44	2.44	2.44
2.0	4.98	4.35	4.11	3.99	3.98	2.61	2.48	2.42	2.39	2.39
3.0	4.80	4.25	4.02	3.90	3.75	2.58	2.45	2.40	2.36	2.32
5.0	4.66	4.18	3.95	3.84	3.70	2.55	2.43	2.38	2.35	2.31
10.0	4.57	4.12	3.91	3.79	3.66	2.53	2.42	2.36	2.33	2.30
15.0	4.53	4.09	3.89	3.77	3.65	2.52	2.41	2.36	2.33	2.29
	p = 0.5									
	$r_{sd}p = 0$	0.1	0.3	0.5	1.0	$r_{sd}p = 0$	0.1	0.3	0.5	1.0
0.5	4.84	4.54	4.55	4.55	4.55	2.37	2.33	2.33	2.33	2.33
1.0	4.33	3.97	3.97	3.97	3.97	2.31	2.25	2.25	2.25	2.25
1.5	4.18	3.83	3.68	3.68	3.68	2.28	2.23	2.20	2.20	2.20
2.0	4.11	3.79	3.65	3.58	3.58	2.27	2.22	2.20	2.19	2.18
3.0	4.04	3.75	3.62	3.54	3.45	2.26	2.22	2.19	2.18	2.16
5.0	3.99	3.72	3.58	3.51	3.43	2.26	2.21	2.19	2.17	2.16
10.0	3.95	3.69	3.56	3.49	3.41	2.25	2.20	2.18	2.17	2.15
15.0	3.94	3.68	3.56	3.48	3.40	2.25	2.20	2.18	2.17	2.15
	p = 0.3									
	$r_{sd}p = 0$	0.1	0.3	0.5	1.0	$r_{sd}p = 0$	0.1	0.3	0.5	1.0
0.5	3.49	3.41	3.41	3.41	3.41	2.11	2.10	2.10	2.10	2.10
1.0	3.40	3.28	3.28	3.28	3.28	2.10	2.08	2.08	2.08	2.08
1.5	3.37	3.25	3.20	3.20	3.20	2.09	2.08	2.07	2.07	2.07
2.0	3.35	3.24	3.20	3.16	3.16	2.09	2.08	2.07	2.07	2.07
3.0	3.34	3.23	3.18	3.15	3.11	2.09	2.08	2.07	2.07	2.06
5.0	3.33	3.22	3.17	3.14	3.11	2.09	2.08	2.07	2.07	2.06
10.0	3.32	3.22	3.17	3.14	3.10	2.09	2.08	2.07	2.07	2.06
15.0	3.32	3.22	3.17	3.14	3.10	2.09	2.08	2.07	2.07	2.06
	ZERO PROJECTING									
	2.83					2.02				

TABLE 62.2

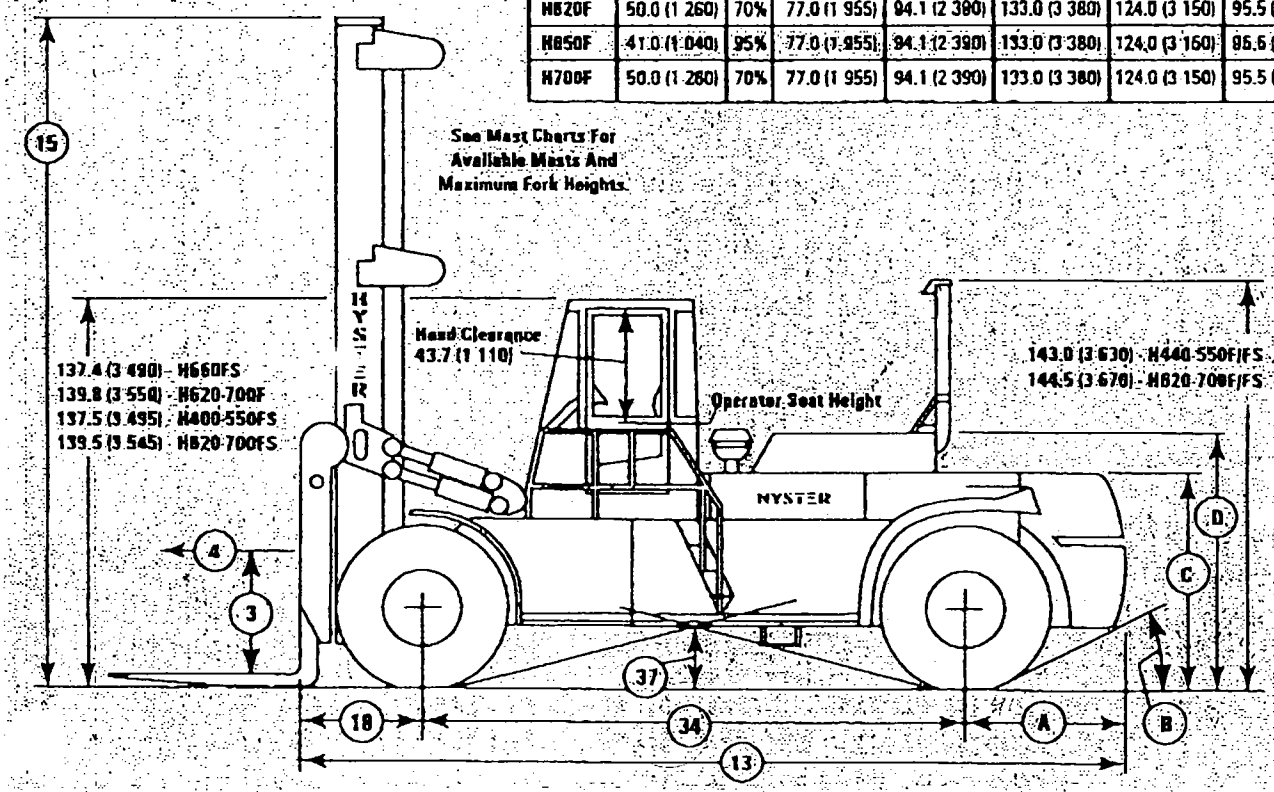
BEDDING FACTORS FOR CIRCULAR PIPE Bf
POSITIVE PROJECTING EMBANKMENT INSTALLATIONS

$\frac{H}{B_c}$	CLASS C BEDDING					CLASS D BEDDING			
	p = 0.9								
	$r_{sd}p = 0$	0.1	0.3	0.5	1.0	$r_{sd}p = 0$	0.1	0.3	0.5
0.5	2.29	2.29	2.29	2.29	2.29	1.31	1.31	1.31	1.31
1.0	2.29	2.29	2.29	2.29	2.29	1.31	1.31	1.31	1.31
1.5	2.29	2.26	2.16	2.16	2.16	1.31	1.29	1.27	1.27
2.0	2.29	2.20	2.14	2.10	2.10	1.31	1.28	1.26	1.24
3.0	2.29	2.17	2.10	2.07	2.02	1.31	1.27	1.24	1.23
5.0	2.27	2.14	2.08	2.04	2.00	1.30	1.26	1.24	1.22
10.0	2.24	2.12	2.06	2.03	1.99	1.29	1.25	1.23	1.22
15.0	2.23	2.10	2.05	2.02	1.98	1.29	1.25	1.23	1.21
	p = 0.7								
	$r_{sd}p = 0$	0.1	0.3	0.5	1.0	$r_{sd}p = 0$	0.1	0.3	0.5
0.5	2.22	2.22	2.22	2.22	2.22	1.28	1.28	1.28	1.28
1.0	2.18	2.08	2.08	2.08	2.08	1.27	1.24	1.24	1.24
1.5	2.13	2.03	1.99	1.99	1.99	1.25	1.22	1.20	1.20
2.0	2.10	2.01	1.97	1.95	1.95	1.24	1.21	1.20	1.19
3.0	2.08	2.00	1.96	1.94	1.91	1.24	1.21	1.19	1.18
5.0	2.06	1.98	1.95	1.93	1.90	1.23	1.20	1.19	1.18
10.0	2.05	1.98	1.94	1.92	1.89	1.22	1.20	1.18	1.18
15.0	2.04	1.97	1.94	1.91	1.89	1.22	1.20	1.18	1.18
	p = 0.5								
	$r_{sd}p = 0$	0.1	0.3	0.5	1.0	$r_{sd}p = 0$	0.1	0.3	0.5
0.5	1.94	1.92	1.92	1.92	1.92	1.19	1.18	1.18	1.18
1.0	1.90	1.86	1.86	1.86	1.86	1.17	1.16	1.16	1.16
1.5	1.88	1.85	1.83	1.83	1.83	1.16	1.15	1.14	1.14
2.0	1.88	1.84	1.83	1.82	1.82	1.16	1.15	1.14	1.14
3.0	1.87	1.84	1.82	1.81	1.80	1.16	1.15	1.14	1.14
5.0	1.86	1.83	1.82	1.81	1.80	1.16	1.14	1.14	1.13
10.0	1.86	1.83	1.81	1.80	1.79	1.15	1.14	1.14	1.13
15.0	1.86	1.83	1.81	1.80	1.79	1.15	1.14	1.14	1.13
	p = 0.3								
	$r_{sd}p = 0$	0.1	0.3	0.5	1.0	$r_{sd}p = 0$	0.1	0.3	0.5
0.5	1.76	1.76	1.76	1.76	1.76	1.12	1.11	1.11	1.11
1.0	1.76	1.75	1.75	1.75	1.75	1.11	1.11	1.11	1.11
1.5	1.75	1.74	1.74	1.74	1.74	1.11	1.11	1.11	1.11
2.0	1.75	1.74	1.74	1.74	1.74	1.11	1.11	1.11	1.11
3.0	1.75	1.74	1.74	1.73	1.73	1.11	1.11	1.11	1.11
5.0	1.75	1.74	1.74	1.73	1.73	1.11	1.11	1.11	1.11
10.0	1.75	1.74	1.74	1.73	1.73	1.11	1.11	1.11	1.10
15.0	1.75	1.74	1.74	1.73	1.73	1.11	1.11	1.11	1.10
	ZERO PROJECTING								
	1.70					1.10			

H440-700F/FS Lift Truck Specifications



MODEL	DIMENSIONS							
	A	B	C	D	E	F	G	H
H440FS	41.0 (1 040)	80%	75.5 (1 920)	92.7 (2 355)	120.0 (3 040)	110.0 (2 795)	95.5 (2 425)	108.8 (2 765)
H550FS	41.0 (1 040)	80%	75.5 (1 820)	82.7 (2 365)	120.0 (3 040)	110.0 (2 795)	95.5 (2 425)	108.8 (2 765)
H620FS	50.0 (1 260)	70%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 425)	109.8 (2 790)
H700FS	50.0 (1 260)	70%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 426)	109.8 (2 790)
H550F	41.0 (1 040)	84%	75.5 (1 920)	92.7 (2 355)	120.0 (3 040)	110.0 (2 785)	95.6 (2 425)	108.8 (2 765)
H620F	50.0 (1 260)	70%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 425)	109.8 (2 790)
H650F	41.0 (1 040)	95%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.6 (2 426)	109.8 (2 790)
H700F	50.0 (1 260)	70%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 425)	109.8 (2 790)



Circled numbers correspond to the line numbers on the tabulated charts inside the Technical Guide.
Figures are in inches/pounds (metric equivalent).

HYSTER

H550-620F Lift Truck Specifications

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GENERAL	1	Manufacturer		Hyster Company	Hyster Company
	2	Model		H550F	H620F
	3	Capacity rated	lb. (kg)	55,000 (25 000)	62,000 (28,000)
	4	Load Center	in. (mm)	48.0 (1 200)	48.0 (1 200)
	5	Power type		Diesel	Diesel
	6	Operator type		Sit	Sit
	7	Tire type, front / rear		Pneumatic / Pneumatic	Pneumatic / Pneumatic
	8	Wheels, front / rear	(X=drive)	4X / 2	4X / 2
DIMENSIONS	10	Standard mast (top of forks)	in. (mm)	124.5 (3 163)	124.5 (3 163)
	11	Forks, length / width / thickness	in. (mm)	96.0 x 8.0 x 4.5 (2 438 x 203 x 114)	96.0 x 12.0 x 4.5 (2 438 x 305 x 114)
	12	Tilt angle, standard mast, forward / rearward	in. (mm)	6 / 10	6 / 10
	13	Length to face of forks	in. (mm)	252.1 (6 403)	261.6 (6 645)
	14	Width, standard tires	in. (mm)	120.0 (3 040)	133.0 (3 380)
	15	Height, standard mast lowered	in. (mm)	155.0 (3 937)	168.5 (4 280)
	16	Height, standard mast extended, without LBE	in. (mm)	269.0 (6 960)	228.2 (5 798)
	17	Turning radius, minimum outside	in. (mm)	241.3 (6 129)	245.3 (6 231)
	18	Length, cntr drive axle to face of forks	in. (mm)	41.1 (1 045)	42.1 (1 069)
		Length, cntr drive axle to face of forks w/s.s.	in. (mm)	43.6 (1 110)	45.6 (1 160)
	19	Aisle width, (add load length for 90 degree stack)	in. (mm)	282.3 (7 170)	294.7 (7 555)
	20	Equal intersecting right angle aisle	in. (mm)	203.7 (5 174)	214.2 (5 440)
PERFORMANCE †	20	Stability (comply with ANSI)		YES	YES
	22	Travel speed, maximum forward (powershift)	mph (km/hr.)	18.4 (29.6)	16.3 (26.2)
	23	Lift speed, standard mast, NL / RL	ft/min. (m/s)	131.0 (0.67) / 61.0 (0.31)	106.0 (0.54) / 45.0 (0.23)
	24	Lowering, standard mast, NL / RL	ft/min. (m/s)	45.0 (0.23) / (96.0 (0.49)	65.0 (0.33) / 90.0 (0.46)
	25	Drawbar pull, powershift xmsn, 1 mph	lb. (kN)	37,550 (167)	42,480 (188)
	26	Gradeability, pow. shift xsmn. 1 mph NL / RL	Percent	31 / 31	33 / 30
WT	28	Total approximate weight, standard equipped truck	lb. (kg)	72,280 (32 767)	87,840 (39 820)
	29	Axle loading, static-RL front / rear	lb. (kg)	113,130 (51 306) / 14,100 (6 395)	133,130 (60 376) / 16,685 (7 567)
WHEELS & TIRES	31	Number of tires, front / rear		4/2	4/2
	32	Tire size, drive tires (front)		14.00 x 24 - 28 Ply	16.00 x 25 - 24 Ply
	33	Tire size, steer tires (rear)		14.00 x 24 - 28 Ply	16.00 x 25 - 24 Ply
	34	Wheelbase, center of steer to center of drive axle	in. (mm)	170.0 (4 320)	170.0 (4 320)
	35	Tread, center to center of tires, steer / drive	in. (mm)	104.0 (2 640) / 93.0 (2 362)	116.0 (2 950) / 93.0 (2 362)
	36	Ground clearance, lowest point-NL	in. (mm)	13.5 (343)	15.0 (381)
	37	Ground clearance, center of wheelbase-NL	in. (mm)	20.5 (520)	22.0 (559)
	38	Brakes, method of control, service / parking		Hydraulic / Hydraulic	Hydraulic / Hydraulic
	39	Brakes, method of operation, service / parking		Foot / Hand	Foot / Hand
DRIVETRAIN	41	Battery, volts / cold cranking amps	V / amps	24 / 660	24 / 660
	42	Engine, make-model		Cummins 6CT8.3	Cummins 6CT8.3
	43	Output per SAE standards	hp (kW)	215 (160)	215 (160)
	44	Governed speed, NL	RPM	2500	2500
	45	Cycle / number of cylinders / displacement	cu.in. (cm3)	4 / 6 / 504.5 (8 267)	4 / 6 / 504.5 (8 267)
	46	Clutch type, powershift		Torque Converter	Torque Converter
	47	Gear change type, powershift		Hand Lever	Hand Lever
	48	Number of speeds, forward / reverse		3 / 3	3 / 3
	49	Transmission type		Powershift	Powershift
	51	Relief pressure for attachments	psi (kPa)	3,200 (22 050)	3,200 (22 050)

* **CERTIFICATION:** These Hyster lift trucks meet design specifications of Part II ANSI B56.1-1969, as required by OSHA Section 1910.178 (a) (2) and with Part III ANSI B56.1-Revision in effect at the time of manufacture. Certification of compliance with the applicable ANSI standards appears on the lift truck's nameplate which is affixed to truck when shipped complete the factory.

† **NOTE:** Performance specifications are for truck equipped as described under Standard Equipment on the back of this Technical Guide. Performance specifications are affected by the condition of the vehicle and how it is equipped, as well as the nature and condition of the operating environment. If these specifications are critical, the proposed application should be discussed with your dealer.

Optional cab and lights are shown in the front cover photograph.

HYSTER

H650-700F Lift Truck Specifications

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GENERAL	1	Manufacturer		Hyster Company	Hyster Company	
	2	Model		H650F	H700F	
	3	Capacity, rated	lb. (kg)	65,000 (30,000)	70,000 (32,000)	
	4	Load Center	in. (mm)	48.0 (1 200)	48.0 (1 200)	
	5	Power type		Diesel	Diesel	
	6	Operator type		Sit	Sit	
	7	Tire type, front / rear		Pneumatic / Pneumatic	Pneumatic / Pneumatic	
	8	Wheels, front / rear	(X=drive)	4X / 2	4X / 2	
DIMENSIONS	10	2-Stg V/SFA mast (Top of forks)	in. (mm)	124.5 (3 163)	124.5 (3 163)	
	11	Forks, length / width / thickness	in. (mm)	96.0 x 12.0 x 4.5 (2 438 x 305 x 114)	96.0 x 12.0 x 4.5 (2 438 x 305 x 114)	
	12	Tilt angle, standard mast, forward / rearward	in. (mm)	6 / 10	6 / 10	
	13	Length to face of forks	in. (mm)	273.1 (6 937)	281.6 (7 153)	
	14	Width, standard tires	in. (mm)	133.0 (3 380)	135.0 (3 430)	
	15	Height, standard mast lowered	in. (mm)	168.5 (4 280)	168.5 (4 280)	
	16	Height, standard mast extended, without LBP	in. (mm)	228.2 (5 798)	228.2 (5 798)	
	17	Turning radius, minimum outside	in. (mm)	264.4 (6 716)	268.4 (6 817)	
	18	Length, cntr drive axle to face of forks	in. (mm)	42.1 (1 069)	42.1 (1 069)	
		Length, cntr drive axle to face of forks w/s.s.	in. (mm)	45.6 (1 160)	45.6 (1 160)	
	19	Aisle width, (add load length for 90 degree stack)	in. (mm)	306.5 (7 785)	310.5 (7 890)	
	20	Equal intersecting right angle aisle	in. (mm)	221.8 (5 634)	225.8 (5 735)	
PERFORMANCE †	21	Stability complies with ANSI*		YES	YES	
	22	Travel speed, maximum forward (powershift)	mph (km/hr.)	16.3 (26.2)	16.3 (26.2)	
	23	Lift speed, standard mast, NL / RL	ft/min. (m/s)	106.0 (0.54) / 45.0 (0.23)	106.0 (0.54) / 45.0 (0.23)	
	24	Lowering, standard mast, NL / RL	ft/min. (m/s)	65.0 (0.33) / 94.0 (0.48)	65.0 (0.33) / 96.0 (0.49)	
	25	Drawbar pull, powershift xmsn, max. / 1 mph	lb. (kN)	42,500 (189)	42,450 (188)	
	26	Gradeability, powershift xsmn, 1 mph NL / RL	Percent	36 / 30	33 / 28	
WEIGHTS	28	Total approximate weight, standard equipped truck	lb. (kg)	86,580 (39 282)	89,670 (40 667)	
	29	Axle loading, static-RL front / rear	lb. (kg)	136,180 (61 760) / 15,350 (6 961)	141,865 (64 338) / 17,805 (8 074)	
WHEELS & TIRES	31	Number of tires, front / rear		4 / 2	4 / 2	
	32	Tire size, drive tires (front)		16.00 x 25 - 24 Ply	16.00 x 25 - 28 Ply	
	33	Tire size, steer tires (rear)		16.00 x 25 - 24 Ply	16.00 x 25 - 28 Ply	
	34	Wheelbase, center of steer to center of drive axle	in. (mm)	190.0 (4 826)	190.0 (4 826)	
	35	Tread, center to center of tires, steer / drive	in. (mm)	116.0 (2 950) / 93.0 (2 362)	116.0 (2 950) / 93.0 (2 362)	
	36	Ground clearance, lowest point-NL	in. (mm)	15.0 (381)	15.0 (381)	
	37	Ground clearance, center of wheelbase-NL	in. (mm)	22.0 (559)	22.0 (559)	
	38	Brakes, method of control, service / parking		Hydraulic / Hydraulic	Hydraulic / Hydraulic	
	39	Brakes, method of operation, service / parking		Foot / Hand	Foot / Hand	
DRIVETRAIN	41	Battery, volts / cold cranking amps	V / amps	24 / 660	24 / 660	
	42	Engine, make-model		Cummins 6CTA8.3	Cummins 6CTA8.3	
	43	Output per SAE standards	hp (kW)	215 (160)	215 (160)	
	44	Governed speed, NL	RPM	2500	2500	
	45	Cycle / number of cylinders / displacement	cu.in. (cm3)	4 / 6 / 504.5 (8 267)	4 / 6 / 504.5 (8 267)	
	46	Clutch type, powershift		Torque Converter	Torque Converter	
	47	Gear change type, powershift		Hand Lever	Hand Lever	
	48	Number of speeds, forward / reverse		3 / 3	3 / 3	
	49	Transmission type		Powershift	Powershift	
	51	Relief pressure for attachments	psi (kPa)	3,200 (22,050)	3,200 (22,050)	

* **CERTIFICATION:** These Hyster lift trucks meet design specifications of Part II ANSI B56.1-1969, as required by OSHA Section 1910.178 (a) (2) and with Part III ANSI B56.1-Revision in effect at the time of manufacture. Certification of compliance with the applicable ANSI standards appears on the lift truck's nameplate which is affixed to truck when shipped complete from factory.

† **NOTE:** Performance specifications are for truck equipped as described under Standard Equipment on the back of this Technical Guide. Performance specifications are affected by the condition of the vehicle and how it is equipped, as well as the nature and condition of the operating environment. If these specifications are critical, the proposed application should be discussed with your dealer.

Optional cab and lights are shown in the front cover photograph.

LOAD AND INFLATION TABLES: ENGLISH

DIAGONAL CONSTRUCTION — CONVENTIONAL SIZE TIRES
FOR MOBILE CRANES
(INTERMITTENT HIGHWAY SERVICE)

GOODYEAR

DANGER — Operation of vehicles over the road, ignoring speed limitations and cooling requirements as noted below, can void tire warranty and induce premature tire failure!

HIGHWAY — INTERMITTENT

TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES — POUNDS PER SQUARE INCH (PSI)

		Speed	50 MPH		40 MPH		30 MPH		20 MPH		10 MPH		5 MPH		+Creep		Static	
Size	LR	PR	Inf.	Load	Inf.	Load	Inf.	Load	Inf.	Load	Inf.	Load	Inf.	Load	Inf.	Load	Inf.	Load
13.00-20ML	H	16	85	7400	85	8070	85	8730	85	9770	95	11840	95	13690	105	19240	105	22940
	J	18	100	8140	100	8870	100	9610	100	10740	110	13020	110	15060	120	21160	120	25230
13.00-24/25ML	H	16	85	8290	85	9040	85	9780	85	10940	95	13260	95	15340	105	21550	105	25700
	J	18	100	9120	100	9940	100	10760	100	12040	110	14590	110	16870	120	23710	120	28270
14.00-20ML	J	18	85	8740	85	9530	85	10310	85	11540	95	13980	95	16170	105	22720	105	27090
	L	20	100	9610	100	10470	100	11340	100	12680	110	15380	110	17780	120	24990	120	29790
14.00-24/25ML	L	20	100	10730	100	11700	100	12660	100	14160	110	17170	110	19850	120	27900	120	33260
	N	24	100	10730	100	11700	100	12660	100	14160	110	17170	110	19850	120	27900	120	33260
16.00-25		24					70	13450	80	15660	95	20410	95	23510	100	31740	100	38240
18.00-25		24					60	15900	70	18740			80	27490	100	41050	100	49460
*15.5-25		18											95	21460	95	25850		
*17.5-25		20											95	25890	95	31190		
*20.5-25		24									80	22410	95	32460	95	39110		
21.00-25		24					50	18380	60	22030	70	28380	70	32700				
		28					60	20450	70	24110	85	31790	85	36630	100	52820	100	63640
*23.5-25		24					50	16760	60	19290	70	23200	70	26730				
		28											100	43170	100	52010		
*26.5-25		32											100	55020	100	66290		

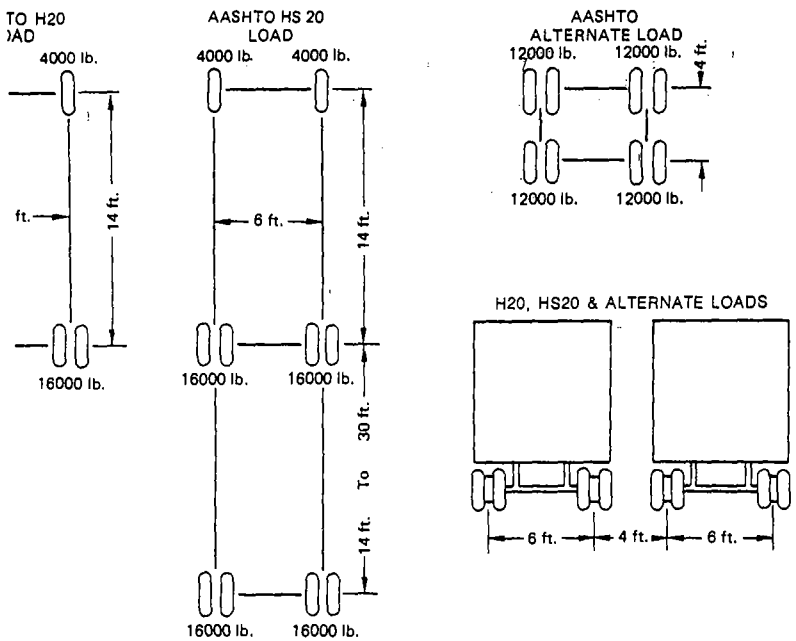
Above loads and inflation are maximum for ply ratings shown at speeds indicated

NOTES:
1. Above loads and inflation are maximum for ply ratings shown at speeds indicated.
2. Intermittent highway service means that 1 hr. cooling stop is required for each of the following speed ranges at max. travel time indicated. 40-50 MPH 1 hr., 30-40 MPH 1 hr., 20-30 MPH 2 hrs., & 10-20 MPH 3 hrs.
3. Mining and Logging tires are not intended for sustained highway service.
4. For special operating conditions, cold inflation pressures may be increased up to 10 PSI (but to exceed the maximum rim capacity), with no increase in loads. [illegible] MPH rating & higher & only up to [illegible] MPH (max.)
5. [illegible]

y so that the live load transmitted to the pipe is negligible. In the of flexible pavements designed for light duty traffic but subjected to truck traffic; the flexible pavement should be considered as fill ial over the top of the pipe.

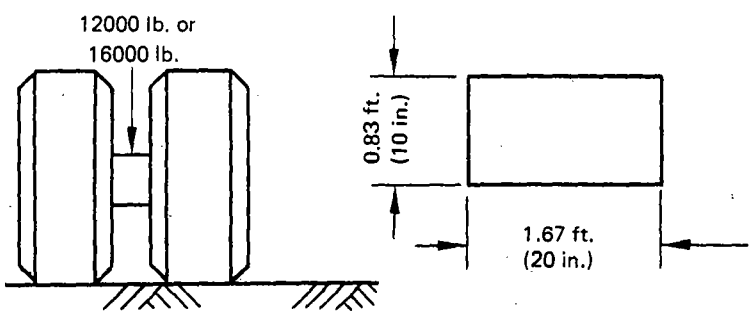
analyses, the most critical AASHTO loadings shown in illustration e used in either the single mode or passing mode.

Illustration 4.5 — AASHTO Live Loads



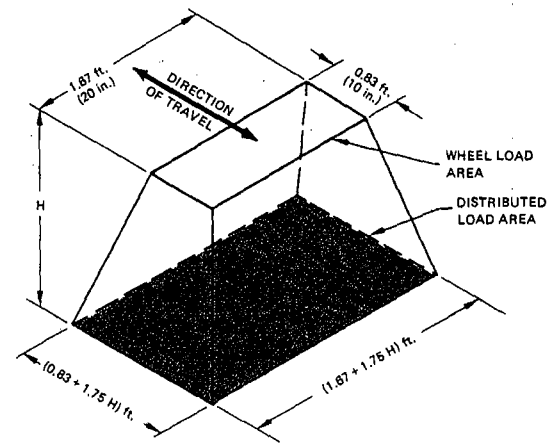
of these loadings is assumed to be applied through dual wheel ies uniformly distributed over a surface area of 10 inches by 20 s shown in Illustration 4.6.

Illustration 4.6 — Wheel Load Surface Contact Area



As recommended by AASHTO, the total wheel load is then assumed to be transmitted and uniformly distributed over a rectangular area on a horizontal plane at the depth, H, as shown in Illustration 4.7 for a single HS-20 dual wheel.

Illustration 4.7 — Distributed Load Area, Single Dual Wheel



Distributed load areas for the alternate load and the passing mode for either loading are developed in a similar manner.

The average pressure intensity on the subsoil plan at the outside top of the pipe at depth, H, is determined by the equation:

$$w_L = \frac{P(I_f)}{A_{LL}} \tag{20}$$

where

w_L = average pressure intensity, pounds per square foot
P = total applied surface wheel loads, pounds
A_{LL} = distributed live load area, square feet
I_f = impact factor

Recommended impact factors, I_f, to be used in determining live loads imposed on pipe with less than 3 feet of cover when subjected to dynamic traffic loads are listed in the accompanying Table.

Impact Factors For Highway Truck Loads

H, HEIGHT OF COVER	I_f, IMPACT FACTOR
0'-0" to 1'-0"	1.3
1'-1" to 2'-0"	1.2
2'-1" to 2'-11"	1.1
3'-0" and greater	1.0

NOTE: Impact Factors recommended by the American Association of State Highway and Transportation Officials in "Standard Specifications for Highway Bridges."

TABLE 1 Design Requirements for Class I Reinforced Concrete Pipe[A]

NOTE 1—See Section 5 for basis of acceptance specified by the owner.

The strength test requirements in pounds-force per linear foot of pipe under the three-edge-bearing method shall be either the D-load (test load expressed in pounds-force per linear foot per foot of diameter) to produce a 0.01-in. crack, or the D-loads to produce the 0.01-in. crack and the ultimate load as specified below, multiplied by the internal diameter of the pipe in feet.

D-load to produce a 0.01-in. crack	800
D-load to produce the ultimate load	1200

Internal Designated Diameter, in.	Reinforcement, in.²/linear ft of pipe wall								
	Wall A					Wall B				
	Concrete Strength, 4000 psi					Concrete Strength, 4000 psi				
	Wall Thickness, in.	Circular Reinforcement[B]		Elliptical Reinforcement[C]		Wall Thickness, in.	Circular Reinforcement[B]		Elliptical Reinforcement[C]	
		Inner Cage	Outer Cage				Inner Cage	Outer Cage		
60	5	0.25	0.15	0.28		6	0.21	0.13	0.23	
66	5½	0.30	0.18	0.33		6½	0.25	0.15	0.28	
72	6	0.35	0.21	0.39		7	0.29	0.17	0.32	
78	6½	0.40	0.24	0.44		7½	0.32	0.19	0.36	
84	7	0.45	0.27	0.50		8	0.37	0.22	0.41	
90	7½	0.49	0.29	0.54		8½	0.41	0.25	0.46	
96	8	0.54	0.32	0.60		9	0.46	0.28	0.51	
	Concrete Strength, 5000 psi									
102	8½	0.63	0.38	Inner Circular	0.25	9½	0.54	0.32	Inner Circular	0.22
				Plus Elliptical	0.38				Plus Elliptical	0.32
108	9	0.68	0.41	Inner Circular	0.27	10	0.61	0.37	Inner Circular	0.24
				Plus Elliptical	0.41				Plus Elliptical	0.37
114	[A]	...	...	...	...	[A]	...	...	...	...
120	[A]	...	...	...	...	[A]	...	...	...	...
126	[A]	...	...	...	...	[A]	...	...	...	...
132	[A]	...	...	...	...	[A]	...	...	...	...
138	[A]	...	...	...	...	[A]	...	...	...	...
144	[A]	...	...	...	...	[A]	...	...	...	...

[A] For modified or special designs see 7.2 or with the permission of the owner utilize the provisions of Specification C 655. Steel areas may be interpolated between those shown for variations in diameter, loading, or wall thickness. Pipe over 96 in. in diameter shall have two circular cages or an inner circular plus one elliptical cage.

[B] As an alternative to designs requiring both inner and outer circular cages the reinforcement may be positioned and proportioned in either of the following manners:

An inner circular cage plus an elliptical cage such that the area of the elliptical cage shall not be less than that specified for the outer cage in the table and the total area of the inner circular cage plus the elliptical cage shall not be less than that specified for the inner cage in the table,

An inner and outer cage plus quadrant mats in accordance with Fig. 1, or

An inner and outer cage plus an elliptical cage in accordance with Fig. 2.

[C] Elliptical and quadrant steel must be held in place by means of holding rods, chairs, or other positive means throughout the entire casting operation.

Acceptability of the pipe in all diameters and classes produced in accordance with 7.1 or 7.2 shall be determined by the results of such material tests as are required in 6.1, 6.2, and 6.4; by crushing tests on concrete cores or cured concrete cylinders; by absorption tests on selected samples from the wall of the pipe; and by inspection of the finished pipe including amount and placement of reinforcement to determine its conformance with the accepted design and its freedom from defects.

5.1.3 When agreed upon by the owner and manufacturer, any portion or any combination of the tests itemized in 5.1.1 or 5.1.2 may form the basis of acceptance.

5.2 *Age for Acceptance*—Pipe shall be considered ready for acceptance when it conforms to the requirements as indicated by the specified tests.

6. Materials

6.1 The aggregate shall be so sized, graded, proportioned, and mixed with such proportions of Portland cement, blended hydraulic cement, or Portland cement and supplementary cementing materials, or admixtures, if used, or a combination thereof, and water to produce a homogenous concrete mixture of such quality that the pipe will conform to the test and design requirements of the specification. In no case, however, shall the proportion of Portland cement, blended hydraulic cement, or a combination of Portland cement and supplementary cementing materials be less than 470 lb/yd³.

6.2 *Cementitious materials*:

6.2.1 *Cement*—Cement shall conform to the requirements for portland cement of Specification C 150 or shall be portland blast-furnace slag cement or portland-pozzolan cement conforming to the requirements of Specification C 595, except that the pozzolan constituent in the Type IP portland-pozzolan cement shall be fly ash.

6.2.2 *Fly Ash*—Fly ash shall conform to the requirements o Class F or Class C of Specification C 618.

6.2.3 *Allowable Combinations of Cementitious Materials*—The combination of cementitious materials used in the concret shall be one of the following:

6.2.3.1 Portland cement only,

6.2.3.2 Portland blast furnace slag cement only;

6.2.3.3 Portland pozzolan cement only, or

6.2.3.4 A combination of portland cement and fly ash.

6.3 *Aggregates*—Aggregates shall conform to Specificatic

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TABLE 2 Design Requirements for Class II Reinforced Concrete Pipe[A]

NOTE 1—See Section 5 for basis of acceptance specified by the owner.

The strength test requirements in pounds-force per linear foot of pipe under the three-edge-bearing method shall be either the D-load (test load expressed in pounds-force per linear foot per foot of diameter) to produce a 0.01-in. crack, or the D-loads to produce the 0.01-in. crack and the ultimate load as specified below, multiplied by the internal diameter of the pipe in feet.

D-load to produce a 0.01-in. crack 1000
D-load to produce the ultimate load 1500

Internal Designated Diameter, in.	Reinforcement, in.²/linear ft of pipe wall												
	Wall A				Wall B				Wall C				
	Concrete Strength, 4000 psi				Concrete Strength, 4000 psi				Concrete Strength, 4000 psi				
	Wall Thickness, in.	Circular Reinforcement[B] Inner Cage	Circular Reinforcement[B] Outer Cage	Elliptical Reinforcement[C]	Wall Thickness, in.	Circular Reinforcement[B] Inner Cage	Circular Reinforcement[B] Outer Cage	Elliptical Reinforcement[C]	Wall Thickness, in.	Circular Reinforcement[C] Inner Cage	Circular Reinforcement[C] Outer Cage	Elliptical Reinforcement[D]
12	1¾	0.07[B]	...	...	2	0.07[B]	...	...	2¾	0.07[B]	...	...
15	1⅞	0.07[B]	...	...	2¼	0.07[B]	...	...	3	0.07[B]	...	...
18	2	0.07[B]	...	0.07[B]	2½	0.07[B]	...	0.07[B]	3¼	0.07[B]	...	0.07[B]
21	2¼	0.12	...	0.10	2¾	0.07[B]	...	0.07[B]	3½	0.07[B]	...	0.07[B]
24	2½	0.13	...	0.11	3	0.07[B]	...	0.07[B]	3¾	0.07[B]	...	0.07[B]
27	2⅝	0.15	...	0.13	3¼	0.13	...	0.11	4	0.07[B]	...	0.07[B]
30	2¾	0.15	...	0.14	3½	0.14	...	0.12	4¼	0.07[B]	...	0.07[B]
33	2⅞	0.16	...	0.15	3¾	0.15	...	0.13	4½	0.07[B]	...	0.07[B]
36	3	0.14	0.08	0.15	4[E]	0.12	0.07	0.13	4¾[E]	0.07	0.07	0.08
42	3½	0.16	0.10	0.18	4½	0.15	0.09	0.17	5¼	0.10	0.07	0.11
48	4	0.21	0.13	0.23	5	0.18	0.11	0.20	5¾	0.14	0.08	0.15
54	4½	0.25	0.15	0.28	5½	0.22	0.13	0.24	6¼	0.17	0.10	0.19
60	5	0.30	0.18	0.33	6	0.25	0.15	0.28	6¾	0.22	0.13	0.24
66	5½	0.35	0.21	0.39	6½	0.31	0.19	0.34	7¼	0.25	0.15	0.28
72	6	0.41	0.25	0.45	7	0.35	0.21	0.39	7¾	0.30	0.18	0.33
78	6½	0.46	0.28	0.51	7½	0.40	0.24	0.44	8¼	0.35	0.21	0.39
84	7	0.51	0.31	0.57	8	0.46	0.28	0.51	8¾	0.41	0.25	0.46
90	7½	0.57	0.34	0.63	8½	0.51	0.31	0.57	9¼	0.48	0.29	0.53
96	8	0.62	0.37	0.69	9	0.57	0.34	0.63	9¾	0.55	0.33	0.61
	Concrete Strength, 5000 psi												
102	8½	0.76	0.46	Inner Circular Plus Elliptical 0.30 / 0.46	9½	0.68	0.41	Inner Circular Plus Elliptical 0.27 / 0.41	10¼	0.62	0.37	Inner Circular Plus Elliptical 0.25 / 0.37
108	9	0.85	0.51	Inner Circular Plus Elliptical 0.34 / 0.51	10	0.76	0.46	Inner Circular Plus Elliptical 0.30 / 0.46	10¾	0.70	0.42	Inner Circular Plus Elliptical 0.28 / 0.42
114	[A]	...	...	...	[A]	...	...	...	[A]	...	...	...
120	[A]	...	...	...	[A]	...	...	...	[A]	...	...	...
126	[A]	...	...	...	[A]	...	...	...	[A]	...	...	...
132	[A]	...	...	...	[A]	...	...	...	[A]	...	...	...
138	[A]	...	...	...	[A]	...	...	...	[A]	...	...	...
144	[A]	...	...	...	[A]	...	...	...	[A]	...	...	...

[A] For modified or special designs see 7.2 or with the permission of the owner utilize the provisions of Specification C 655. Steel areas may be interpolated between those shown for variations in diameter, loading, or wall thickness. Pipe over 96 in. in diameter shall have two circular cages or an inner circular plus one elliptical cage.

[B] For these classes and sizes, the minimum practical steel reinforcement is specified. The actual ultimate strength is greater than the minimum strength specified for nonreinforced pipe of equivalent diameters in Specification C 14.

[C] As an alternative to designs requiring both inner and outer circular cages the reinforcement may be positioned and proportioned in either of the following manners:
An inner circular cage plus an elliptical cage such that the area of the elliptical cage shall not be less than that specified for the outer cage in the table and the total area of the inner circular cage plus the elliptical cage shall not be less than that specified for the inner cage in the table,
An inner and outer cage plus quadrant mats in accordance with Fig. 1 , or
An inner and outer cage plus an elliptical cage in accordance with Fig. 2.

[D] Elliptical and quadrant steel must be held in place by means of holding rods, chairs, or other positive means throughout the entire casting operation.

[E] As an alternative, single cage reinforcement may be used. The reinforcement area in square in. per linear foot shall be 0.20 for wall B and 0.16 for wall C.

C 33 except that the requirement for gradation shall not apply.

6.4 *Admixtures and Blends*—Admixtures and blends may be used with the approval of the owner.

6.5 *Steel Reinforcement*—Reinforcement shall consist of wire conforming to Specification A 82 or Specification A 496 or of wire fabric conforming to Specification A 185 or Specification A 497 or of bars of Grade 40 steel conforming to Specification A 615/A 615M.

6.6 *Synthetic Fibers*— Collated fibrillated virgin polypropylene fibers may be used, at the manufacturer's option, in concrete pipe as a nonstructural manufacturing material. Only Type III synthetic fibers designed and manufactured specifically for use in concrete and conforming to the requirements of Specification C 1116 shall be accepted.

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TABLE 3 Design Requirements for Class III Reinforced Concrete Pipe[A]

NOTE 1—See Section 5 for basis of acceptance specified by the owner.

The strength test requirements in pounds-force per linear foot of pipe under the three-edge-bearing method shall be either the D-load (test load expressed in pounds-force per linear foot per foot of diameter) to produce a 0.01-in. crack, or the D-loads to produce the 0.01-in. crack and the ultimate load as specified below, multiplied by the internal diameter of the pipe in feet.

D-load to produce a 0.01-in. crack	1350
D-load to produce the ultimate load	2000

Internal Designated Diameter, in.	Reinforcement, in.²/linear ft of pipe wall											
	Wall A				Wall B				Wall C			
	Concrete Strength, 4000 psi				Concrete Strength, 4000 psi				Concrete Strength, 4000 psi			
	Wall Thicknesses, in.	Circular Reinforcement[B] Inner Cage	Circular Reinforcement[B] Outer Cage	Elliptical Reinforcement[C]	Wall Thicknesses, in.	Circular Reinforcement[B] Inner Cage	Circular Reinforcement[B] Outer Cage	Elliptical Reinforcement[C]	Wall Thicknesses, in.	Circular Reinforcement[B] Inner Cage	Circular Reinforcement[B] Outer Cage	Elliptical Reinforcement[C]
12	1¾	0.07[D]	...	...	2	0.07[D]	...	...	2¾	0.07[D]	...	...
15	1⅞	0.07[D]	...	...	2¼	0.07[D]	...	...	3	0.07[D]	...	...
18	2	0.07[D]	...	0.07[D]	2½	0.07[D]	...	0.07[D]	3¼	0.07[D]	...	0.07[D]
21	2¼	0.14	...	0.11	2¾	0.07[D]	...	0.07[D]	3½	0.07[D]	...	0.07[D]
24	2½	0.17	...	0.14	3	0.07[D]	...	0.07[D]	3¾	0.07	...	0.07[D]
27	2⅝	0.18	...	0.16	3¼	0.16	...	0.14	4	0.08	...	0.07[D]
30	2¾	0.19	...	0.18	3½	0.18	...	0.15	4¼	0.10	...	0.08
33	2⅞	0.21	...	0.20	3¾	0.20	...	0.17	4½	0.12	...	0.10
36	3	0.21	0.13	0.23	4[E]	0.17	0.10	0.19	4¾[E]	0.08	0.07	0.09
42	3½	0.25	0.15	0.28	4½	0.21	0.13	0.23	5¼	0.12	0.07	0.13
48	4	0.32	0.19	0.35	5	0.24	0.14	0.27	5¾	0.16	0.10	0.18
54	4½	0.38	0.23	0.42	5½	0.29	0.17	0.32	6¼	0.21	0.13	0.23
60	5	0.44	0.26	0.49	6	0.34	0.20	0.38	6¾	0.25	0.15	0.28
66	5½	0.50	0.30	0.55	6½	0.41	0.25	0.46	7¼	0.31	0.19	0.34
72	6	0.57	0.34	0.63	7	0.49	0.29	0.54	7¾	0.36	0.22	0.40
	Concrete Strength, 5000 psi											
78	6½	0.64	0.38	0.71	7½	0.57	0.34	0.63	8¼	0.42	0.25	0.47
84	7	0.72	0.43	0.80	8	0.64	0.38	0.71	8¾	0.50	0.30	0.56
					Concrete Strength, 5000 psi				Concrete Strength, 5000 psi			
90	7½	0.81	0.49	0.90	8½	0.69	0.41	0.77	9¼	0.59	0.35	0.66
96	8	0.93	0.56	1.03	9	0.76	0.46	0.84	9¾	0.70	0.42	Inner Circular 0.28 Plus Elliptical 0.42
102	8½	1.03	0.62	Inner Circular 0.41 Plus Elliptical 0.62	9½	0.90	0.54	Inner Circular 0.36 Plus Elliptical 0.54	10¼	0.83	0.50	Inner Circular 0.33 Plus Elliptical 0.50
108	9	1.22	0.73	Inner Circular 0.49 Plus Elliptical 0.73	10	1.08	0.65	Inner Circular 0.43 Plus Elliptical 0.65	10¾	0.99	0.59	Inner Circular 0.40 Plus Elliptical 0.59
114	[A]	...	...	...	...	[A]	...	...	...	...	[A]	...	...	...	...
120	[A]	...	...	...	...	[A]	...	...	...	...	[A]	...	...	...	...
126	[A]	...	...	...	...	[A]	...	...	...	...	[A]	...	...	...	...
132	[A]	...	...	...	...	[A]	...	...	...	...	[A]	...	...	...	...
138	[A]	...	...	...	...	[A]	...	...	...	...	[A]	...	...	...	...
144	[A]	...	...	...	...	[A]	...	...	...	...	[A]	...	...	...	...

[A] For modified or special designs see 7.2 or with the permission of the owner utilize the provisions of Specification C 655. Steel areas may be interpolated between those shown for variations in diameter, loading, or wall thickness. Pipe over 96 in. in diameter shall have two circular cages or an inner circular plus one elliptical cage.

[B] As an alternative to designs requiring both inner and outer circular cages the reinforcement may be positioned and proportioned in either of the following manners:

An inner circular cage plus an elliptical cage such that the area of the elliptical cage shall not be less than that specified for the outer cage in the table and the total area of the inner circular cage plus the elliptical cage shall not be less than that specified for the inner cage in the table,

An inner and outer cage plus quadrant mats in accordance with Fig. 1, or

An inner and outer cage plus an elliptical cage in accordance with Fig. 2.

[C] Elliptical and quadrant steel must be held in place by means of holding rods, chairs, or other positive means throughout the entire casting operation.

[D] For these classes and sizes, the minimum practical steel reinforcement is specified. The actual ultimate strength is greater than the minimum strength specified for nonreinforced pipe of equivalent diameters in Specification C 14.

[E] As an alternative, single cage reinforcement may be used. The reinforcement area in square in. per linear foot shall be 0.30 for wall B and 0.20 for wall C.

B.4 SETTLEMENT ANALYSIS CALCULATION

Settlement Analysis
Site 8 – Herbicide Orange Storage Area
NCBC Gulfport
Gulfport, Mississippi

By: RCM 03/30/04
Chk'd By: RJB

TtNUS Project No. N7379
CTO 0272
Contract No. N62467-94-D-0888

PROBLEM STATEMENT:

Estimate the differential settlement impact on the slope of the roller compacted concrete (RCC) pavement for Site 8 – Herbicide Orange Storage Area (Site 8).

REFERENCES:

1. Drawings titled "100% Remedial Design, Site 8 – Herbicide Orange Storage Area, Naval Construction Battalion Center, Gulfport, Mississippi" dated [May] 2004 prepared by Tetra Tech NUS, Inc., Pittsburgh, PA.

2. Specifications titled "Site 8 – Herbicide Orange Storage Area and Off-Base Area of Contamination at the Naval Construction Battalion Center, Gulfport, Mississippi" dated [May] 2004 prepared by Tetra Tech NUS, Inc., Pittsburgh, Pennsylvania.

3. Document titled "Basis of Design for Site 8 – Herbicide Orange Storage Area and Off-Base Area of Contamination, Naval Construction Battalion Center, Gulfport, Mississippi" dated [May] 2004 prepared by Tetra Tech NUS, Inc., Pittsburgh, Pennsylvania.

4. Appendix A titled "Subsurface Investigation Logs" from the document titled "Basis of Design for Site 8 – Herbicide Orange Storage Area and Off-Base Area of Contamination, Naval Construction Battalion Center, Gulfport, Mississippi" dated [May] 2004 prepared by Tetra Tech NUS, Inc., Pittsburgh, Pennsylvania.

5. Appendix B.2 titled "Roller-Compacted Concrete Calculation" from the document titled "Basis of Design for Site 8 – Herbicide Orange Storage Area and Off-Base Area of Contamination, Naval Construction Battalion Center, Gulfport, Mississippi" dated [May] 2004 prepared by Tetra Tech NUS, Inc., Pittsburgh, Pennsylvania.

6. Document titled "Technical Memorandum No. 1, Site A, Former Herbicide Orange Storage Area, Groundwater Sampling Event No. 1, Naval Construction Battalion Center, Gulfport, Mississippi" dated December 1994 prepared by ABB Environmental Services, Inc., Tallahassee, Florida included under cover of document titled "Technical Memorandums No. 1 through 6, Site A, Former Herbicide Orange Storage Area, Groundwater Sampling Events, Naval Construction Battalion Center, Gulfport, Mississippi" dated December 1994 - August 1997 prepared by ABB Environmental Services, Inc., Tallahassee, Florida.

7. Document titled "Final Draft Groundwater Monitoring Report, Naval Construction Battalion Center, Gulfport, Mississippi" dated September 1999 prepared by Harding-Lawson Associates, Tallahassee, Florida.

8. Document titled "Geotechnical Engineering Report, Proposed Warehouses, Naval Construction Battalion Center, Gulfport, Mississippi" prepared for JH&H, Limited, Jackson, Mississippi prepared by Professional Service Industries, Inc., Jefferson, Louisiana dated May 2, 2001. Document provided as Attachment 3-3 "Soils Report (includes one drawing)" of unknown document for the Army Reserve Warehouse, NCBC, Gulfport, MS.

9. Document titled "Geotechnical Engineering Report, Proposed Building P-777, NCBC, Gulfport, Mississippi" prepared for JH&H Ltd., Jackson, Mississippi prepared by Professional Service Industries, Inc., Jefferson, Louisiana dated June 12, 2002. Document provided as Attachment 4 "Soils Report" of unknown document for the Communications/Instruction Facility, NCBC, Gulfport, MS.

10. "Boring log B-1, proposed warehouse, NCBC, Gulfport, Mississippi" prepared by Professional Service Industries, Jefferson, Louisiana dated September 5, 2002. Document provided by PSI via facsimile transmittal. Provided as sheet 17.

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12. Department of the Navy, Naval Facilities Engineering Command, September 1986. Soil Mechanics, Design Manual 7.1 (NAVFAC DM-7.1), May 1982.

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17. Yoder, E. J. and Witczak, M. W., Principles of Pavement Design (Second Edition), John Wiley & Sons, Inc., New York, 1975.

18. Department of Defense (DOD), 1979. DOD 4145.19-R-I, Storage and Materials Handling, September 1979.

19. Department of the Army (Army), 1997. FM 55-80, Army Container Operations, 13 August 1997.

20. Department of the Army (USACE), 1993. ETL 1110-2-343, Structural Design Using The Roller-Compacted Concrete (RCC) Construction Process, 31 May 1993.

21. Department of the Army (USACE), 2000. EM 1110-2-2006, Engineering and Design - Roller-Compacted Concrete, 15 January 2000.

22. Department of the Army (Army), 1995. FM 55-65, Strategic Deployment, 3 October 1995.

23. Record of Telephone Conversation w/Professional Service Industries, Jefferson, Louisiana, March 25, 2004. Provided as sheet 15.

APPROACH / ASSUMPTIONS:

For soils less than approximately 25-feet below ground surface (ft bgs), subsurface investigation data at Site 8 was judged adequate and was used to perform settlement analyses.

For soils greater than approximately 25-ft bgs, subsurface investigation data was not available for Site 8 but limited data at depth greater than 25-ft bgs was available for a few borings located across NCBC Gulfport. For depths greater than 25-ft bgs, stratigraphy and soil parameters were estimated, with values judged to be in the reasonable to conservative range for these depths.

The following calculation evaluates ONLY the impact of differential settlement on the slope of the RCC pavement and is NOT an estimation or prediction of settlement.

Localized differential settlement of the RCC pavement surface will be addressed through routine O&M activities as required.

The approach used to estimate the differential settlement impact on the slope of the RCC pavement for Site 8 - Herbicide Orange Storage Area consists of the following:

- review existing ground surface topography and the proposed final grades, and estimate stratigraphy to identify areas where the total settlement would be at maximum and minimum values;
- estimate parameters for native soil, existing stabilized soil, subbase, base course, and RCC pavement for use in subsequent analyses;
- determine surcharge loads resulting from use of RCC pavement as storage area;
- determine loading due to subbase, base course, and roller compacted concrete pavement for use in subsequent analysis;
- perform settlement analyses using the information determined/estimated above; and
- estimate the differential settlement and impact on the RCC slope.

SOLUTION:

Topography/Grades

The existing ground surface topography is presented on Drawing Nos. C-18 and C-19 (ref. 1). The existing ground surface elevation is, on average, at El. 31.1+ based on review of topography using Terramodel. The existing topography will be cut to El. 31± through removal of the existing soil ash piles over the entire area comprising Site 8A.

The proposed final grades are presented on Drawing Nos. C-23 and C-24 (ref. 1). The proposed final grading plan has sideslopes of 10H:1V with a rise averaging 6 ft (from El. 29 to 32 at the toe of slope to El. 36.5 at the crest of slope) and a plateau grade of 1.0% rising from El. 36.5 to El. 37.9.

The maximum settlement will occur at the locations where the RCC pavement is at its highest elevation (El. 37.9) with the minimum settlement occurring at the RCC pavement perimeter provided the stratigraphy is relatively uniform beneath Site 8A. The differential settlement is then the difference between the settlement at the highest elevation and the settlement at the perimeter.

Material Properties

Material properties for the settlement analysis were determined or estimated for each layer or stratigraphic unit, in descending order, as follows:

RCC Pavement:

The RCC pavement is 12-inches thick and has a specified minimum flexural strength (i.e., concrete modulus of rupture, MR) of 550 psi at 90 days, and corresponding minimum compressive strength of 4,000 psi at 28 days (Drawing C-27 Detail 5 ref. 1; ref. 2 and 5).

Unit weight of RCC pavement ranges from 140 pcf to 160 pcf (p. 4-10 ref. 21); a unit weight of 145 pcf will be used for this analysis. Poisson's ratio, μ, for concrete is 0.25 (p. 6-8 ref. 15). Poisson's ratio for RCC is the same as for conventionally placed mass concrete with most values ranging from 0.17 to 0.22 and a value of 0.20 recommended when testing has not been performed (p. 4-8 ref. 21 and p. 1-20 ref. 20). Poisson's ratio of 0.20 will be used for this analysis.

The static stress-strain modulus, E_C, for RCC is equal to or greater than conventionally placed mass concrete (p. 4-7 ref. 21 and p. 1-20 ref. 20) with conventionally placed mass concrete modulus expressed as follows:

$E_C = w^{1.5}\ 33\ (f'_c)^{1/2}$ (p. 8-3 ref. 15)
where w = weight of concrete in pcf
f'_c = specified compressive strength in psi
$E_C = (145\ \text{pcf})^{1.5}\ 33\ (4{,}000\ \text{psi})^{1/2}$
$E_C = 3.6 \times 10E06$ psi

RCC Pavement Property Summary:
MR = 550 psi
q_u = 4,000 psi
γ = 145 pcf
μ = 0.20
$E_C = 3.6 \times 10E06$ psi

Base Course:

The base course is 6-inches thick and consists of stabilized material blend with a specified minimum unconfined compressive strength of 500 psi at 90 days (Drawing C-27 Detail 5 ref. 1). Poisson's ratio for most cement treated materials ranges from 0.10 to 0.25 with 0.15 being common (p. 281 ref. 17). Poisson's ratio of 0.15 will be used for this analysis. The modulus may be estimated as follows:

$E_C = w^{1.5}\ 33\ (f'_c)^{1/2}$ (p. 8-3 ref. 15)
$E_C = (130\ \text{pcf})^{1.5}\ 33\ (500\ \text{psi})^{1/2}$
$E_C = 1.09 \times 10E06$ psi

Base Course Property Summary:
q_u = 500 psi
γ = 130 pcf used for modulus estimation and 145 pcf used for loading (conservative)
μ = 0.15
E = 1.09 x 10E06 psi

Subbase:

The subbase course is a minimum of 6-inches thick and consists of stabilized material blend with a minimum CBR of 50, minimum unconfined compressive strength of 50 psi at 90 days or a minimum of 6-inches of existing Portland cement stabilized soil (Drawing C-27 Detail 5 ref. 1; and sheet 4 ref. 5). Note that a modulus of subgrade reaction or k-value 500 pci was used for the RCC pavement design (ref. 5). The k-value of 500 pci used corresponds to a CBR of 50, however field testing during Pilot-Scale testing demonstrated that the base layer achieved an average CBR of 82 (std. dev. = 39.2) at 3-days and 94 (std. dev. = 41.8) at 7-days (ref. 5). The unconfined compressive strength of the existing stabilized soil is reportedly significantly stronger than 50 psi. The modulus may be estimated as follows:

E = 1500 x CBR (p. 276 ref. 17)
E = 1500 (82)
E = 123,000 psi

Subbase Property Summary:
CBR = 82
$q_u \geq 50$ psi

γ = 120 pcf (assumed)
μ = 0.15 (assumed)
E = 1.23 x 10E05 psi

Native Soil:

Investigations Summary

Site 8 is underlain by unconsolidated deposits of Holocene, Pleistocene, and Miocene ages. The alluvium (Holocene) zone to a probable maximum depth of 80-ft consists of discontinuous layers of sand, silt, clay, and minor amounts of gravel. The Pleistocene zone is approximately 100-ft thick and consists of thick lenticular sand and gravel layers separated by thinner clay layers. The Miocene zone consists of thick beds of sand and gravel with minor clay layers (pp. 4-3 and 4-4, ref. 7). Based on a telephone conversation with a geotechnical consultant who performed numerous geotechnical investigations at NCBC Gulfport, the upper clay unit is "firm to stiff and overconsolidated" (ref. 23, sheet 15).

Four shallow monitoring wells were installed within and around Site 8 during April 1994 by ABB Environmental Services, Inc. (ABB). Three of the monitoring wells were installed within or at the perimeter of Site 8A (i.e., GPT-A-2, GPT-A-3, GPT-A-4). The soil borings were advanced using hollow-stem augers (HSA) to depths of 13 to 15 ft below ground surface (bgs). Split-barreled sampling was performed and standard penetration test (SPT) N-values, recovery, soil description, and depth to water were recorded on the boring logs. Limited geotechnical laboratory testing consisting of grain size analysis and moisture content were performed on selected soil boring samples. Soil boring locations are shown on sheet 16. Soil boring logs and geotechnical laboratory test results are provided in ref. 4.

Thirty four monitoring wells were installed around Sites 1 through 5, 7 and 8 during February 1999 by Harding Lawson Associates (HLA). The monitoring wells consisted of 23 shallow monitoring wells (i.e., 15 to 25-ft bgs), 7 intermediate monitoring wells (i.e., 35 to 45-ft bgs), 1 deep monitoring well, and 3 replacement monitoring wells. Ten of the monitoring wells were installed around Site 8 (i.e., GPT-08-05 through GPT-08-14). The Site 8 monitoring wells consisted of 7 shallow, 2 intermediate, and 1 deep monitoring well. The monitoring wells were installed using the Rotasonic method to depths up to 186-ft bgs at Site 8 with the deepest monitoring well at Site 5 (256-ft bgs). A soil description and Unified Soil Classification System (USCS) visual-manual classification were recorded on the boring logs. Monitoring well locations are shown on sheet 16. Site 8 boring logs are provided in ref. 4 and Sites 1 through 5 and 7 boring logs are provided in ref. 7.

Twenty two shallow soil borings were installed across Sites 8A, 8B, and 8C during December 1999 by HLA [i.e., soil borings GB01 through GB26; GB03, 18, 20 & 24 not installed]. Nine of the soil borings were installed within the Site 8A limits (i.e., GB01, 02, 04, 08 through 13). The soil borings were advanced using HSA to depths of 15 or 16 ft bgs. Split-barreled sampling was performed at 5-ft maximum intervals and SPT N-values, percent recovery, soil description, USCS visual-manual soil classification, and depth to water were recorded on the boring logs. Limited geotechnical laboratory testing consisting of grain size analysis, Atterberg limits, and USCS classification were performed on selected soil boring samples. Soil boring locations are shown on sheet 16. Soil boring logs and geotechnical laboratory test results are provided in ref. 4.

Seventeen soil borings (i.e., B-9 through B-25) were installed for the proposed 150k sq ft warehouse to be constructed northeast of Site 8A and 8 soil borings (i.e., B-1 through B-8) were installed for the proposed 95k sq ft warehouse to be constructed northwest of Site 8A. The proposed warehouses are located approximately 1,400-ft northeast and 1,800-ft northwest of the

center of Site 8A. The soil borings were installed during March 2001 by PSI. The soil borings were advanced using HSA to depths of 25 ft bgs. Split-barreled sampling was performed and SPT N-values, soil description, and depth to water were recorded on the boring logs. Geotechnical laboratory testing consisting of moisture content and percent finer than the No. 200 sieve was performed. The general warehouse locations are shown on sheet 16. Soil boring logs are available in ref. 8.

Two soil borings (i.e., B-1 and B-2) were installed for the proposed communications/instruction facility (P-777) to be constructed approximately 1,900-ft west/southwest of Site 8A. The soil borings were installed during May 2002 by PSI. The soil borings were advanced using HSA to depths of 25 ft bgs. Split-barreled sampling was performed and SPT N-values, soil description, and depth to water were recorded on the boring logs. Geotechnical laboratory testing consisting of moisture content and percent finer than the No. 200 sieve was performed. Soil boring logs are available in ref. 9.

A soil boring (i.e., B-1) was installed for a proposed warehouse to be constructed near the intersection of 9th and 10th Streets approximately 2,800-ft northeast of Site 8A. The soil boring was installed during September 2002 by PSI. The soil boring was advanced to a depth of 50 ft bgs. Split-barreled sampling was performed and SPT N-values, soil description, depth to water, and field and laboratory geotechnical results were recorded on the boring log. Geotechnical laboratory testing consisted of unit weight, moisture content, Atterberg limits, and percent finer than the No. 200 sieve. The soil boring log is provided as sheet 17.

A generalized profile of the Site 8A geology based on the above information is provided as sheet 18.

Sand

Several subsurface investigations were previously performed at NCBC Gulfport as summarized above. The range of N-values and average N-values with depth for investigations by ABB, HLA, and PSI are summarized in tabular form on sheet 19 and summarized in graphical form on sheet 20. These investigations are discussed below.

Based on review of the ABB April 1994 and HLA December 1999 field investigations, native soil beneath Site 8A to a depth of 16-ft consists predominantly of loose to medium fine- to medium-grained SAND and to a much lesser extent silty SAND. The topmost 2-ft will be regraded, stabilized, and proof-rolled, therefore the average N-values for the depth interval 2- to 15-ft bgs for the native soil beneath Site 8A is 12.3 (medium density) based on the ABB logs and 17.1 (medium density) based on the HLA logs. Note that the average N-values for the depth interval 2-ft bgs to 18-ft bgs for the native soil beneath Sites 8A, 8B, and 8C based on the HLA logs is 17.4 (medium). Native soil beneath Site 8A to a depth of 16-ft is therefore relatively homogeneous. Note that the density of SAND across NCBC appears to vary slightly (see paragraphs below).

Based on review of the warehouse geotechnical investigation information (ref. 8 and 10), native soil to a depth of 25-ft consists of loose to dense SAND under the proposed 150k sq ft warehouse, medium to dense SAND under the proposed 95k sq ft warehouse, and medium to dense SAND under the proposed 9th and 10th St. warehouse. Note that at least a portion of the proposed 150k sq ft warehouse footprint is located where stockpiles of bauxite were formerly located. Average N-values for native soil beneath the proposed 150k square foot (sq ft) warehouse from 2- to 25-ft bgs is 22.5 (average calculated with N-limit of 50) based on the PSI logs. The deeper SAND under the proposed 150k sq ft warehouse is 2.2 times stiffer than the shallower SAND. Average N-values for native soil beneath the proposed 95k sq ft warehouse from 2- to 25-ft bgs is 26.6 (average calculated with N-limit of 50) based on the PSI logs. The deeper SAND under the proposed 95k

sq ft warehouse has the same stiffness as the shallower SAND. Average N-values for native soil beneath the proposed 9th and 10th St. warehouse from 2- to 25-ft bgs is 26.0 (average calculated with N-limit of 50) based on the PSI logs. The deeper SAND under the proposed 9th and 10th St. warehouse is 2.3 times stiffer than the shallower SAND. The native soils beneath the proposed warehouse locations which are located north of Site 8A are consistent with SAND to a depth of 25-ft bgs; however the SAND is of relatively uniform density beneath the proposed 95k sq ft warehouse whereas the density (i.e., stiffness) of the native SAND increases with depth beneath the proposed 150k sq ft and 9th and 10th St. warehouses. Although the shallow ($\leq$ 25-ft) lithology is relatively consistent, the density of the SAND under the proposed warehouses and Site 8 does not appear to be uniform.

Based on review of the communications/instruction facility (P-777) geotechnical investigation report (ref. 9), native soil to a depth of 25-ft consists of loose to medium SAND under the proposed P-777. The average N-value for native soil beneath the proposed P-777 from 2- to 25-ft bgs is 10.6 and is relatively uniform. The shallow ($\leq$ 25-ft) lithology is relatively consistent beneath proposed P-777, the proposed warehouses, and Site 8; however, the density of the SAND varies slightly from area to area at NCBC.

Moist unit weight of medium fine-grained SAND to a depth of 16-ft is approximately 110 pcf (p. 100 ref. 11). Typical ranges for static stress-strain modulus, E_s, for loose sand and dense sand are 200 to 500 ksf and 1,000 to 1,700 ksf, respectively. The typical value for medium sand would therefore be approximately 500 to 1,500 ksf (i.e. $E_s \approx 50 \times N$). The average N-value for SAND for the 2-ft to 18-ft and 18-ft to 25-ft bgs depth intervals beneath Site 8, the warehouses and P-777 are 17.0 and 35.3, respectively (average of averages from sheet 19) with N-values corresponding to medium to dense material. The SAND is therefore of medium density with average N-value of approximately 26...an N-value of 20 will conservatively be used to estimate SAND properties. The typical range of Poisson's ratio, μ, for fine-grained SAND is 0.25 (p. 67 ref. 11). The stress-strain modulus, E_s, for sand may be estimated using the N-value as follows (3 eqs., p. 189 ref. 11...divide kPa by 50 to obtain ksf)):

$E_s = 500\ (N + 15)$ for sand
$E_s = 500\ (20 + 15)$
$E_s = 17{,}500$ kPa
$E_s = 350$ ksf
(note $E_s = 410$ ksf if $N = 26$)

$E_s = 18000 + 750N$ for sand
$E_s = 18000 + 750\ (20)$
$E_s = 33{,}000$ kPa
$E_s = 660$ ksf
(note $E_s = 750$ ksf if $N = 26$)

$E_s = (15200 \text{ to } 22000) \ln N$ for sand
$E_s = (18{,}600) \ln 20$
$E_s = 55{,}721$ kPa
$E_s = 1{,}114$ ksf
(note $E_s = 1{,}212$ ksf if $N = 26$)

Use average E_s for $N = 20$ or $E_s = 700$ ksf.

Sand Property Summary:
$\gamma_m = 110$ pcf
$\mu = 0.25$
$E_s = 700$ ksf

Clay

The typical range of Poisson's ratio, μ, for saturated and unsaturated clays is 0.4 to 0.5 and 0.1 to 0.3, respectively (p. 67 ref. 11). The typical range of Poisson's ratio for saturated clay, unsaturated clay,

and clay with sand and silt is 0.50, 0.30 to 0.42, and 0.35 to 0.45, respectively (p. 116 ref. 14). For saturated clay soils a Poisson's ratio of 0.5, corresponding to an incompressible medium, is usually assumed. A Poisson' ratio of 0.5 will be used (p. 154 ref. 14).

Clay geotechnical properties for the Site are not available and clay geotechnical properties for NCBC Gulfport are limited to a single boring for the 9th and 10th St. warehouse. Clay geotechnical properties will therefore be estimated for the purpose of estimating consolidation settlement. The clay portion of the Holocene alluvium is reportedly overconsolidated (ref. 23). Compression indices for the Holocene clay are not available; however Atterberg limits and moisture content of the Holocene clay from a depth of 35-ft to 50-ft bgs for the 9th and 10th St. warehouse are available. The properties of the clay based on the boring log (sheet 17) are as follows:

average unconfined compressive strength, q_u = (0.97 tsf + 0.63 tsf)/2 = 0.80 tsf
cohesion, c is equal to undrained shear strength, s_u; therefore $s_u = q_u/2$ (p. 53 ref. 11; p. 58 ref. 11)
$s_u = q_u/2$ = 0.80 tsf (2000 lb/ton)/2 = 800 psf
average unit dry weight, γ_d = (97 pcf + 99 pcf)/2 = 98 pcf
average moisture content, ω_L = (27% + 27% + 25%)/3 = 26.3%
average moist unit weight, γ_m = 98 pcf (1 + 0.263) = 123.8 pcf
average LL = (31 + 30)/2 = 30.5
average PI = (16 + 14)/2 = 15
average PL = LL – PI = 30.5 – 15 = 15.5

E_s may be estimated as follows:
E_s = (750 to 1200) s_u for normally consolidated to lightly overconsolidated clay (p. 70 ref. 11)
E_s = 1000 (800 psf)
E_s = 800,000 psf

$c_c = 0.009\ (\omega_L - 10)$ for medium to low sensitivity inorganic clays (p. 49 ref. 11)
[same equation as c_c = 0.009 (LL -10%) for inorganic soils with sensitivity less than 4 (p. 7.1-224 ref. 12)]
c_c = 0.009 (30.5 -10)
c_c = 0.185

The recompression index, c_r is equal to or less than the swell index, c_s (p. 7.1-143 ref. 12). The swell index is generally 1/5 to 1/10 of the compression index, c_c (p. 7.1-141 ref. 12). Conservatively assume...
$c_r = c_s = 1/5\ c_c$
c_r = 1/5 (0.185)
c_r = 0.037

$c_c = 1.15\ (e_o - 0.35)$ for all clays (p. 7.1-224 ref. 12)
rearranging...
$e_o = (c_c/1.15) + 0.35$
e_o = (0.185/1.15) + 0.35
e_o = 0.51
The preconsolidation pressure may be estimated as follows:
$\rho_c = (q_u / 2) / (0.11 + 0.0037\ PI)$ (p. 7.1-141 ref. 12)
ρ_c = ((0.80 tsf)(2,000 lb/ton)/2)) / ((0.11 + 0.0037 (15))
ρ_c = 4,833 psf for 38- to 50-ft bgs interval...assume varies directly with σ'_o
based on review of sheet 26... $\sigma'_o+\Delta\sigma \approx$ 3,500 psf at a depth of 35- to 50-ft bgs; the clay is therefore overconsolidated since $\sigma'_o+\Delta\sigma < \rho_c$ (preconsolidation pressure = $\rho_c = \sigma'_p$) thus

confirming ref. 23; the recompression index can be used for the consolidation settlement calculation (i.e., no virgin compression)

Clay Property Summary:
γ_m = 123.8 pcf
ω_N = 26.3% (ref. 10)
μ = 0.5
c_c = 0.185 (empirically derived)
c_r = 0.037 (empirically derived)
e_o = 0.51 (empirically derived)

Surcharge

Estimate the maximum surcharge loading due to fully loaded containers on the surface of the RCC pavement. The worst case loading from MILVANs or ANSI/ISO containers will be used.

NCBC typically handles 20-ft military-owned demountable containers (MILVANs) that weigh 3,500 pounds empty, have a 41,300 pound cargo capacity for a total weight of 44,800 pounds (44.8 kips or 22.4 tons), and have outside dimensions of 20-ft (L) by 8-ft (D) by 8-ft (H) (p. E-3 ref. 22). MILVANs are still in use today with older MILVANs gradually being phased out of the system and replaced by commercial containers, namely ANSI/ISO containers (Sect. E-9 ref. 19).

ANSI/ISO 20-ft containers have a maximum gross weight of 52,900 pounds (52.9 kips or 26.5 tons), and have outside dimensions of 19.875-ft (L) by 8-ft (D) by 8-ft or 8.5-ft (H) (Table E-2 ref. 19).

ANSI/ISO 40-ft containers have a maximum gross weight of 67,200 pounds (67.2 kips or 33.6 tons), and have outside dimensions of 40-ft (L) by 8-ft (D) by 8-ft or 9.5-ft (H) (Table E-2 ref. 19).

The USACE recommends that most modern Materials-Handling Equipment (MHE) have the capability of stacking fully loaded 40-ft containers (67,200 pounds) three high; however, only two-high stacking is recommended due to the additional weight and maintenance of pavement surfaces. Container dead loading should be based on fully loaded containers stacked two-high. For purposes of analysis assume the load is uniformly distributed over the container footprint. Dead load is therefore (2 high x 44,800 lb/each container)/(20-ft)(8-ft) = 560 psf for a 20-ft MILVAN, (2 high x 52,900 lb/each container)/(19.875-ft)(8-ft) = 665 psf for a 20-ft ANSI/ISO container, and (2 high x 67,200 lb/each container)/(40-ft)(8-ft) = 420 psf for a 40-ft ANSI/ISO container. Conservatively use 665 psf for a 20-ft ANSI/ISO container.

The settlement analysis must account for aisle space which is not loaded with containers when estimating large area load effects. The smallest MHE is used to conservatively estimate the unloaded aisle width between stacked containers. Based on review of anticipated MHE from ref. 5, review of vendors literature (sheets 21 and 22), assumed 90-degree stacking aisle, MHE dimensions (i.e., Hyster H550F), and vendors method for calculating aisle width requirements: MHE has a minimum outside turning radius of 20.1-ft plus the length from the center drive axle to the face of the forks of 3.4-ft plus the depth of the container of 8.0-ft for a conservative aisle width of 31.5-ft excluding space required for maneuvering and safety. Assume back-to-back container storage in rows of two containers which would occupy 2 containers x 8-ft/container or 16-ft of space with a 31.5-ft aisle per stored row of containers; the average applied load is therefore (16/(16 + 31.5)) x 665 psf = 113 psf. (Assume containers will cover 16/(16 + 31.5) = 34% of the RCC pavement area).

Analyses

Consider the following analyses:

- Analysis 1: estimate distortion settlement of shallow sand due to live load (i.e. container) and total load (live plus surcharge) using elastic layered theory.
- Analysis 2: estimate distortion settlement of clay due to live load (i.e. container) load and total load (live plus surcharge) using elastic layered theory.
- Analysis 3a and 3b: estimate consolidation (i.e., distortion and consolidation) settlement of the clay layer to depth of 80-ft bgs (Analysis 2a) and to a depth of 180-ft bgs (Analysis 2b) due to loading above existing grade.
- Long-term differential settlement on the RCC surface is then the consolidation settlement of the clay layer which may be estimated by subtracting the estimated distortion settlement of the clay layer (Analysis 2) from the consolidation settlement of the clay layer (Analysis 3).

Analysis 1: Estimate the distortion settlement of the sand layer beneath Site 8A using elastic layered theory.

The native soil beneath Site 8 is fine- to medium-grained sand to a depth of at least 16-ft bgs. Granular soils are evaluated using elastic theory and settle instantaneously upon application of load. The settlement that will occur in the sand will therefore occur instantaneously during construction as the stabilized material blend, RCC subbase, RCC base course, and RCC pavement layers are placed. The RCC pavement surface will be subject to surcharge loads in the form of fully loaded storage containers (i.e., ANSI/ISO 20-ft containers). A worst case scenario is evaluated, namely that all of Site 8A is loaded with fully loaded storage containers. Site 8A is modeled as a 1045-ft by 400-ft rectangle for ease of analysis. Settlement of the stabilized material blend, RCC subbase, RCC base course, and RCC pavement layers is insignificant compared to the distortion settlement of the sand due to the conservativeness of this analysis as well as the relative stiffness/moduli of these layers compared to the sand (i.e., modulus of these layers is orders of magnitude greater than modulus of sand).

For the center of the RCC paved area the change in vertical stress at the center of any layer is assumed equal to the vertical stress due to the stabilized material/base course/RCC pavement and live loads on the storage area...
$\Delta\sigma$ = 145 pcf (El. 37.9 – El. 36.4) + 120 pcf (El. 36.4 – El. 31.1) + 113 psf
$\Delta\sigma$ = 217.5 psf + 636 psf + 113 psf
$\Delta\sigma$ = 966.5 psf.

The distortion settlement of the sand using elastic layered theory may be calculated using the following equation:

$S_d = C'_d\, p\, B\, ((1-\mu^2)/E)$ (p. 149 ref. 14 modified per p. 150 text ref. 14; refer to sheet 23)

where S_d = settlement of a point
C'_d = parameter which accounts for loaded shape area and position of point for which settlement is being calculated
p = magnitude of uniformly distributed load
B = characteristic dimension of loaded area
μ = Poisson's ratio
E = Young's modulus

for settlement at the center of the rectangular area (peak of the RCC pavement surface)...
from Table 4.2 p. 150 ref. 14 (sheet 23) for rectangle with length/width ratio (L/B) = 1045-ft/400-ft = 2.6, layer thickness/width ratio (H/B) = 16-ft/400-ft = 0.04 and linear interpolation...
C'_d = 0.00 + (0.04 – 0.00)(0.09 – 0.00)/(0.10 – 0.00) = 0.036

distortion settlement of sand only at center of area due to live loads only...
S_d = 0.036 (113 psf)(400-ft)((1- 0.25^2)/700,000 psf)
S_d = 0.0022-ft = 0.03-inches

distortion settlement of sand only at center of area due to stabilized material/base course/RCC pavement and live loads...
S_d = 0.036 (966.5 psf)(400-ft)((1- 0.25^2)/700,000 psf)
S_d = 0.0186-ft = 0.22-inches

for settlement at the middle of the long side of the rectangular area...
from Table 4.3 p. 151 ref. 14 (sheet 24) for L/B = 2.6 and H/B = 0.04
C'_d = 0.00 + (0.04 – 0.00)(0.05 – 0.00)/(0.10 – 0.00) = 0.020

distortion settlement of sand only at middle of the long side of area due to live loads only...
S_d = 0.020 (113 psf)(400-ft)((1- 0.25^2)/700,000 psf)
S_d = 0.0012-ft = 0.01-inches

distortion settlement of sand only at middle of the long side of area due to stabilized material/base course/RCC pavement and live loads...
S_d = 0.020 (966.5 psf)(400-f((1- 0.25^2)/700,000 psf)
S_d = 0.010-ft = 0.12-inches

The distortion settlement of the sand layer using elastic layered theory is summarized below:

Estimated Sand Distortion Settlement		
	Center	Middle of Long Side
Live Load Only	0.03-inches	0.01-inches
Total Load	0.22-inches	0.12-inches

<u>Analysis 2</u>: Estimate the distortion portion of total settlement of the clay layer beneath Site 8A using elastic layered theory.

The empirically derived sand and clay elastic moduli are essentially equal. The distortion settlement portion of overall settlement of the clay can therefore be estimated using elastic layered theory. The surcharge and live loads cover a large area; the vertical effective stress is therefore assumed constant with depth.

It is assumed that clay to a depth of 180-ft bgs is overconsolidated based on the 35-50 ft bgs boring.

for clay to 80-ft bgs, settlement beneath the center of the rectangular area (peak of the RCC pavement surface)...
from Table 4.2 p. 150 ref. 14 for L/B = 2.6 and H/B = (80-ft - 16-ft)/400-ft = 0.16
C'_d = 0.09 + (0.16 - 0.10)(0.23 - 0.09)/(0.25 - 0.10) = 0.146

distortion settlement of clay to 80-ft bgs beneath center of area due to total load...
S_d = 0.146 (966.5 psf)(400-ft)((1- 0.50^2)/800,000 psf
S_d = 0.053-ft = 0.63-inches

for clay to 180-ft bgs, settlement beneath the center of the rectangular area (peak of the RCC pavement surface)...
from Table 4.2 p. 150 ref. 14 for L/B = 2.6 and H/B = (180-ft - 16-ft)/400-ft = 0.41
C'_d = 0.23 + (0.41 - 0.25)(0.47 - 0.23)/(0.50 - 0.25) = 0.384

distortion settlement of clay to 180-ft bgs beneath center of area due to total load...
S_d = 0.384 (966.5 psf)(400-ft)((1- 0.50^2)/800,000 psf
S_d = 0.139-ft = 1.67-inches

for clay to 80-ft bgs, settlement beneath middle of long side of the rectangular area...
from Table 4.3 p. 151 ref. 14 for L/B = 2.6 and H/B = 0.16
C'_d = 0.05 + (0.16 - 0.10)(0.11 - 0.05)/(0.25 - 0.10) = 0.07

distortion settlement of clay to 80-ft bgs beneath middle of the long side of area due to total load...
S_d = 0.07 (966.5 psf)(400-ft)((1- 0.50^2)/800,000 psf
S_d = 0.025-ft = 0.30-inches

for clay to 180-ft bgs, settlement beneath the middle of the long side of the rectangular area...
from Table 4.3 p. 151 ref. 14 for L/B = 2.6 and H/B = 0.41
C'_d = 0.11 + (0.41 - 0.25)(0.23 - 0.11)/(0.50 - 0.25) = 0.187

distortion settlement of clay to 180-ft bgs beneath middle of long side of area due to total load...
S_d = 0.187 (966.5 psf)(400-ft)((1- 0.50^2)/800,000 psf
S_d = 0.068-ft = 0.81-inches

Estimated Clay Distortion Settlement, Total Load		
	Center	Middle of Long Side
Clay to 80-ft bgs	0.63-inches	0.30-inches
Clay to 180-ft bgs	1.67-inches	0.81-inches

Analyses 3a and 3b: Estimate the total (i.e., distortion and consolidation) settlement of the clay portion of the alluvium beneath Site 8A assuming clay to 80-ft bgs (Analysis 3a) and clay to 180-ft bgs (Analysis 3b).

There are two cases for consolidation settlement based on the maximum past effective stress as follows:
1) Consolidation settlement for cases where the effective stress, $\Delta\sigma'$ is greater than $(\sigma'_p - \sigma'_o)$ the consolidating layer will undergo both recompression and virgin compression as follows:

$$\rho_i = (H_i / (1 + e_o)) [c_r \log (\sigma'_p / \sigma'_o) + c_c \log ((\sigma'_o + \Delta\sigma')/ \sigma'_p)$$

(derived from eq. 4.24 ref. 14)

2) Consolidation settlement for cases where the effective stress, $\Delta\sigma'$ less than or equal to $(\sigma'_p - \sigma'_o)$ the consolidating layer will undergo only recompression as follows:

$$\rho_i = (H_i / (1 + e_o)) (c_r \log (\sigma'_o + \Delta\sigma')/ \sigma'_o)$$ (derived from eq. 4.23 ref. 14)

where ρ_i = settlement of layer "i" (the term "ΔH" is frequently used)
H_i = layer "i" thickness
c_c = virgin compression index
c_r = recompression index (same as c_e in eqs. 4-23 & 4-24 ref. 14)
σ'_p = preconsolidation pressure (the term ρ_c is also used)
σ'_o = vertical effective stress at center of layer "i"
$\Delta\sigma'$ = change in effective vertical stress at center of layer "i"

The parameters in the above equation are estimated as follows:

Based on review of boring logs from refs. 4, 6 and 7 and description of the geology at NCBC Gulfport from ref. 7 the silty clay and clay portions of the Holocene alluvium are modeled, for Analysis 3a, to extend from a depth of 16-ft bgs (minimum depth) to 80-ft bgs (maximum depth to base of Holocene alluvium). [The sand is known to extend to a depth of at least 16-ft bgs based on extensive soil borings beneath the Site (see Analysis 1); based on review of deep borings 05-13 and 08-10 from ref. 7 conservatively assume silty clay and clay extend to bottom of Holocene zone)]. For Analysis 3b the silty clay and clay will be modeled to extend from 16- to 180-ft bgs. The typical depth to water is 4-ft bgs. The compressible stratum is modeled with a unit weight of 123.8 pcf and is divided into 5-ft thick increments for Analysis 3a and 10-ft thick increments for Analysis 3b. Analysis 3a is reflected on sheet 26. For Analysis 3a, the first compressible strata increment has a depth interval from 16- to 21-ft bgs and σ'_o is calculated as follows:

σ'_o (16- to 21-ft bgs) = (110 pcf)(4 ft) + (110 pcf – 62.4 pcf)(12 ft) + (123.8 pcf – 62.4 pcf)(2.5 ft)
= 440 psf + 571 pcf + 153.5 psf
= 1,164.5 psf

σ'_o (21- to 26-ft bgs) = (110 pcf)(4 ft) + (110 pcf – 62.4 pcf)(12 ft) + (123.8 pcf – 62.4 pcf)(7.5 ft)
= 440 psf + 571 pcf + 460.5 psf
= 1,471.5 psf (increase of 307 psf which will be constant for subsequent 5-ft thick increments)

σ'_o (26- to 31-ft bgs) = 1,471.5 psf + 307 psf = 1,778.5 psf

etc.; see spreadsheet sheet 26

For the middle of the long side of the RCC paved area the vertical stress for each layer is less than the vertical stress at the center of the RCC paved area. The vertical normal stress is estimated using the influence chart of ref. 14 (sheet 25). The loaded area is modeled as a rectangle with L = 1,045-ft and B = 400-ft. For the influence chart L = 1,045/2 = 522.5-ft. For the center of the first clay increment, z = 18.5-ft. Therefore m = L/z = 522.5/18.5 = 28.3; n = B/z = 400/18.5 = 21.6; and from the influence chart I_z = 0.25. For two rectangles I_z = 2 x 0.25 = 0.50. For the center of the last clay increment, z = 180-ft. Therefore m = L/z = 522.5/180 = 2.9; n = B/z = 400/180 = 2.2; and from the influence chart $I_z \approx 0.25$. For two rectangles I_z = 2 x 0.25 = 0.50. I_z is therefore constant with depth due to the extent of the loaded area and comparatively shallow depth of the compressible strata.

Estimated Clay Consolidation Settlement, Total Load		
	Center	Middle of Long Side
Clay to 80-ft bgs	2.7-inches	1.5-inches
Clay to 180-ft bgs	4.2-inches	2.3-inches

Long-Term Settlement and Differential Settlement

Using the settlement estimates from above...

1) Long-term settlement beneath the center of the RCC paved area due to total load application assuming clay to depth of 80-ft bgs (Analysis 3a – Analysis 2)... 2.7-inches - 0.63-inches = 2.1-inches

2) Long-term settlement beneath the middle of the long side of the RCC paved area due to total load application assuming clay to depth of 80-ft bgs (Analysis 3a – Analysis 2)... 1.5-inches - 0.30-inches = 1.2-inches

Using 1) and 2)...RCC pavement slope resulting from long-term settlement assuming clay to depth of 80-ft bgs... (((150-ft (0.01)) - ((2.1-inches – 1.2-inches)/12-inches/ft)) / 150-ft) x 100 = 0.95%
0.95% > 0% therefore acceptable

3) Long-term settlement beneath the center of the RCC paved area due to total load application assuming clay to depth of 180-ft bgs (Analysis 3b – Analysis 2)... 4.2-inches - 1.67-inches = 2.5-inches

4) Long-term settlement beneath the middle of the long side of the RCC paved area due to total load application assuming clay to depth of 180-ft bgs (Analysis 3b – Analysis 2)... 2.3-inches - 0.81-inches = 1.5-inches

Using 3) and 4)...RCC pavement slope resulting from long-term settlement assuming clay to depth of 180-ft bgs... (((150-ft (0.01)) - ((2.5-inches - 1.5-inches)/12-inches/ft)) / 150-ft) x 100 = 0.94%
0.94% > 0% therefore acceptable

CONCLUSIONS:

The settlement of the shallow sand will occur nearly instantaneously during construction as the stabilized material blend, RCC subbase, RCC base course, and RCC pavement layers are placed.

The estimated long-term differential settlement between the peak and the crest of the sideslope results in a slope of 0.94 to 0.95%. Conclude, surface water will drain from the RCC pavement surface.

RECORD OF TELEPHONE CONVERSATION

Call to: Bob Mertz – TtNUS (Pittsburgh, PA)
Call by: Mohammad Tavassoli – Professional Service Industries, Inc. (Jefferson, LA)
Date: March 25, 2004
Time: 10:30 a.m. – 10:50 a.m.
Subject: Clay Geologic Description
Site 8
NCBC Gulfport, Gulfport, MS
CTO 0272

MT: Secretary compiled geotechnical reports for NCBC Gulfport prepared by PSI. Majority of borings extend to depths of approximately 20 to 25 feet bgs.

A boring log for a warehouse located at the intersection of 9th and 10th Streets extended to a depth of 50-feet bgs (PSI report no. 254-25127 prepared for Carl Franco of JH&H, Ltd.). The 50-foot boring stratigraphy consisted of 30- to 35-feet of sand underlain by 20-feet of firm clay. The clay is firm to stiff, overconsolidated, and has a water content of approximately 27%. UCS tests were performed on the clay. Settlement in the clay shouldn't be an issue because it is overconsolidated.

The report can be provided pending release from the client (JH&H Ltd.). Also if approval is sent from NCBC Gulfport then I guess the report can be released.

mohammad.tavassoli@psiusa.com
504 733-9411

RCM: I will request that Mr. Bernie Walker (Public Works NCBC Gulfport) approve release of report to TtNUS by PSI.

Thanks for the assistance.

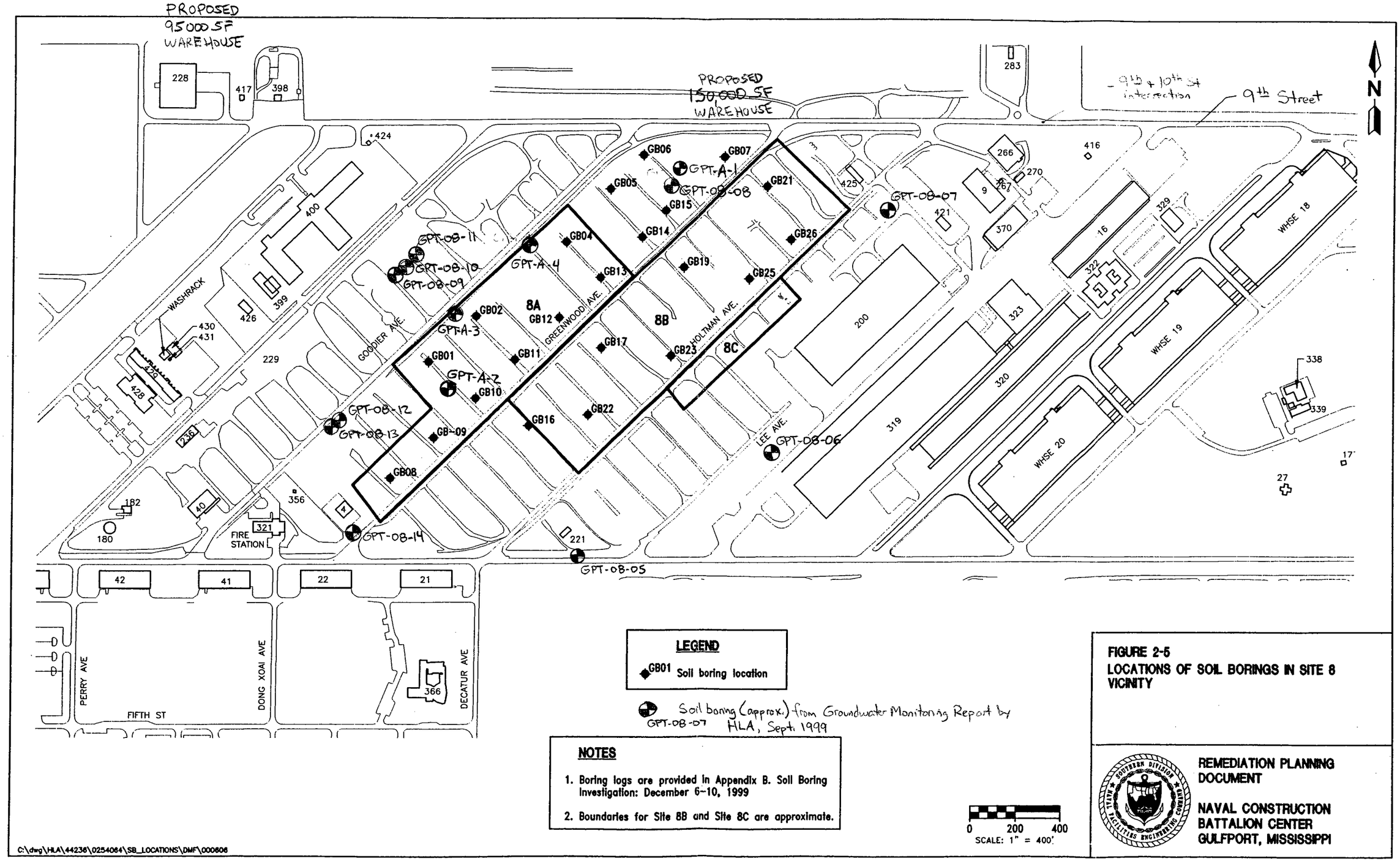


FIGURE 2-5
LOCATIONS OF SOIL BORINGS IN SITE 8 VICINITY

REMEDIATION PLANNING DOCUMENT

NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI

LOG OF BORING B-1

Near intersection of 9th & 10th street

PROPOSED WAREHOUSE
NCBC
GULFPORT, MISSISSIPPI

TYPE OF BORING: WET ROTARY | LOCATION: SEE APPENDIX | PSI PROJECT NO.: 254-25127

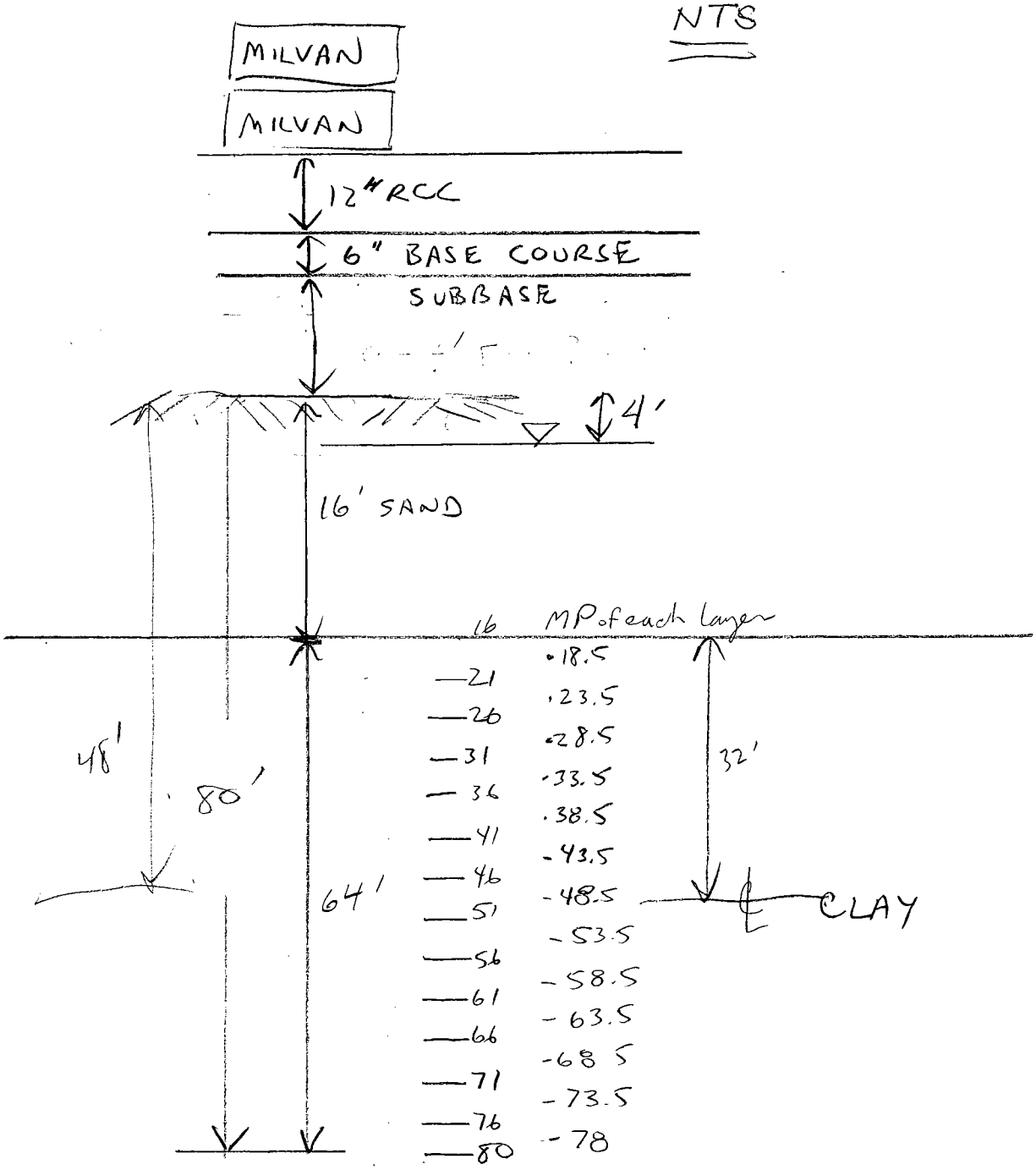
DEPTH, FT.	SOIL TYPE	SAMPLES	DESCRIPTION	N-BLOWS/FT.	UNCONFINED COMPRESSIVE STRENGTH tsf	HAND PENTROMETER tsf	TORVANE tsf	UNIT DRY WEIGHT pcf	MOISTURE CONTENT %	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200 SIEVE
			FILL: Red Bauxite Gravel with sand						7			
			Very loose, gray, Clayey Sand	2					14			
5			Medium dense to dense, gray, Clayey Sand	13					17			26
				13					18			
			-trace organics, 8' to 10'									
10				17					19			12
			-trace organics and gravel, 13' to 15'									
15				30					21			
			Dense, gray, Poorly Graded Sand, trace gravel									
20				41					18			
			-trace organics and gravel, 23' to 25'									
25				42					8			1
30				17					18			
			Loose, greenish-gray, Clayey Sand									
35				8					27			16
			Firm, greenish-gray to gray, Sandy Fat Clay, with sand pockets									
					0.97	1		97	27	31	16	
40			based on LL & PI... USCS CL									
							0.35		27			
45												
					0.63		0.3	99	25	30	14	
50												
			Boring Terminated at 50'									

DEPTH OF BORING: 50 Feet | GROUNDWATER: MEASURED AT 4.5' UPON COMPLETION
DATE: 9/5/02

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE _____ OF _____

CLIENT		JOB NUMBER	
SUBJECT			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE 3/11/04

NTS

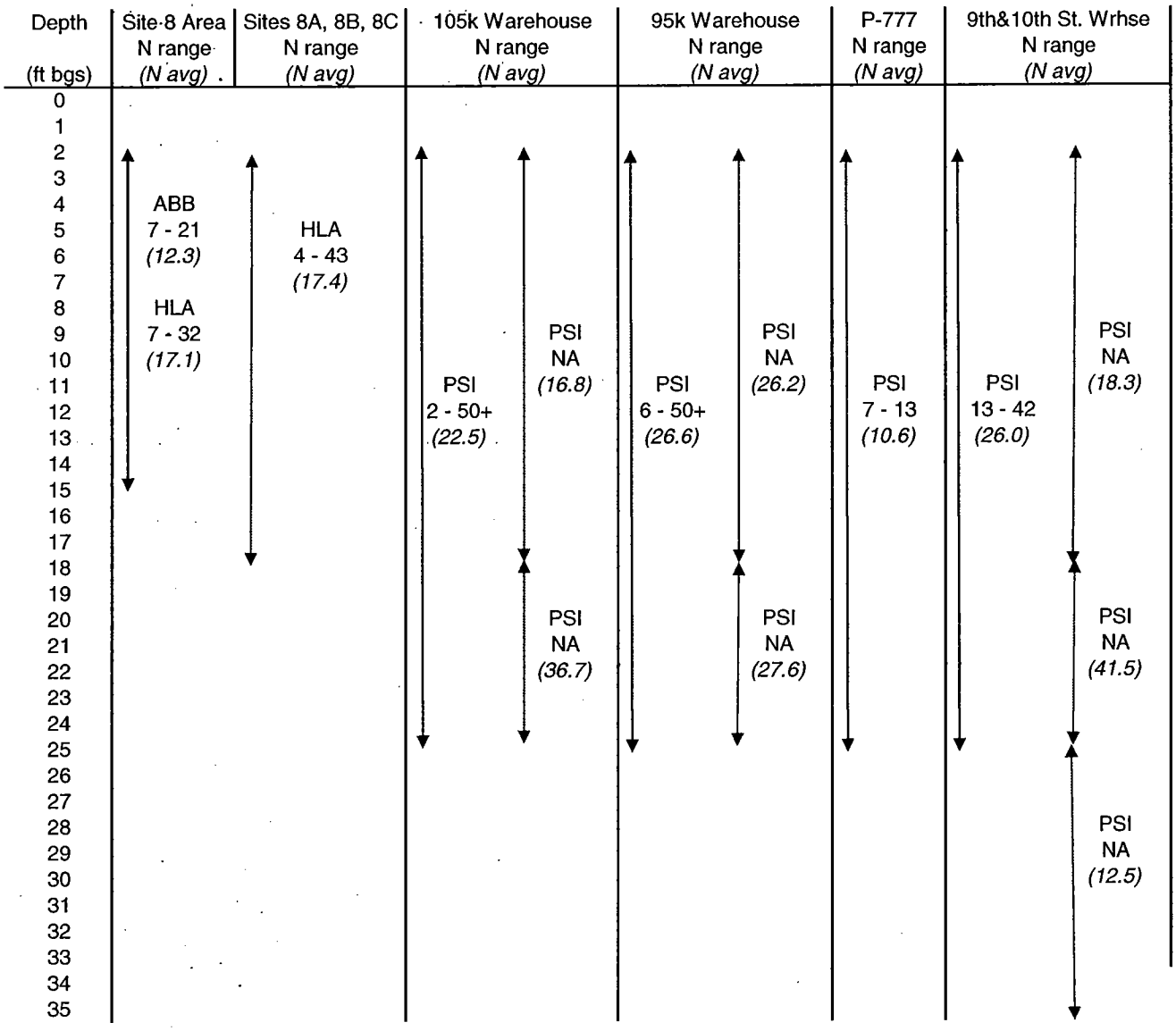


Tabulated Summary of Standard Penetration "N" Values
Sand Layer
NCBC, Gulfport, MS

Depth Interval (ft bgs)		ABB 04/94 Site 8A	HLA 12/99 Site 8A	HLA 12/99 Sites 8A, B, C	HLA 12/99 Sites 8A, B, C	PSI 03/01 150k Warehouse	PSI 03/01 95k Warehouse	PSI 05/02 P-777	PSI 09/02 9th & 10th St. Warehouse
0 - 16									
	N range	7 - 21		4 - 32	NA				
2 - 15									
	N range	7 - 21		7 - 32	NA				
	N avg	12.3		17.4					
	std. dev.	5.2		6.3					
2 - 25									
	N range				NA	2 - 50+	6 - 50+	7 - 13	13 - 42
	N avg					22.5	26.6	10.6	26.0
2 - 18									
	N range			4 - 43	NA				13 - 30
	N avg			17.4		16.8	26.2		18.3
	std. dev.			7.1					8.1
18 - 25									
	N avg				NA	36.7	27.6		41.5

Average N for 2' to 18' bgs range for all samples = (12.3 + 17.1 + 17.4 + 16.8 + 26.2 + 10.6 + 18.3) / 7 = 16.96
Average N for 18' to 25' bgs range for all samples = (36.7 + 27.6 + 41.5) / 3 = 35.3

Graphical Summary of Standard Penetration "N" Values
Sand Layer
NCBC, Gulfport, MS



HYSTER

H550-620F Lift Truck Specifications

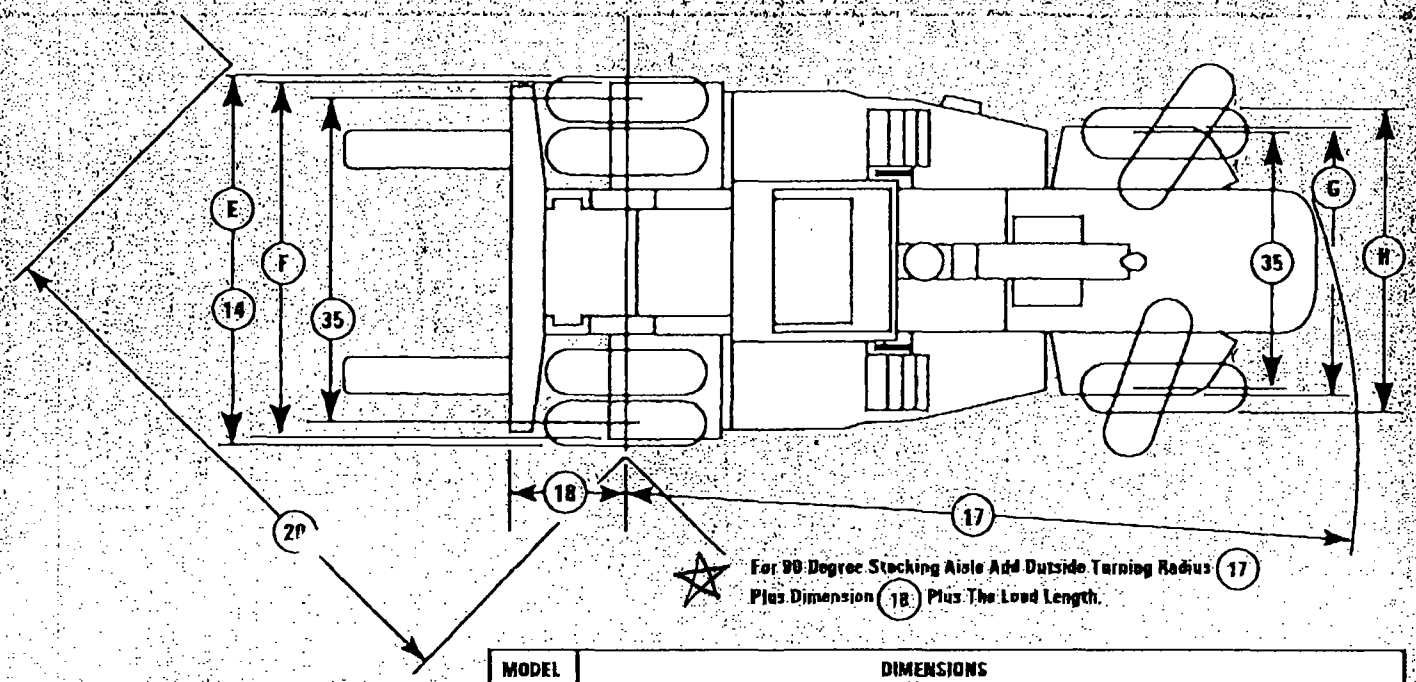
GENERAL	1	Manufacturer		Hyster Company	Hyster Company
	2	Model		H550F	H620F
	3	Capacity, rated	lb. (kg)	55,000 (25 000)	62,000 (28,000)
	4	Load Center	in. (mm)	48.0 (1 200)	48.0 (1 200)
	5	Power type		Diesel	Diesel
	6	Operator type		Sit	Sit
	7	Tire type, front / rear		Pneumatic / Pneumatic	Pneumatic / Pneumatic
	8	Wheels, front / rear	(X=drive)	4X / 2	4X / 2
DIMENSIONS	10	Standard mast (top of forks)	in. (mm)	124.5 (3 163)	125.5 (3 188)
	11	Forks, length / width / thickness	in. (mm)	96.0 x 8.0 x 4.5 (2 438 x 203 x 114)	96.0 x 12.0 x 4.5 (2 438 x 305 x 114)
	12	Tilt angle, standard mast, forward / rearward	in. (mm)	6 / 10	6 / 10
	13	Length to face of forks	in. (mm)	252.1 (6 403)	261.6 (6 645)
	14	Width, standard tires	in. (mm)	120.0 (3 040)	133.0 (3 380)
	15	Height, standard mast lowered	in. (mm)	155.0 (3 937)	168.5 (4 280)
	16	Height, standard mast extended, without LBE	in. (mm)	240.0 (6 096)	228.2 (5 798)
	17	Turning radius, minimum outside	in. (mm)	→ 241.3 (6 129)	245.3 (6 231)
	18	Length, cntr drive axle to face of forks	in. (mm)	→ 41.1 (1 045)	42.1 (1 069)
		Length, cntr drive axle to face of forks w/s.s.	in. (mm)	43.6 (1 110)	45.6 (1 160)
	19	Aisle width, (add load length for 90 degree stack)	in. (mm)	282.3 (7 170)	294.7 (7 555)
	20	Equal intersecting right angle aisle	in. (mm)	203.7 (5 174)	214.2 (5 440)
PERFORMANCE †	20	Stability (comply with ANSI)		YES	YES
	22	Travel speed, maximum forward (powershift)	mph (km/hr.)	18.4 (29.6)	16.3 (26.2)
	23	Lift speed, standard mast, NL / RL	ft/min. (m/s)	131.0 (0.67) / 61.0 (0.31)	106.0 (0.54) / 45.0 (0.23)
	24	Lowering, standard mast, NL / RL	ft/min. (m/s)	45.0 (0.23) / (96.0 (0.49)	65.0 (0.33) / 90.0 (0.46)
	25	Drawbar pull, powershift xmsn, 1 mph	lb. (kN)	37,550 (167)	42,480 (188)
	26	Gradeability, pow shift xsmn. 1 mph NL / RL	Percent	31 / 31	33 / 30
WT	28	Total approximate weight, standard equipped truck	lb. (kg)	77,290 (32 767)	87,840 (39 820)
	29	Axle loading, static-RL front / rear	lb. (kg)	113,130 (51 306) / 14,100 (6 395)	133,130 (60 376) / 16,685 (7 567)
WHEELS & TIRES	31	Number of tires, front / rear		4/2	4/2
	32	Tire size, drive tires (front)		14.00 x 24 - 28 Ply	16.00 x 25 - 24 Ply
	33	Tire size, steer tires (rear)		14.00 x 24 - 28 Ply	16.00 x 25 - 24 Ply
	34	Wheelbase, center of steer to center of drive axle	in. (mm)	170.0 (4 320)	170.0 (4 320)
	35	Tread, center to center of tires, steer / drive	in. (mm)	104.0 (2 640) / 93.0 (2 362)	116.0 (2 950) / 93.0 (2 362)
	36	Ground clearance, lowest point-NL	in. (mm)	13.5 (343)	15.0 (381)
	37	Ground clearance, center of wheelbase-NL	in. (mm)	20.5 (520)	22.0 (559)
	38	Brakes, method of control, service / parking		Hydraulic / Hydraulic	Hydraulic / Hydraulic
	39	Brakes, method of operation, service / parking		Foot / Hand	Foot / Hand
DRIVETRAIN	41	Battery, volts / cold cranking amps	V / amps	24 / 660	24 / 660
	42	Engine, make-model		Cummins 6CT8.3	Cummins 6CT8.3
	43	Output per SAE standards	hp (kW)	215 (160)	215 (160)
	44	Governed speed, NL	RPM	2500	2500
	45	Cycle / number of cylinders / displacement	cu.in. (cm3)	4 / 6 / 504.5 (8 267)	4 / 6 / 504.5 (8 267)
	46	Clutch type, powershift		Torque Converter	Torque Converter
	47	Gear change type, powershift		Hand Lever	Hand Lever
	48	Number of speeds, forward / reverse		3 / 3	3 / 3
	49	Transmission type		Powershift	Powershift
	51	Relief pressure for attachments	psi (kPa)	3,200 (22 050)	3,200 (22 050)

* **CERTIFICATION:** These Hyster lift trucks meet design specifications of Part II ANSI B56.1-1969, as required by OSHA Section 1910.178 (a) (2) and with Part III ANSI B56.1-Revision in effect at the time of manufacture. Certification of compliance with the applicable ANSI standards appears on the lift truck's nameplate which is affixed to truck when shipped complete from the factory.

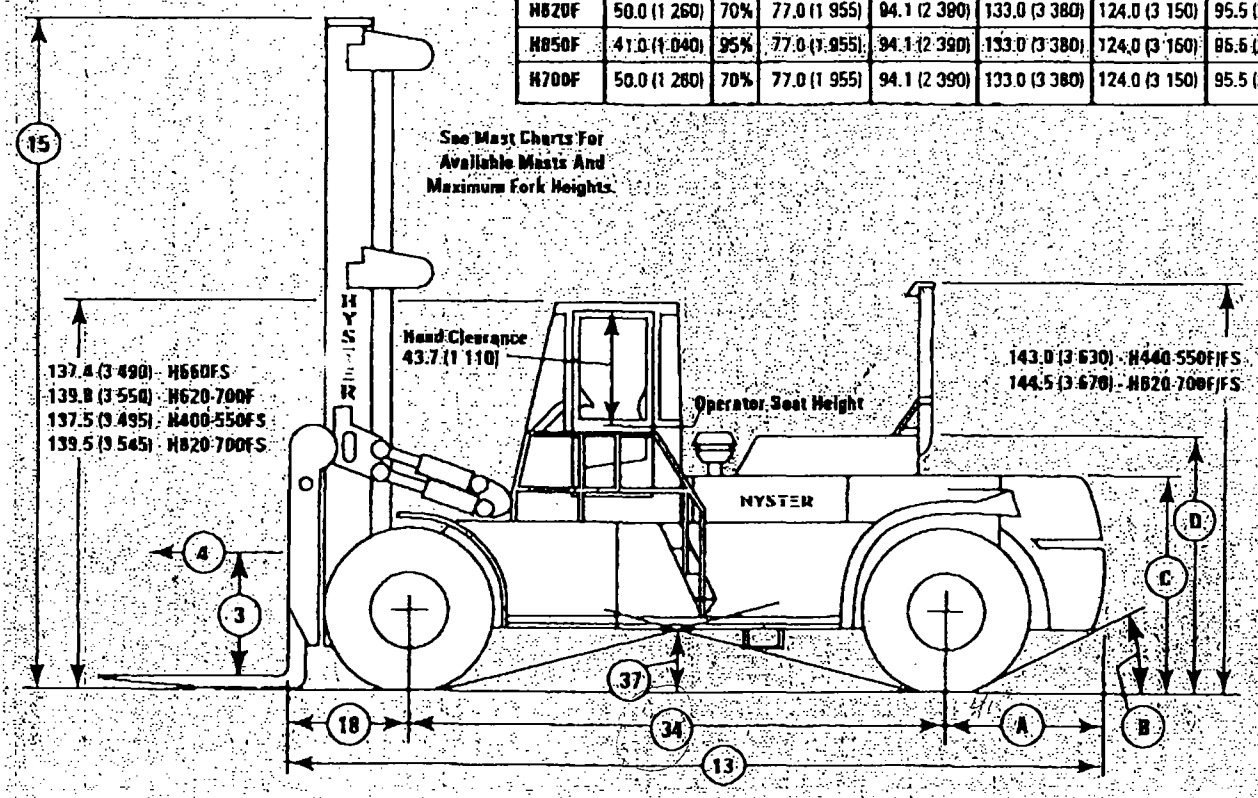
† **NOTE:** Performance specifications are for truck equipped as described under Standard Equipment on the back of this Technical Guide. Performance specifications are affected by the condition of the vehicle and how it is equipped, as well as the nature and condition of the operating environment. If these specifications are critical, the proposed application should be discussed with your dealer.

Optional cab and lights are shown in the front cover photograph.

H440-700F/FS Lift Truck Specifications



MODEL	DIMENSIONS							
	A	B	C	D	E	F	G	H
H440FS	41.0 (1 040)	80%	75.5 (1 920)	92.7 (2 355)	120.0 (3 040)	110.0 (2 795)	95.5 (2 425)	108.8 (2 765)
H550FS	41.0 (1 040)	80%	75.5 (1 820)	82.7 (2 365)	120.0 (3 040)	110.0 (2 795)	95.5 (2 425)	108.8 (2 765)
H620FS	50.0 (1 260)	70%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 425)	109.8 (2 790)
H700FS	50.0 (1 260)	70%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 425)	109.8 (2 790)
H550F	41.0 (1 040)	84%	75.5 (1 920)	92.7 (2 355)	120.0 (3 040)	110.0 (2 785)	95.5 (2 425)	108.8 (2 785)
H620F	50.0 (1 260)	70%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 425)	109.8 (2 790)
H850F	41.0 (1 040)	95%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 425)	109.8 (2 790)
H700F	50.0 (1 260)	70%	77.0 (1 955)	94.1 (2 390)	133.0 (3 380)	124.0 (3 150)	95.5 (2 425)	109.8 (2 790)



Circled numbers correspond to the line numbers on the tabulated charts inside the Technical Guide.
Figures are in inches/pounds (metric equivalent).

23/26

TABLE 4.1. SHAPE AND RIGIDITY FACTORS C_d FOR CALCULATING SETTLEMENTS OF POINTS ON LOADED AREAS AT THE SURFACE OF AN ELASTIC HALF-SPACE.

Shape	*Center*	*Corner*	*Middle of Short Side*	*Middle of Long Side*	*Average*
Circle	1.00	0.64	0.64	0.64	0.85
Circle (rigid)	0.79	0.79	0.79	0.79	0.79
Square	1.12	0.56	0.76	0.76	0.95
Square (rigid)	0.99	0.99	0.99	0.99	0.99
Rectangle: length/width					
1.5	1.36	0.67	0.89	0.97	1.15
2	1.52	0.76	0.98	1.12	1.30
3	1.78	0.88	1.11	1.35	1.52
5	2.10	1.05	1.27	1.68	1.83
10	2.53	1.26	1.49	2.12	2.25
100	4.00	2.00	2.20	3.60	3.70
1000	5.47	2.75	2.94	5.03	5.15
10000	6.90	3.50	3.70	6.50	6.60

rigid case. Values for C_d for these cases are also given in Table 4.1.

EXAMPLE 4.1. A structure is to be supported on a mat foundation whose dimensions are 70 by 180 feet. The load on the mat is to be uniformly distributed; its magnitude is 1250 psf. The mat rests on a deep saturated clay deposit for which Young's modulus is approximately 800×10^3 psf. Estimate the immediate settlement at the center and corner of the mat.

Solution:

For a saturated soil there is no initial elastic volume change so Poisson's ratio is assumed to be 0.5. From Table 4.1 with

$$\frac{L}{B} = \frac{180}{70} = 2.57$$

the shape factors are determined by interpolation to be

$$\text{At the center, } C_d = 1.67$$

$$\text{At the corner, } C_d = 0.83$$

Thus from Eq. 4.2 the immediate surface settlement is

$$S_d \text{ (center)} = (1.67)(1250)(70)\left(\frac{1 - 0.5^2}{800 \times 10^3}\right)$$

$$= 0.137 \text{ ft} = 1.6 \text{ inches}$$

$$S_d \text{ (corner)} = (0.83)(1250)(70)\left(\frac{1 - 0.5^2}{800 \times 10^3}\right)$$

$$= 0.068 \text{ ft} = 0.8 \text{ inches}$$

A mat is neither completely flexible nor completely rigid. Because of its large size the distribution of contact pressure may be, as assumed, nearly uniform over the center portion of the mat. At the corners, the rigidity of the mat (due to the thickness of the mat and amount of reinforcing) may be significant, and settlements are likely to be less than predicted.

Effect of Layered Systems In practice, most soil profiles are nonhomogeneous and/or multilayered. If the thickness of the uppermost layer is large relative to the dimensions of the loaded area, immediate surface displacement may be calculated as if the soil were a homogeneous layer of infinite depth. If, however, the upper stratum is relatively thin, ignoring the effect of layering may have an appreciable influence on the magnitude of the calculated immediate settlement. This is likely to be especially important when a soft compressible stratum is underlain by rock or very hard or dense soils. This special case can be approximated by a layer of elastic material of finite thickness underlain by a rigid base. Displacements for this case may be evaluated by Eq. 4.2 in which the shape factor C_d is replaced by a shape factor C_d' which accounts for the presence of the rigid base, and E and μ are the elastic parameters for the compressible layer. Values for the shape factor C_d' have been tabulated and are given in Table 4.2 for the settlement under the center of a uniformly loaded area at the upper surface of a compressible layer underlain by a rigid boundary, and in Table 4.3 for the settlement under the midpoint of the long side. These shape factors depend upon both the shape of the loaded area and the thickness of the compressible stratum relative to the width of the loaded area as illustrated in Fig. 4.3.

The value of C_d depends upon the assumed interface conditions between the compressible material and the rigid base. Those values given in Table 4.2 and 4.3 are determined as the average of values computed for two limiting cases: no horizontal shear stress acting at the rigid boundary, and no horizontal displacement at the rigid boundary. In the absence of detailed measurements concerning which of these is the most appropriate, an intermediate value has been selected.

Examination of Table 4.2 indicates the importance of the presence of a rigid boundary. When $H/B = 0.5$ the reduction in surface displacements of the center of the loaded

TABLE 4.2. VALUES OF THE SHAPE FACTOR C_d' FOR SETTLEMENT OF THE CENTER OF A UNIFORMLY LOADED AREA ON AN ELASTIC LAYER UNDERLAIN BY A RIGID BASE. (Modified from Egorov, 1958, as cited by Harr, 1966.)

		Rectangle						
H/B	*Circle Diameter = B*	*L/B = 1*	*L/B = 1.5*	*L/B = 2*	*L/B = 3*	*L/B = 5*	*L/B = 10*	*Infinite Strip L/B = ∞*
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
0.25	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23
0.5	0.48	0.48	0.47	0.47	0.47	0.47	0.47	0.47
1.0	0.70	0.75	0.81	0.83	0.83	0.83	0.83	0.83
1.5	0.80	0.86	0.97	1.03	1.07	1.08	1.08	1.08
2.5	0.88	0.97	1.12	1.22	1.33	1.39	1.40	1.40
3.5	0.91	1.01	1.19	1.31	1.45	1.56	1.59	1.60
5.0	0.94	1.05	1.24	1.38	1.55	1.72	1.82	1.83
∞	1.00	1.12	1.36	1.52	1.78	2.10	2.53	∞

C_d' constant for $H/B \leq 0.1$

TABLE 4.3. VALUES OF THE SHAPE FACTOR C'_d FOR SETTLEMENT OF THE MIDPOINT OF THE LONG SIDE OF A UNIFORMLY LOADED AREA ON AN ELASTIC LAYER UNDERLAIN BY A RIGID BASE.
(Modified from Egorov, 1958, as cited by Harr, 1966.)

		Rectangle						
H/B	*Circle Diameter = B*	*L/B = 1*	*L/B = 1.5*	*L/B = 2*	*L/B = 3*	*L/B = 5*	*L/B = 10*	*Infinite Strip L/B = ∞*
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.25	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
0.5	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23
1.0	0.36	0.46	0.46	0.47	0.47	0.47	0.47	0.47
1.5	0.44	0.52	0.60	0.64	0.68	0.68	0.68	0.68
2.5	0.51	0.61	0.74	0.82	0.91	0.97	0.97	0.97
3.5	0.55	0.65	0.80	0.90	1.03	1.13	1.17	1.17
5.0	0.58	0.69	0.85	0.96	1.12	1.28	1.39	1.39
∞	0.64	0.76	0.97	1.12	1.35	1.68	2.12	∞

C'_d constant for $H/B \le 0.25$

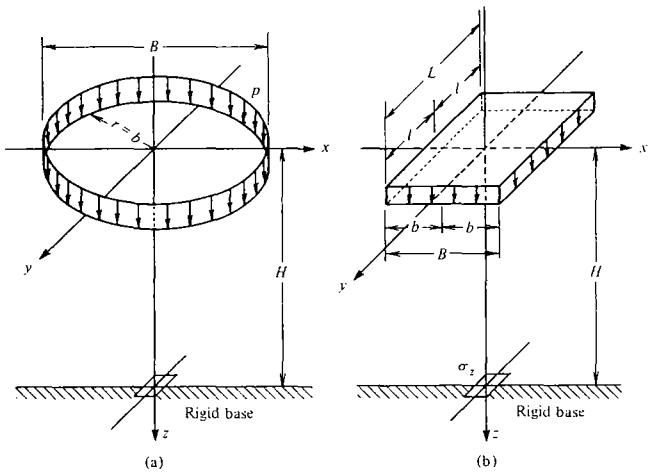


Fig. 4.3 Finite compressible material underlain by a rigid base. (a) Circular loaded area; (b) rectangular loaded area.

TABLE 4.4. ELASTIC DISTORTION SETTLEMENT CORRECTION FACTOR α, AT THE CENTER OF A CIRCULAR UNIFORMLY LOADED AREA ON AN ELASTIC LAYER E_1 UNDERLAIN BY A LESS STIFF ELASTIC MATERIAL E_2, OF INFINITE DEPTH; $\mu_1 = \mu_2 = 0.4$.
(Data from Burmister, 1965.)

H/B \ E_1/E_2	*1*	*2*	*5*	*10*	*100*
0	1.000	1.000	1.000	1.000	1.000
0.1	1.000	0.972	0.943	0.923	0.760
0.25	1.000	0.885	0.779	0.699	0.431
0.5	1.000	0.747	0.566	0.463	0.228
1.0	1.000	0.627	0.399	0.287	0.121
2.5	1.000	0.550	0.274	0.175	0.058
5	1.000	0.525	0.238	0.136	0.036
∞	1.000	0.500	0.200	0.100	0.010

area relative to that for a half-space is greater than 50 percent.

Alternately, the layered profile may best be represented by the case of a stiff stratum of finite thickness underlain by a less rigid layer of great depth. Such systems are exemplified by pavements as well as precompressed soil strata overlying less highly prestressed materials.

Surface displacements at the center of a uniformly loaded circular area on a stiff elastic layer underlain by an infinite depth of less stiff elastic material have been calculated (Burmister, 1965). The results are most conveniently described in terms of the surface settlement of a homogeneous system:

$$S_{d_l} = \alpha S_{d_\infty} \tag{4.3}$$

in which S_{d_l} is the settlement at the center of a uniformly loaded circular area at the surface of a layer with elastic modulus E_1, Poisson's ratio μ_1 and thickness H, underlain by an infinite depth of material with elastic modulus E_2 and Poisson's ratio μ_2; S_{d_∞} is the calculated settlement at the center of the uniformly loaded circular area on the surface of a homogeneous half-space with elastic parameters E_2 and μ_2; α is the correction factor relating the two settlements.

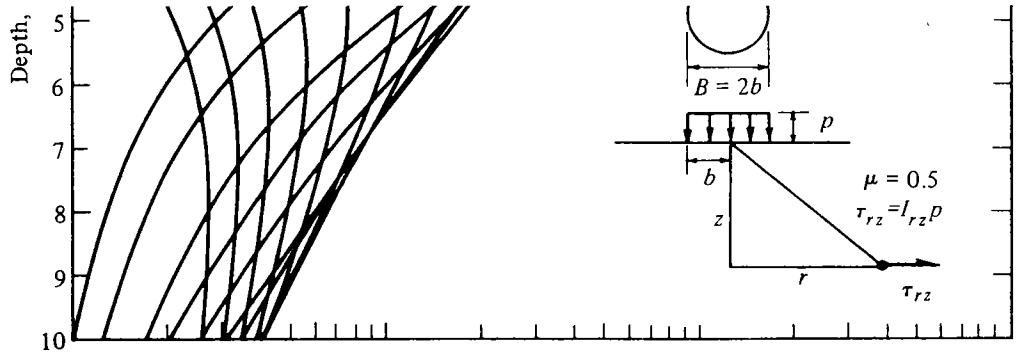
Values of α for various ratios H/B and E_1/E_2 are given in Table 4.4. In this table $\mu_1 = \mu_2 = 0.4$, and no slip at the interface between the two layers has been assumed. The table indicates that the introduction of a stiff layer can produce a significant reduction in the surface displacement. Even for a relatively small thickness, $H/B = 0.25$, of a moderately stiff layer, $E_1/E_2 = 10$, we obtain a calculated reduction in settlement of 30 percent.

Analytical and/or numerical methods for the determination of displacements in multilayered systems are available for cases other than those described above.* Except for special cases, however, the use of such layered system analyses is not justified because:

1. The procedures are not readily available in a form applicable for immediate computation.
2. Material parameters are generally not obtainable with the degree of accuracy required to justify a sophisticated analysis.
3. The boundary conditions under the load and at the interface between strata cannot be clearly defined.
4. The approximations required to "fit" the geometry of the real problem to that of the problem for which the solution is available are usually inconsistent with the precision of the solution procedure.

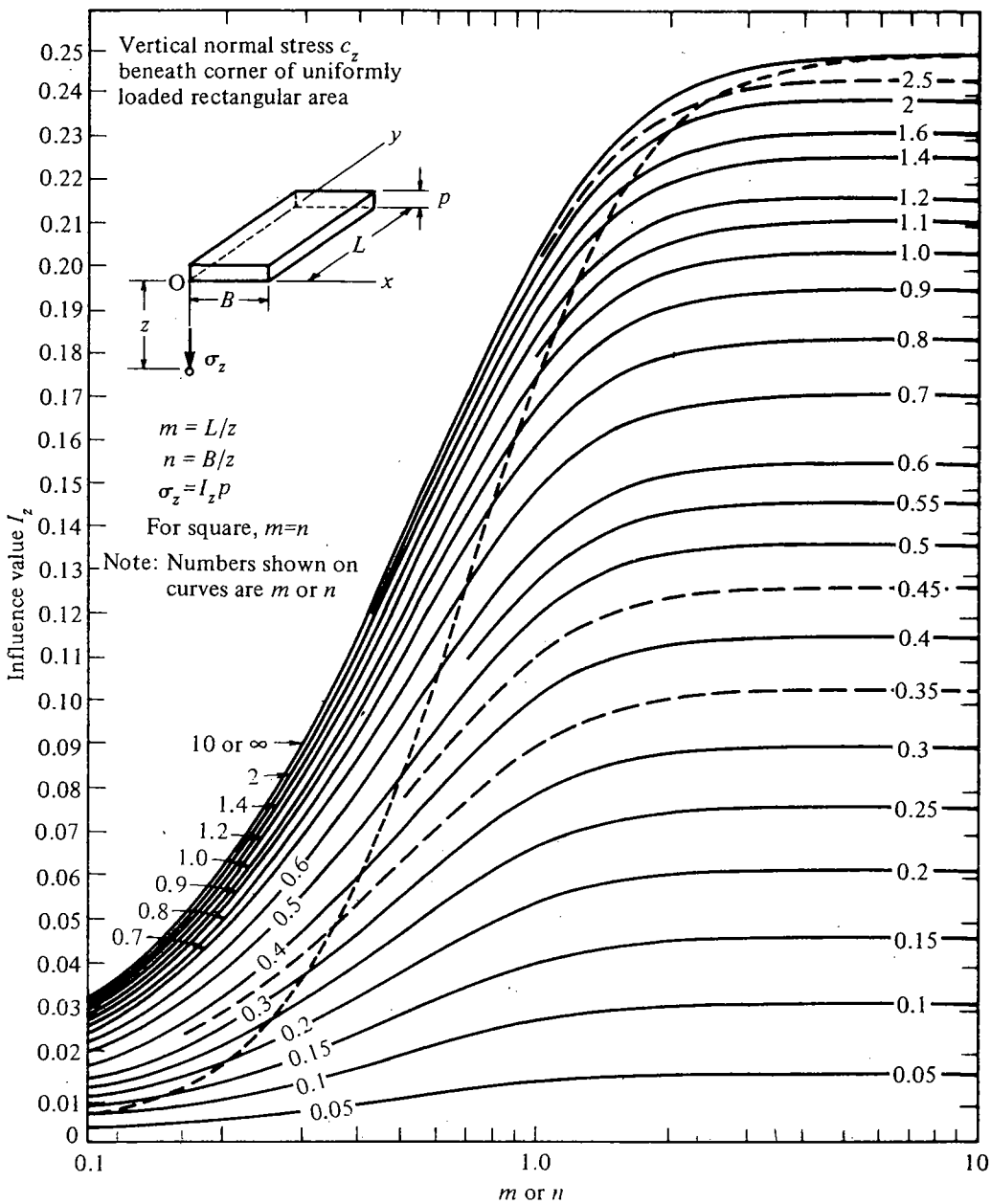
Thus, in many situations an approximate analysis of the immediate settlement is appropriate. The following examples illustrate two approaches.

*A bibliography of "Solutions to Boundary Value Problems of Stresses and Displacements in Earth Masses and Layered Systems" (Hampton et al., 1969) is available. The bibliography is not limited to analysis of elastic and/or isotropic media, and thus provides a very useful listing. However, reference is made only to works published prior to 1966.



25/26

uence diagram for horizontal and vertical shear stress τ_{rz} at various points within an elastic half-space under a uniformly loaded
(After Foster and Ahlvin, 1954.)



uence diagram for vertical normal stress at a point within elastic half-space beneath corner of uniformly loaded rectangular area.
1948.)

Winterkorn & Fang

Unit weight:

Sand	110	pcf
Clay	123.8	pcf
Piezo	4	ft bgs

surcharge + live load

c_c = 0.185
c_r = 0.037
e_o = 0.51

Layer "i" (ft bgs)	σ'_o (psf)	σ'_p (psf)	$\Delta\sigma$ (=dσ) (psf)	$\sigma'_p - \sigma'_o$ (psf)	for recompression only...d$\sigma' \le (\sigma'_p - \sigma'_o)$: log $((\sigma'_o+d\sigma')/\sigma'_o)$	for recompression & virgin compression...d$\sigma' > (\sigma'_p - \sigma'_o)$: log (σ'_p / σ'_o)	log $(\sigma'_o+d\sigma)/\sigma'_p)$	e_o	ρ middle (ft)	I_z	$\Delta\sigma$ (=dσ) (psf)	$\sigma'_p - \sigma'_o$ (psf)	for recompression only...d$\sigma' \le (\sigma'_p - \sigma'_o)$: log $((\sigma'_o+d\sigma')/\sigma'_o)$	for recompression & virgin compression...d$\sigma' > (\sigma'_p - \sigma'_o)$: log (σ'_p / σ'_o)	log $(\sigma'_o+d\sigma)/\sigma'_p)$	ρ side (ft)
16								0.48								
	1,165	3,605	966.5	2440	0.2624	0.0000	0.0000	0.48	0.033	0.5	483.3	2440	0.1507	0.0000	0.0000	0.019
21																
	1,472	3,912	966.5	2440	0.2193	0.0000	0.0000	0.48	0.027	0.5	483.3	2440	0.1233	0.0000	0.0000	0.015
26																
	1,779	4,219	966.5	2440	0.1885	0.0000	0.0000	0.48	0.024	0.5	483.3	2440	0.1044	0.0000	0.0000	0.013
31																
	2,086	4,526	966.5	2440	0.1654	0.0000	0.0000	0.48	0.021	0.5	483.3	2440	0.0905	0.0000	0.0000	0.011
36																
	2,393	4,833	966.5	2440	0.1473	0.0000	0.0000	0.48	0.018	0.5	483.3	2440	0.0799	0.0000	0.0000	0.010
41																
	2,700	4,833	966.5	2133	0.1329	0.0000	0.0000	0.48	0.017	0.5	483.3	2133	0.0715	0.0000	0.0000	0.009
46																
	3,007	4,833	966.5	1826	0.1211	0.0000	0.0000	0.48	0.015	0.5	483.3	1826	0.0647	0.0000	0.0000	0.008
51																
	3,314	5,140	966.5	1826	0.1112	0.0000	0.0000	0.48	0.014	0.5	483.3	1826	0.0591	0.0000	0.0000	0.007
56																
	3,621	5,447	966.5	1826	0.1028	0.0000	0.0000	0.48	0.013	0.5	483.3	1826	0.0544	0.0000	0.0000	0.007
61																
	3,928	5,754	966.5	1826	0.0955	0.0000	0.0000	0.48	0.012	0.5	483.3	1826	0.0504	0.0000	0.0000	0.006
66																
	4,235	6,061	966.5	1826	0.0893	0.0000	0.0000	0.48	0.011	0.5	483.3	1826	0.0469	0.0000	0.0000	0.006
71																
	4,542	6,368	966.5	1826	0.0838	0.0000	0.0000	0.48	0.010	0.5	483.3	1826	0.0439	0.0000	0.0000	0.005
76																
80	4,849	6,675	966.5	1826	0.0789	0.0000	0.0000	0.48	0.010	0.5	483.3	1826	0.0413	0.0000	0.0000	0.005
81																
								Total if 80' (Case 2a)	**0.225** ft						**Total if 80' (Case 2a)**	**0.12** ft
									2.7 in							1.5 in
81																
	5,309	7,136	966.5	1826	0.0726	0.0000	0.0000	0.48	0.018	0.5	483.3	1826	0.0378	0.0000	0.0000	0.009
91																
	5,923	7,750	966.5	1826	0.0656	0.0000	0.0000	0.48	0.016	0.5	483.3	1826	0.0341	0.0000	0.0000	0.009
101																
	6,537	8,364	966.5	1826	0.0599	0.0000	0.0000	0.48	0.015	0.5	483.3	1826	0.0310	0.0000	0.0000	0.008
111																
	7,151	8,978	966.5	1826	0.0551	0.0000	0.0000	0.48	0.014	0.5	483.3	1826	0.0284	0.0000	0.0000	0.007
121																
	7,765	9,592	966.5	1826	0.0509	0.0000	0.0000	0.48	0.013	0.5	483.3	1826	0.0262	0.0000	0.0000	0.007
131																
	8,379	10,206	966.5	1826	0.0474	0.0000	0.0000	0.48	0.012	0.5	483.3	1826	0.0244	0.0000	0.0000	0.006
141																
	8,993	10,820	966.5	1826	0.0443	0.0000	0.0000	0.48	0.011	0.5	483.3	1826	0.0227	0.0000	0.0000	0.006
151																
	9,607	11,434	966.5	1826	0.0416	0.0000	0.0000	0.48	0.010	0.5	483.3	1826	0.0213	0.0000	0.0000	0.005
161																
	10,221	12,048	966.5	1826	0.0392	0.0000	0.0000	0.48	0.010	0.5	483.3	1826	0.0201	0.0000	0.0000	0.005
171																
180	10,835	12,662	966.5	1826	0.0371	0.0000	0.0000	0.48	0.009	0.5	483.3	1826	0.0190	0.0000	0.0000	0.005
181								0.48								
								Total if 180' (Case 2b)	**0.35** ft						**Total if 180' (Case 2b)**	**0.19** ft
									4.2 in							2.3 in

1. σ'_p estimated for 38- to 50-feet bgs interval. σ'_p assumed to vary directly with σ'_o.

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B.5 CLASS III ROLLER-COMPACTED CONCRETE CULVERT EVALUATION

CLIENT: NCBC Gulfport, Site 8A		JOB NUMBER: 7379	
SUBJECT: Class III RCP Culvert Evaluation/Calculation			
BASED ON: TR-55		DRAWING NUMBER:	
BY: T.W.S. Date: 24-Sep-04	CHECKED BY: Date: DCW 9/30/04	APPROVED BY:	DATE:

OBJECTIVE

To determine the flow volume through, and the required size of, the Class III RCP to be installed beneath the roller compacted concrete on the southern end of Site 8A.

APPROACH

1. Determine the tail water conditions on the proposed culvert to be placed beneath the roller compacted concrete by evaluating the two existing 18-inch culverts that convey flow from Site 8A to the downstream channels. The evaluation on the two existing 18-inch culverts uses the hydrology developed for the post-construction conditions (hydrology presented in the Post-Construction Runoff Calculation provided in Appendix B of the Erosion, Sediment, and Stormwater Control Plan).

2. Delineate the drainage areas that contributes to the proposed culvert to be placed beneath the roller compacted concrete in the southern portion of Site 8A and determine the peak stormwater runoff associated with the 25-year 24-hour storm event using Haestad Method's PondPack Version 9 software.

3. Using the Hydraulic Design of Highway Culverts, determined the required size of the proposed culvert to be placed beneath the roller compacted concrete.

REFERENCES

1) Haestad Method PondPack Users Guide, Version 9.
2) USDA, 1994. Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater, First Edition. A cooperative effort by the USDA Natural Resources Conservation Service, the Mississippi Department of Environmental Quality, and the Mississippi Soil and Water Conservation Commission, April.
3) SCS TR 55 Users Guide, Release 5.0, 1989
4) USDA, 1975. Soil Survey of Harrison County, Mississippi. Published cooperatively by the USDA Soil Conservation Service, the Forest Service, and the Mississippi Agricultural and Forestry Experiment Station, June.
5) Haestad Method FlowMaster, Version 7.
6) Hydraulic Design of Highway culverts. U.S. Department of Transportation, Federal Highway Administration, Report # FHWA-IP-85-15, September 1985.

CALCULATIONS

1. Tail Water Conditions on the Proposed Culvert:

CLIENT:	NCBC Gulfport, Site 8A	JOB NUMBER:	7379
SUBJECT:	Class III RCP Culvert Evaluation/Calculation		
BASED ON:	TR-55	DRAWING NUMBER:	
BY: T.W.S. Date: 24-Sep-04	CHECKED BY: Date: 9/30/04 DCW	APPROVED BY:	DATE:

The drainage area that contribute flow to the two 18" diameter culverts that convey flow from Site 8A include four areas. The first drainage area (Area 1) is Drainage Area 1 evaluated in the post-construction runoff calculation provided in Appendix B of the Erosion and Sediment Control Plan. The second area (Area A) is the off site area located southeast of Site 8A and contributes flow to the single 18" culvert that contributes flow to the southern portion of Site 8A. The third area (Area B) is the off site area located southwest of Site 8B and contributes flow to the two 8" culverts that contribute flow to the southern portion of Site 8A. The last area (Area C) is off site but within the railroad loop that surrounds Site 8A. These drainage areas are identified on the figure provided in on page 6 of 39.

In order to determine the tail water conditions in the channel beyond the two 18" culverts that convey flow from Site 8A, the four drainage areas contributing to the two 18" culverts were evaluated using Haestad's PondPack software and a 25-year, 24-hour storm event. The hydrographs from these evaluations were added together to determine the combined flow to the two 18" culverts.

To determine the runoff from each of the four areas, the areas of the watersheds were determined along with the surface types (i.e., grass covered, paved, etc.) to get a composite runoff number that represents each drainage area. In addition, the time of concentration was determined by evaluating the type of flow over the drainage area (sheet flow, shallow concentrated flow, channel flow, or any combination of these flows) to the drainage areas discharge point. This is done by evaluating several potential drainage pathways to determine which flowpath results in the longest time of concentration. Lastly the composite runoff number, time of concentration and the appropriate storm data is used to generate a hydrograph that models the concentration of flow at the discharge point over the duration of the storm event used.

The following is a summary of the areas, composite runoff numbers, and time of concentrations for each of the four drainage areas contributing flow to the two existing 18-inch culverts.

Area Identification	Watershed Area (acres)	Runoff Number	Time of Concentration (hours)	Peak Flow (cfs)
Drainage Area 1	6.62	93.9	0.0916	57.73
Drainage Area A	8.4	73	1.1045	25.37
Drainage Area B	2.88	73	1.4918	7.23
Drainage Area C	1.566	73	0.5299	6.99

Area 1 PondPack printouts are provided on pages 8 to 11 of 39; Area A PondPack printouts are provided on pages 12 to 15 of 39; Area B PondPack printouts are provided on pages 16 to 18 of 39; and Area C PondPack printouts are provided on pages 19 to 21 of 39.

Note: The information presented for Area 1 was taken from the post-construction runoff calculation provided in Appendix B of the Erosion, Sediment, and Stormwater Control Plan Report. In addition, the procedures used to determine the composite runoff number and the time of concentration in this calculation are the same as those used in the pre- and post-construction calculations.

Following the evaluation of the individual drainage areas, the hydrographs from these areas were combined to determine the peak combined flow at the two existing 18-inch culverts. The combined flow information (hydrographs) are presented on pages 22 to 25 of 39.

CLIENT: NCBC Gulfport, Site 8A			JOB NUMBER: 7379
SUBJECT: Class III RCP Culvert Evaluation/Calculation			
BASED ON: TR-55			DRAWING NUMBER:
BY: T.W.S. Date: 24-Sep-04	CHECKED BY: Date: DCW 9/30/04		APPROVED BY: DATE:

The peak flow from the contributing areas = 73.54 cfs

Using Haestad's FlowMaster software and the proposed channel cross section for channels that will be remediated, the depth of flow associated with the peak flow (73.54 cfs) in the channel downgradient of the two 18" culverts was determined. The data input is provided below, the software output is provided on page 26 of 39.

FlowMaster Date input:	Channel Shape:	Trapezoidal
	Channel surface description:	Grass
	Channel slope:	0.00297 ft/ft
	Channel side slope (left):	2H:1V
	Channel slope (right):	2H:1V
	Channel bottom width:	5 ft
	Flow	73.54 cfs
	Tail water depth (depth of flow in channel):	2.26 ft

This tail water elevation and the charts provided on pages 27 to 29 of 39 from the Hydraulic Design of Highway Culverts manual were used to evaluate the efficiency of the two 18" culverts and to determine the head on the two culverts to force the required 73.54 cfs through the two 18" culverts with 2.26 feet of tail water. This head elevation is then used as the tail water for the proposed culvert to be placed beneath the roller compacted concrete.

Culvert Evaluation: Under proposed conditions, the required head on the two existing culverts needs to be at least 20.02 feet to convey 73.54 cfs. With a top of channel elevation of 29 feet (see page 7 of 39), the available head within the channel equals 3.2 feet (29 ft - 25.8 ft). Therefore, it is concluded that the two existing 18" culverts are not adequate to convey the required 73.54 cfs runoff resulting from a 25-year 24-hour storm event.

Because the required head exceeds the top of channel elevations, the tail water on the proposed culvert will be evaluated at the elevation equal to the top of channel elevation (top of channel 29 ft msl - channel invert 26.5 ft msl).

Head required to push 73.54 cfs =	20.02 ft
Tail water elevation for proposed culvert evaluation =	2.5 ft (29-26.5)

Note: Under the proposed conditions, the enlarged drainage channels will provide some additional runoff storage. An evaluation can be performed to determine how much storage is realized within these channels, and how much more storage would be needed in the channels or pond to alleviate the runoff load on downstream channels and culverts (this calculation is beyound the scope of this calculation).

CLIENT: NCBC Gulfport, Site 8A			JOB NUMBER: 7379	
SUBJECT: Class III RCP Culvert Evaluation/Calculation				
BASED ON: TR-55			DRAWING NUMBER:	
BY: T.W.S. Date: 24-Sep-04		CHECKED BY: Date: DCW 9/30/04	APPROVED BY:	DATE:

2. Delineate Drainage Areas and Calculate Peak Runoff:

The Site 8A drainage area that contributes flow to the proposed culvert is delineated on page 6 of 34. The drainage area contributing to the proposed culvert also includes Area A, which was evaluated for the tail water elevation analysis. Area A is delineated on page 5 of 34. With regard to land cover for drainage areas, the site 8A drainage area is roller compacted concrete and grass lined channels. The off site area (Area A) is grass and brush.

Using Haestad's PondPack software and the approach used for the pre- and post-construction runoff calculations, the two drainage areas were modeled to determine the peak runoff from each area. Following the individual area evaluations the hydrographs of the two areas were combined to determine the flow that needs to be conveyed through the proposed culvert. The Curve Numbers (CN), time of concentration (Tc), and peak runoff flows for each drainage area and the combined drainage area are presented below.

Curve Numbers:	Site 8A Area =	95	page 30 of 39
	Off site area (Area A) =	73	page 12 of 39
Time of concentration:	Site 8A Area =	0.05 hrs	page 31 of 39
	Off site area (Area A) =	1.1 hrs	page 14 of 39
Peak Runoff (25-year storm):	Site 8A Area =	30.89 cfs	page 32 of 39
	Off site area (Area A) =	25.37 cfs	page 15 of 39
	Combined Hydrographs =	40.26 cfs	page 33 of 39

The page information identifies the page that contains the PondPack software printouts for that piece of information. In addition, the drainage area maps are provided on page 7 of 34 (Site 8A drainage area) and page 6 of 34 (off site drainage area).

3. Evaluation of the Proposed Class III RCP Culvert:

The proposed culvert must convey the flow from the on site drainage area plus the expected flow from the contributing off site area with an expected tail water condition.

Flow to be conveyed =	40.26 cfs
Tail water depth =	2.5 ft

The Hydraulic Design of Highway Culverts manual was used to determined the required culvert diameter and the associated head needed to convey 40.26 cfs of flow. The charts and tables associated with this evaluation are provided on pages 37 to 39 of 39.

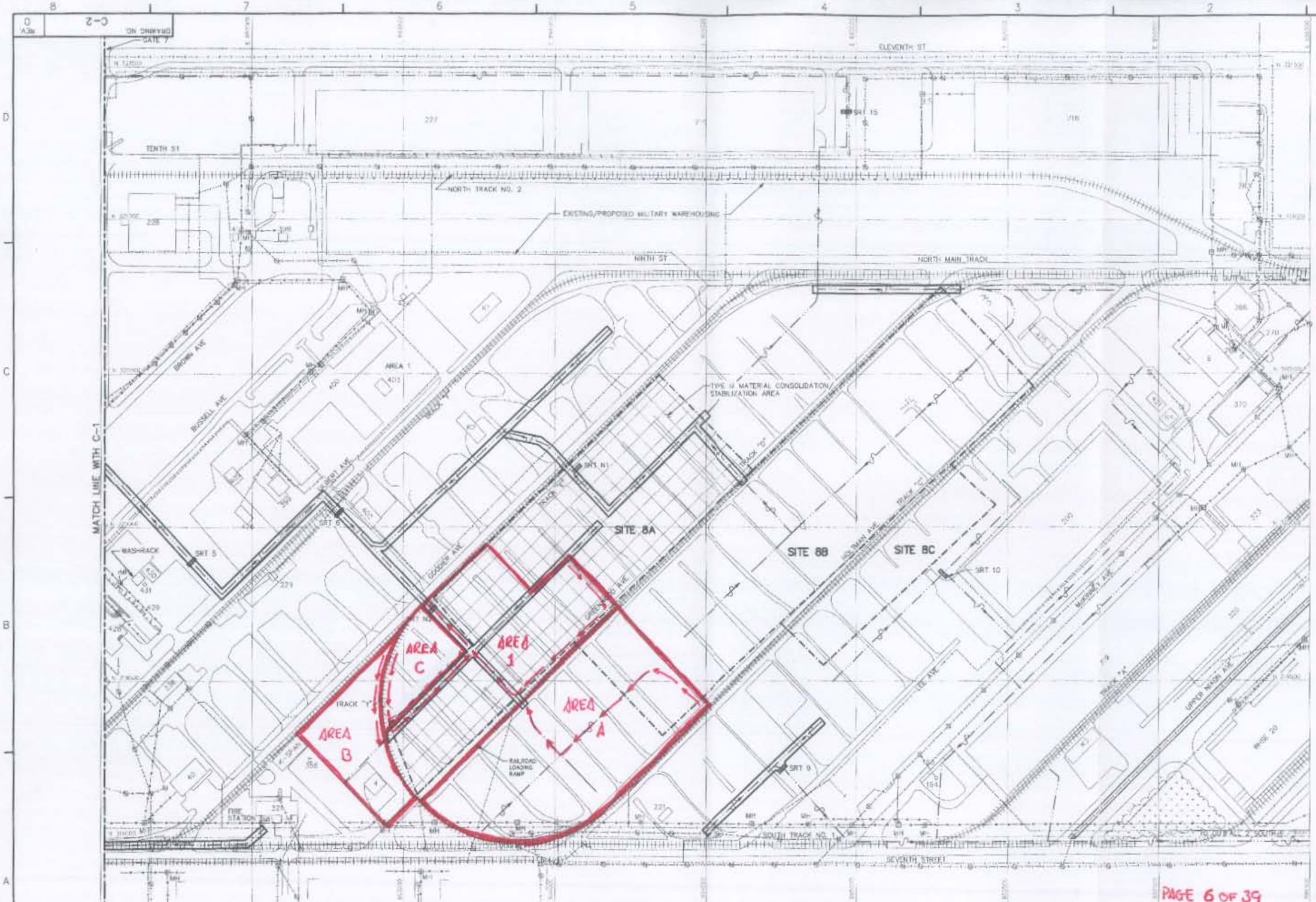
CLIENT: NCBC Gulfport, Site 8A		JOB NUMBER: 7379	
SUBJECT: Class III RCP Culvert Evaluation/Calculation			
BASED ON: TR-55		DRAWING NUMBER:	
BY: T.W.S. Date: 24-Sep-04	CHECKED BY: Date: DCW 9/30/04	APPROVED BY:	DATE:

The evaluation was run for three culvert sizes (24, 30, and 36 inch diameter culverts). The results indicate that a 24" diameter culvert requires a head that exceed the channel banks (32 ft msl) by 6.8 feet to convey the required 40.26 cfs flow. A 30" diameter culvert requires a head that exceeds the channel banks by 0.4 feet. Lastly the 36" diameter culvert can pass the required flow with a head elevation that is 1.53 feet bellow the top of the channel banks. Therefore the standard culvert size required to convey the flow of 40.26 cfs without exceeding channel banks is the 36" in diameter culvert. However, because the two 18" diameter culverts down gradient of the proposed culvert are not adequate to handle the proposed flows the proposed culvert should be sized to take advantage of upstream storage within the onsite channels and within the offsite areas which will have the effect of attenuating the flow before it reaches the down stream 18" diameter pipes. Therefore the proposed culvert will be sized at 24-inches in diameter. The following is a summary of the evaluation.

Proposed Culvert Size	Required Head (ft)	Feet Above Channel Banks
24"	9.8	6.8
30"	3.4	0.4
36"	1.45	-1.53

CONCLUSION

In order to take advantage of upstream storage area and to not convey flow as fast as possible to culverts that can not handle the expected flows, the proposed culvert will be sized at 24" in diameter.



DRAINAGE AREA

Flowpath

AREA A

CN = 73

T_c = 1.1 hrs.

AREA B

CN = 73

T_c = 1.5 hrs.

AREA C

CN = 73

T_c = 0.5 hrs

AREA 1

CN = 93.9

T_c = 0.0916 hr

DRAWING KEY

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) BOUNDARIES FOR SITES 8B AND 8C ARE SHOWN APPROXIMATE.

PAGE 6 OF 39

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

DRAWN BY DM DATE 6/28/04
CHECKED BY TWS DATE
REVISED BY DATE
SCALE AS SHOWN

EXISTING CONDITIONS PLAN
(SHEET 2 OF 5)
60% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO.
APPROVED BY DATE
DRAWING NO. C-2
REV. 0

— DRAINAGE AREA

CN = 95

T_c = 0.05 hrs.

EXISTING
2 - 18" CULVERTS
NW INV= 25.3
SE INV= 25.8

LOCATION OF PROPOSED CULVERT

FROM AREA C

FROM AREA B

FROM AREA A

T_c

GOODIER AVENUE

INV. ELEV. 25.8

INV. ELEV. 31.0

ROLLER COMPACTED CONCRETE PAVEMENT/DIVERSION CHANNEL TERMINATION (TYPICAL) C-23 C-28

ROLLER COMPACTED CONCRETE PAVEMENT CAP C-23 C-27

DRAINAGE CHANNEL EXCAVATION AND RESTORATION C-23 C-28

INV. ELEV. 26.5

ROLLER COMPACTED CONCRETE PAVEMENT/THICKENED EDGE (TYPICAL) C-23 C-27

INV. ELEV. 27.6

2 - 8" CULVERTS
NE INV= 27.6
SW INV= 27.8

INV. ELEV. 32.0

ROLLER COMPACTED CONCRETE PAVEMENT/ASPHALT ROAD TERMINATION C-23 C-26

BASELINE A
N 319,060.6643
E 893,538.9024

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00

18" CULVERT
NW INV= 25.9
SE INV= 27.3

CLASS III RCP CULVERT

ROLLER COMPACTED CONCRETE PAVEMENT/ASPHALT ROAD TERMINATION C-23 C-26

MATCH LINE DRAWING C-24

AREA OF UNDISTURBED CONTRIBUTING TO CLASS III RCP CULVERT: 153,470 sf or 3.52 acres

ADDITIONAL CONTRIBUTIONS: 18" CULVERT BYPASSING THE SITE FROM THE SOUTHEAST

GRASS LINED CHANNEL — AREA = 23,780 sf or 0.550 acres

ROLLER COMPACTED CONCRETE — AREA = 11067.0 sf or 0.254 acres

PAVEMENT — AREA = 21,120 sf or 0.485 acres

DRAWING KEY

C-22 C-23 C-24 C-20 C-21

LEGEND:

FOR GENERAL LEGEND SEE DRAWING T-2.

AREA TO RECEIVE PERMANENT SEED MIXTURE.

NOTES:

FOR GENERAL NOTES SEE DRAWING T-2.

SCALE IN FEET
CHECK DRAWING SCALE BEFORE USING

PAGE 7 OF 39

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY NF DATE 3/6/03
CHECKED BY TWS DATE 3/12/03
REVISED BY DATE
SCALE AS NOTED

FINAL GRADING PLAN
(SHEET 4 OF 5)
60% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO.
APPROVED BY DATE
DRAWING NO. C-23 REV 0

DRAWING NO. C-23 REV 0

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (POST).PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Grassed Area	74	1.130			74.00
Roller Compacted Concrete	98	5.490			98.00
COMPOSITE AREA & WEIGHTED CN --->		6.620			93.90 (94)

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (POST).PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	165.00	ft
2yr, 24hr P	5.8000	in
Slope	.010000	ft/ft
Avg.Velocity	1.55	ft/sec

Segment #1 Time: .0295 hrs

Segment #2: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	30.00	ft
2yr, 24hr P	5.8000	in
Slope	.100000	ft/ft
Avg.Velocity	2.77	ft/sec

Segment #2 Time: .0030 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	33.6875	sq.ft
Wetted Perimeter	21.39	ft
Hydraulic Radius	1.57	ft
Slope	.009900	ft/ft
Mannings n	.0250	
Hydraulic Length	515.00	ft
Avg.Velocity	8.03	ft/sec

Segment #3 Time: .0178 hrs

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (POST).PPW

Segment #4: Tc: TR-55 Channel

Flow Area	3.9760	sq.ft
Wetted Perimeter	14.14	ft
Hydraulic Radius	.28	ft
Slope	.002100	ft/ft
Mannings n	.0170	
Hydraulic Length	190.00	ft
Avg.Velocity	1.72	ft/sec

Segment #4 Time: .0306 hrs

Segment #5: Tc: TR-55 Channel

Flow Area	39.0000	sq.ft
Wetted Perimeter	22.97	ft
Hydraulic Radius	1.70	ft
Slope	.003600	ft/ft
Mannings n	.0250	
Hydraulic Length	195.00	ft
Avg.Velocity	5.09	ft/sec

Segment #5 Time: .0106 hrs

==========
Total Tc: .0916 hrs
==========

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport, MS

Storm Tag Name = GP 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DRAINAGE AREA 1	AREA	5.390		12.1000	57.73	
Outfall OUT FALL	JCT	5.390		12.1000	57.73	

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT AREA A.PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Brush - brush, weed, grass mix - go	73	8.400			73.00
COMPOSITE AREA & WEIGHTED CN --->		8.400			73.00 (73)

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT AREA A.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	210.00	ft
2yr, 24hr P	5.8000	in
Slope	.001000	ft/ft
Avg.Velocity	.06	ft/sec

Segment #1 Time: 1.0601 hrs

Segment #2: Tc: TR-55 Channel

Flow Area	22.0000	sq.ft
Wetted Perimeter	13.60	ft
Hydraulic Radius	1.62	ft
Slope	.001000	ft/ft
Mannings n	.0180	
Hydraulic Length	390.00	ft
Avg.Velocity	3.61	ft/sec

Segment #2 Time: .0300 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	27.5000	sq.ft
Wetted Perimeter	14.87	ft
Hydraulic Radius	1.85	ft
Slope	.001000	ft/ft
Mannings n	.0180	
Hydraulic Length	205.00	ft
Avg.Velocity	3.94	ft/sec

Segment #3 Time: .0144 hrs

==========
Total Tc: 1.1045 hrs
==========

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport Mississ

Storm Tag Name = Pre 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall 18" CULVERT	JCT	4.955		12.7000	25.37	
UPGRADIENT SE	AREA	4.955		12.7000	25.37	

PAGE 16 OF 39

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT AREA B.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Brush - brush, weed, grass mix - go	73	2.880			73.00
COMPOSITE AREA & WEIGHTED CN --->		2.880			73.00 (73)

::

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT AREA B.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	300.00	ft
2yr, 24hr P	5.8000	in
Slope	.001000	ft/ft

Avg.Velocity .06 ft/sec

Segment #1 Time: 1.4101 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	150.00	ft
Slope	.001000	ft/ft
Unpaved		

Avg.Velocity .51 ft/sec

Segment #2 Time: .0817 hrs

==========
Total Tc: 1.4918 hrs
==========

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport Mississ

Storm Tag Name = Pre 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall 2 - 8" CULVERTS	JCT	1.699	--	12.9500	7.23	
UPGRADIENT SW	AREA	1.699		12.9500	7.23	

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT AREA C.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Brush - brush, weed, grass mix - go	73	1.566			73.00
COMPOSITE AREA & WEIGHTED CN --->		1.566			73.00 (73)

::

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT AREA C.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	190.00	ft
2yr, 24hr P	5.8000	in
Slope	.005200	ft/ft

Avg.Velocity .10 ft/sec

Segment #1 Time: .5060 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6.00	ft
Slope	.333000	ft/ft
Unpaved		

Avg.Velocity 9.31 ft/sec

Segment #2 Time: .0002 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	20.0000	sq.ft
Wetted Perimeter	16.65	ft
Hydraulic Radius	1.20	ft
Slope	.003500	ft/ft
Mannings n	.0250	
Hydraulic Length	340.00	ft

Avg.Velocity 3.98 ft/sec

Segment #3 Time: .0237 hrs

==========
Total Tc: .5299 hrs
==========

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport Mississ

Storm Tag Name = Pre 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall 2 - 8" CULVERTS	JCT	.924		12.3500	6.99	
INSIDE LOOP	AREA	.924		12.3500	6.99	

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUTFALL

HYG Directory: C:\Program Files\Haestad\PPKW\Sample\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
FLOWPATH 1	AREA A		AREA A	25
FLOWPATH 2	AREA B		AREA B	25
FLOWPATH 4	AREA C		AREA C	25
FLOWPATH 3	DRAINAGE AREA 1		DRAINAGE AREA 1	25

INFLOWS TO: OUTFALL

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	AREA A	25	4.955	12.7000	25.37
	AREA B	25	1.699	12.9500	7.23
	AREA C	25	.924	12.3500	6.99
	DRAINAGE AREA 1	25	5.390	12.1000	57.74

TOTAL FLOW INTO: OUTFALL

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	OUTFALL	25	12.967	12.1000	73.54

TOTAL NODE INFLOW...
HYG file =
HYG ID = OUTFALL
HYG Tag = 25

Peak Discharge = 73.54 cfs
Time to Peak = 12.1000 hrs
HYG Volume = 12.967 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
1.2500	.00	.01	.01	.03	.04
1.5000	.05	.06	.07	.08	.09
1.7500	.10	.10	.11	.12	.13
2.0000	.14	.15	.16	.17	.17
2.2500	.18	.19	.20	.21	.22
2.5000	.23	.24	.25	.26	.27
2.7500	.27	.28	.29	.30	.31
3.0000	.32	.33	.34	.35	.36
3.2500	.36	.37	.38	.39	.40
3.5000	.41	.42	.43	.44	.45
3.7500	.45	.46	.47	.48	.49
4.0000	.50	.51	.52	.52	.53
4.2500	.54	.55	.56	.57	.57
4.5000	.58	.59	.60	.61	.62
4.7500	.63	.63	.64	.65	.66
5.0000	.67	.67	.68	.69	.70
5.2500	.71	.72	.72	.73	.74
5.5000	.75	.76	.76	.77	.78
5.7500	.79	.79	.80	.81	.82
6.0000	.82	.84	.85	.86	.88
6.2500	.90	.92	.94	.96	.98
6.5000	1.00	1.02	1.04	1.07	1.09
6.7500	1.12	1.14	1.16	1.19	1.22
7.0000	1.24	1.27	1.30	1.33	1.36
7.2500	1.39	1.43	1.45	1.48	1.52
7.5000	1.55	1.59	1.62	1.65	1.69
7.7500	1.72	1.76	1.79	1.83	1.87
8.0000	1.91	1.95	2.00	2.05	2.11
8.2500	2.17	2.24	2.29	2.36	2.42
8.5000	2.49	2.55	2.62	2.69	2.76
8.7500	2.83	2.90	2.97	3.05	3.12

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
9.0000	3.20	3.28	3.36	3.44	3.52
9.2500	3.60	3.69	3.77	3.86	3.94
9.5000	4.03	4.12	4.21	4.30	4.40
9.7500	4.49	4.59	4.68	4.78	4.88
10.0000	4.97	5.09	5.21	5.34	5.49
10.2500	5.63	5.79	5.93	6.09	6.25
10.5000	6.41	6.57	6.74	6.91	7.08
10.7500	7.25	7.44	7.62	7.80	7.99
11.0000	8.19	8.45	8.77	9.14	9.59
11.2500	10.03	10.50	10.96	11.47	11.96
11.5000	12.50	13.89	15.81	18.52	22.00
11.7500	25.31	29.14	32.87	37.02	48.17
12.0000	64.07	70.26	73.54	67.50	56.38
12.2500	52.80	51.35	50.59	49.35	48.23
12.5000	46.60	45.55	44.28	44.13	43.73
12.7500	43.16	42.50	41.44	40.23	39.02
13.0000	37.38	35.83	34.30	32.82	31.31
13.2500	29.84	28.51	27.19	25.84	24.70
13.5000	23.56	22.45	21.50	20.56	19.63
13.7500	18.86	18.10	17.37	16.71	16.09
14.0000	15.49	14.98	14.46	14.00	13.60
14.2500	13.20	12.81	12.47	12.14	11.83
14.5000	11.53	11.25	10.98	10.74	10.49
14.7500	10.26	10.05	9.84	9.63	9.44
15.0000	9.26	9.08	8.91	8.74	8.58
15.2500	8.43	8.27	8.12	7.98	7.83
15.5000	7.69	7.55	7.41	7.29	7.15
15.7500	7.03	6.90	6.78	6.66	6.54
16.0000	6.42	6.31	6.21	6.11	6.01
16.2500	5.92	5.84	5.75	5.66	5.58
16.5000	5.50	5.42	5.34	5.26	5.19
16.7500	5.12	5.04	4.98	4.91	4.84
17.0000	4.78	4.72	4.66	4.60	4.54
17.2500	4.48	4.43	4.37	4.32	4.26
17.5000	4.21	4.16	4.10	4.05	4.00
17.7500	3.95	3.90	3.85	3.80	3.75
18.0000	3.70	3.65	3.61	3.57	3.53
18.2500	3.50	3.46	3.43	3.39	3.36
18.5000	3.33	3.30	3.27	3.24	3.21
18.7500	3.19	3.16	3.14	3.11	3.09
19.0000	3.07	3.05	3.02	3.00	2.99
19.2500	2.97	2.95	2.93	2.91	2.89
19.5000	2.87	2.86	2.84	2.83	2.81
19.7500	2.79	2.78	2.76	2.74	2.73
20.0000	2.72	2.70	2.68	2.67	2.66

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
20.2500	2.65	2.63	2.62	2.60	2.59
20.5000	2.58	2.56	2.55	2.54	2.52
20.7500	2.51	2.50	2.49	2.48	2.47
21.0000	2.46	2.44	2.43	2.42	2.41
21.2500	2.40	2.39	2.37	2.36	2.35
21.5000	2.34	2.33	2.32	2.31	2.29
21.7500	2.28	2.28	2.26	2.25	2.24
22.0000	2.23	2.22	2.21	2.20	2.19
22.2500	2.17	2.16	2.15	2.14	2.13
22.5000	2.12	2.11	2.10	2.09	2.08
22.7500	2.06	2.05	2.04	2.03	2.02
23.0000	2.01	2.00	1.99	1.98	1.97
23.2500	1.96	1.94	1.93	1.93	1.92
23.5000	1.90	1.89	1.88	1.87	1.86
23.7500	1.85	1.84	1.83	1.81	1.80
24.0000	1.79	1.59	1.29	1.18	1.13
24.2500	1.09	1.05	1.01	.96	.91
24.5000	.86	.81	.75	.70	.65
24.7500	.60	.55	.51	.46	.42
25.0000	.38	.34	.31	.28	.26
25.2500	.23	.21	.19	.17	.16
25.5000	.14	.13	.12	.10	.10
25.7500	.09	.08	.07	.06	.06
26.0000	.05	.05	.04	.04	.04
26.2500	.03	.03	.03	.02	.02
26.5000	.02	.02	.02	.01	.01
26.7500	.01	.01	.01	.01	.01
27.0000	.01	.01	.01	.01	.00
27.2500	.00	.00	.00	.00	.00
27.5000	.00	.00	.00	.00	.00
27.7500	.00	.00	.00	.00	

Depth of Flow in Down Gradient Channel
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Downgradient Ch
Flow Element	Trapezoidal Char
Method	Manning's Formu
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Channel Slope	002970	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	5.00	ft
Discharge	73.54	cfs

Results		
Depth	2.26	ft
Flow Area	21.5	ft²
Wetted Perim	15.11	ft
Top Width	14.04	ft
Critical Depth	1.53	ft
Critical Slope	0.013778	ft/ft
Velocity	3.42	ft/s
Velocity Head	0.18	ft
Specific Energ	2.44	ft
Froude Numb	0.49	
Flow Type	Subcritical	

PROJECT: NCBC GULFPORT, MS
SITE 8A 2 - 18" DRAINAGE PIPES

STATION: _____
SHEET _____ OF _____

CULVERT DESIGN FORM

DESIGNER / DATE: _____ / _____
REVIEWER / DATE: _____ / _____

HYDROLOGICAL DATA

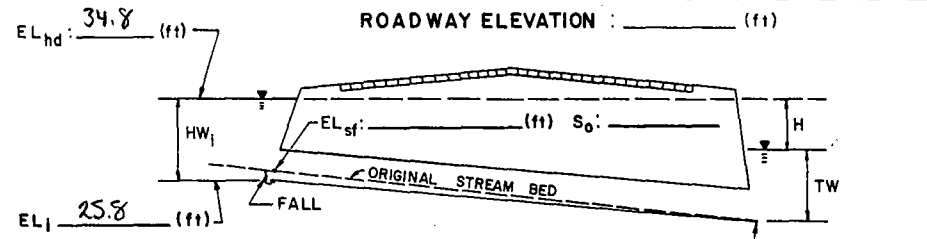
SEE ADD'L. SHTS.

- ☐ METHOD: _____
- ☐ DRAINAGE AREA: _____ ☐ STREAM SLOPE: _____
- ☐ CHANNEL SHAPE: _____
- ☐ ROUTING: _____ ☐ OTHER: _____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
25 yr - 24 hr.	73.54	2.26

ROADWAY ELEVATION: _____ (ft)



Q = 73.54
N = 2
D = 1.5

$S \approx S_o - FALL / L_a$
S = 0.006 ft/ft
L_a = 83'

CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	k_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
RCP - Circle - Projecting	73.54	36.77	>6	>9	-	34.8	2.26	1.5'	1.5'	2.26	0.5	20.02	47.58	47.58	20.77	INLET CONTROL OFF-CHART

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) $HW_i/D = HW/D$ OR HW_f/D FROM DESIGN CHARTS

(3) $FALL = HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e + (29 n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

a. APPROXIMATE
f. CULVERT FACE
hd. DESIGN HEADWATER
hi. HEADWATER IN INLET CONTROL
ho. HEADWATER IN OUTLET CONTROL
i. INLET CONTROL SECTION
o. OUTLET
sf. STREAMBED AT CULVERT FACE
tw. TAILWATER

COMMENTS / DISCUSSION:

$H = \left[1 + 0.5 + \left[29(0.013^2)(83)\right] / (0.3758^{1.33})\right] 19.59^2/32.2(2)$

$R = A/WP = 1.77\ ft^2 / 4.71\ ft = 0.3758$

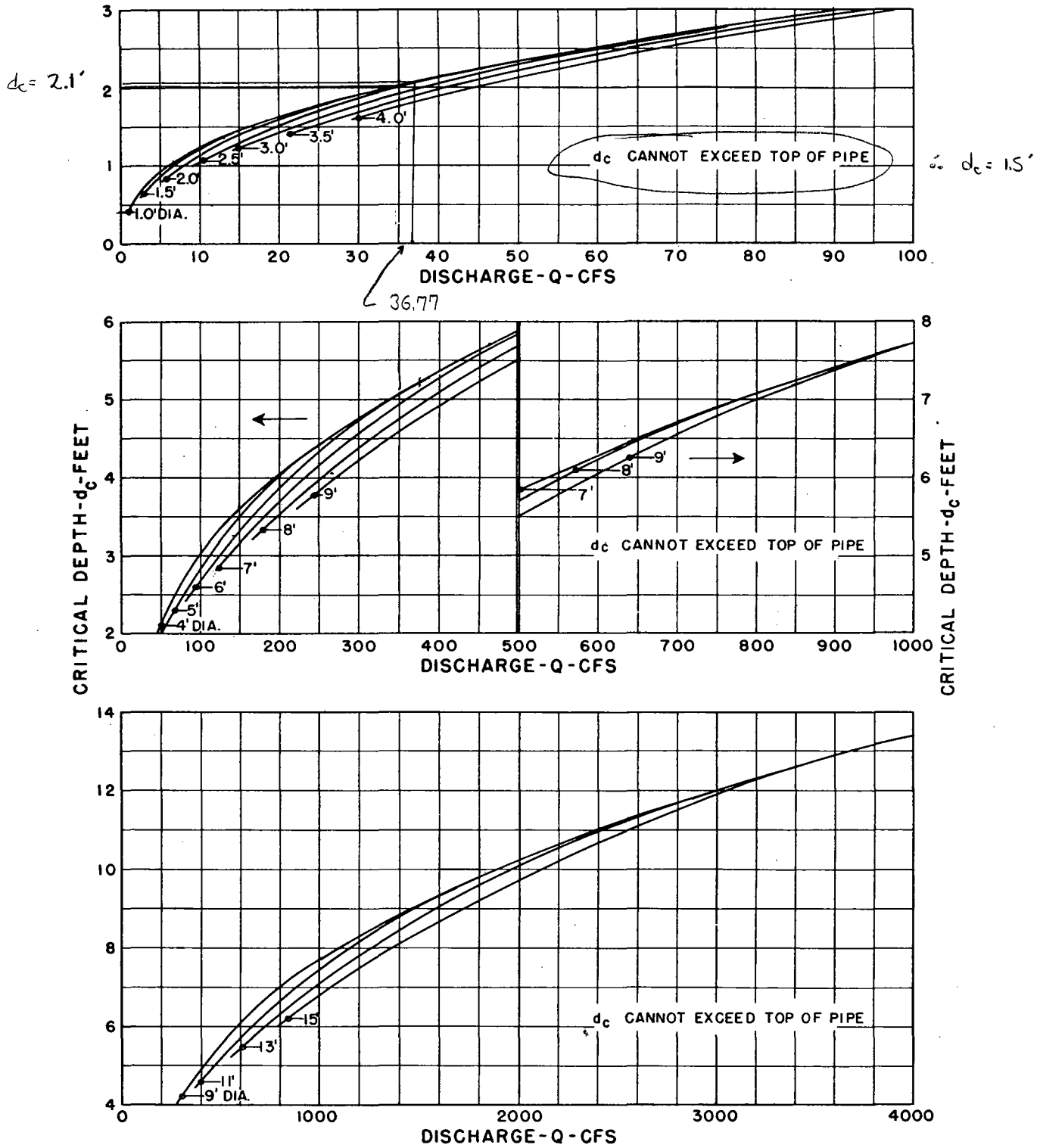
$V = Q/A = 36.77/1.77 = 20.77$

$H = (2.99)(20.77^2)/(64.4) = 20.02$

CULVERT BARREL SELECTED:

SIZE: 18" Dia
SHAPE: Circle
MATERIAL: Concrete n 0.013
ENTRANCE: Projecting

CHART 4

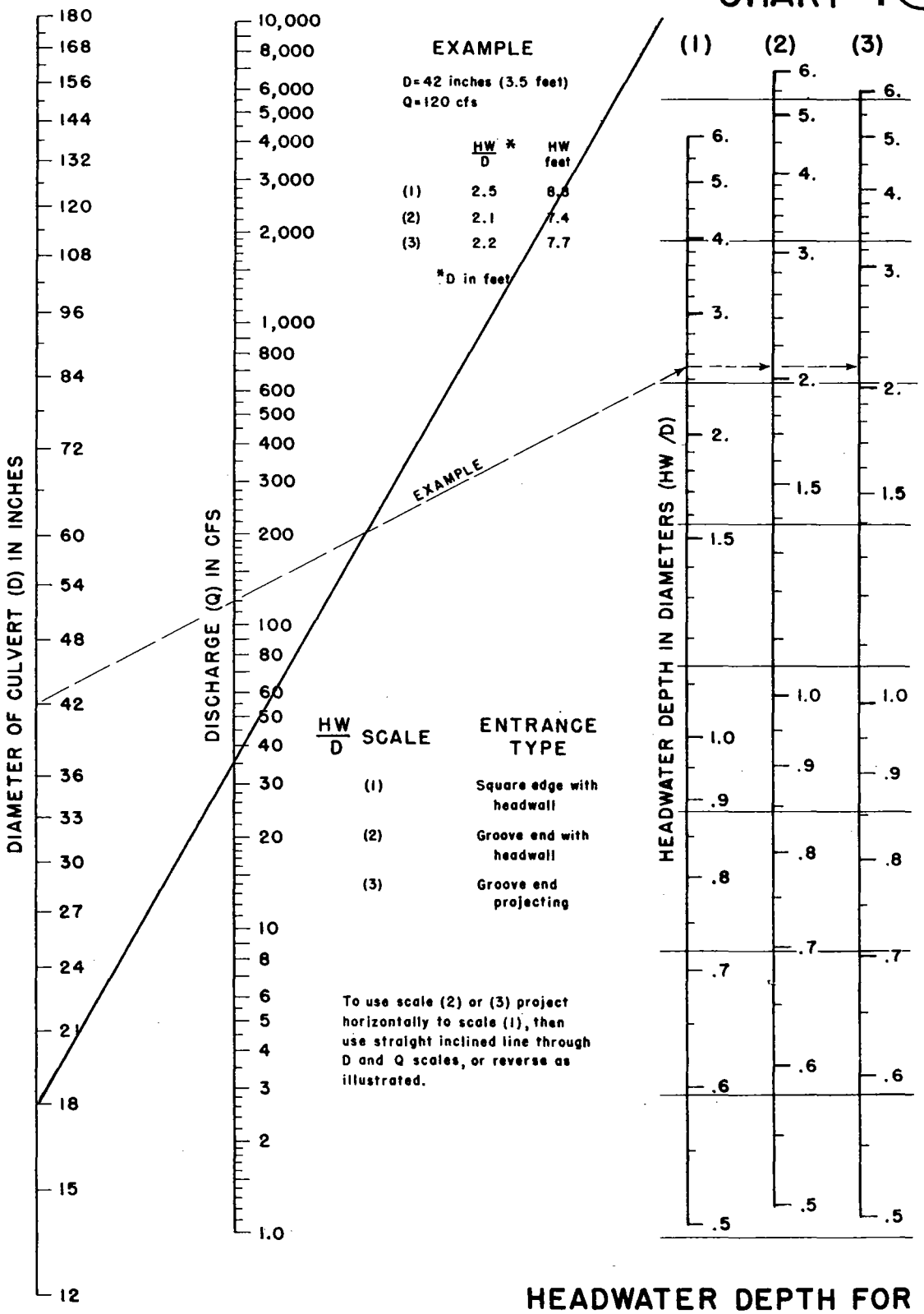


BUREAU OF PUBLIC ROADS

JAN. 1964

CRITICAL DEPTH
CIRCULAR PIPE

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A PROPOSED CULVERT EVALUATION.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Topsoil (HSG = C)	74	.500			74.00
Portland Cement Amended Soil	98	2.540			98.00
Pavement	98	.480			98.00
COMPOSITE AREA & WEIGHTED CN --->		3.520			94.59 (95)

::

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A PROPOSED CULVERT EVALUATION.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	140.00	ft
2yr, 24hr P	5.8000	in
Slope	.010000	ft/ft
Avg.Velocity	1.50	ft/sec

Segment #1 Time: .0259 hrs

Segment #2: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	45.00	ft
2yr, 24hr P	5.8000	in
Slope	.100000	ft/ft
Avg.Velocity	3.00	ft/sec

Segment #2 Time: .0042 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	28.7500	sq.ft
Wetted Perimeter	19.81	ft
Hydraulic Radius	1.45	ft
Slope	.009900	ft/ft
Mannings n	.0250	
Hydraulic Length	515.00	ft
Avg.Velocity	7.60	ft/sec

Segment #3 Time: .0188 hrs

==========
Total Tc: .0489 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .0833 hrs
==========

Type.... Executive Summary (Nodes) Page 2.09
Name.... Watershed Event: 25 yr
File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A PROPOSED CULVERT EVALUATION.PPW
Storm... TypeIII 24hr Tag: 25

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport Mississ

Storm Tag Name = 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DRAINAGE AREA 1	AREA	2.902		12.1000	30.89	
Outfall OUT FALL	JCT	2.902		12.1000	30.89	

Type.... Node: Addition Summary Page 8.17
Name.... PROPOSED CULVERT Event: 25 yr
File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT CULVERT AREA AND AREA A.PPW
Storm... TypeIII 24hr Tag: 25

SUMMARY FOR HYDROGRAPH ADDITION
at Node: PROPOSED CULVERT

HYG Directory: C:\Program Files\Haestad\PPKW\Sample\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
FLOWPATH 2	AREA A		AREA A	25
FLOWPATH 1	SITE 8A		SITE 8A	25

INFLOWS TO: PROPOSED CULVERT

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	AREA A	25	4.955	12.7000	25.37
	SITE 8A	25	2.902	12.1000	30.89

TOTAL FLOW INTO: PROPOSED CULVERT

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	PROPOSED CULVERT	25	7.857	12.1000	40.26

PAGE 34 OF 39

TOTAL NODE INFLOW...
HYG file =
HYG ID = PROPOSED CULVERT
HYG Tag = 25

Peak Discharge = 40.26 cfs
Time to Peak = 12.1000 hrs
HYG Volume = 7.857 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
1.0500	.00	.01	.01	.02	.03
1.3000	.03	.04	.04	.05	.06
1.5500	.06	.07	.07	.08	.08
1.8000	.09	.09	.10	.10	.11
2.0500	.11	.12	.12	.13	.13
2.3000	.14	.14	.15	.15	.16
2.5500	.16	.17	.17	.18	.18
2.8000	.19	.19	.20	.20	.21
3.0500	.21	.22	.22	.23	.23
3.3000	.24	.24	.25	.25	.26
3.5500	.26	.26	.27	.27	.28
3.8000	.28	.29	.29	.30	.30
4.0500	.31	.31	.32	.32	.32
4.3000	.33	.33	.34	.34	.35
4.5500	.35	.36	.36	.36	.37
4.8000	.37	.38	.38	.39	.39
5.0500	.39	.40	.40	.41	.41
5.3000	.42	.42	.42	.43	.43
5.5500	.44	.44	.44	.45	.45
5.8000	.46	.46	.46	.47	.47
6.0500	.48	.49	.49	.50	.51
6.3000	.52	.53	.54	.55	.57
6.5500	.58	.59	.60	.62	.63
6.8000	.64	.66	.68	.69	.70
7.0500	.72	.74	.76	.77	.79
7.3000	.81	.83	.84	.86	.88
7.5500	.90	.92	.94	.96	.98
7.8000	1.00	1.03	1.05	1.07	1.09
8.0500	1.12	1.15	1.18	1.21	1.25
8.3000	1.28	1.32	1.35	1.39	1.43
8.5500	1.47	1.51	1.55	1.59	1.63

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
8.8000	1.67	1.71	1.76	1.80	1.84
9.0500	1.89	1.94	1.99	2.03	2.08
9.3000	2.13	2.18	2.23	2.29	2.34
9.5500	2.39	2.45	2.50	2.56	2.61
9.8000	2.67	2.73	2.79	2.85	2.90
10.0500	2.97	3.04	3.13	3.21	3.30
10.3000	3.38	3.47	3.56	3.65	3.75
10.5500	3.84	3.94	4.04	4.14	4.24
10.8000	4.35	4.46	4.57	4.68	4.80
11.0500	4.96	5.14	5.37	5.62	5.88
11.3000	6.14	6.40	6.68	6.97	7.26
11.5500	8.13	9.14	10.75	12.59	14.46
11.8000	16.44	18.56	20.74	27.53	35.77
12.0500	38.64	40.26	36.19	30.52	29.14
12.3000	29.02	29.15	29.19	29.12	29.05
12.5500	29.04	28.90	29.33	29.34	29.13
12.8000	28.92	28.23	27.36	26.50	25.32
13.0500	24.11	22.91	21.74	20.58	19.42
13.3000	18.41	17.42	16.42	15.62	14.82
13.5500	14.03	13.39	12.75	12.13	11.62
13.8000	11.12	10.63	10.22	9.82	9.43
14.0500	9.10	8.78	8.48	8.23	7.98
14.3000	7.74	7.53	7.33	7.13	6.95
14.5500	6.78	6.61	6.46	6.31	6.18
14.8000	6.05	5.92	5.80	5.69	5.58
15.0500	5.48	5.38	5.28	5.19	5.09
15.3000	5.00	4.91	4.83	4.74	4.66
15.5500	4.57	4.49	4.42	4.34	4.27
15.8000	4.19	4.12	4.05	3.98	3.91
16.0500	3.85	3.79	3.73	3.67	3.62
16.3000	3.56	3.51	3.45	3.40	3.35
16.5500	3.31	3.26	3.21	3.17	3.12
16.8000	3.08	3.04	3.00	2.96	2.92
17.0500	2.88	2.85	2.81	2.77	2.74
17.3000	2.71	2.68	2.64	2.61	2.58
17.5500	2.55	2.51	2.48	2.45	2.42
17.8000	2.39	2.36	2.33	2.30	2.27
18.0500	2.24	2.21	2.19	2.17	2.14
18.3000	2.12	2.10	2.08	2.06	2.04
18.5500	2.02	2.00	1.98	1.96	1.94
18.8000	1.93	1.91	1.90	1.88	1.87
19.0500	1.86	1.84	1.83	1.82	1.81
19.3000	1.80	1.79	1.78	1.77	1.75
19.5500	1.75	1.74	1.73	1.71	1.71
19.8000	1.70	1.69	1.68	1.67	1.66

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HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
20.0500	1.65	1.64	1.63	1.63	1.62
20.3000	1.61	1.60	1.59	1.58	1.58
20.5500	1.57	1.56	1.55	1.54	1.54
20.8000	1.53	1.52	1.51	1.51	1.50
21.0500	1.49	1.49	1.48	1.47	1.47
21.3000	1.46	1.45	1.45	1.44	1.43
21.5500	1.42	1.42	1.41	1.40	1.40
21.8000	1.39	1.39	1.38	1.37	1.36
22.0500	1.36	1.35	1.34	1.34	1.33
22.3000	1.32	1.32	1.31	1.30	1.30
22.5500	1.29	1.29	1.28	1.27	1.26
22.8000	1.26	1.25	1.24	1.24	1.23
23.0500	1.22	1.22	1.21	1.21	1.20
23.3000	1.19	1.18	1.18	1.17	1.16
23.5500	1.16	1.15	1.14	1.14	1.13
23.8000	1.13	1.12	1.11	1.10	1.10
24.0500	.97	.81	.77	.74	.72
24.3000	.71	.68	.65	.62	.59
24.5500	.55	.51	.47	.44	.40
24.8000	.36	.33	.29	.27	.24
25.0500	.21	.19	.17	.15	.13
25.3000	.12	.11	.10	.09	.08
25.5500	.07	.06	.05	.05	.04
25.8000	.04	.03	.03	.03	.02
26.0500	.02	.02	.02	.02	.01
26.3000	.01	.01	.01	.01	.01
26.5500	.01	.01	.01	.00	.00
26.8000	.00	.00	.00	.00	.00
27.0500	.00	.00	.00	.00	

PROJECT: NCBC GULFPORT, MS SITE 8A PROPOSED CULVERT EVALUATION	STATION: _____ SHEET ____ OF ____	CULVERT DESIGN FORM DESIGNER / DATE: ____ / ____ REVIEWER / DATE: ____ / ____

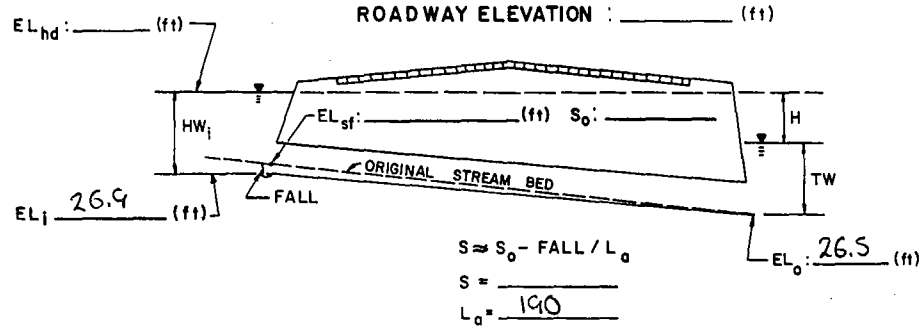
HYDROLOGICAL DATA

SEE ADD'L. SHTS.

- ☐ METHOD: _____
- ☐ DRAINAGE AREA: _____ ☐ STREAM SLOPE: _____
- ☐ CHANNEL SHAPE: _____
- ☐ ROUTING: _____ ☐ OTHER: _____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
25-Year	40.26	2.5



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL: HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL: TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	k_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
Concrete - Circle - 24" dia	40.26	40.26	3.3	6.6	0	33.5	2.5	2	2	2.5	0.5	9.8	38.8	38.8	12.82	EXCEEDS BANKS
CONCRETE - Circle = 30" dia	40.26	40.26	1.56	3.9	0	30.8	2.5	2.15	2.33	2.5	0.5	3.4	32.4	32.4	8.2	EXCEED BANKS
Concrete - Circle = 36" dia	40.26	40.26	1.04	3.12	0	30.02	2.5	2.05	2.52	2.52	0.5	1.45	30.47	30.47	5.7	WITHIN BANKS

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW /D OR HW_f/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e + (29n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

a. APPROXIMATE
f. CULVERT FACE
hd. DESIGN HEADWATER
hi. HEADWATER IN INLET CONTROL
ho. HEADWATER IN OUTLET CONTROL
i. INLET CONTROL SECTION
o. OUTLET
sf. STREAMBED AT CULVERT FACE
tw. TAILWATER

COMMENTS / DISCUSSION:

24" Φ R = A/WP = 3.14/6.28 = 0.5
V = 40.26/3.14 = 12.82

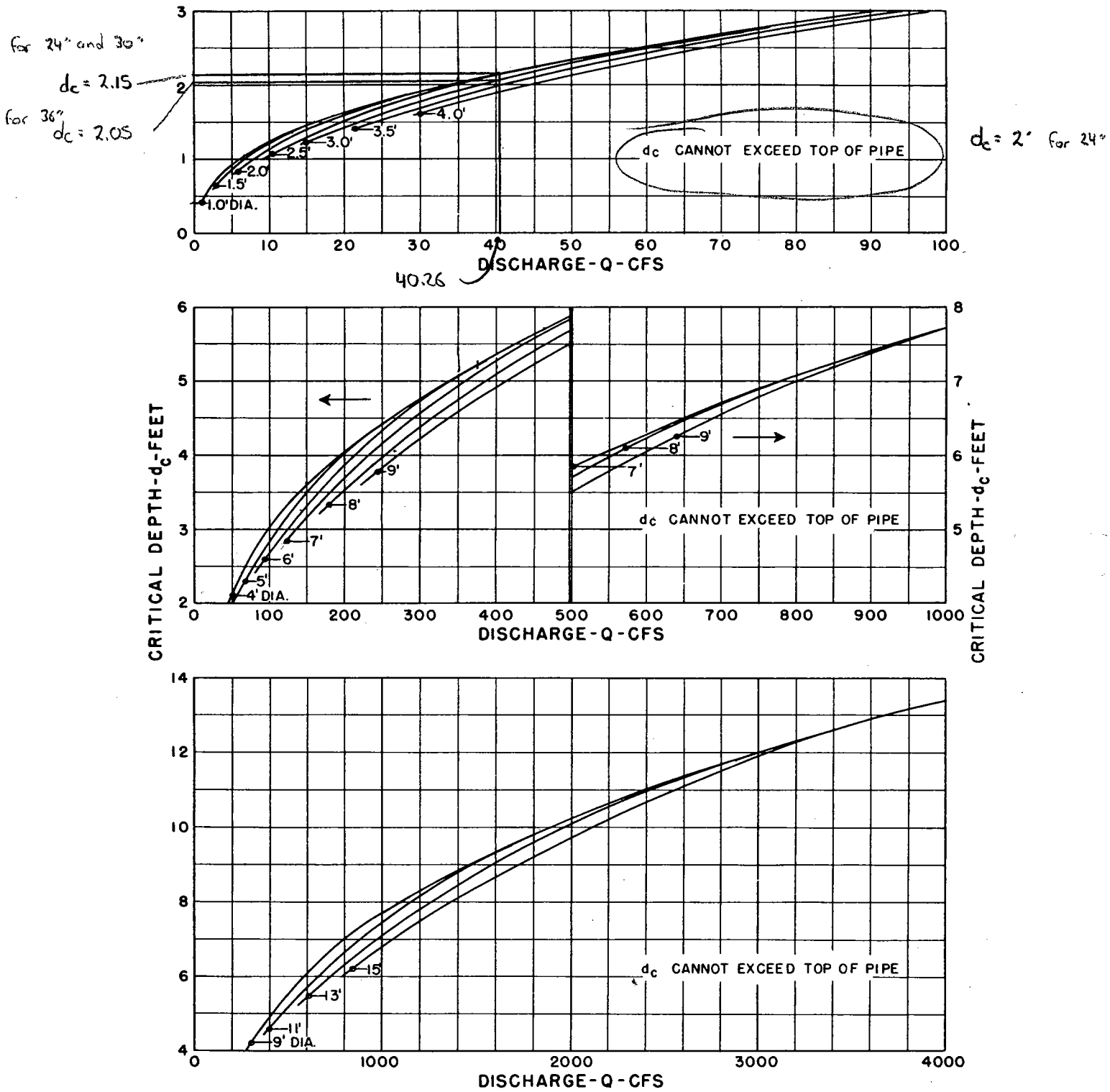
30" Φ R = A/WP = 4.91/7.85 = 0.62
V = 40.26/4.91 = 8.2

36" Φ R = A/WP = 7.07/9.42 = 0.75
V = 40.26/7.07 = 5.7

CULVERT BARREL SELECTED:

SIZE: _____
SHAPE: Circle
MATERIAL: Concrete n 0.013
ENTRANCE: Projecting

CHART 4

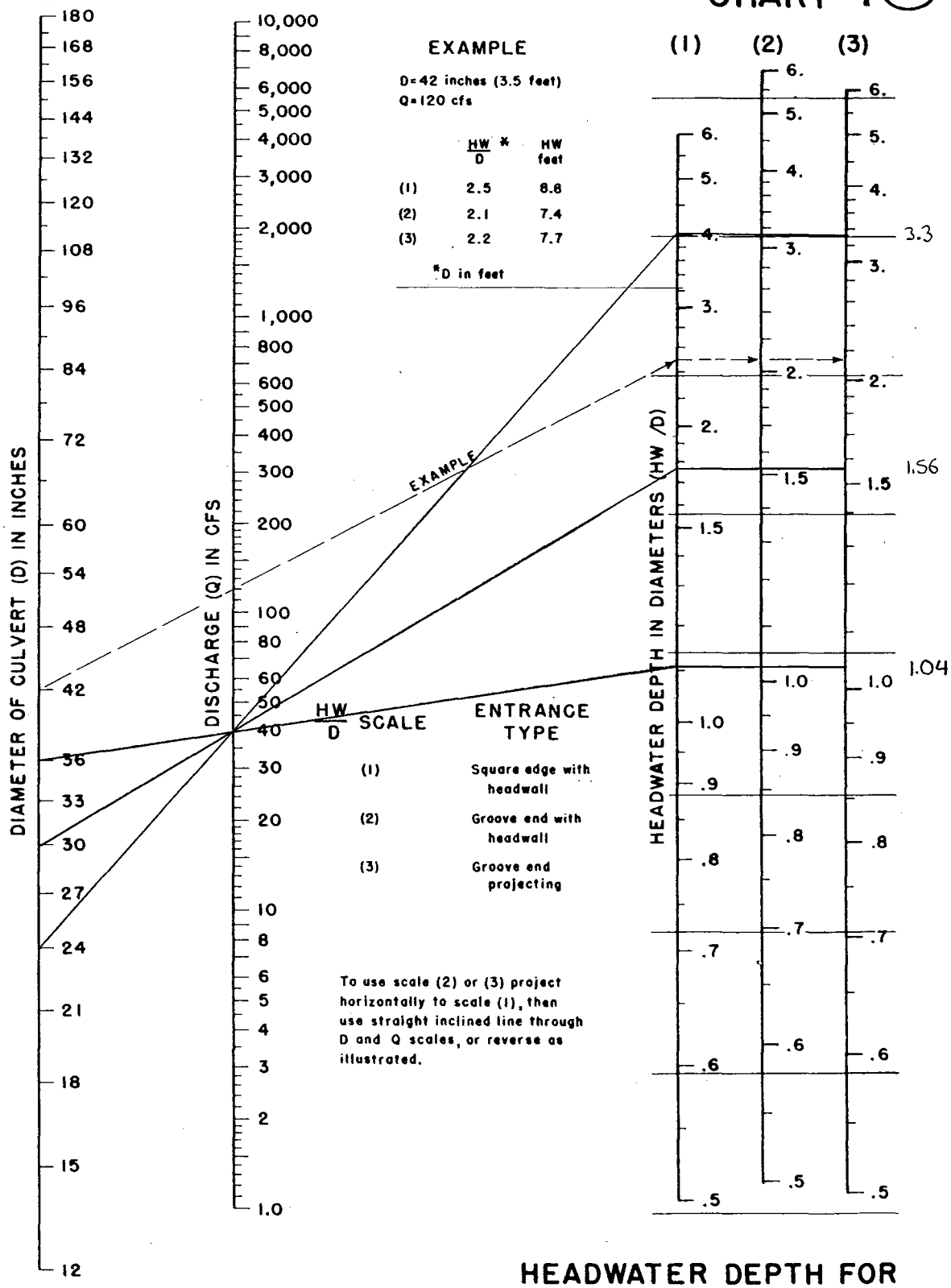


BUREAU OF PUBLIC ROADS

JAN. 1964

CRITICAL DEPTH
CIRCULAR PIPE

CHART 1



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

APPENDIX C

WETLAND DELINEATION REPORT

Wetland Delineation Report
for
Off-Base Area of Contamination Associated with Site 8 – Herbicide Orange Storage Area

Naval Construction Battalion Center
Gulfport, Mississippi

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888

Contract Task Order 0272

May 2003

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4.0 CONCLUSIONS **4-1**

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Attachments

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FIGURES

NUMBER **PAGE NO.**

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ACRONYMS

AOC	Area of Contamination
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DBH	diameter at breast height
FAC	Facultative
FACU	Facultative Upland
FACW	Facultative Wetland
FICWD	Federal Interagency Committee for Wetland Delineation
FWS	United States Fish & Wildlife Service
HO	Herbicide Orange
µg/kg	microgram per kilogram
NCBC	Naval Construction Battalion Center
NTCHS	National Technical Committee for Hydric Soils
NWS	National Weather Service
OBL	Obligate Wetland
PFO	Palustrine Forested
SAF	Society of American Foresters
SCS	United States Soil Conservation Service
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
UPL	Obligate Upland
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USC	United States Code

1.0 INTRODUCTION

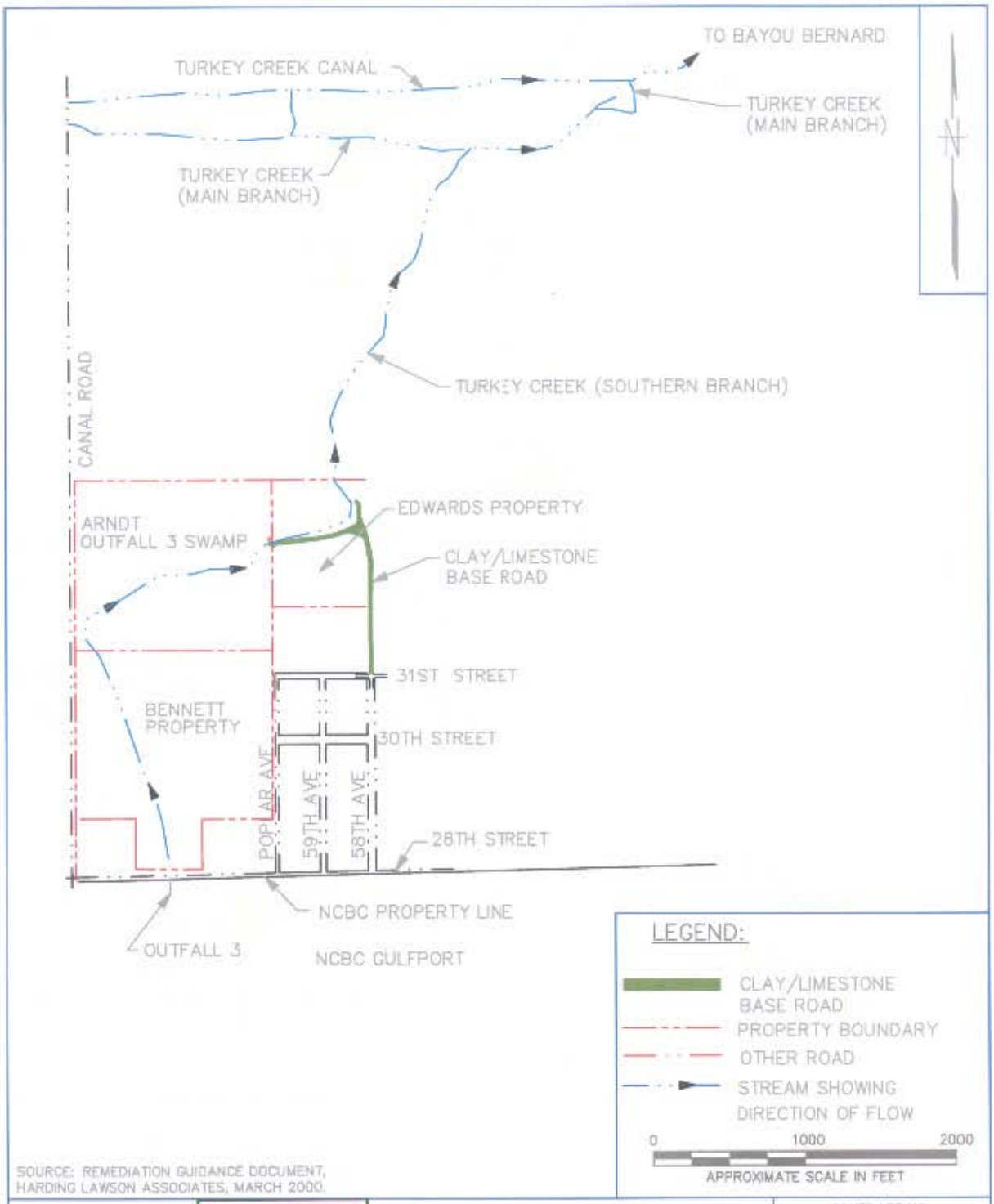
Areas meeting the definition of wetlands used by the United States Environmental Protection Agency (USEPA) and the United States Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (33 USC 1344) were delineated on off-base property potentially affected by chemical contamination originating from that part of the Naval Construction Battalion Center (NCBC) Gulfport, Mississippi designated as Site 8 - Herbicide Orange (HO) Storage Area. The chemical contamination will be remediated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC 9601 et seq.). The USACE and USEPA define wetlands as "those areas that are inundated or saturated at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 230.3 and 33 CFR 328.3)". Under this definition, wetlands may be either under the influence of tides (tidal) or unaffected by tides (nontidal).

Site 8 is located in the north-central part of NCBC Gulfport. Prior to 1968, Site 8 was used for equipment storage and staging. Between 1968 and 1977, the site was used for the storage and handling of HO. Spills and leaks occurred that contaminated the surface soil and sediment with HO mixture components including 2,4,5-T and 2,4-D as well as with HO byproduct contaminants (dioxins and furans), primarily 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). In 1977, the HO was removed and incinerated off site, after which the site was fenced and left inactive. From 1985 to 1987, soil and sediment on Site 8 containing in excess of 1.0 microgram per kilogram (µg/kg) TCDD were excavated and incinerated on site, and the ash was stockpiled on site. This remedial action did not, however, address soil and sediment in a system of drainage channels that received contaminants from the site.

Contamination thought to have originated at Site 8 has apparently migrated via the drainage channel system to three off-base, privately owned properties [the off-base Area of Contamination (AOC)] north of the central part of NCBC Gulfport. These off-base properties are located downgradient (north-northeast) of Outfall 3, north of 28th Street and east of Canal Road (Figure 1-1). The properties are referred to as the Bennett, Arndt, and Edwards properties, respectively.

NCBC Gulfport, including Site 8 and other on-base areas potentially affected by Site 8, has been the subject of an earlier base-wide wetland delineation. This wetland delineation report, therefore, addresses only off-base areas (i.e., those portions of the Bennett, Arndt, and Edwards properties) potentially affected by contamination originating from Site 8. Information from this report will be combined with information from the previously completed base-wide wetland delineation to prepare a Joint Permit

Application requesting authorization to impact wetlands as necessary to remediate all areas affected by Site 8.



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

DRAWN BY AL DATE 12/13/02	AREAL EXTENT OF OFF-BASE OFFBASE PROPERTIES AFFECTED BY SITE 8 HERBICIDE ORANGE STORAGE AREA NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 7379	
CHECKED BY PD DATE 12/13/02		APPROVED BY	DATE
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SCALE AS NOTED		DRAWING NO. FIGURE 1-1	REV. 0

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2.0 METHODOLOGY

Fieldwork for the wetland delineation was conducted between October 20 and 23, 2002. The wetland delineation followed the routine on-site methodology outlined in the USACE Wetlands Delineation Manual (1987 Manual) (Environmental Laboratory, 1987) and the USACE memorandum on clarification and interpretation of that manual (USACE, 1992). With a few exceptions referred to as problem areas, any area identified as a wetland according to the 1987 Manual must display positive evidence of each of the following three parameters indicative of wetland conditions:

- Hydrophytic vegetation – Defined as the sum total of macrophytic plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

- Hydric soil – Defined as a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation.

- Wetland hydrology – Defined as the sum total of wetness characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation (Environmental Laboratory, 1987).

The fieldwork commenced with a site walkover to identify areas displaying positive evidence of the three parameters. Representative data collection points were then selected for each area to record data used as the basis for determining the wetland boundary. The data points were located on representative transects oriented perpendicular to the hydrological gradient. For each transect, one data point was positioned approximately 10 feet downgradient of the boundary (i.e., inside of the wetland), one data point was positioned on the boundary, and one data point was positioned approximately 10 feet upgradient of the boundary (i.e., outside of the wetland). Because of the relatively homogeneous character of vegetation and soils on each wetland boundary, only one transect of data points per boundary was needed to obtain adequate data.

The transects of data points used in determining wetland boundaries provided descriptive information only about the outermost (drier) margin of the wetlands. Vegetation, soils, and hydrology data characterizing the interior (wetter) part of wetlands is not necessary for a wetland delineation report. However, because descriptive data about the interior portions of the wetlands could support permitting activities, six additional data points were selected at representative locations from the interior of the wetlands. Vegetation, soils, and hydrology data were recorded at these interior locations in the same manner as for locations near the wetland boundaries.

At each data point, dominant plant species for each vegetative stratum (tree canopy, saplings, shrubs, herbs, and woody vines) were determined based on estimated percent aerial cover (Table 2-1). Wetland indicator status categories developed by the U.S. Fish & Wildlife Service (FWS) (Reed, 1988) were assigned to each dominant species and were used as the basis for determining whether the vegetation was hydrophytic (Table 2-2). A soil pit was hand augured at each data point location to a minimum depth of 20 inches, and color, texture, and other descriptive data were recorded for each encountered soil horizon. These observations were used to determine whether field indicators of hydric soils, as listed in the 1987 Manual and by the Natural Resources Conservation Service (NRCS, 1998), were present. Surface and subsurface observations were made at each data point to determine which field indicators of wetland hydrology, as listed in the 1987 Manual, were present.

Wetland delineation data sheets developed by the USACE (USACE, 1992) were completed for each data point and are provided in Attachment 1. Four wetland boundaries were identified in the area addressed by the wetland delineation (Boundaries A through D). Each wetland boundary was marked in the field using wooden stakes and pink surveying tape. Each stake was labeled "WET X-N", with "X" as a letter from A to D (corresponding to the boundary and "N" as the numeric order of the stake. A land survey depicting the location of each stake was subsequently completed and is the basis for the wetland delineation map provided in Section 3.0.

Data point locations were also staked and labeled. Data points on transects to the boundary were labeled "WET DP X-N-Y", where "X-N" corresponds to the wetland boundary stake included in the transect and "Y" corresponds to the position on the transect. For each transect, position "1" was assigned to the downgradient data point, position "2" was assigned to the data point on the boundary, and position "3" was assigned to the upgradient data point. Data points in the interior of the wetlands were are labeled with reference to other physical features in the area.

TABLE 2-1

**DEFINITIONS OF VEGETATION STRATA USED IN WETLAND DELINEATION
OFF-BASE AOC ASSOCIATED WITH SITE 8
NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI**

Stratum	Symbol	Definition[1]	Plot Diameter (feet)[2]
Canopy	C	Trees over 5 inches in diameter at breast height (DBH)	30
Saplings	SA	Woody plants over 20 feet in height but under 5 inches DBH	15
Shrubs	SH	Woody plants under 20 feet in height	15
Herbaceous Groundcover	H	Nonwoody plants and woody seedlings under 3 feet in height	5
Woody Vines	V	Woody vines attached to the trunks of trees or saplings	15

1 Source: FICWD, 1989
2 Plot size used for visually estimating percent aerial cover for plant species (circular plots)

TABLE 2-2

DEFINITIONS OF VEGETATION STRATA USED IN WETLAND DELINEATION OFF-BASE AOC ASSOCIATED WITH SITE 8 NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI

Vegetation Strata	Definition
Obligate wetland (OBL)	Species recognized as occurring in wetlands greater than 99 percent of the time
Facultative wetland (FACW)	Species recognized as occurring in wetlands 67 to 99 percent of the time
Facultative (FAC)	Species equally likely to occur in wetlands or uplands (nonwetlands)
Facultative upland (FACU)	Species recognized as occurring in wetlands 1 to 33 percent of the time
Obligate upland (UPL)	Species recognized as occurring in wetlands less than 1 percent of the time

Source: Reed, 1988.

3.0 RESULTS AND DISCUSSION

Overview: Four wetland boundaries (Boundaries A, B, C, and D) were identified within the area addressed by the wetland delineation (Figure 3-1). All of the boundaries enclose a single, contiguous wetland area. The southern part of the wetland, occupying most of the central and western parts of the Bennett property, adjoins each side of a man-made drainage ditch that flows northwest from Outfall 3 on the northern NCBC perimeter (28th Street). The ditch exits the area addressed by the wetland delineation via a culvert under Canal Road. The northern part of the wetland, occupying most of the western and northeastern part of the Arndt property and the western part of the Edwards property, lacks a distinct channel but appears to convey surface flow in an easterly-northeasterly direction.

Boundary A (WET A-1 to WET A-37) marks the western edge of the wetland on the Bennett property. Boundary B (WET B-1 to WET B-16) marks the eastern edge of the wetland in the southern part of the Bennett property (and on adjoining areas of another property termed the Jebco Property). Uplands east of Boundary B (on the Jebco Property) support a communication tower and associated guy wires. The delineation of Boundary B was terminated north of the tower because this boundary is substantially distant from the area subject to contamination from Site 8.

The majority of the Edwards property west of 58th Avenue and the associated gravel-paved access road is wetland. Boundary C (WET C-1 to WET C-6) identifies a very small area of non-wetlands at the southern limit of the access road. Boundary D (WET D-1 to WET D-33) marks the southward extension of wetlands in the southwestern part of the Edwards property and the southeastern part of the Arndt property. The delineation of Boundary D was terminated at WET D-33 because the boundary at that point is substantially distant from the area subject to contamination.

Attachment 1 includes completed data sheets for each data point shown in Figure 3-1. Table 3-1 summarizes information from the data sheets including field observations of vegetation, soils, and hydrology for each data point on representative transects perpendicular to each of the four delineated boundaries. Each transect includes data points located approximately 10 feet inside the wetland boundary, on the wetland boundary, and approximately 10 feet outside the wetland boundary. Table 3-1 illustrates how the vegetation, soils, and hydrology change with respect to the delineated wetland boundaries.

The sections below summarize the vegetation, soils, hydrology, classification, and functions and values for the delineated wetland. The discussion focuses on the wetland as a whole rather than on specific areas within the wetland.

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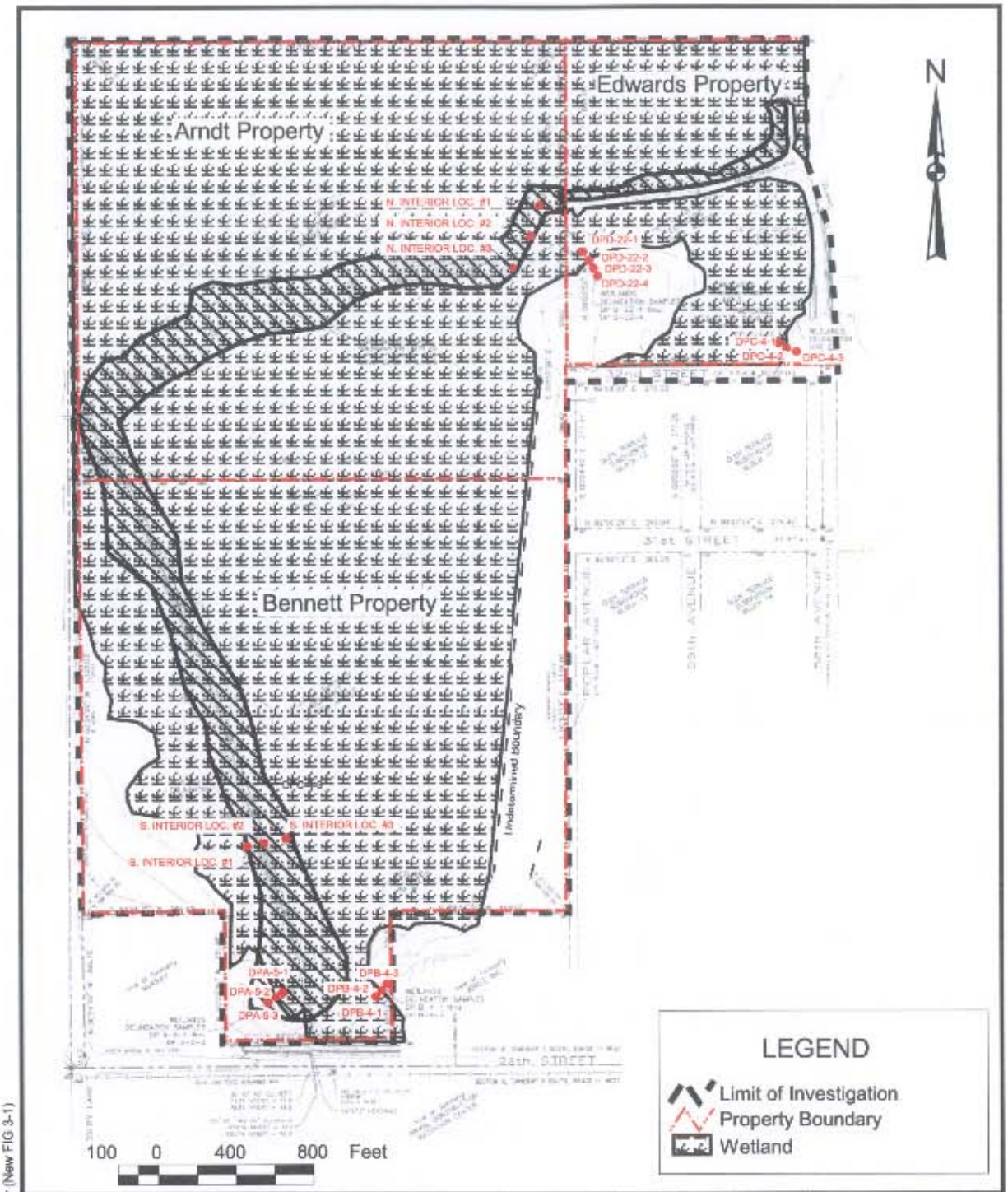

DRAWN BY AL DATE 01/07/03	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7379	OWNER NO. —
CHECKED BY PD DATE 01/07/03	WETLAND DELINEATION MAP OFFBASE AREAS ASSOCIATED WITH SITE 8 HERBICIDE ORANGE STORAGE AREA NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	APPROVED BY — DATE —	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO FIGURE 3-1	REV 0

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TABLE 3-1

SUMMARY OF VEGETATION, SOILS, AND HYDROLOGY DATA USED IN WETLAND DELINEATION
OFF-BASE AOC ASSOCIATED WITH SITE 8
NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI
PAGE 1 OF 2

Data Point	Vegetation			Soils				Hydrology					Wetland
	Description	% OBL FACW FAC	Hydrophytic	Matrix	Mottle	NTCHS Indicator	Hydric	Depth of Inundation (inches)	Depth to Saturation (inches)	Primary Indicators	Secondary Indicators	Wetland Hydrology	
Transect A (Perpendicular to Stake WET A-5)													
1 (10' Inside)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/1	10YR 5/6	F3	Yes	0	2	Visible Saturation	Root Ch. FAC Neut.	Yes	Yes
2	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/2	10YR 5/6	F3	Yes	0	8	Visible Saturation	Root Ch. FAC Neut.	Yes	Yes
3 (10' Out)	Slash Pine Forest (SAF 84)	83	Yes	10YR 5/2	10YR 5/3 Polychromatic	None	No	0	15	None	FAC Neut.	No	No
Transect B (Perpendicular to Stake WET B-4)													
1 (10' Inside)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/2	10YR 5/6	F3	Yes	0	4	Visible Saturation	Root Ch. FAC Neut.	Yes	Yes
2 (Boundary)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/2	10YR 5/6	F3	Yes	0	4	Visible Saturation	Root Ch. FAC Neut.	Yes	Yes
3 (10' Out)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/1	10YR 5/3 Polychromatic	None	No	0	10	None (Recent Heavy Rain)	FAC Neut.	No	No
Transect C (Perpendicular to Stake WET C-4)													
1 (10' Inside)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/1	10YR 5/6	F3	Yes	0	6	Visible Saturation	Root Ch. FAC Neut.	Yes	Yes

TABLE 3-1

SUMMARY OF VEGETATION, SOILS, AND HYDROLOGY DATA USED IN WETLAND DELINEATION
OFF-BASE AOC ASSOCIATED WITH SITE 8
NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI
PAGE 2 OF 2

Data Point	Vegetation			Soils				Hydrology					Wetland
	Description	% OBL FACW FAC	Hydrophytic	Matrix	Mottle	NTCHS Indicator	Hydric	Depth of Inundation (inches)	Depth to Saturation (inches)	Primary Indicators	Secondary Indicators	Wetland Hydrology	
2 (Boundary)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/1	10YR 5/6	F3	Yes	0	15	None	Root Ch. FAC Neut.	No	No
3 (10' Out)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/1	10YR 5/6	F3	Yes	0	18	None	FAC Neut.	No	No
Transect D (Perpendicular to Stake D-22)													
1 (10' Inside)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/1	10YR 5/4	F3	Yes	0	0	Visible Saturation Water Marks	Root Ch. Water Stain FAC Neut.	Yes	Yes
2 (Boundary)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/1	10YR 5/6	F3	Yes	0	4	Visible Saturation	Root Ch. FAC Neut.	Yes	Yes
3 (10' Out)	Slash Pine Forest (SAF 84)	100	Yes	10YR 5/1	10YR 5/2	None	No	0	10	None (Recent Heavy Rain)	FAC Neut.	No	No
4 (20' Out)	Slash Pine Forest (SAF 84)	100	Yes	10YR 6/4	10YR 6/3	None	No	0	15	None	FAC Neut.	No	No

OBL = Obligate Wetland
FACW = Facultative Wetland
FAC = Facultative
NTCHS = National Technical Committee for Hydric Soils

See Figure 3-1 for transect and data point locations.

Vegetation: Vegetation within the wetland consists of two general zones. Vegetation in the outer (drier) zone (see vegetation data for data points WET DP A-5-1, WET DP B-4-1, WET DP C-4-1, and WET DP D-22-1 in Attachment 1) is dominated throughout by slash pine (*Pinus elliottii*) [Facultative Wetland (FACW)], a needle-leaved evergreen tree. Most of the slash pines are less than 12 inches in diameter at breast height (DBH), but occasional trees are as much as 18 inches DBH. Baldcypress[1] (*Taxodium distichum*, a needle-leaved deciduous tree) [Obligate Wetland (OBL)], sweetbay (*Magnolia virginiana*, a broad-leaved evergreen tree) (FACW+), and red maple (*Acer rubrum*, a broad-leaved deciduous tree) [Facultative (FAC)] are infrequent in the tree canopy but are common throughout as saplings. The canopy cover formed by the slash pines is relatively sparse (estimated at less than 30 to 40 percent cover) and is undergrown by a dense understory of woody broad-leaved evergreen shrubs such as gallberries (*Ilex glabra* and *Ilex coriacea*, both FACW) and vines such as greenbriers (*Smilax* sp.). Most greenbrier species are FAC or FACW. Herbaceous groundcover is variable, with some areas virtually lacking groundcover and other areas supporting dense patches of wetland ferns such as chain fern (*Woodwardia areolata*) (OBL) or wetland forbs such as pitcher plant (*Sarracenia leucophylla*) (OBL). Poison ivy (Toxicodendron radicans) (FAC) occurs frequently as a groundcover plant and occasionally as a vine supported by trees.

The inner (wetter) zone of the wetland supports forest vegetation dominated by a mixture of swamp and bottomland tree species such as baldcypress (or pondcypress) (OBL, regardless of common name), sweetbay (FACW+), and tupelo (*Nyssa aquatica*) (OBL) (see vegetation data for "interior" locations 1 through 6 in Attachment 1). Slash pine occurs infrequently. Most trees near the man-made drainage ditch crossing the Bennett property are less than 12 inches DBH.

However, some trees in the wettest part of the Arndt and Edwards properties are more than 18 inches DBH. Baldcypress tends to be more dominant in the wettest part of the Bennett property, while sweetbay and tupelo tend to be more dominant in the wettest part of the Arndt and Edwards properties. Understory and groundcover are relatively sparse throughout this inner zone of vegetation.

The uplands adjoining all four of the delineated wetland boundaries support slash pine forest with a tree, sapling, and shrub composition generally indistinguishable from the forest in the outer (drier) zone of the wetlands (see vegetation data for data points WET DP A-5-3, WET DP B-4-3, WET DP C-4-3, WET DP D-22-3, and WET DP D-22-4 in Attachment 1). A canopy of slash pines generally similar in size and density to that in the wetlands grows over a dense understory of gallberries and other shrub species also

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[1] The baldcypress trees on the site would be labeled as pondcypress (*T. ascendens*) by some botanists. However, most botanists do not presently consider pondcypress to be taxonomically distinct from baldcypress.

dominant in the wetlands. The only perceptible differences between the slash pine forest in the uplands and the wetlands are the absence of baldcypress and OBL and FACW groundcover species. Even in the uplands, the slash pine forest on the site is still dominated mostly by FACW plants and therefore, technically meets the criteria for identification as hydrophytic vegetation. The position of the delineated boundary is based more on changes in soils, hydrology, and groundcover vegetation than on differences in the predominant woody vegetation.

The slash pine forest, both in the outer (drier) part of the wetlands and in uplands on the site, resembles the Society of American Foresters (SAF) Forest Cover Type 84, Slash Pine Forest (Eyre, 1980). The native range of Slash Pine Forest reportedly extends from the southern tip of South Carolina south to central Florida and west along the Coastal Plain to southeast Louisiana. Typical undergrowth in Slash Pine Forest on moist to wet sites reportedly includes waxmyrtle (*Myrica cerifera*), gallberry, buckwheat tree (*Cliftonia monophylla*), dahoon (*Ilex cassine*), yaupon (*Ilex vomitoria*), and pitcher plant. Typical undergrowth in Slash Pine Forest on better-drained soils include pineland three-awn (*Aristida stricta*), saw-palmetto (*Serenoa repens*), gallberry, Curtis dropseed (*Sporobolus curtissii*), dwarf huckleberry (*Gaylussacia dumosa*), ground blueberry (*Vaccinium* sp.), yaupon, and dahoon (Eyre, 1980). These descriptions closely match the differences in the understory vegetation actually observed in the Slash Pine Forest on each side of the delineated wetland boundary.

The vegetation in the inner (wetter) part of the wetlands most closely resembles SAF Forest Cover Types 100 (Pondcypress Forest) or SAF Forest Type 104 (Sweetbay - Swamp Tupelo - Redbay Forest). Pondcypress Forest is described as dominated by pondcypress, which is now regarded by most botanists as taxonomically indistinct from baldcypress. It corresponds well to vegetation in the wetter part of the wetlands on the Bennett property. Sweetbay - Swamp Tupelo - Redbay Forest, described as dominated by a combination of sweetbay, tupelo, and redbay (*Persea borbonia*), corresponds well to the vegetation in the wetter parts of the Arndt and Edwards properties. Even though redbay was not observed, sweetbay and tupelo clearly dominated much of the subject area. Both plant community types typically occur in bottomlands in the southeastern Coastal Plain, including coastal areas along the Gulf of Mexico from Florida to Texas (Eyre, 1980).

Soils: The off-base properties are located in an area characterized by loamy and sandy soils on broad flats and floodplains. Soils in the eastern part of the Bennett and Arndt properties are mapped in the Smithton - Plummer soil association, which is described as consisting of poorly drained soils that have a loamy subsoil. Soils in the Edwards property and the western part of the Bennett and Arndt properties are mapped in the Atmore - Harleston - Plummer soil association, which is described as consisting of poorly drained and moderately well-drained soils that have a loamy subsoil. Soils in both associations

reportedly present limitations on agriculture, development, and other land uses due to a seasonal high water table and flooding (SCS, 1975).

Soils in the central part of the Bennett property are mapped in the very poorly drained Hyde soil series. Soils in the western part of the Bennett property are mapped in the moderately well-drained Harleston soil series. Soils in the southeastern part of the Bennett property are mapped in the poorly drained Plummer soil series, moderately well-drained Harleston soil series, and somewhat poorly drained Ocilla soil series. Soils in the northeastern part of the Bennett property, southeastern part of the Arndt property, and southwestern part of the Edwards property are mapped in the poorly drained Plummer soil series. Soils in the remainder of the Arndt and Edwards properties are mapped in the very poorly drained Ponzer soil series and poorly drained Smithton soil series (SCS, 1975).

The soil profiles described on the data sheets in Attachment 1 generally corroborate the soil survey maps. The shallow soil borings collected from the inner part of the wetland (the six "interior" locations) revealed a shallow (less than 6 inches deep) surface layer (topsoil or A-horizon) more indicative of Smithton rather than Hyde or Ponzer soils, which are described as having deeper surface layers. Soils below the surface layer were observed to be predominantly silt loam (or fine sandy loam) with a grayish matrix color (chroma 1) interrupted with frequent but small mottles of brighter colors (chromas 4 and higher). The matrix color refers to the predominant soil color, and grayer matrix colors are indicative of the reduced iron resulting from extended periods of soil saturation. The low matrix chroma under the A-horizon qualifies these soils as hydric soils based on the criteria presented in the 1987 Manual. Matrix chromas of 2 with mottling or 1 with or without mottling are typically regarded by the 1987 Manual as potentially indicative of hydric soil. The low matrix chroma in the upper 10 inches of the soil profile is indicative of the "depleted matrix" criterion for a hydric soil (Criterion F3) established by the National Technical Committee for Hydric Soils (NTCHS) (NRCS, 1998).

The soil borings taken close to the wetland boundary revealed silt loams or fine sandy loams with grayish matrix colors (chroma 1) generally similar to soils in the inner part of the wetland. The hydric status of these soils is also based on the low chroma matrix color criteria in the 1987 Manual and the depleted matrix criterion established by the NTCHS. The transition from hydric (wetland) soils to upland soils is very gradual throughout the site. Matrix chromas remain at 1 until very close to the wetland boundary. Soils at the delineated wetland boundary and just outside of the boundary generally display "polychromatic matrices" (matrices with blocks of differing colors but without the spots and streaks characteristic of mottling) consisting of zones of gray (chromas 1 and 2) and yellow-gray (chromas between 2 and 3). Soils dominated by the brighter yellow colors (chroma 3 and higher) characteristic of upland soils do not occur close to the delineated wetland boundary.

Hydrology: All wetlands on the subject properties are freshwater, nontidal wetlands. Tidal influence from the Gulf of Mexico does not extend to areas north of NCBC Gulfport.

The ditch crossing the central part of the Bennett property contained approximately 3 inches of nearly stagnant water at the time of the wetland delineation (October 20 through 23, 2002). Surface flow in the ditch is to the northwest. The ditch was straight and of nearly uniform width. The abrupt embankments to the ditch could have contained at least 3 to 6 inches of additional standing water without overflowing. The inner wetlands adjoining the ditch were saturated to the surface and contained shallow pools of 1 to 2 inches of standing water (see hydrology data for "interior" locations 4 through 6 in Attachment 1).

Surface flow across the Arndt and Edwards properties is toward the north-northeast, toward Turkey Creek, which passes roughly 0.5 mile north of the properties. However, surface flow across the Arndt and Edwards properties did not involve a ditch or other well-defined channel. Instead, a band of deeper wetlands contained a series of small pools of shallow standing water separated by areas of saturated soil at the time of the wetland delineation (October 20 through 23, 2002). However, low watermarks on the buttresses of trees in this area suggest that continuous surface flow does occur episodically (see hydrology data for "interior" locations 1 through 3 in Attachment 1).

The outer (drier) zone of the wetlands, as represented by transects A through D, was saturated to the surface or within 6 to 10 inches of the surface (i.e., throughout the major part of the plant rooting depth) at the time of the wetland delineation. The 1987 Manual treats visual observation of soil saturation within 12 inches of the surface as a primary indicator of wetland hydrology but cautions that the preceding weather conditions must be considered when determining whether wetland hydrology exists. The region had experienced very heavy rainfall during September and October 2002, with reported cumulative precipitation of 8 to 9 inches in October versus a normal of 3 to 4 inches and estimated precipitation of 16 to 18 inches in September versus a normal of 4 to 5 inches (NWS, 2002). Therefore, soil saturation was considered indicative of wetland hydrological conditions only if the saturation was within 6 to 8 inches of the soil surface.

Classification: The ditch crossing the central part of the Bennett property would be classified as Riverine under the classification system developed by the FWS (Cowardin et al., 1979). The Riverine system is defined as all wetlands contained within a channel. The wetlands adjoining the ditch and all of the other wetlands on the properties would be classified as Palustrine Forested (PFO). The Palustrine system is described by the FWS as consisting of nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens (as well as tidal wetlands with salinity less than 0.5 parts per thousand). The east-northeast surface flow across the Arndt and Edwards properties does not follow a

defined channel, and thus the wetlands supporting the flow would be classified as Palustrine rather than Riverine.

Functions and Values: Wetland functions are physical, chemical, and biological processes or attributes of wetlands that are vital to the integrity of a wetland system, regardless of how those benefits are perceived by society. Wetland values are attributes that are not necessarily important to the integrity of a wetland system but that are perceived as valuable to society (Adamus et al., 1991). Table 3-2 lists several commonly recognized functions and values provided by wetlands. The following discussion of the functions and values of the delineated wetlands is subjective. More rigorous quantitative and semi-quantitative models are available for assessing the functions and values of wetlands but are rarely necessary to support most permitting and planning decisions affecting wetlands.

Because the wetland is situated in a relatively flat landscape with little topographic relief and a shallow water table throughout, it is unlikely to play a key role in regulating the recharge or discharge of groundwater. The wetland lacks a large watershed clearly defined by topography and therefore, does not likely contribute substantially to the modulation of flood flows. However, activities that partially fill the wetland could cause increased channel flow that does not readily pass through the culvert under Canal Road. Because of the absence of open water adjoining the wetland, the wetland clearly does not play a role in stabilizing shorelines against wave action. However, the vegetation, especially the mature tree roots and dense understory, functions to stabilize the soils in the wetland against surface erosion during high water flows.

The dense vegetation in the wetland likely serves to reduce the velocity of flow discharged from NCBC Gulfport via Outfall 3, thereby trapping at least a portion of any sediments or toxicants contained in the surface flow. Without the dense vegetation in the wetland, the plume of soil contaminated by HO and its by-products might have extended further downgradient (north) toward Turkey Creek. The dense and diverse vegetation and rich soils in the wetland likely contribute substantial quantities of organic carbon, organically fixed nitrogen and other nutrients, and microbes and other low food chain organisms to downgradient water bodies such as Turkey Creek (production export function).

The forested wetlands on the Bennett and Arndt properties adjoin a large area of forested wetlands to the north providing a contiguous block of several hundred acres of swap habitat. Although some selective logging has recently occurred north of the Arndt property, the block still provides an extensive swath of habitat largely unaffected by roads or agricultural or urban development. Increasing urbanization of the landscape between NCBC Gulfport and Interstate Route 10 to the north has reduced the regional availability of large unfragmented tracts of wetland and upland forest cover that is required by many

TABLE 3-2

**COMMON FUNCTIONS AND VALUES OF WETLANDS
OFF-BASE AOC ASSOCIATED WITH SITE 8
NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI
PAGE 1 OF 2**

Functions	Description
Groundwater Recharge	Some wetlands function to catch and detain surface runoff, allowing at least some of the detained water to leach down into underlying aquifers. Wetlands capable of best performing this function tend to receive runoff from a large watershed, support dense vegetation, and have a narrow (constricted) outlet (or no outlet).
Groundwater Discharge	Some wetlands function as areas where groundwater is discharged to the surface. Such wetlands are commonly referred to as seeps or springs and represent a means by which wildlife inhabiting the surface can access water reserves held in the ground.
Floodflow Alteration	Some wetlands function to slow the overland runoff of floodwaters, thereby reducing peak flow levels following heavy precipitation events. Wetlands capable of best performing this function tend to be located in the upper parts of the watershed to stream systems.
Sediment/ Shoreline Stabilization	Vegetation in wetlands bordering streams and other waterbodies can stabilize banks and shorelines against erosion caused by currents and waves.
Sediment/ Toxicant Retention	Some wetlands serve to detain surface flow (surface runoff or channel flow) allowing some suspended sediments, toxicants, and/or pathogens to settle out into the wetland soil, thereby preventing their migration into downstream waters. Wetlands capable of best performing this function tend to support dense vegetation, have constricted (or no) outlets, and be located near disturbed soils or toxicant sources.
Nutrient Removal/ Transformation	Some wetlands serve to detain surface flow (surface runoff or channel flow) allowing nutrients such as nitrogen and phosphorus to settle out into the wetland soil, thereby preventing their migration into downstream waters. High nutrient levels in waterbodies cause eutrophication, a condition where undesirable algal growths deplete dissolved oxygen and interfere with other aquatic biota. Wetlands capable of best performing this function tend to support dense vegetation, have constricted (or no) outlets, and be located near areas of heavy fertilizer use.
Production Export	Some wetlands serve as sources of biomass, nutrients, and food sources supporting aquatic ecosystems in downgradient waterbodies. Wetlands capable of best performing this function tend to have dense, diverse vegetation and be connected to areas of open water.
Aquatic Diversity/ Abundance	Wetlands adjoining or forming a part of streams, lakes, and other areas of open water tend to provide specialized habitat for many species of fish and other aquatic biota, thereby enhancing the diversity of aquatic ecosystems.
Wildlife Diversity/ Abundance	Wetlands provide favored habitat for many amphibian, reptile, bird, and mammal species. The exact species of wildlife attracted by a wetland depends largely on the wetland's vegetation composition.
Recreation	Many wetlands provide opportunities for recreational activities such as hiking, canoeing, boating, fishing, and hunting. The recreational value of a wetland depends not only on its physical characteristics but also on its public accessibility and proximity to population centers.

TABLE 3-2

**COMMON FUNCTIONS AND VALUES OF WETLANDS
OFF-BASE AOC ASSOCIATED WITH SITE 8
NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI
PAGE 2 OF 2**

Functions	Description
Uniqueness/ Heritage	Many wetlands are inherently "special" places that reflect or contribute to the history and/or culture of the surrounding region.
Educational/ Scientific Value	Many wetlands, especially wetlands that have experienced little human alteration or disturbance, are of value for scientific research and/or for public outdoor education. The location of a wetland on public land and/or in close proximity to schools enhances this value.
Visual Quality/ Aesthetics	Especially in urban/suburban settings, many wetlands are visually pleasing natural areas that can buffer, screen, or offset the visual impacts of developed areas.

Source: Adamus *et al.*, 1991 and De Santo and Flieger, 1995.

species of wildlife, especially many species of "forest-interior" songbirds. Although the wetland provides terrestrial habitat including good amphibian habitat, it provides no substantial aquatic habitat.

The wetland and adjoining uplands have not been developed for recreation and provide few recreational opportunities. They occupy private property that is not open to the public. Because of their urbanizing surroundings, the properties do not appear to offer significant opportunities for hunting, and their value for hunting will likely decrease even more in the future. The wetland does represent a regionally typical example of swamp adjoined by wet pine flatwoods. Such features are common throughout southern Mississippi, but urbanization is making such features increasingly infrequent in the immediate vicinity of NCBC Gulfport. The presence of ditching in the wetland and its history of receiving surface runoff from NCBC Gulfport has compromised the natural integrity of the wetland. The wetland is of some aesthetic value because it provides a visual break in the urban development fronting much of 28th Street and Canal Road.

4.0 CONCLUSIONS

Most of the potentially contaminated areas within the Bennett, Arndt, and Edwards properties meet the technical criteria for wetlands established in the 1987 Manual. The affected area consist of a single wetland feature beginning at Outfall 3, which discharges from the NCBC Gulfport drainage channel network into a channel on the north side of 28th Street. That channel continues for approximately 1,600 feet to the northwest, flowing through a culvert under Canal Road near the northwestern corner of the Bennett property and the southwestern corner of the Arndt property. The channel is bounded by a wide swath of wetlands, more than 250 feet wide at some points, that occupies much of the central and western parts of the Bennett property. Except for a small area of uplands near the southeastern corner, most of the Arndt property constitutes wetlands. Most of the western portion of the Edwards property, west of 59th Avenue (extended as an access road), is also wetland. The eastern part of the Edwards property was not included within the wetlands delineation study area.

All of the wetlands on the subject properties are nontidal, freshwater wetlands regulated as a water of the United States under Section 404 of the Clean Water Act. In the context of Section 404, the subject wetlands would most likely be considered by the USACE to be an "adjacent" wetland possessing a surface connection to Turkey Creek, which ultimately flows into Bayou Bernard and the Gulf of Mexico. Recent controversy over the regulatory status of "isolated" wetlands lacking surface connections to navigable waterways does not likely apply to the subject wetlands.

None of the wetlands on the subject properties are "coastal wetlands" regulated under the Mississippi Coastal Wetlands Protection Act (Mississippi Code §49-27). Under the Act, coastal wetlands are defined as "all publicly owned lands subject to the ebb and flow of the tide, which are below the watermark of ordinary high tide and all publicly owned submerged water bottoms below the watermark of ordinary high tide." This definition extends only to tidal wetlands, which do not occur on the subject properties.

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ATTACHMENT 1

FIELD DATA SHEETS

DATA POINT A-5-1
10 FEET WETLAND (EAST) OF STAKE "WETA-5"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/20/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	**Yes**	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	**No**	Transect ID:	A-1
Is the area a potential Problem Area?:	Yes	**No**	Plot ID:	1
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	TAXODIUM DISTICHUM	C	OBL
MAGNOLIA VIRGINIANA	SA	FACW+	MAGNOLIA VIRGINIANA	C	FACW+
ACER RUBRUM	SA	FAC	QUERCUS NIGRA	C	FAC
ILEX CORIACEA	SH	FACW	TAXODIUM DISTICHUM	SA	OBL
			QUERCUS NIGRA	SA	FAC
			ACER RUBRUM	SH	FAC
			QUERCUS NIGRA	SH	FAC
			WOODWARDIA AREOLATA	H	OBL
			WISTERIA SP.	H	VAR

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). CYPRESS TREES DISPLAY DISTINCT KNEES, A MORPHOLOGICAL PLANT ADAPTATION TO WETLAND HYDROLOGY.

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	____ Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: NONE (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 3 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 2 (in.)	X Oxidized Root Channels in Upper 12 inches
	____ Water-Stained Leaves
	X Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY. DECISION TAKES INTO ACCOUNT RECENT HEAVY PRECIPITATION.

DATA POINT A-5-1
10 FEET WETLAND (EAST) OF STAKE "WET A-5"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	HYDE SILT LOAM	Drainage Class:	VERY POORLY DR.
Taxonomy (subgroup):	ULTISOLS – UMBRIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-10	A	10YR 3/1	NONE	N/A	SILT LOAM
10-20+	B	10 YR 5/1	10 YR 5/6	FREQUENT, DISTINCT (<10%)	SILT LOAM

Hydric Soil Indicators:

___	Histosol	X	Concretions IRON
___	Histic Epipedon	___	High Organic Content in Surface Layer in Sandy Soil
___	Sulfidic Odor	___	Organic Streaking in Sandy Soils
___	Aquic Moisture Regime	___	Listed on Local Hydric Soils List
X	Reducing Conditions	___	Listed on National Hydric Soils List
X	Gleyed or Low-Chroma Colors	___	Other (Explain in Remarks)

Remarks: HYDRIC SOIL. NTCHS HYDRIC SOIL FIELD INDICATOR F4 "DEPLETED BELOW DARK SURFACE."

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND (HYDROPHYTIC VEGETATION, HYDRIC SOIL, AND WETLAND HYDROLOGY PARAMETERS MET).

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, NEEDLE-LEAVED EVERGREEN, SATURATED (PFO4B).

DATA POINT A-5-2
ON DELINEATED WETLAND BOUNDARY AT STAKE "WETA-5"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/20/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	**Yes**	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	**No**	Transect ID:	A-1
Is the area a potential Problem Area?:	Yes	**No**	Plot ID:	2
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	MAGNOLIA VIRGINIANA	C	FACW+
MAGNOLIA VIRGINIANA	SA	FACW+	QUERCUS NIGRA	C	FAC
ACER RUBRUM	SA	FAC	QUERCUS NIGRA	SA	FAC
ILEX CORIACEA	SH	FACW	QUERCUS NIGRA	SH	FAC
ACER RUBRUM	SH	FAC			
TOXICODENDRON RADICANS	H	FAC			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	____ Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: NONE (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 10 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 8 (in.)	X Oxidized Root Channels in Upper 12 inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: TRANSITION FROM WETLAND TO UPLAND HYDROLOGY. DECISION TAKES INTO ACCOUNT RECENT HEAVY PRECIPITATION.

DATA POINT A-5-2
ON DELINEATED WETLAND BOUNDARY AT STAKE "WET A-5"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	BOUNDARY HYDE SILT LOAM/ HARLESTON FINE SANDY LOAM	Drainage Class:	VERY POORLY DR./ MODER. WELL DR.
Taxonomy (subgroup):	ULTISOLS – UMBRIC PALEAQUULTS (HYDE)/ AQUIC PALEUDULTS (HARLESTON)	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-3	A	10YR 3/1	NONE	N/A	SILT LOAM
3-10	B	10 YR 5/1	10 YR 5/2	50:50	SILT LOAM
				POLYCHROMATIC	
10-20+	B	10YR 5/2	10YR 5/6	FAINT, <10%	SILT LOAM

Hydric Soil Indicators:

___	Histosol	X	Concretions IRON
___	Histic Epipedon	___	High Organic Content in Surface Layer in Sandy Soil
___	Sulfidic Odor	___	Organic Streaking in Sandy Soils
___	Aquic Moisture Regime	___	Listed on Local Hydric Soils List
X	Reducing Conditions	___	Listed on National Hydric Soils List
X	Gleyed or Low-Chroma Colors	___	Other (Explain in Remarks)

Remarks: TRANSITION FROM HYDRIC SOIL TO UPLAND SOIL. POLYCHROMATIC MATRIX UNDER A HORIZON SUGGESTS A TRANSITION FROM POOR TO GOOD DRAINAGE.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: ALTHOUGH THE THREE PARAMETERS ARE MET, THE HYDROLOGY AND SOIL PARAMETERS ARE IN TRANSITION FROM WETLAND TO UPLAND CHARACTERISTICS.

USFWS CLASSIFICATION: BOUNDARY BETWEEN PALUSTRINE FORESTED WETLAND, NEEDLE-LEAVED EVERGREEN, SATURATED (PFO4B) AND UPLAND (U).

DATA POINT A-5-3
10 FEET UPLAND (WEST) OF STAKE "WETA-5"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/20/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	A-1
Is the area a potential Problem Area?:	Yes	No	Plot ID:	3
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	MAGNOLIA VIRGINIANA	C	FACW+
NYSSA SYLVATICA	C	FAC	QUERCUS NIGRA	C	FAC
MAGNOLIA VIRGINIANA	SA	FACW+	QUERCUS NIGRA	SA	FAC
ACER RUBRUM	SA	FAC	TOXICODENDRON RADICANS	H	FAC
SERENOA REPENS	SH	FACU			
SMILAX ROTUNDIFOLIA	H	FAC			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 83

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). IT IS NOTED, HOWEVER, THAT THERE ARE NO OBLIGATE PLANT SPECIES AND NO MORPHOLOGICAL PLANT ADAPTATIONS TO SATURATION OR INUNDATION.

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated
____ Other	____ Saturated in Upper 12 inches
X No Recorded Data Available	____ Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: NONE (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: NONE (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 15 (in.)	____ Oxidized Root Channels in Upper 12 inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY PARAMETER NOT MET.

DATA POINT A-5-3
10 FEET UPLAND (WEST) OF STAKE "WET A-5"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	HARLESTON FINE SANDY LOAM	Drainage Class:	MODER. WELL DR.
Taxonomy (subgroup):	ULTISOLS – AQUIC PALEUDULTS	Field Observations Confirmed Mapped Type?	**Yes** No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-4	A	10YR 3/1	NONE	N/A	SILT LOAM
4-15	B	10 YR 5/2	10 YR 5/3	60:40	SILT LOAM
				POLYCHROMATIC	
10-20+	B	10YR 5/2	10YR 5/3	FAINT, <20%	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: UPPER EDGE OF TRANSITION FROM HYDE TO HARLESTON SOILS.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	**Yes**	No	Is this Sampling Point Within a Wetland?	Yes	**No**
Wetland Hydrology Present?	Yes	**No**			
Hydric Soils Present?	Yes	**No**			

Remarks: NOT A WETLAND. THE HYDROLOGY AND SOIL PARAMETERS ARE NOT MET.

USFWS CLASSIFICATION: UPLAND (U).

DATA POINT B-4-1
10 FEET WETLAND (WEST) OF STAKE "WETB-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/21/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	B-1
Is the area a potential Problem Area?:	Yes	No	Plot ID:	1
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	ACER RUBRUM	C	FAC
ACER RUBRUM	SA	FAC	MAGNOLIA VIRGINIANA	SA	FACW+
ILEX CORIACEA	SH	FACW	QUERCUS SP.	SA	VAR
OSMUNDA REGALIS	H	OBL	MAGNOLIA VIRGINIANA	H	FACW+
WOODWARDIA AREOLATA	H	OBL			
TOXICODENDRON RADICANS	H	FAC			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	____ Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: NONE (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 6 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 4 (in.)	X Oxidized Root Channels in Upper 12 inches
	____ Water-Stained Leaves
	X Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY. DECISION TAKES INTO ACCOUNT RECENT HEAVY PRECIPITATION.

DATA POINT B-4-1
10 FEET WETLAND (WEST) OF STAKE "WET B-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	HYDE SILT LOAM	Drainage Class:	VERY POORLY DR.
Taxonomy (subgroup):	ULTISOLS – UMBRIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	0	10YR 3/1	NONE	N/A	SILT LOAM
1-5	A	10YR 4/2	NONE	NONE	SILT LOAM
5-8	B	10YR 5/2	10YR 5/6	OCCASIONAL DISTINCT	SILT LOAM
8-20+	B	10YR 5/1	10YR 5/6	MANY, DISTINCT	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- X Concretions IRON
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOIL. NTCHS HYDRIC SOIL FIELD INDICATOR F3 "DEPLETED MATRIX."

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND (HYDROPHYTIC VEGETATION, HYDRIC SOIL, AND WETLAND HYDROLOGY PARAMETERS MET).

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, NEEDLE-LEAVED EVERGREEN, SATURATED (PFO4B).

DATA POINT B-4-2
ON DELINEATED WETLAND BOUNDARY AT STAKE "WETB-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/21/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	B-1
Is the area a potential Problem Area?:	Yes	No	Plot ID:	2
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	MAGNOLIA VIRGINIANA	C	FACW+
MAGNOLIA VIRGINIANA	SA	FACW+			
ACER RUBRUM	SA	FAC			
QUERCUS SP.	SA	VAR			
ILEX CORIACEA	SH	FACW			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	____ Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: NONE (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 8 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 4 (in.)	X Oxidized Root Channels in Upper 12 inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: DEFINITE WETLAND HYDROLOGY BUT VERY CLOSE TO TRANSITION FROM WETLAND TO UPLAND HYDROLOGY. DECISION TAKES INTO ACCOUNT RECENT HEAVY PRECIPITATION.

DATA POINT B-4-2
ON DELINEATED WETLAND BOUNDARY AT STAKE "WET B-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	BOUNDARY HYDE SILT LOAM/ PLUMMER LOAMY SAND	Drainage Class:	VERY POORLY DR./ POORLY DRAINED
Taxonomy (subgroup):	ULTISOLS – UMBRIC PALEAQUULTS (HYDE)/ GROSSARENIC PALEAQUULTS (PLUMMER)	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	A	10YR 3/1	NONE	N/A	SILT LOAM
1-10	B	10 YR 5/1	10 YR 5/3	60:40	SILT LOAM
				POLYCHROMATIC	
10-20+	B	10YR 5/1	10YR 5/6	FREQUENT,	SILT LOAM
				DISTINCT, <10%	

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: TRANSITION FROM HYDRIC SOIL TO UPLAND SOIL. POLYCHROMATIC MATRIX UNDER A HORIZON SUGGESTS A TRANSITION FROM POOR TO GOOD DRAINAGE.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: ALTHOUGH THE THREE PARAMETERS ARE MET, THE PARAMETER IS IN TRANSITION FROM WETLAND TO UPLAND CHARACTERISTICS, AND POINT LIES CLOSE TO TRANSITION TO WETLAND HYDROLOGY

USFWS CLASSIFICATION: BOUNDARY BETWEEN PALUSTRINE FORESTED WETLAND, NEEDLE-LEAVED EVERGREEN, SATURATED (PFO4B) AND UPLAND (U).

DATA POINT B-4-3
10 FEET UPLAND (EAST) OF STAKE "WETB-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/21/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	**Yes**	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	**No**	Transect ID:	B-1
Is the area a potential Problem Area?:	Yes	**No**	Plot ID:	3
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	MAGNOLIA VIRGINIANA	C	FACW+
MAGNOLIA VIRGINIANA	SA	FACW+	ACER RUBRUM	SA	FAC
PINUS ELLIOTTII	SA	FACW	OSMUNDA REGALIS	H	OBL
ILEX CORIACEA	SH	FACW			
ILEX CORIACEA	SH	FACW			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

_____ Recorded Data (Described in Remarks):
- _____ Stream, Lake, or Tide Gauge
- _____ Aerial Photographs
- _____ Other

X No Recorded Data Available

Field Observations:

Depth of Surface Water:	NONE	(in.)
Depth to Free Water in Pit:	12	(in.)
Depth to Saturated Soil:	10	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- _____ Inundated
- _____ Saturated in Upper 12 inches
- _____ Water Marks
- _____ Drift Lines
- _____ Sediment Deposits
- _____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- _____ Oxidized Root Channels in Upper 12 inches
- _____ Water-Stained Leaves
- _____ Local Soil Survey Data
- X FAC-Neutral Test
- _____ Other (Explain in Remarks)

Remarks: ALTHOUGH SATURATION OBSERVED ABOVE 12-INCH DEPTH, RECENT HEAVY PRECIPITATION MUST BE CONSIDERED.

DATA POINT B-4-3
10 FEET UPLAND (WEST) OF STAKE "WET B-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PLUMMER LOAMY SAND	Drainage Class:	POORLY DRAINED
Taxonomy (subgroup):	ULTISOLS – GROSSARENIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No UPPER EDGE

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	A	10YR 3/1	NONE	N/A	SILT LOAM
1-20+	B	10 YR 5/1	10 YR 5/3	60:40	SILT LOAM
				POLYCHROMATIC	

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: UPPER EDGE OF PLUMMER SOILS, BEGINNING OF TRANSITION TO HARLESTON SOILS.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: NOT A WETLAND. THE HYDROLOGY AND SOIL PARAMETERS ARE NOT MET.

USFWS CLASSIFICATION: UPLAND (U).

DATA POINT C-4-1
10 FEET WETLAND (NORTHWEST) OF STAKE "WETC-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	C-1
Is the area a potential Problem Area?:	Yes	No	Plot ID:	1
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	QUERCUS NIGRA	C	FAC
MAGNOLIA VIRGINIANA	C	FACW+	MAGNOLIA VIRGINIANA	SH	FACW+
TAXODIUM DISTICHUM	SA	OBL			
ACER RUBRUM	SA	FAC			
MAGNOLIA VIRGINIANA	SA	FACW+			
ILEX CORIACEA	SH	FACW			
TOXICODENDRON RADICANS	H	FAC			
VITIS SP.	H	VAR			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). SLIGHT TRUNK BUTTRESSING ON CYPRESS TREES.

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	____ Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: NONE (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 8 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 6 (in.)	X Oxidized Root Channels in Upper 12 inches
	____ Water-Stained Leaves
	X Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY. DECISION TAKES INTO ACCOUNT RECENT HEAVY PRECIPITATION.

DATA POINT C-4-1
10 FEET WETLAND (NORTHWEST) OF STAKE "WET C-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PLUMMER LOAMY SAND	Drainage Class:	POORLY DRAINED
Taxonomy (subgroup):	ULTISOLS – GROSSARENIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	0	10YR 3/1	NONE	N/A	SILT LOAM
1-4	B	10YR 5/1	10YR 5/2	50:50	SILT LOAM
4-20+	B	10YR 5/1	10YR 5/6	10%, FAINT	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOIL. NTCHS HYDRIC SOIL FIELD INDICATOR F3 "DEPLETED MATRIX."

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND (HYDROPHYTIC VEGETATION, HYDRIC SOIL, AND WETLAND HYDROLOGY PARAMETERS MET).

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, NEEDLE-LEAVED EVERGREEN, SATURATED (PFO4B).

DATA POINT C-4-2
ON DELINEATED WETLAND BOUNDARY AT STAKE "WET C-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	C-1
Is the area a potential Problem Area?:	Yes	No	Plot ID:	2
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	QUERCUS NIGRA	C	FAC
MAGNOLIA VIRGINIANA	C	FACW+	QUERCUS NIGRA	SH	FAC
TAXODIUM DISTICHUM	SA	OBL	MAGNOLIA VIRGINIANA	SH	FACW+
ACER RUBRUM	SA	FAC			
MAGNOLIA VIRGINIANA	SA	FACW+			
ILEX CORIACEA	SH	FACW			
MYRICA CERIFERA	SH	FAC+			
ILEX CORIACEA	H	FACW			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

_____ Recorded Data (Described in Remarks):
- _____ Stream, Lake, or Tide Gauge
- _____ Aerial Photographs
- _____ Other

X No Recorded Data Available

Field Observations:

Depth of Surface Water:	NONE	(in.)
Depth to Free Water in Pit:	NONE	(in.)
Depth to Saturated Soil:	15	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- _____ Inundated
- _____ Saturated in Upper 12 inches
- _____ Water Marks
- _____ Drift Lines
- _____ Sediment Deposits
- _____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- _____ Oxidized Root Channels in Upper 12 inches
- _____ Water-Stained Leaves
- _____ Local Soil Survey Data
- X FAC-Neutral Test
- _____ Other (Explain in Remarks)

Remarks: NO WETLAND HYDROLOGY. SATURATION WITHIN AT LEAST 12 INCHES OF THE SURFACE WOULD BE EXPECTED CONSIDERING THE RECENT HEAVY PRECIPITATION.

DATA POINT C-4-2
ON DELINEATED WETLAND BOUNDARY AT STAKE "WET C-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PLUMMER LOAMY SAND	Drainage Class:	POORLY DRAINED
Taxonomy (subgroup):	GROSSARENIC PALEAQUULTS (PLUMMER)	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	A	10YR 3/1	NONE	N/A	SILT LOAM
1-6	B	10 YR 4/1	10 YR 5/2	50:50	SILT LOAM
10-20+	B	10YR 5/1-2	10YR 5/6	FREQUENT, DISTINCT, <10%	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: TRANSITION FROM HYDRIC SOIL TO UPLAND SOIL.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: POINT LIES CLOSE TO TRANSITION TO FROM WETLAND TO UPLAND.

USFWS CLASSIFICATION: BOUNDARY BETWEEN PALUSTRINE FORESTED WETLAND, NEEDLE-LEAVED EVERGREEN, SATURATED (PFO4B) AND UPLAND (U).

DATA POINT C-4-3
10 FEET UPLAND (SOUTHEAST) OF STAKE "WET C-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	C-1
Is the area a potential Problem Area?:	Yes	No	Plot ID:	3
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	MAGNOLIA VIRGINIANA	C	FACW+
ACER RUBRUM	SA	FAC	ACER RUBRUM	C	FAC
TAXODIUM DISTICHUM	SA	OBL	QUERCUS NIGRA	C	FAC
MAGNOLIA VIRGINIANA	SA	FACW+	MAGNOLIA VIRGINIANA	SH	FACW+
ILEX CORIACEA	SH	FACW	QUERCUS NIGRA	SH	FAC
TOXICODENDRON RADICANS	H	FAC	MAGNOLIA VIRGINIANA	H	FACW+

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

Recorded Data (Described in Remarks):
- ____ Stream, Lake, or Tide Gauge
- ____ Aerial Photographs
- ____ Other
- X No Recorded Data Available

Field Observations:

Depth of Surface Water:	NONE	(in.)
Depth to Free Water in Pit:	NONE	(in.)
Depth to Saturated Soil:	18	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ____ Inundated
- ____ Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water-Stained Leaves
- ____ Local Soil Survey Data
- X FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks: NO WETLAND HYDROLOGY. SATURATION WITHIN AT LEAST 12 INCHES OF THE SURFACE WOULD BE EXPECTED CONSIDERING THE RECENT HEAVY PRECIPITATION.

DATA POINT C-4-3
10 FEET UPLAND (SOUTHEAST) OF STAKE "WET C-4"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
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SOIL

Map Unit Name (Series and Phase):	PLUMMER LOAMY SAND	Drainage Class:	POORLY DRAINED
Taxonomy (subgroup):	ULTISOLS – GROSSARENIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No UPPER EDGE

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	A	10YR 3/1	NONE	N/A	SILT LOAM
1-6	B	10YR 4/1	10 YR 5/2	50:50	SILT LOAM
6-15	B	10YR 5/2	10YR 5/6	FEW, <5%, DISTINCT	SILT LOAM
15-20+	B	10YR 5/1	10YR 5/6	MANY, <10%, DISTCT.	SILT LOAM

Hydric Soil Indicators:

___	Histosol	___	Concretions
___	Histic Epipedon	___	High Organic Content in Surface Layer in Sandy Soil
___	Sulfidic Odor	___	Organic Streaking in Sandy Soils
___	Aquic Moisture Regime	___	Listed on Local Hydric Soils List
X	Reducing Conditions	___	Listed on National Hydric Soils List
X	Gleyed or Low-Chroma Colors	___	Other (Explain in Remarks)

Remarks: UPPER EDGE OF PLUMMER SOILS, BEGINNING OF TRANSITION TO HARLESTON OR LATONIA SOILS.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: NOT A WETLAND. THE HYDROLOGY PARAMETER IS NOT MET. ON UPPER EDGE OF TRANSITION OUT OF HYDRIC SOILS.

USFWS CLASSIFICATION: UPLAND (U).

DATA POINT D-22-1
10 FEET WETLAND (NORTH) OF STAKE "WET D-22"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	D-1
Is the area a potential Problem Area?:	Yes	No	Plot ID:	1
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	PINUS ELLIOTTII	SA	FACW
MAGNOLIA VIRGINIANA	C	FACW+	ACER RUBRUM	SH	FAC
TAXODIUM DISTICHUM	C	OBL			
TAXODIUM DISTICHUM	SA	OBL			
MAGNOLIA VIRGINIANA	SA	FACW+			
ILEX CORIACEA	SH	FACW			
WOODWARDIA VIRGINICA	H	OBL			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). SLIGHT TRUNK BUTTRESSING ON CYPRESS TREES.

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	X Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: NONE (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 2 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 0 (in.)	X Oxidized Root Channels in Upper 12 inches
	X Water-Stained Leaves
	X Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY. DECISION TAKES INTO ACCOUNT RECENT HEAVY PRECIPITATION.

DATA POINT D-22-1
10 FEET WETLAND (NORTHWEST) OF STAKE "WET D-22"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
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SOIL

Map Unit Name (Series and Phase):	PLUMMER LOAMY SAND	Drainage Class:	POORLY DRAINED
Taxonomy (subgroup):	ULTISOLS – GROSSARENIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	A	10YR 3/1	NONE	N/A	SILT LOAM
1-6	A	10YR 4/1	NONE	N/A	SILT LOAM
6-20+	B	10YR 5/1	10YR 5/4	<5%, FAINT	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOIL. NTCHS HYDRIC SOIL FIELD INDICATOR F3 "DEPLETED MATRIX."

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND (HYDROPHYTIC VEGETATION, HYDRIC SOIL, AND WETLAND HYDROLOGY PARAMETERS MET).

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, NEEDLE-LEAVED EVERGREEN, SATURATED (PFO4B).

DATA POINT D-22-2
ON DELINEATED WETLAND BOUNDARY AT STAKE "WET D-22"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	**Yes**	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	**No**	Transect ID:	D-1
Is the area a potential Problem Area?:	Yes	**No**	Plot ID:	2
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	MAGNOLIA VIRGINIANA	SA	FACW+
PINUS ELLIOTTII	SA	FACW	SMILAX ROTUNDIFOLIA	H	FAC
TAXODIUM DISTICHUM	SA	OBL			
ILEX CORIACEA	SH	FACW			
WOODWARDIA VIRGINICA	H	OBL			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	____ Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: NONE (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 5 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 4 (in.)	____ Oxidized Root Channels in Upper 12 inches
	____ Water-Stained Leaves
	X Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY. ON GRADIENT TO NON-WETLAND HYDROLOGY.

DATA POINT D-22-2
ON DELINEATED WETLAND BOUNDARY AT STAKE "WET D-22"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PLUMMER LOAMY SAND	Drainage Class:	POORLY DRAINED
Taxonomy (subgroup):	GROSSARENIC PALEAQUULTS (PLUMMER)	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	A	10YR 3/1	NONE	N/A	SILT LOAM
1-6	B	10 YR 4/1	NONE	N/A	SILT LOAM
10-20+	B	10YR 5/1-2	10YR 5/6	FREQUENT, DISTINCT, <10%	SILT LOAM

Hydric Soil Indicators:

___	Histosol	___	Concretions
___	Histic Epipedon	___	High Organic Content in Surface Layer in Sandy Soil
___	Sulfidic Odor	___	Organic Streaking in Sandy Soils
___	Aquic Moisture Regime	___	Listed on Local Hydric Soils List
X	Reducing Conditions	___	Listed on National Hydric Soils List
X	Gleyed or Low-Chroma Colors	___	Other (Explain in Remarks)

Remarks: TRANSITION FROM HYDRIC SOIL TO UPLAND SOIL.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: POINT LIES CLOSE TO TRANSITION TO FROM WETLAND TO UPLAND.

USFWS CLASSIFICATION: BOUNDARY BETWEEN PALUSTRINE FORESTED WETLAND, NEEDLE-LEAVED EVERGREEN, SATURATED (PFO4B) AND UPLAND (U).

DATA POINT D-22-3
10 FEET UPLAND (SOUTH) OF STAKE "WET D-22"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	D-1
Is the area a potential Problem Area?:	Yes	No	Plot ID:	3
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	TAXODIUM DISTICHUM	SA	OBL
MAGNOLIA VIRGINIANA	SA	FACW+	MAGNOLIA VIRGINIANA	H	FACW+
ACER RUBRUM	SA	FAC	SMILAX ROTUNDIFOLIA	H	FAC
ILEX CORIACEA	SH	FACW			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

Recorded Data (Described in Remarks):
- ____ Stream, Lake, or Tide Gauge
- ____ Aerial Photographs
- ____ Other
- X No Recorded Data Available

Field Observations:

Depth of Surface Water:	NONE	(in.)
Depth to Free Water in Pit:	12	(in.)
Depth to Saturated Soil:	10	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ____ Inundated
- X Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water-Stained Leaves
- X Local Soil Survey Data
- X FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks: NO WETLAND HYDROLOGY. SATURATION CLOSER TO THE SURFACE WOULD BE EXPECTED CONSIDERING THE RECENT HEAVY PRECIPITATION.

DATA POINT D-22-3
10 FEET UPLAND (SOUTH) OF STAKE "WET D-22"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PLUMMER LOAMY SAND	Drainage Class:	POORLY DRAINED
Taxonomy (subgroup):	ULTISOLS – GROSSARENIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No UPPER EDGE

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	A	10YR 3/1	NONE	N/A	SILT LOAM
1-6	B	10YR 4/1	NONE	N/A	SILT LOAM
6-20+	B	10YR 5/1	10YR 5/2	50:50, FAINT 10YR 5/6	SILT LOAM

Hydric Soil Indicators:

___	Histosol	___	Concretions
___	Histic Epipedon	___	High Organic Content in Surface Layer in Sandy Soil
___	Sulfidic Odor	___	Organic Streaking in Sandy Soils
___	Aquic Moisture Regime	___	Listed on Local Hydric Soils List
X	Reducing Conditions	___	Listed on National Hydric Soils List
X	Gleyed or Low-Chroma Colors	___	Other (Explain in Remarks)

Remarks: UPPER EDGE OF PLUMMER SOILS, BEGINNING OF TRANSITION TO HARLESTON OR LATONIA SOILS.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: NOT A WETLAND. THE HYDROLOGY PARAMETER IS NOT MET. ON UPPER EDGE OF TRANSITION OUT OF HYDRIC SOILS.

USFWS CLASSIFICATION: UPLAND (U).

DATA POINT D-22-4
20 FEET UPLAND (SOUTH) OF STAKE "WET D-22"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	**Yes**	No	Community ID:	SLASH PINE FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	**No**	Transect ID:	D-1
Is the area a potential Problem Area?:	Yes	**No**	Plot ID:	4
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	NYSSA SYLVATICA	SA	FAC
PINUS ELLIOTTII	SA	FACW			
MAGNOLIA VIRGINIANA	SA	FACW+			
ACER RUBRUM	SA	FAC			
ILEX CORIACEA	SH	FACW			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-).

HYDROLOGY

_____ Recorded Data (Described in Remarks):
- _____ Stream, Lake, or Tide Gauge
- _____ Aerial Photographs
- _____ Other

X No Recorded Data Available

Field Observations:

Depth of Surface Water:	NONE	(in.)
Depth to Free Water in Pit:	NONE	(in.)
Depth to Saturated Soil:	15	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- _____ Inundated
- _____ Saturated in Upper 12 inches
- _____ Water Marks
- _____ Drift Lines
- _____ Sediment Deposits
- _____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- _____ Oxidized Root Channels in Upper 12 inches
- _____ Water-Stained Leaves
- X Local Soil Survey Data
- X FAC-Neutral Test
- _____ Other (Explain in Remarks)

Remarks: NO WETLAND HYDROLOGY. SATURATION CLOSER TO THE SURFACE WOULD BE EXPECTED CONSIDERING THE RECENT HEAVY PRECIPITATION.

DATA POINT D-22-4
20 FEET UPLAND (SOUTH) OF STAKE "WET D-22"
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PLUMMER LOAMY SAND	Drainage Class:	POORLY DRAINED
Taxonomy (subgroup):	ULTISOLS – GROSSARENIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No UPPER EDGE

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-1	A	10YR 3/1	NONE	N/A	SILT LOAM
1-6	B	10YR 4/1	NONE	N/A	SILT LOAM
6-10	B	10YR 5/2	10YR 5/3	50:50	SILT LOAM
10-20+	B	10YR 6/4	10YR 6/3	50:50	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: NOT HYDRIC SOILS. SOILS MOST LIKELY IN THE HARLESTON OR LATONIA SOIL SERIES.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: NOT A WETLAND. THE HYDROLOGY AND SOILS PARAMETERS ARE NOT MET.

USFWS CLASSIFICATION: UPLAND (U).

NORTH INTERIOR LOCATION #1
APPROXIMATELY 50 FEET WEST OF TERMINUS OF GRAVEL ROAD
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	BAY-TUPELO FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	INTERIOR-NORTH
Is the area a potential Problem Area?:	Yes	No	Plot ID:	1
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
PINUS ELLIOTTII	C	FACW	MAGNOLIA VIRGINIANA	C	FACW+
MAGNOLIA VIRGINIANA	SA	FACW+	NYSSA AQUATICA	C	OBL
MYRICA CERIFERA	SH	FAC+	ACER RUBRUM	C	FAC
CAREX SP.	H	FACW	ACER RUBRUM	SA	FAC
			ACER RUBRUM	SH	FAC
			WOODWARDIA AREOLATA	H	OBL

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). ALL TREES WITH BUTTRESSED TRUNKS AND PRONOUNCED SHALLOW ROOTS.

HYDROLOGY

Recorded Data (Described in Remarks):
- ____ Stream, Lake, or Tide Gauge
- ____ Aerial Photographs
- ____ Other
- X No Recorded Data Available

Field Observations:

Depth of Surface Water:	NONE	(in.)
Depth to Free Water in Pit:	2	(in.)
Depth to Saturated Soil:	0	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ____ Inundated
- X Saturated in Upper 12 inches
- X Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 inches
- X Water-Stained Leaves
- X Local Soil Survey Data
- X FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY.

NORTH INTERIOR LOCATION #1
APPROXIMATELY 50 FEET WEST OF TERMINUS OF GRAVEL ROAD
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PONZER AND SMITHTON SOILS	Drainage Class:	POORLY/VP. DRAINED
Taxonomy (subgroup):	ULTISOLS – TERRIC MEDISAPRISTS (PONZER)/ TYPIC PALEAQUULTS (SMITHTN)	Field Observations Confirmed Mapped Type?	Yes No UPPER EDGE

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-3	A	10YR 4/1	NONE	N/A	SILT LOAM
3-20+	B	10YR 5/1	10YR 5/4	DISTINCT, <10%	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- X Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOILS. DEPLETED MATRIX (F3).

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND. THE THREE PARAMETERS ARE MET.

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, BROAD-LEAVED EVERGREEN AND DECIDUOUS, SATURATED (PFO1/3B).

NORTH INTERIOR LOCATION #2
APPROXIMATELY 100 FEET WEST OF TERMINUS OF GRAVEL ROAD
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	BAY-TUPELO FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	INTERIOR-NORTH
Is the area a potential Problem Area?:	Yes	No	Plot ID:	2
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
MAGNOLIA VIRGINIANA	C	FACW+	PINUS ELLIOTTII	C	FACW
NYSSA AQUATICA	C	OBL	FRAXINUS SP.	C	VAR
MAGNOLIA VIRGINIANA	SA	FACW+			
ACER RUBRUM	SA	FAC			
ILEX CORIACEA	SH	FACW			
MAGNOLIA VIRGINIANA	SH	FACW+			
MYRICA CERIFERA	SH	FAC+			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). ALL TREES WITH BUTTRESSED TRUNKS AND PRONOUNCED SHALLOW ROOTS.

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	X Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	X Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: 1-2 (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 0 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 0 (in.)	X Oxidized Root Channels in Upper 12 inches
	X Water-Stained Leaves
	X Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY.

NORTH INTERIOR LOCATION #2
APPROXIMATELY 100 FEET WEST OF TERMINUS OF GRAVEL ROAD
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PONZER AND SMITHTON SOILS	Drainage Class:	POORLY/VP. DRAINED
Taxonomy (subgroup):	ULTISOLS – TERRIC MEDISAPRISTS (PONZER)/ TYPIC PALEAQUULTS (SMITHTN)	Field Observations Confirmed Mapped Type?	Yes No UPPER EDGE

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-3+	A	10YR 4/1	NONE	N/A	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOILS. SOILS SO SATURATED THAT IT WAS IMPOSSIBLE TO EXTRACT SOILS DEEPER THAN 3' TO EXAMINE THE PROFILE.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND. THE THREE PARAMETERS ARE MET.

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, BROAD-LEAVED EVERGREEN AND DECIDUOUS, SATURATED (PFO1/3B).

NORTH INTERIOR LOCATION #3
APPROXIMATELY 150 FEET WEST OF TERMINUS OF GRAVEL ROAD
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/22/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	BAY-TUPELO FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	INTERIOR-NORTH
Is the area a potential Problem Area?:	Yes	No	Plot ID:	3
(If needed, explain on reverse)				

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
NYSSA AQUATICA	C	OBL	TAXODIUM DISTICHUM	C	OBL
MAGNOLIA VIRGINIANA	C	FACW+	MAGNOLIA VIRGINIANA	SH	FACW+
MAGNOLIA VIRGINIANA	SA	FACW+			
ACER RUBRUM	SA	FAC			
MYRICA CERIFERA	SH	FAC+			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). ALL TREES WITH BUTTRESSED TRUNKS AND PRONOUNCED SHALLOW ROOTS.

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	X Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	X Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: 1-2 (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 0 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 0 (in.)	X Oxidized Root Channels in Upper 12 inches
	X Water-Stained Leaves
	X Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY.

NORTH INTERIOR LOCATION #3
APPROXIMATELY 150 FEET WEST OF TERMINUS OF GRAVEL ROAD
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	PONZER AND SMITHTON SOILS	Drainage Class:	POORLY/VP. DRAINED
Taxonomy (subgroup):	ULTISOLS – TERRIC MEDISAPRISTS (PONZER)/ TYPIC PALEAQUULTS (SMITHTN)	Field Observations Confirmed Mapped Type?	Yes No UPPER EDGE

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-3+	A	10YR 4/1	NONE	N/A	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOILS. SOILS SO SATURATED THAT IT WAS IMPOSSIBLE TO EXTRACT SOILS DEEPER THAN 3' TO EXAMINE THE PROFILE.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND. THE THREE PARAMETERS ARE MET.

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, BROAD-LEAVED EVERGREEN AND DECIDUOUS, SATURATED (PFO1/3B).

SOUTH INTERIOR LOCATION #1
APPROXIMATELY 50 FEET WEST OF PZ002
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/23/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI
Do Normal Circumstances exist on the site?:	Yes **No**	Community ID:	BALD(POND)CYPRESS FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes **No**	Transect ID:	INTERIOR-SOUTH
Is the area a potential Problem Area?: (If needed, explain on reverse)	Yes **No**	Plot ID:	1

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
MAGNOLIA VIRGINIANA	C	FACW+	QUERCUS NIGRA	C	FAC
TAXODIUM DISTICHUM	C	OBL	WOODWARDIA AREOLATA	H	OBL
MAGNOLIA VIRGINIANA	SA	FACW+	PINUS ELLIOTTI	H	FACW
TAXODIUM DISTICHUM	SA	OBL			
ACER RUBRUM	SA	FAC			
MYRICA CERIFERA	SH	FAC+			
OSMUNDA REGALIS	H	OBL			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). MANY TREES WITH SLIGHTLY BUTTRESSED TRUNKS.

HYDROLOGY

Recorded Data (Described in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other
- X No Recorded Data Available

Field Observations:
- Depth of Surface Water: 2 (in.)
- Depth to Free Water in Pit: 0 (in.)
- Depth to Saturated Soil: 0 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- X Saturated in Upper 12 inches
- X Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 inches
- X Water-Stained Leaves
- X Local Soil Survey Data
- X FAC-Neutral Test
- Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY.

SOUTH INTERIOR LOCATION #1
APPROXIMATELY 50 FEET WEST OF PZ002
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	HYDE SILT LOAM	Drainage Class:	VERY POORLY DR.
Taxonomy (subgroup):	ULTISOLS – UMBRIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-20+	A/B	10YR 4/1	10YR 5/4	DISTINCT, <10%	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- X Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOILS. DEPLETED MATRIX (F3).

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND. THE THREE PARAMETERS ARE MET.

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, BROAD-LEAVED EVERGREEN, SATURATED (PFO3B).

SOUTH INTERIOR LOCATION #2
IN STRAIGHTENED CHANNEL AT PZ002
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/23/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI
Do Normal Circumstances exist on the site?:	Yes **No**	Community ID:	BALD(POND)CYPRESS FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes **No**	Transect ID:	INTERIOR-SOUTH
Is the area a potential Problem Area?: (If needed, explain on reverse)	Yes **No**	Plot ID:	2

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). N/A

Remarks: NO EMERGENT VEGETATION IN CHANNEL, WHICH IS APPROXIMATELY 5-10 FEET WIDE WITH ABRUPT BANKS. CHANNEL IS, HOWEVER, SHADED BY NUMEROUS BALDCYPRESS, SLASH PINE, AND RED MAPLE TREES GROWING IN THE ADJOINING FORESTED WETLANDS.

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	X Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	____ Water Marks
Field Observations:	____ Drift Lines
Depth of Surface Water: 3-6 (in.)	____ Sediment Deposits
Depth to Free Water in Pit: 0 (in.)	____ Drainage Patterns in Wetlands
Depth to Saturated Soil: 0 (in.)	Secondary Indicators (2 or more required):
	____ Oxidized Root Channels in Upper 12 inches
	____ Water-Stained Leaves
	X Local Soil Survey Data
	____ FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY.

SOUTH INTERIOR LOCATION #2
IN STRAIGHTENED CHANNEL AT PZ002
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	HYDE SILT LOAM	Drainage Class:	VERY POORLY DR.
Taxonomy (subgroup):	ULTISOLS – UMBRIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- X Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOILS ASSUMED (EXAMINATION OF PROFILE NOT POSSIBLE DUE TO INUNDATION).

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: THE THREE PARAMETERS ARE MET. WHILE NOT TECHNICALLY A WETLAND, THE CHANNEL IS A WATER OF THE UNITED STATES REGULATED UNDER THE SAME FEDERAL STATUTES THAT REGULATE WETLANDS.

USFWS CLASSIFICATION: RIVERINE UPPER PERENNIAL (R3).

SOUTH INTERIOR LOCATION #3
APPROXIMATELY 50 FEET WEST OF PZ002
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 1
1987 MANUAL

Project/Site:	NCBC GULFPORT SITE 8-OFF BASE	Date:	10/23/02
Applicant:	SOUTHERN DIVISION NAVFAC	County:	HARRISON
Investigator:	J. PEYTON DOUB, JENNIFER BARTON	State:	MISSISSIPPI

Do Normal Circumstances exist on the site?:	Yes	No	Community ID:	BALD(POND)CYPRESS FOREST
Is the site significantly disturbed (Atypical Situation)?:	Yes	No	Transect ID:	INTERIOR-SOUTH
Is the area a potential Problem Area?: (If needed, explain on reverse)	Yes	No	Plot ID:	3

VEGETATION

Dominant Plant Species	Stratum	Indicator	Other Plant Species	Stratum	Indicator
TAXODIUM DISTICHUM	C	OBL			
TAXODIUM DISTICHUM	SA	OBL			
ACER RUBRUM	SA	FAC			
MYRICA CERIFERA	SH	FAC+			
WOODWARDIA AREOLATA	H	OBL			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100

Remarks: HYDROPHYTIC VEGETATION. GREATER THAN 50% OF DOMINANT PLANT SPECIES ARE OBL, FACW, OR FAC (EXCLUDING FAC-). MANY TREES WITH SLIGHTLY BUTTRESSED TRUNKS.

HYDROLOGY

____ Recorded Data (Described in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake, or Tide Gauge	Primary Indicators:
____ Aerial Photographs	X Inundated
____ Other	X Saturated in Upper 12 inches
X No Recorded Data Available	X Water Marks
	____ Drift Lines
Field Observations:	____ Sediment Deposits
Depth of Surface Water: 1-2 (in.)	____ Drainage Patterns in Wetlands
Depth to Free Water in Pit: 0 (in.)	Secondary Indicators (2 or more required):
Depth to Saturated Soil: 0 (in.)	X Oxidized Root Channels in Upper 12 inches
	X Water-Stained Leaves
	X Local Soil Survey Data
	X FAC-Neutral Test
	____ Other (Explain in Remarks)

Remarks: WETLAND HYDROLOGY.

SOUTH INTERIOR LOCATION #3
APPROXIMATELY 50 FEET WEST OF PZ002
OFF-BASE AREAS AFFECTED BY NCBC GULFPORT SITE 8
WETLAND DELINEATION DATA FORM, PAGE 2
1987 MANUAL

SOIL

Map Unit Name (Series and Phase):	HYDE SILT LOAM	Drainage Class:	POORLY/VP. DRAINED
Taxonomy (subgroup):	ULTISOLS – UMBRIC PALEAQUULTS	Field Observations Confirmed Mapped Type?	Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture Concretions, Structure, etc,
0-3+	A/B	10YR 4/1	10YR 5/4	DISTINCT, <10%	SILT LOAM

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soil
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: HYDRIC SOILS.

WETLAND DETERMINATION

	(Circle)			(Circle)	
Hydrophytic Vegetation Present?	Yes	No	Is this Sampling Point Within a Wetland?	Yes	No
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No			

Remarks: WETLAND. THE THREE PARAMETERS ARE MET.

USFWS CLASSIFICATION: PALUSTRINE FORESTED WETLAND, BROAD-LEAVED EVERGREEN, SATURATED (PFO3B).

REVISION 0
OCTOBER 2004

Environmental Permits Report
for
Site 8 – Herbicide Orange Storage Area
and
Off-Base Area of Contamination

Naval Construction Battalion Center
Gulfport, Mississippi

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0272

October 2004

REVISION 0
OCTOBER 2004

ENVIRONMENTAL PERMITS REPORT
for
SITE 8 – HERBICIDE ORANGE STORAGE AREA
and
OFF-BASE AREA OF CONTAMINATION

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0272

OCTOBER 2004

PREPARED UNDER THE SUPERVISION OF:

ROBERT FISHER
TASK ORDER MANAGER
TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA

APPROVED FOR SUBMITTAL BY:

DEBRA M. HUMBERT
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

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3-1 Project Permits Checklist

FIGURES

NUMBER
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ACRONYMS LIST

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
µg/kg	microgram per kilogram
AO	Agreed Order
AOC	Area of Contamination
CLEAN	Comprehensive Long-Term Environmental Action Navy
CNOI	Construction Notice of Intent
COC	chemical of concern
CTO	Contract Task Order
DMR	Department of Marine Resources
DOD	Department of Defense
FFS	Focused Feasibility Study
HO	Herbicide Orange
MDEQ	Mississippi Department of Environmental Quality
msl	mean sea level
Navy	United States Department of the Navy
NCBC	Naval Construction Battalion Center
NWP	nationwide permit
OPC	Office of Pollution Control
PCN	preconstruction notification
POTW	publicly owned treatment works
PVC	polyvinyl chloride
RA	remedial action
RAO	remedial action objective
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
SRT	sediment recovery trap
SWPPP	Stormwater Pollution Prevention Plan
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TtNUS	Tetra Tech NUS, Inc.
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Environmental Permits Report was prepared under Contract Task Order (CTO) No. 0272 under Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62467-94-D-0888. Under this CTO, Tetra Tech NUS, Inc. (TtNUS) is performing engineering and design services for the remedial action (RA) at Site 8 – Herbicide Orange Storage Area (Site 8) and contiguous on-base drainage channels at the Naval Construction Battalion Center (NCBC or "base"), and associated off-base Area of Contamination (AOC) in Gulfport, Mississippi.

1.1 SITE BACKGROUND

NCBC Gulfport is located in the southeastern corner of Mississippi, approximately 2 miles north of the Gulf of Mexico. The base is located in the western part of the City of Gulfport in Harrison County. Figure 1-1 shows the location of the base in relation to the City of Gulfport and the Gulf of Mexico. The off-base AOC is located north of NCBC, across 28th Street near Outfall 3. The base occupies 1,100 acres with an average elevation of approximately 30 feet above sea level. A map of NCBC Gulfport is provided as Figure 1-2.

From 1968 through 1977, approximately 31 acres of the base, now known as Site 8, were used for the storage and handling of approximately 850,000 gallons of herbicide orange (HO) in 55-gallon drums. As shown on Figure 1-2, Site 8 was divided into three adjacent areas (Site 8A, Site 8B, and Site 8C), based on the level of storage and handling of HO. Site 8A was continually in use. Sites 8B and 8C were used periodically as overflow storage areas. HO is a herbicide formulation used during the Vietnam War to defoliate trees and shrubbery. It is an equal mixture of two agricultural herbicides [2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T)] in a diesel fuel or jet fuel mixture. Spills and leaks of HO occurred within all three areas of Site 8, contaminating the surface soil and sediment with 2,4,5-T and 2,4-D and byproduct contaminants (dioxins and furans), primarily 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Concentrations of 2,4,5-T and 2,4-D have degraded over time; however, dioxin and furan concentrations have remained above regulatory limits. Throughout this report, TCDD and its chemically related dioxin and furan congeners will be collectively referred to as "dioxins."

1.1.1 Site Description

Site 8A, which is approximately 13 acres in size, has an undulating surface because of previous remedial activities and is covered with light vegetation. Approximately one-third of the site consists of stabilized areas (soil cement) that were used as the lay-down areas for the HO drums. The surface soil in non-

stabilized areas is typically a fine- to medium-grained sand. Site 8A includes the upper reaches of the drainage areas for the eastern two-thirds of the base. Surface drainage from Site 8A flows to the northwest and exits the base at Outfall 3 into the off-base AOC, a swampy area that is part of the Turkey Creek Basin (HLA, 2000).

Sites 8B and 8C, which total approximately 18 acres, are relatively flat with almost no vegetation. The surface soil consists of a fine- to medium-grained sand, and approximately one-third of the surface areas are stabilized with cement. Sites 8B and 8C are also located at the heads of local drainage areas. Surface water from Site 8B flows north and exits the base at Outfall 4. Surface water from Site 8C flows to the southeast and exits the base at Outfall 2 (south) into Brickyard Creek (TtNUS, 2003).

1.1.2 Site History

The area now known as Site 8 was used as an equipment storage and staging area prior to 1968. Between 1968 and 1977, the areas was used by the United States Air Force (USAF) as a storage and handling area for HO in support of the defoliation program in Vietnam known as Operation Ranchhand. In 1977, the HO was removed from Site 8, transported to port by railroad, and placed in an incinerator ship for destruction at sea in the South Pacific. The release of associated dioxins was confirmed in 1977, and the site was fenced and left inactive until 1985.

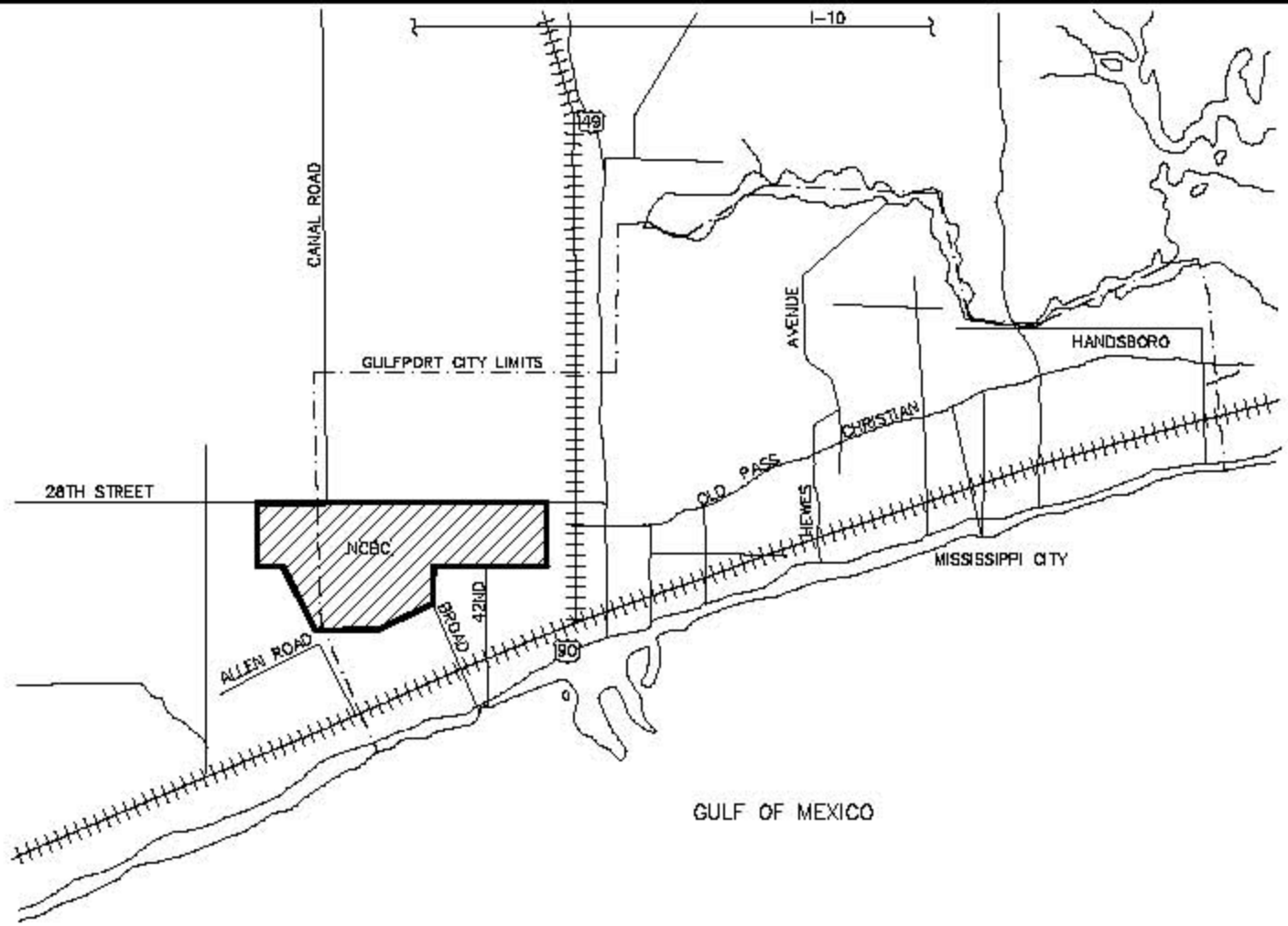
Dioxin-related investigations at Site 8 began in 1977. The initial HO monitoring programs were conducted from 1977 to 1984. Comprehensive soil characterization and confirmation studies were conducted from 1984 to 1988. Between 1985 and 1987, the soil at Site 8 was remediated to the current United States Environmental Protection Agency (USEPA) dioxin criterion of 1.0 micrograms per kilogram (µg/kg). The excavated soil and sediment with dioxin concentrations greater than this level were incinerated and placed on Site 8A. However, the investigation did not include the drainage systems carrying surface water and sediment from the site into lower reaches of the local drainage basins (Design Drawings C-1 through C-5). Dioxin delineation studies were conducted from 1995 through 1999. In 2000 and 2001, TtNUS performed bench- and pilot-scale treatability studies to determine whether HO-impacted media could be effectively remediated through stabilization and landfilling at Site 8A (TtNUS, 2001a; 2001b).

On November 6, 1997, the Navy, USAF, and Mississippi Department of Environmental Quality (MDEQ) finalized Agreed Order (AO) No. 3466-97, which requires adequate identification, delineation, and remediation of all impacted media related to the storage and handling of HO and related chemicals at Site 8.

1.2 PURPOSE

The purpose of this Environmental Permits Report is to identify applicable permits, filing procedures, and filing costs required to complete the RA outlined in Section 2.0.

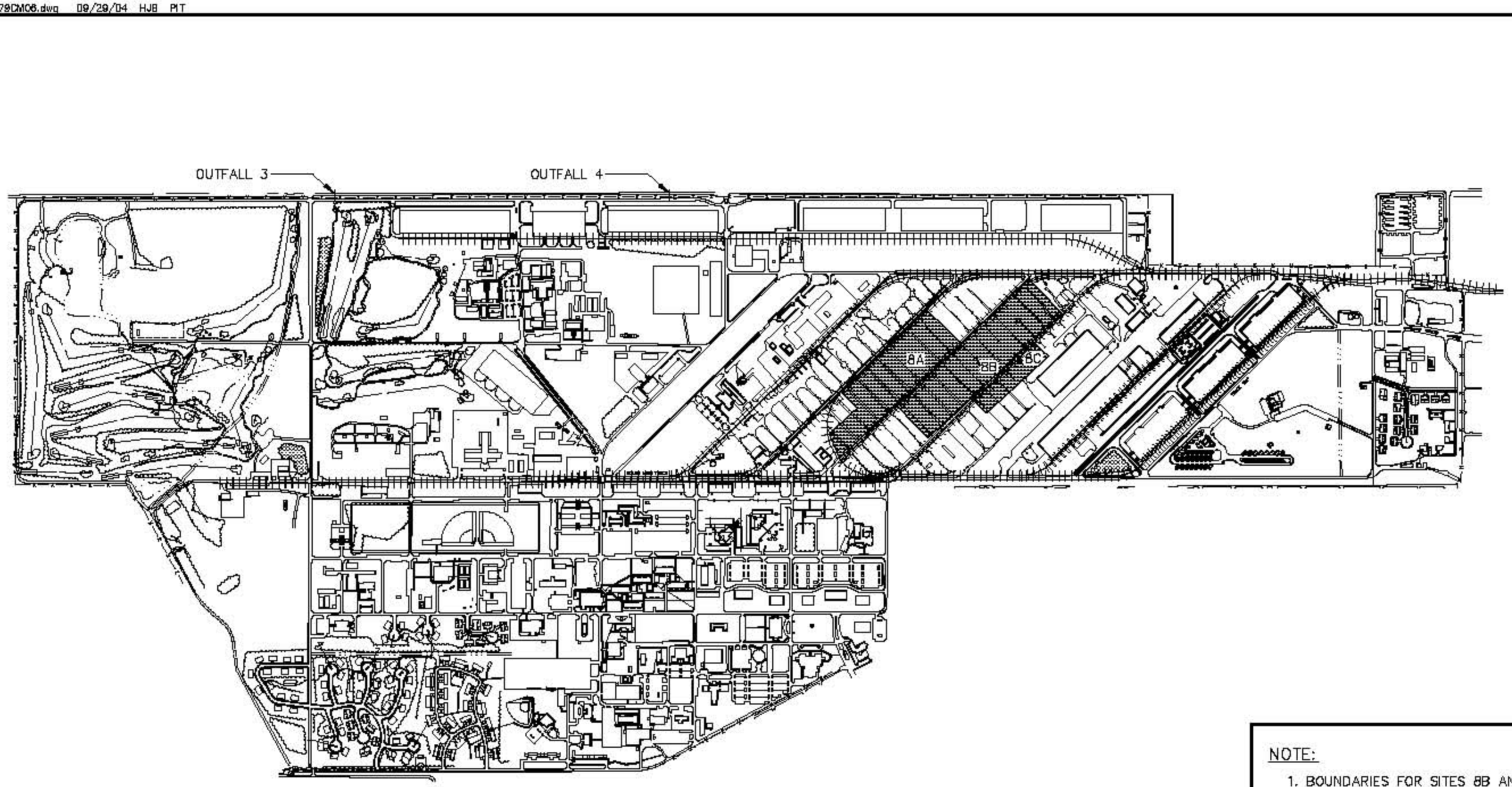
ACAD: 7379CM02.dwg 09/29/04 HJB PIT



DRAWN BY MF DATE 11/14/02	VICINITY MAP SITE B ENVIRONMENTAL PERMITS REPORT NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 7379	
CHECKED BY JJB DATE 5/13/03		APPROVED BY DATE	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE NONE		DRAWING NO. FIGURE 1-1	REV. 0

FORM CADD NO. SDIV_AHJDWG - REV 0 - 1/20/98

ACAD: 7379DM06.dwg 09/29/04 HJB PIT



NOTE:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.

0 1000 2000
SCALE IN FEET

SOURCE: BASEMAP DWG., PUBLIC WORKS DEPARTMENT, NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MS, JUNE 2001

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 11/14/02
CHECKED BY JJB DATE 5/13/03
COST/SCHED-AREA
SCALE AS NOTED

INSTALLATION MAP
SITE 8
ENVIRONMENTAL PERMITS REPORT
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 1-2
REV. 0

FORM CADD NO. SDIV_BHJDWG - REV 0 - 1/20/98

2.0 PROPOSED REMEDIAL ACTION

2.1 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are based on the contaminated media, potential human health and environmental threats, and regulatory standards, requirements, and guidance. Based on previous investigations and human health and ecological risk assessments, the media of concern are Site 8A soil ash, associated on-base drainage system sediment, off-base AOC sediment, and groundwater. The chemicals of concern (COCs) are dioxins.

Groundwater is retained as a medium of concern; however, Focused Feasibility Study (FFS) remedial alternatives were not developed to directly address impacts to groundwater. Dioxins are highly organophillic in nature, and many of the groundwater samples with elevated dioxin concentrations were turbid. As a result, the elevated dioxin levels are likely associated with the overlying sediment contamination. Remedial actions taken to address sediment are expected to indirectly address dioxin impacts to groundwater.

Surface water is not considered at medium of concern at Site 8 or within the associated drainage systems based on the results of past monitoring. No unacceptable risks to ecological receptors were identified during previous investigations and risk assessments.

The RAOs are as follows:

- Protect human health from the potential carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated surface soil and sediment.

- Protect human health from the carcinogenic risks associated with ingestion of and dermal contact with on-site and off-site groundwater based on potential residential future use scenarios.

- Comply with federal and State regulations and guidance criteria in accordance with accepted USEPA and MDEQ guidelines.

2.2 REMEDIAL ACTION DESCRIPTION

The RA for Site 8 will consist of surface water controls, excavation of contaminated media, stabilization and on-site disposal of contaminated media, and installation of a cap over the stabilized media. Institutional controls will be imposed, and the site will be monitored.

The major construction activities to be performed during this work are as follows:

Surface Water Controls: Surface water controls will divert water from the areas of sediment excavation through installation of marine-grade polyvinyl chloride (PVC) sheet piling and pumping with bladder-type mud pumps. Surface water controls will also consist of installing silt screens and sediment recovery traps (SRTs) downstream of the excavation areas to capture potentially contaminated sediment particles that may migrate as a result of excavation activities.

Excavation of Soil Ash and Contaminated Sediment: Media with contaminant concentrations in excess of the dioxin preliminary remediation goals (PRGs), including Site 8A soil ash and contaminated on-base drainage channel sediment, and contaminated off-base AOC sediment, will be excavated Approximately 71,000 cubic yards of material will be excavated. Excavated sediment will be loaded onto trucks for staging at Site 8A. Verification sampling will be conducted to verify that the PRGs have been attained.

Chemical Stabilization and On-Base Disposal: The soil ash, on-base drainage channel sediment, and off-base AOC sediment will be removed from their respective Site 8A stockpiles or staging areas and placed into dump trucks in alternating layers until the trucks are full. This pre-mixed material blend will then be spread as loose lifts over the area of Site 8A dedicated to this purpose. A layer of Portland cement will be spread over each lift then mixed into the material blend. Each loose lift of amended material blend will be leveled and compacted.

Capping: A cover system will be installed over the final lift of amended material blend. The cover system will consist of 12 inches of rigid pavement (e.g., roller-compacted concrete) designed in accordance with United States Army Corps of Engineers (USACE) technical manual TM 5-822-5 (USACE, 1992). This cover system will allow the cap to be used as a storage area for heavy equipment.

Institutional Controls and Monitoring: Institutional controls will be implemented to restrict access to the capped area and to control future land use. Residential use will not be permitted. Institutional controls will also include regular inspection, maintenance, and repair of the capped area to ensure continued structural integrity. Periodic monitoring of groundwater will be conducted to verify that dioxin is not leaching from the stabilized material at unacceptable levels. Periodic monitoring of sediment in drainage channels downgradient of the capped area will also be performed to verify that dioxin is not migrating via erosion at levels greater than regulatory criteria.

3.0 REQUIRED PERMITS

Table 3-1 presents a project permits checklist to assess permit requirements potentially applicable to the RA to ensure regulatory compliance. The table lists the type of permit, license, or certification that may be required by government agencies for specific types of projects. Based on a review of the permit checklist, permits are required for excavating sediment from off-base wetlands and for stormwater associated with construction activities. The requirements are summarized below and described in Section 4.0.

3.1 FEDERAL PERMITS AND REQUIREMENTS

No USEPA permits are required for this project. Requirements for stormwater discharges are administered by State agencies.

A USACE permit is required for removing sediment from the off-base AOC. There are two types of authorizations [nationwide permit (NWP) or individual permit] that may be applicable to work at this site. The District Engineer has the discretion to determine which type of permit is applicable to the work to be performed.

- NWPs are a form of general permit and are the simplest type of permits. General permits are designed to regulate activities of small scope and that have minimal impacts. NWP 38, Cleanup of Hazardous and Toxic Waste, is for specific activities required to effect the containment, stabilization, or removal of hazardous or toxic waste materials.

- Standard individual permits are processed through the typical review and coordination procedures including the publishing of a public notice, the opportunity for a public hearing, and receipt of comments from environmental and governmental agencies and the public. This permit is used for any activity that does not qualify under other permit processes, is controversial in nature, or is expected to cause more than minimal environmental impacts.

After preliminary consultations with the USACE in February 2003, an NWP 38 permit application will be submitted for the upcoming excavation actions in the off-base AOC.

3.2 STATE PERMITS

State permits are required to discharge stormwater from construction activities and to excavate sediment from the off-base AOC.

The MDEQ Office of Pollution Control (OPC) Storm Water Construction General Permit (Permit No. MSR10) is applicable to discharges composed entirely of stormwater from construction activity including clearing, grading, excavation, and other land-disturbance activities disturbing 5 or more acres.

The Mississippi Department of Marine Resources (DMR) is the point of contact for wetland permits in the Mississippi Coastal Zone, which includes Harrison County. Under a Memorandum of Agreement with the USACE, permits for wetland activities in the Mississippi Coastal Zone are submitted to DMR. The DMR will then evaluate the permit application and forward copies to the appropriate agencies. For minor activities within the jurisdiction of the DMR, at or below the watermark of the ordinary high tide, DMR will issue a joint USACE/DMR permit. For major activities such as those not covered by the General Permit Guidelines, a separate permit will be used by the DMR and by the USACE. In any case, the application is submitted to DMR on the Joint Application Form.

TABLE 3-1

PROJECT PERMITS CHECKLIST
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NCBC, GULFPORT, MISSISSIPPI

Type of Project	Type of Permit, License, or Certification	Issuing Agency	Applicability	Reason
Stationary Air Emission Source	Permit to Construct	State	Not applicable	Construction of an air emission source will not occur.
	Permit to Operate	State	Not applicable	
Construction in Floodplain, Waterway, or Wetland	Section 404 Dredge/Fill Permit	State and USACE	Applicable	Sediment will be excavated from a wetland.
	Coastal Zone Wetlands Permit	State and USACE	Applicable	
Wastewater Discharge to "Waters of the U.S."	Surface Water Discharge Permit (National Pollutant Discharge Elimination System)	State and USEPA	Not applicable	Discharge of wastewater to surface water will not occur.
Wastewater Discharge to Sewer	Pretreatment Permit [if to municipal Publicly Owned Treatment Works (POTW)]	State or local	Not applicable	Discharge of wastewater to sewer will not occur.
Dredge/Fill and Filling Wetlands	Section 404 Dredge/Fill Permit	State and USACE	Applicable	Sediment will be excavated from a wetland.
	Coastal Zone Wetlands Permit	State and USACE	Applicable	
	Ocean Disposal Permit	State or USEPA	Not applicable	Ocean disposal will not be performed.
Structure in Navigable Waters	Section 10 Permit	USACE	Not applicable	No structures are being built (placed) in navigable waters.
Stormwater Discharge to "Waters of the U.S."	General Permit for Construction Activity	State	Applicable	Construction activity covers more than 5 acres.
Earth-Moving Operations	Stormwater Pollution Prevention Plan	State	Applicable	Plan required for General Permit for Construction Activity.
Solid Waste Landfills	Permit to Operate	State	Not applicable	On-site disposal is being conducted under Agreed Order No. 3466-97. State is not requiring a landfill permit.

TABLE 3-1

PROJECT PERMITS CHECKLIST
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NCBC, GULFPORT, MISSISSIPPI

Type of Project	Type of Permit, License, or Certification	Issuing Agency	Applicability	Reason
Hazardous Waste Generation	USEPA Identification Number	State	Not applicable	Off-site shipment of hazardous waste will not occur.
Hazardous Waste Transporting	USEPA Identification Number	State	Not applicable	Off-site shipment of hazardous waste will not occur.
Hazardous Waste Treatment, Storage, or Disposal	Part A Permit Part B Permit	State	Not applicable	Hazardous waste will not be treated, stored, or disposed on site.
Underground Storage Tanks	Permit to Construct Permit to Operate Registration	State or USEPA	Not applicable	No underground storage tanks are associated with this project.
Pesticide Application	Applicator Certification	DOD	Not applicable	Pesticides will not be used.

DOD Department of Defense
USEPA United States Environmental Protection Agency
POTW Publicly owned treatment works
USACE United States Army Corps of Engineers
NPDES Nationwide Pollution Discharge Elimination System

4.0 PERMIT APPLICATION AND COMPLIANCE

4.1 NATIONWIDE PERMIT 38 – CLEANUP OF HAZARDOUS AND TOXIC WASTE

NWP 38 may be applicable, at the discretion of the USACE District Engineer, for excavation of sediment from the off-base AOC. NWP 38 is for activities required to removal hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal and regulatory authority (e.g., MDEQ) provided the permittee notifies the District Engineer in accordance with the "Notification" General Condition. Court-ordered remedial action plans or related settlements are also authorized by this NWP. This NWP does not authorize the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste.

The prospective permittee must notify the District Engineer with a preconstruction notification (PCN) as early as possible. The District Engineer must determine if the notification is complete within 30 days of the date of receipt and can request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, the District Engineer will notify the prospective permittee that the notification is still incomplete, and the PCN review process will not commence until all of the requested information has been received by the District Engineer. The prospective permittee shall not begin the activity until notified in writing by the District Engineer that the proposed activities may proceed under the NWP with any special conditions imposed by the District Engineer. The District Engineer may also notify the prospective permittee that an individual permit is required.

The notification must be in writing and include the following information:

- Name, address, and telephone numbers of the prospective permittee.
- Location of the proposed project.
- Brief description of the proposed project, the purpose of the project, direct and indirect adverse environmental effects the project would cause, any other NWP(s), General Permit(s), or Individual Permit(s) used or intended to be used to authorize any part of the proposed project or related activity. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP.
- A delineation of affected special aquatic sites, including wetlands.

The standard individual permit application form (Form ENG 4345) may be used as the PCN if it is clearly indicated as such. A letter containing the required notification information may also be used. The notification is sent to the District Engineer, United States Army Engineer District Mobile, P.O. Box 2288, Mobile, AL 36628-0001.

In reviewing the PCN for the proposed activity, the District Engineer will determine whether the activity will result in more than minimal individual or cumulative adverse environmental impacts or may be contrary to the public interest. The prospective permittee may submit a plan of mitigation activities with the PCN to expedite the process.

In addition to any special conditions that may be imposed by the District Engineer, there are many general conditions that must be followed for any authorization by an NWP to be valid. General conditions are contained in Appendix A. General conditions that may affect the permitting and design for Site 8 are as follows:

- Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction. All exposed soil and other fills and any work below the ordinary high water mark must be permanently stabilized at the earliest practicable date. Work during periods of low flow or no flow is encouraged.

- No activity may substantially disrupt the necessary life-cycle movements of those species of aquatic life indigenous to the waterbody, including those that normally migrate through the area.

- Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.

- An individual state coastal zone management consistency concurrence must be obtained or waived.

- Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable.

- Activities in breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

A compliance certification must be submitted at the completion of the work and any required mitigation. The certification includes the following:

- A statement that the authorized work was done in accordance with USACE authorization, including any general or specific conditions.

- A statement that any required mitigation was completed in accordance with the permit conditions.

- The signature of the permittee certifying the completion of work and mitigation.

There are no permit fees associated with NWPs.

4.2 JOINT APPLICATION AND NOTIFICATION

A Joint Application and Notification form (Appendix B) is used for individual permits issued by USACE and/or Mississippi DMR. Discussions with the local USACE field office and/or Mississippi DMR are encouraged prior to submitting the permit application to identify possible problems and to attempt to rectify these initial concerns prior to the permit review. For a DMR staff member to evaluate the site and discuss any proposed activities, the request must be submitted in writing and include the following information: directions, map, detailed diagram, proposed plans, contact number, and mailing address. Site inspections may take several weeks to complete after all requested information has been received.

The DMR is the point of contact for wetland permits in the Mississippi Coastal Zone, which includes Harrison County. Under a Memorandum of Agreement with the Mobile, Alabama District of the USACE, permits for wetlands in the Mississippi Coastal Zone are to be submitted to the DMR on a standard permit form. The DMR will then evaluate the permit application for completeness and forward copies to the appropriate agencies. For minor activities within the jurisdiction of the DMR, at or below the watermark of ordinary high tide, DMR will issue the joint USACE permit. For major activities, a separate permit will be issued by DMR and by the USACE.

Information required for the Joint Application and Notification includes the following:

- Name, mailing address, and telephone number of applicant.

- Project location (address, name of waterway, and geographic location).

- Project description (length, width, existing depth, and proposed depth of sediment removal; cubic yards of sediment to be removed; location and dimensions of sediment disposal area; method of

excavation; and how excavated material will be contained). Additional information relating to the proposed activity (e.g., presence of marsh vegetation).

- Project schedule and estimated cost.

- Purpose of the project and public benefits of the proposed activity.

- List of all approvals and certifications received or applied for from federal, State, and local agencies.

- Vicinity map showing the location of the proposed site and a written description of how to reach the site from major highways and landmarks. Accurate drawing of the project site with proposed activities shown in detail. All drawings must be to scale or with dimensions noted on the drawing and must show a plan view and cross section or elevation. Drawings are to be 8.5 by 11 inches.

- It the applicant desires to have an agent or consultant act in his behalf for permit coordination, a signed authorization designating such agent must be provided with the application forms. The authorized agent may sign the application forms and consistency statement. A copy of the authorization form is provided in Appendix B.

- Adjacent property owner authorization form (Appendix B).

- Appropriate report or statement assessing environmental impacts of the proposed activity and the final project dependent on it. The project's effects on the wetlands and the effects on the life dependent on them should be addressed. A complete description of any measures to be taken to reduce detrimental off-site effects to coastal wetlands during and after the proposed activity is to be provided.

The completed application and appropriate fees are sent to the Department of Marine Resources, 152 Gateway Drive, Biloxi, Mississippi 39531.

The typical processing procedure for a standard individual permit is as follows:

- Pre-application consultation (optional)
- Permit application submitted
- Application received and assigned an identification number
- Public notice issued (within 15 days of receiving all information)
- 15- to 30-day comment period depending on the nature of the activity

- Proposal reviewed by federal, State, and local agencies, the public, and special interest groups
- Comments are considered and other agencies are consulted, if appropriate
- Applicant may be requested to provide additional information
- Public hearing held, if needed
- Decision is made [permit is either issued or denied and applicant is advised of the reason(s)]

Individual permits are usually processed within 120 days from the date a complete application is submitted. In some cases, however, the processing time may be greater than 120 days.

4.3 STORMWATER CONSTRUCTION GENERAL PERMIT

This permit is for discharges composed entirely of stormwater from construction activity including clearing, grading, excavation, and other land-disturbance activities disturbing 5 or more acres. Owners and/or prime contractors must submit a Construction Notice of Intent (CNOI) in accordance with the requirements of the general permit. Copies of the CNOI and general permit are provided in Appendix C. The MDEQ OPC authorizes owners or operators to discharge stormwater associated with construction activities under the terms and conditions of this permit only upon receipt of written notification of approval of coverage. Persons desiring coverage under this general permit shall submit a CNOI form at least 30 days prior to the commencement of construction [or 15 days if the Stormwater Pollution Prevention Plan (SWPPP) has previously been approved)]. Submittal of the CNOI must include a United States Geological Survey Quadrangle Map (or copy) showing site location and stormwater outfalls and the SWPPP.

The applicant must be the owner or prime contractor. The applicant receives coverage and is responsible for permit compliance. The owner may apply and at a later date require the prime contractor to assume permit compliance. Information required for the CNOI includes the following:

- Owner information (contact person, agency, address, and telephone number).
- Prime contractor information (contact person, company, address, and telephone number).
- Project information (name, description of construction activity, proposed description of property after construction has been completed, physical site address, nearest named receiving stream, wetland/streams within 0.5 mile downstream of project boundary, total acreage that will be disturbed, estimated start and completion dates, type of soil on site).
- Documentation of compliance with other regulations and requirements.

CNOI forms are to be submitted to Chief, Environmental Permits Division, Mississippi Department of Environmental Quality, Office of Pollution Control, P.O. Box 10385, Jackson, Mississippi 39289-0385.

The covered owner or prime contractor must notify the MDEQ OPC at least 30 days whenever there are any changes in information previously submitted to the MDEQ OPC in the CNOI.

A SWPPP will be developed and submitted with the CNOI and will identify potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges associated with construction activity. The SWPPP will describe and ensure the implementation of practices that will reduce pollutants in stormwater discharges and assure compliance with the terms and conditions of the general permit. The SWPPP will be amended whenever there is a change in design, construction, operation, or maintenance that may potentially effect the discharge of pollutants or if the SWPPP proves to be ineffective in controlling stormwater pollutants. The SWPPP will be in compliance with all local stormwater ordinances.

The SWPPP will be developed in accordance with the Mississippi SWPPP Guidance Manual for Construction Activities (Office of Pollution Control, 2000) and will contain details on the following:

- Erosion and sediment controls (vegetative practices, structural practices, and post-construction control measures) in accordance with the standards set forth in Planning and Design Manual for the Control of Erosion, Sediment and Stormwater (United States Department of Agriculture, 1994) or other recognized manual of design.

- Housekeeping practices appropriate to prevent pollutants from entering stormwater from construction sites because of poor housekeeping.

- Scaled site maps showing original and proposed contours (if practicable), drainage patterns, adjacent receiving water bodies, north arrow, all erosion and sediment controls, post-construction control methods, and locations of housekeeping practices.

- Implementation sequence that coordinates the timing of all major land-disturbing activities together with necessary erosion and sediment controls.

- Procedures to maintain erosion and sediment controls. All erosion controls are to be inspected at least once a week. Monthly inspection forms are to be completed.

A Notice of Termination of Coverage is to be submitted after construction activities have ceased and upon successful completion of all permanent erosion and sediment controls. All monthly inspection forms must be attached.

REFERENCES

Harding Lawson Associates (HLA), 2000. *Remediation Planning Document, Naval Construction Battalion Center, Gulfport, Mississippi.* Prepared for Southern Division Naval Facilities Engineering Command (SOUTHDIVNAVFACENGCOM), Charleston, South Carolina. August.

Office of Pollution Control (OPC), 2000. *Mississippi Stormwater Pollution Prevention Plan (SWPPP) Guidance Manual for Construction Activities*. General Permits Branch, OPC, Mississippi Department of Environmental Quality, March.

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

TtNUS, 2001b. *Report for Pilot-Scale Soil/Sediment Treatability Study, Site 8, Herbicide Orange Storage Area at Naval Construction Battalion Center, Gulfport, Mississippi.* Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina. December.

TtNUS, 2003. *Focused Feasibility Study, Site 8, Herbicide Orange Storage Area at Naval Construction Battalion Center, Gulfport, Mississippi.* Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina. March.

United States Department of Agriculture (USDA), 1994. *Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater*, *First Edition*. A cooperative effort by the United States Department of Agriculture Natural Resources Conservation Service, the Mississippi Department of Environmental Quality, and the Mississippi Soil and Water Conservation Commission, April.

United States Army Corps of Engineers (USACE), 1992. TM 5-822-5/AFM 88-7, Chapter 1, Pavement Design for Roads, Streets, Walks, and Open Storage Areas, 12 June 1992.

APPENDIX A

NATIONWIDE PERMIT GENERAL CONDITIONS

Federal Register

Tuesday,
January 15, 2002

Part II

Department of Defense

Department of the Army, Corps of Engineers

Issuance of Nationwide Permits; Notice

US at the project site to the maximum extent practicable, and the notification must include a written statement detailing compliance with this condition (i.e., why the discharge must occur in waters of the US and why additional minimization cannot be achieved);

c. In addition to General Conditions 17 and 20, activities authorized by this permit must not substantially alter the sediment characteristics of areas of concentrated shellfish beds or fish spawning areas. Normally, the mandated water quality management plan should address these impacts;

d. The permittee must implement necessary measures to prevent increases in stream gradient and water velocities and to prevent adverse effects (e.g., head cutting, bank erosion) to upstream and downstream channel conditions;

e. Activities authorized by this permit must not result in adverse effects on the course, capacity, or condition of navigable waters of the US;

f. The permittee must use measures to minimize downstream turbidity;

g. Wetland impacts must be compensated through mitigation approved by the Corps;

h. Beneficiation and mineral processing for hard rock/mineral mining activities may not occur within 200 feet of the ordinary high water mark of any open waterbody. Although the Corps does not regulate discharges from these activities, a CWA section 402 permit may be required;

i. All activities authorized must comply with General Conditions 9 and 21. Further, the District Engineer may require modifications to the required water quality management plan to ensure that the authorized work results in minimal adverse effects to water quality;

j. Except for aggregate mining activities in lower perennial streams, no aggregate mining can occur within stream beds where the average annual flow is greater than 1 cubic foot per second or in waters of the US within 100 feet of the ordinary high water mark of headwater stream segments where the average annual flow of the stream is greater than 1 cubic foot per second (aggregate mining can occur in areas immediately adjacent to the ordinary high water mark of a stream where the average annual flow is 1 cubic foot per second or less);

k. Single and complete project: The discharge must be for a single and complete project, including support activities. Discharges of dredged or fill material into waters of the US for multiple mining activities on several designated parcels of a single and complete mining operation can be authorized by this NWP provided the ½-acre limit is not exceeded; and

l. *Notification:* The permittee must notify the District Engineer in accordance with General Condition 13. The notification must include: (1) A description of waters of the US adversely affected by the project; (2) A written statement to the District Engineer detailing compliance with paragraph (b), above (i.e., why the discharge must occur in waters of the US and why additional minimization cannot be achieved); (3) A description of measures taken to ensure that the proposed work complies with paragraphs (c) through (f), above; and (4) A reclamation plan (for aggregate mining in isolated waters and non-tidal wetlands adjacent to headwaters and hard rock/mineral mining only).

This NWP does not authorize hard rock/mineral mining, including placer mining, in streams. No hard rock/mineral mining can occur in waters of the US within 100 feet of the ordinary high water mark of headwater streams. The term's "headwaters" and "isolated waters" are defined at 33 CFR 330.2(d) and (e), respectively. For the purposes of this NWP, the term "lower perennial stream" is defined as follows: "A stream in which the gradient is low and water velocity is slow, there is no tidal influence, some water flows throughout the year, and the substrate consists mainly of sand and mud." (Sections 10 and 404)

C. Nationwide Permit General Conditions

The following General Conditions must be followed in order for any authorization by an NWP to be valid:

1. *Navigation.* No activity may cause more than a minimal adverse effect on navigation.

2. *Proper Maintenance.* Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.

3. *Soil Erosion and Sediment Controls.* Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

4. *Aquatic Life Movements.* No activity may substantially disrupt the necessary life-cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. Culverts placed in streams must be installed to maintain low flow conditions.

5. *Equipment.* Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.

6. *Regional and Case-By-Case Conditions.* The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)). Additionally, any case specific conditions added by the Corps or by the state or tribe in its Section 401 Water Quality Certification and Coastal Zone Management Act consistency determination.

7. *Wild and Scenic Rivers.* No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

8. *Tribal Rights.* No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

9. *Water Quality.* (a) In certain states and tribal lands an individual 401 Water Quality Certification must be obtained or waived (See 33 CFR 330.4(c)).

(b) For NWPs 12, 14, 17, 18, 32, 39, 40, 42, 43, and 44, where the state or tribal 401 certification (either generically or individually) does not require or approve water quality management measures, the permittee must provide water quality management measures that will ensure that the authorized work does not result in more than minimal degradation of water quality (or the Corps determines that compliance with state or local standards, where applicable, will ensure no more than minimal adverse effect on water quality). An important component of water quality management includes stormwater management that minimizes degradation of the downstream aquatic system, including water quality (refer to General Condition 21 for stormwater

management requirements). Another important component of water quality management is the establishment and maintenance of vegetated buffers next to open waters, including streams (refer to General Condition 19 for vegetated buffer requirements for the NWPs).

This condition is only applicable to projects that have the potential to affect water quality. While appropriate measures must be taken, in most cases it is not necessary to conduct detailed studies to identify such measures or to require monitoring.

10. *Coastal Zone Management.* In certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see Section 330.4(d)).

11. *Endangered Species.* (a) No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the District Engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or is located in the designated critical habitat and shall not begin work on the activity until notified by the District Engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that may affect Federally-listed endangered or threatened species or designated critical habitat, the notification must include the name(s) of the endangered or threatened species that may be affected by the proposed work or that utilize the designated critical habitat that may be affected by the proposed work. As a result of formal or informal consultation with the FWS or NMFS the District Engineer may add species-specific regional endangered species conditions to the NWPs.

(b) Authorization of an activity by a NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the USFWS or the NMFS, both lethal and non-lethal "takes" of protected species are in violation of the ESA. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the USFWS and NMFS or their world wide web pages at *http://www.fws.gov/r9endspp/endspp.html* and *http://www.nfms.gov/prot_res/esahome.html* respectively.

12. *Historic Properties.* No activity which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is authorized, until the District Engineer has complied with the provisions of 33 CFR part 325, Appendix C. The prospective permittee must notify the District Engineer if the authorized activity may affect any historic properties listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places (see 33 CFR 330.4(g)). For activities that may affect historic properties listed in, or eligible for listing in, the National Register of Historic Places, the notification must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property.

13. *Notification.*

(a) *Timing;* where required by the terms of the NWP, the prospective permittee must notify the District Engineer with a preconstruction notification (PCN) as early as possible. The District Engineer must determine if the notification is complete within 30 days of the date of receipt and can request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the District Engineer will notify the prospective permittee that the notification is still incomplete and the PCN review process will not commence until all of the requested information has been received by the District Engineer. The prospective permittee shall not begin the activity:

(1) Until notified in writing by the District Engineer that the activity may proceed under the NWP with any special conditions imposed by the District or Division Engineer; or

(2) If notified in writing by the District or Division Engineer that an Individual Permit is required; or

(3) Unless 45 days have passed from the District Engineer's receipt of the complete notification and the prospective permittee has not received written notice from the District or Division Engineer. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) *Contents of Notification:* The notification must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed project;

(3) Brief description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), Regional General Permit(s), or Individual Permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP (Sketches usually clarify the project and when provided result in a quicker decision.);

(4) For NWPs 7, 12, 14, 18, 21, 34, 38, 39, 41, 42, and 43, the PCN must also include a delineation of affected special aquatic sites, including wetlands, vegetated shallows (e.g., submerged aquatic vegetation, seagrass beds), and riffle and pool complexes (see paragraph 13(f));

(5) For NWP 7 (Outfall Structures and Maintenance), the PCN must include information regarding the original design capacities and configurations of those areas of the facility where maintenance dredging or excavation is proposed;

(6) For NWP 14 (Linear Transportation Crossings), the PCN must include a compensatory mitigation proposal to offset permanent losses of waters of the US and a statement describing how temporary losses of waters of the US will be minimized to the maximum extent practicable;

(7) For NWP 21 (Surface Coal Mining Activities), the PCN must include an Office of Surface Mining (OSM) or state-approved mitigation plan, if applicable. To be authorized by this NWP, the District Engineer must determine that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are minimal both individually and cumulatively and must notify the project sponsor of this determination in writing;

(8) For NWP 27 (Stream and Wetland Restoration), the PCN must include documentation of the prior condition of the site that will be reverted by the permittee;

(9) For NWP 29 (Single-Family Housing), the PCN must also include:

(i) Any past use of this NWP by the Individual Permittee and/or the permittee's spouse;

(ii) A statement that the single-family housing activity is for a personal residence of the permittee;

(iii) A description of the entire parcel, including its size, and a delineation of wetlands. For the purpose of this NWP, parcels of land measuring ¼-acre or less will not require a formal on-site delineation. However, the applicant shall provide an indication of where the wetlands are and the amount of wetlands that exists on the property. For parcels greater than ¼-acre in size, formal wetland delineation must be prepared in accordance with the current method required by the Corps. (See paragraph 13(f));

(iv) A written description of all land (including, if available, legal descriptions) owned by the prospective permittee and/or the prospective permittee's spouse, within a one mile radius of the parcel, in any form of ownership (including any land owned as a partner, corporation, joint tenant, co-tenant, or as a tenant-by-the-entirety) and any land on which a purchase and sale agreement or other contract for sale or purchase has been executed;

(10) For NWP 31 (Maintenance of Existing Flood Control Projects), the prospective permittee must either notify the District Engineer with a PCN prior to each maintenance activity or submit a five year (or less) maintenance plan. In addition, the PCN must include all of the following:

(i) Sufficient baseline information identifying the approved channel depths and configurations and existing facilities. Minor deviations are authorized, provided the approved flood control protection or drainage is not increased;

(ii) A delineation of any affected special aquatic sites, including wetlands; and,

(iii) Location of the dredged material disposal site;

(11) For NWP 33 (Temporary Construction, Access, and Dewatering), the PCN must also include a restoration plan of reasonable measures to avoid and minimize adverse effects to aquatic resources;

(12) For NWPs 39, 43 and 44, the PCN must also include a written statement to the District Engineer explaining how avoidance and minimization for losses of waters of the US were achieved on the project site;

(13) For NWP 39 and NWP 42, the PCN must include a compensatory mitigation proposal to offset losses of waters of the US or justification explaining why compensatory mitigation should not be required. For discharges that cause the loss of greater than 300 linear feet of an intermittent stream bed, to be authorized, the District Engineer must determine that the activity complies with the other terms and conditions of the NWP, determine adverse environmental effects are minimal both individually and cumulatively, and waive the limitation on stream impacts in writing before the permittee may proceed;

(14) For NWP 40 (Agricultural Activities), the PCN must include a compensatory mitigation proposal to offset losses of waters of the US. This NWP does not authorize the relocation of greater than 300 linear-feet of existing serviceable drainage ditches constructed in non-tidal streams unless, for drainage ditches constructed in intermittent non-tidal streams, the District Engineer waives this criterion in writing, and the District Engineer has determined that the project complies with all terms and conditions of this NWP, and that any adverse impacts of the project on the aquatic environment are minimal, both individually and cumulatively;

(15) For NWP 43 (Stormwater Management Facilities), the PCN must include, for the construction of new stormwater management facilities, a maintenance plan (in accordance with state and local requirements, if applicable) and a compensatory mitigation proposal to offset losses of waters of the US. For discharges that cause the loss of greater than 300 linear feet of an intermittent stream bed, to be authorized, the District Engineer must determine that the activity complies with the other terms and conditions of the NWP, determine adverse environmental effects are minimal both individually and cumulatively, and waive the limitation on stream impacts in writing before the permittee may proceed;

(16) For NWP 44 (Mining Activities), the PCN must include a description of all waters of the US adversely affected by the project, a description of measures taken to minimize adverse effects to waters of the US, a description of measures taken to comply with the criteria of the NWP, and a reclamation plan (for all aggregate mining activities in isolated waters and non-tidal wetlands adjacent to headwaters and any hard rock/mineral mining activities);

(17) For activities that may adversely affect Federally-listed endangered or threatened species, the PCN must include the name(s) of those endangered or threatened species that may be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work; and

(18) For activities that may affect historic properties listed in, or eligible for listing in, the National Register of Historic Places, the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property.

(c) *Form of Notification*: The standard Individual Permit application form (Form ENG 4345) may be used as the notification but must clearly indicate that it is a PCN and must include all of the information required in (b) (1)–(18) of General Condition 13. A letter containing the requisite information may also be used.

(d) *District Engineer's Decision*: In reviewing the PCN for the proposed activity, the District Engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. The prospective permittee may submit a proposed mitigation plan with the PCN to expedite the process. The District Engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed work are minimal. If the District Engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the District Engineer will notify the permittee and include any conditions the District Engineer deems necessary. The District Engineer must approve any compensatory mitigation proposal before the permittee commences work. If the prospective permittee is required to submit a compensatory mitigation proposal with the PCN, the proposal may be either conceptual or detailed. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the District Engineer will expeditiously review the proposed compensatory mitigation plan. The District Engineer must review the plan within 45 days of receiving a complete PCN and determine whether the conceptual or specific proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the District Engineer to

be minimal, the District Engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP.

If the District Engineer determines that the adverse effects of the proposed work are more than minimal, then the District Engineer will notify the applicant either: (1) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an Individual Permit; (2) that the project is authorized under the NWP subject to the applicant's submission of a mitigation proposal that would reduce the adverse effects on the aquatic environment to the minimal level; or (3) that the project is authorized under the NWP with specific modifications or conditions. Where the District Engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period. The authorization will include the necessary conceptual or specific mitigation or a requirement that the applicant submit a mitigation proposal that would reduce the adverse effects on the aquatic environment to the minimal level. When conceptual mitigation is included, or a mitigation plan is required under item (2) above, no work in waters of the US will occur until the District Engineer has approved a specific mitigation plan.

(e) *Agency Coordination*: The District Engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

For activities requiring notification to the District Engineer that result in the loss of greater than ½-acre of waters of the US, the District Engineer will provide immediately (e.g., via facsimile transmission, overnight mail, or other expeditious manner) a copy to the appropriate Federal or state offices (USFWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will then have 10 calendar days from the date the material is transmitted to telephone or fax the District Engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the District Engineer will wait an additional 15 calendar days before making a decision on the notification. The District Engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency, except as provided below. The District Engineer will indicate in the administrative record associated with each notification that the resource agencies' concerns were considered. As required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act, the District Engineer will provide a response to NMFS within 30 days of receipt of any Essential Fish Habitat conservation recommendations. Applicants are encouraged to provide the Corps multiple copies of notifications to expedite agency notification.

(f) *Wetland Delineations*: Wetland delineations must be prepared in accordance with the current method required by the Corps (For NWP 29 see paragraph (b)(9)(iii) for parcels less than (¼-acre in size). The permittee may ask the Corps to delineate the special aquatic site. There may be some delay if the Corps does the delineation. Furthermore, the 45-day period will not start until the wetland delineation has been completed and submitted to the Corps, where appropriate.

14. *Compliance Certification*. Every permittee who has received NWP verification from the Corps will submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the Corps with the authorization letter and will include:

(a) A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions;

(b) A statement that any required mitigation was completed in accordance with the permit conditions; and

(c) The signature of the permittee certifying the completion of the work and mitigation.

15. *Use of Multiple Nationwide Permits*. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the US authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit (e.g. if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the US for the total project cannot exceed ⅓-acre).

16. *Water Supply Intakes*. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may occur in the proximity of a public water supply intake except where the activity is for repair of the public water supply intake structures or adjacent bank stabilization.

17. *Shellfish Beds*. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWP 4.

18. *Suitable Material*. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may consist of unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.) and material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the CWA).

19. *Mitigation*. The District Engineer will consider the factors discussed below when determining the acceptability of appropriate and practicable mitigation necessary to offset adverse effects on the aquatic environment that are more than minimal.

(a) The project must be designed and constructed to avoid and minimize adverse effects to waters of the US to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing or compensating) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland impacts requiring a PCN, unless the District Engineer determines in writing that some other form of mitigation would be more environmentally appropriate and provides a project-specific waiver of this requirement. Consistent with National policy, the District Engineer will establish a preference for restoration of wetlands as compensatory mitigation, with preservation used only in exceptional circumstances.

(d) Compensatory mitigation (i.e., replacement or substitution of aquatic resources for those impacted) will not be used to increase the acreage losses allowed by the acreage limits of some of the NWPs. For example, ¼-acre of wetlands cannot be created to change a ¾-acre loss of wetlands to a ½-acre loss associated with NWP 39 verification. However, ½-acre of created wetlands can be used to reduce the impacts of a ½-acre loss of wetlands to the minimum impact level in order to meet the

minimal impact requirement associated with NWPs.

(e) To be practicable, the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of the overall project purposes. Examples of mitigation that may be appropriate and practicable include, but are not limited to: reducing the size of the project; establishing and maintaining wetland or upland vegetated buffers to protect open waters such as streams; and replacing losses of aquatic resource functions and values by creating, restoring, enhancing, or preserving similar functions and values, preferably in the same watershed.

(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the establishment, maintenance, and legal protection (e.g., easements, deed restrictions) of vegetated buffers to open waters. In many cases, vegetated buffers will be the only compensatory mitigation required. Vegetated buffers should consist of native species. The width of the vegetated buffers required will address documented water quality or aquatic habitat loss concerns. Normally, the vegetated buffer will be 25 to 50 feet wide on each side of the stream, but the District Engineers may require slightly wider vegetated buffers to address documented water quality or habitat loss concerns. Where both wetlands and open waters exist on the project site, the Corps will determine the appropriate compensatory mitigation (e.g., stream buffers or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where vegetated buffers are determined to be the most appropriate form of compensatory mitigation, the District Engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland impacts.

(g) Compensatory mitigation proposals submitted with the "notification" may be either conceptual or detailed. If conceptual plans are approved under the verification, then the Corps will condition the verification to require detailed plans be submitted and approved by the Corps prior to construction of the authorized activity in waters of the US.

(h) Permittees may propose the use of mitigation banks, in-lieu fee arrangements or separate activity-specific compensatory mitigation. In all cases that require compensatory mitigation, the mitigation provisions will specify the party responsible for accomplishing and/or complying with the mitigation plan.

20. *Spawning Areas.* Activities, including structures and work in navigable waters of the US or discharges of dredged or fill material, in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., excavate, fill, or smother downstream by substantial turbidity) of an important spawning area are not authorized.

21. *Management of Water Flows.* To the maximum extent practicable, the activity must be designed to maintain preconstruction downstream flow conditions (e.g., location, capacity, and flow rates). Furthermore, the activity must not permanently restrict or impede the passage of normal or expected high flows (unless the primary purpose of the fill is to impound waters) and the structure or discharge of dredged or fill material must withstand expected high flows. The activity must, to the maximum extent practicable, provide for retaining excess flows from the site, provide for maintaining surface flow rates from the site similar to preconstruction conditions, and provide for not increasing water flows from the project site, relocating water, or redirecting water flow beyond preconstruction conditions. Stream channelizing will be reduced to the minimal amount necessary, and the activity must, to the maximum extent practicable, reduce adverse effects such as flooding or erosion downstream and upstream of the project site, unless the activity is part of a larger system designed to manage water flows. In most cases, it will not be a requirement to conduct detailed studies and monitoring of water flow.

This condition is only applicable to projects that have the potential to affect waterflows. While appropriate measures must be taken, it is not necessary to conduct detailed studies to identify such measures or require monitoring to ensure their effectiveness. Normally, the Corps will defer to state and local authorities regarding management of water flow.

22. *Adverse Effects From Impoundments.* If the activity creates an impoundment of water, adverse effects to the aquatic system due to the acceleration of the passage of water, and/or the restricting its flow shall be minimized to the maximum extent practicable. This includes structures and work in navigable waters of the US, or discharges of dredged or fill material.

23. *Waterfowl Breeding Areas.* Activities, including structures and work in navigable waters of the US or discharges of dredged or fill material, into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

24. *Removal of Temporary Fills.* Any temporary fills must be removed in their entirety and the affected areas returned to their preexisting elevation.

25. *Designated Critical Resource Waters.* Critical resource waters include, NOAA-designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for Federally listed threatened and endangered species, coral reefs, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment. The District Engineer may also designate additional critical resource waters after notice and opportunity for comment.

(a) Except as noted below, discharges of dredged or fill material into waters of the US are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, and 44 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters. Discharges of dredged or fill materials into waters of the US may be authorized by the above NWPs in National Wild and Scenic Rivers if the activity complies with General Condition 7. Further, such discharges may be authorized in designated critical habitat for Federally listed threatened or endangered species if the activity complies with General Condition 11 and the USFWS or the NMFS has concurred in a determination of compliance with this condition.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with General Condition 13, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The District Engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

26. *Fills Within 100-Year Floodplains.* For purposes of this General Condition, 100-year floodplains will be identified through the existing Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps or FEMA-approved local floodplain maps.

(a) *Discharges in Floodplain; Below Headwaters.* Discharges of dredged or fill material into waters of the US within the mapped 100-year floodplain, below

headwaters (i.e. five cfs), resulting in permanent above-grade fills, are not authorized by NWPs 39, 40, 42, 43, and 44.

(b) *Discharges in Floodway; Above Headwaters.* Discharges of dredged or fill material into waters of the US within the FEMA or locally mapped floodway, resulting in permanent above-grade fills, are not authorized by NWPs 39, 40, 42, and 44.

(c) The permittee must comply with any applicable FEMA-approved state or local floodplain management requirements.

27. *Construction Period.* For activities that have not been verified by the Corps and the project was commenced or under contract to commence by the expiration date of the NWP (or modification or revocation date), the work must be completed within 12-months after such date (including any modification that affects the project).

For activities that have been verified and the project was commenced or under contract to commence within the verification period, the work must be completed by the date determined by the Corps.

For projects that have been verified by the Corps, an extension of a Corps approved completion date maybe requested. This request must be submitted at least one month before the previously approved completion date.

D. Further Information

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.

2. NWPs do not obviate the need to obtain other Federal, state, or local permits, approvals, or authorizations required by law.

3. NWPs do not grant any property rights or exclusive privileges.

4. NWPs do not authorize any injury to the property or rights of others.

5. NWPs do not authorize interference with any existing or proposed Federal project.

E. Definitions

Best Management Practices (BMPs): BMPs are policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural. A BMP policy may affect the limits on a development.

Compensatory Mitigation: For purposes of Section 10/404, compensatory mitigation is the restoration, creation, enhancement, or in exceptional circumstances, preservation of wetlands and/or other aquatic resources for the purpose of compensating for unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Creation: The establishment of a wetland or other aquatic resource where one did not formerly exist.

Enhancement: Activities conducted in existing wetlands or other aquatic resources that increase one or more aquatic functions.

Ephemeral Stream: An ephemeral stream has flowing water only during and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Farm Tract: A unit of contiguous land under one ownership that is operated as a farm or part of a farm.

Flood Fringe: That portion of the 100-year floodplain outside of the floodway (often referred to as "floodway fringe").

Floodway: The area regulated by Federal, state, or local requirements to provide for the discharge of the base flood so the cumulative increase in water surface elevation is no more than a designated amount (not to exceed one foot as set by the National Flood Insurance Program) within the 100-year floodplain.

Independent Utility: A test to determine what constitutes a single and complete project in the Corps regulatory program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Intermittent Stream: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Loss of Waters of the US: Waters of the US that include the filled area and other waters that are permanently adversely affected by flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent above-grade, at-grade, or below-grade fills that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the US is the threshold measurement of the impact to existing waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and values. The loss of stream bed includes the linear feet of stream bed that is filled or excavated. Waters of the US temporarily filled, flooded, excavated, or drained, but restored to preconstruction contours and elevations after construction, are not included in the measurement of loss of waters of the US. Impacts to ephemeral waters are only not included in the acreage or linear foot measurements of loss of waters of the US or loss of stream bed, for the purpose of determining compliance with the threshold limits of the NWPs.

Non-tidal Wetland: A non-tidal wetland is a wetland (i.e., a water of the US) that is not subject to the ebb and flow of tidal waters. The definition of a wetland can be found at 33 CFR 328.3(b). Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

Open Water: An area that, during a year with normal patterns of precipitation, has standing or flowing water for sufficient duration to establish an ordinary high water mark. Aquatic vegetation within the area of standing or flowing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. The term "open water" includes rivers, streams, lakes, and ponds. For the purposes of the NWPs, this term does not include ephemeral waters.

Perennial Stream: A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

Permanent Above-grade Fill: A discharge of dredged or fill material into waters of the US, including wetlands, that results in a substantial increase in ground elevation and permanently converts part or all of the waterbody to dry land. Structural fills authorized by NWPs 3, 25, 36, etc. are not included.

Preservation: The protection of ecologically important wetlands or other aquatic resources in perpetuity through the implementation of appropriate legal and physical mechanisms. Preservation may include protection of upland areas adjacent to wetlands as necessary to

ensure protection and/or enhancement of the overall aquatic ecosystem.

Restoration: Re-establishment of wetland and/or other aquatic resource characteristics and function(s) at a site where they have ceased to exist, or exist in a substantially degraded state.

Riffle and Pool Complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Single and Complete Project: The term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers (see definition of independent utility). For linear projects, the "single and complete project" (i.e., a single and complete crossing) will apply to each crossing of a separate water of the US (i.e., a single waterbody) at that location. An exception is for linear projects crossing a single waterbody several times at separate and distant locations: each crossing is considered a single and complete project. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies.

Stormwater Management: Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

Stormwater Management Facilities: Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and BMPs, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

Stream Bed: The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

Stream Channelization: The manipulation of a stream channel to increase the rate of water flow through the stream channel. Manipulation may include deepening, widening, straightening, armoring, or other activities that change the stream cross-section or other aspects of stream channel geometry to increase the rate of water flow through the stream channel. A channelized stream remains a water of the US, despite the modifications to increase the rate of water flow.

Tidal Wetland: A tidal wetland is a wetland (i.e., water of the US) that is inundated by tidal waters. The definitions of a wetland and tidal waters can be found at 33 CFR 328.3(b) and 33 CFR 328.3(f), respectively. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line (i.e., spring high tide line) and are inundated by tidal waters two times per lunar month, during spring high tides.

Vegetated Buffer: A vegetated upland or wetland area next to rivers, streams, lakes, or other open waters which separates the open water from developed areas, including agricultural land. Vegetated buffers provide a variety of aquatic habitat functions and values (e.g., aquatic habitat for fish and other aquatic organisms, moderation of water temperature changes, and detritus for aquatic food webs) and help improve or maintain local water quality. A vegetated buffer can be established by maintaining an existing vegetated area or planting native trees, shrubs, and herbaceous plants on land next to open-waters. Mowed lawns are not considered vegetated buffers because they provide little or no aquatic habitat functions and values. The establishment and maintenance of vegetated buffers is a method of compensatory mitigation that can be used in conjunction with the restoration, creation, enhancement, or preservation of aquatic habitats to ensure that activities authorized by NWPs result in minimal adverse effects to the aquatic environment. (See General Condition 19.)

Vegetated Shallows: Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

Waterbody: A waterbody is any area that in a normal year has water flowing or standing above ground to the extent that evidence of an ordinary high water mark is established. Wetlands contiguous to the waterbody are considered part of the waterbody.

[FR Doc. 02–539 Filed 1–14–02; 8:45 am]
BILLING CODE 3710–92–P

APPENDIX B

INDIVIDUAL PERMIT FORMS

JOINT APPLICATION AND NOTIFICATION

U.S. DEPARTMENT OF ARMY CORPS OF ENGINEERS
MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY/OFFICE OF POLLUTION CONTROL

This form is to be used for porposed activities in waters of the United States of Mississippi and for the erection of structures on suitable sites for water dependent industry. Note that some items, as indicated, apply only to projects located in the coastal area of Hancock, Harrison, and Jackson Counties.

1. Date

month day year

2. Applicant (mailing address and telephone)

Agent name, address and telephone

3. Official use only

COE _____

DMR _____

DEQ _____

A95 _____

DATE RECEIVED _____

4. Project location

Street Address_____ City/Community _____

Name of Waterway _____ Latitude _____ Longitude (if known) _____

Geographic location: Section _____Township _____ Range _____ County _____

5. Project description New work_____ Maintenance work_____

Dredging

_____ Channel length _____ width _____ existing depth _____ proposed depth_____

_____ Canal length _____ width _____ existing depth _____ proposed depth_____

_____ Boat Slip length _____ width _____ existing depth _____ proposed depth_____

_____ Other (explain) length _____ width _____ existing depth _____ proposed depth_____

Cubic yards of material to be removed _____ Type of material _____

Location of spoil disposal area _____

Dimensions of spoil area _____ Method of excavation _____

How will excavated material be contained? _____

Construction of structures

_____ Bulkhead Total Length _____ Height above water _____

_____ Pier length _____ width _____ height _____

_____ Boat Ramp length _____ width _____ height _____

_____ Boat House length _____ width _____ height _____

_____ Structures on designed sites for water dependent industry (Coastal area only). Explain in Item 11 or include as an attachment.

_____ Other (explain) _____

Filling

Dimensions of fill area _____

Cubic yards to fill _____ Type to fill _____

Other regulated activities (i.e. Seismic exploration, burning or clearing of marsh) Explain.

_____

_____

_____

_____

6. Additional information relating to the proposed activity

Does project area contain any marsh vegetation? Yes _____ No _____ (If yes, explain) _____

_____

Is any portion of the activity for which authorization is sought now complete? Yes _____ No _____

(If yes, explain) _____

Mouth and year activity took place _____

If project is for maintenance work on existing structures or existing channels, describe legal authorization for the existing work. Provide permit number, dates or other form(s) of authorization. _____

_____

Has any agency denied approval for the activity described herein or for any activity that is directly related to the activity described herein? Yes _____ No _____ (If yes, explain) _____

_____

7. Project schedule

Proposed start date _____ Proposed completion date _____

Expected completion date (or development timetable) for any projects dependent on the activity described herein.

_____

8. Estimated cost of the project _____

9. Describe the purpose of this project. Describe the relationship between this project and any secondary or future development the project is designed to support. _____

_____

_____

_____

10. Describe the public benefits of the proposed activity and of the projects dependent on the proposed activity. Also describe the extent of public use of the proposed project. _____

_____

_____

11. Remarks

12. Provide the names and addresses of the adjacent property owners. Also identify the property owners on the plan view of the drawing described in Attachment "A". (Attach additional sheets if necessary.)

1) 2)

13. List all approvals or certifications received or applied for from Federal, State and Local agencies for any structures, construction, discharges, deposits or other activities described in this application. Note that the signature in item 14 certifies that application has been made to or that permits are not required, place N/A in the space for Type Approval.

Agency	Type Approval	Application Date	Approval Date
Dept. of Environmental Quality			
Department of Marine Resources			
U.S. Army Corps of Engineers			
City/County _____			
Other _____			

14. Certification and signatures

Application is hereby made for authorization to conduct the activities described herein. I agree to provide any additional information/data that may be necessary to provide reasonable assurance or evidence to show that the proposed project will comply with the applicable state water quality standards or other environmental protection standards both during construction and after the project is completed. I also agree to provide entry to the project site for inspectors from the environmental protection agencies for the purpose of making preliminary analyses of the site and monitoring permitted works. I certify that I am familiar with and responsible for the information contained in this application, and that to the best of my knowledge and belief, such information is true, complete and accurate. I further certify that I am the owner of the property where the proposed project is located or that I have a legal interest in the property and that I have full legal authority to seek this permit.

Signature of Applicant or Agent Date

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willingly falsifies, conceals, or covers up by any trick, scheme or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both.

15. Mississippi Coastal Program (Coastal area only)

I certify that the proposed project for which authorization is sought complies with the approved Mississippi Coastal Program and will be conducted in a manner consistent with the program.

Signature of Applicant or Agent Date

16. Fees

Payable to State of Mississippi $50.00 Residential $500.00 Commercial $50.00 Cost of public notice fee	Please include appropriate fees for all projects proposed in coastal areas of Hancock, Harrison and Jackson counties.

17. If project is in Hancock, Harrison or Jackson counties, send one completed copy of this application form and appropriate fees listed in Item 16 to:

MS Department of Marine Resources
1141 Bayview Avenue, Suite 101
Biloxi, MS 39530

If project IS NOT in Hancock, Harrison or Jackson Counties, send one completed copy of this application form to each agency listed below:

District Engineer U.S. Army Engineer District Mobile Attn: SAMOP-S P.O. Box 2288 Mobile, AL 36628	District Engineer U.S. Army Engineer District Vicksburg Attn: LMKOD-FE P.O. Box 60 Vicksburg, MS 39180	Director MS Dept. of Environmental Quality Office of Pollution Control P.O. Box 10385 Jackson, MS 39289

18. In addition to the completed application form, the following attachments are required:

Attachment "A" Drawings

Provide a vicinity map showing the location of the proposed site along with a written description of how to reach the site from major highways or landmarks. Provide accurate drawings of the project site with proposed activities shown in detail. All drawings must be to scale or with dimensions noted on drawings and must show a plan view and cross section or elevation. Use 8 1/2 x 11" white paper or drawing sheet attached.

Attachment "B" Authorized Agent

If applicant desires to have an agent or consultant act in his behalf for permit coordination, a signed authorization designating said agent must be provided with the application forms. The authorized agent named may sign the application forms and the consistency statement.

Attachment "C" Environmental Assessment

Provide an appropriate report or statement assessing environmental impacts of the proposed activity and the final project dependent on it. The project's effects on the wetlands and the effects on the list dependent on them should be addressed. Also provide a complete description of any measures to be taken to reduce detrimental offsite effects to the coastal wetlands during and after the proposed activity. Alternative analysis, minimization and mitigation information may be required to complete project evaluation.

Attachment "D" Variance or Revisions to Mississippi Coastal Program *(Coastal area only)*

If the applicant is requesting a variance to the guidelines in Section 2, Part III, or a revision to the Coastal Wetlands Use Plan in Section 2, Part IV of the Rules and Regulations, Guidelines and Procedures of the Mississippi Coastal Program, a request and justification must be provided.

Attachment "A" Drawings

Application by:

Sheet _____ of _____

Date _____

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES

Agent Authorization

I authorize the person(s) and/or company listed below to act as my agent regarding the proposed project as described in the Joint Application and Notification at the location listed below:

_____ (name of agent)

_____ (location of project)

_____ (address)

_____

_____ (city, state, zip code)

_____

_____ (agent phone number)

_____ (print your name)

_____ (your signature)

_____ (date)

Do you want the permit mailed to the agent? _____Yes _____ No

Date: _____ DMR# _____
(For Office Use Only)

To Department of Marine Resources:

_____ Has my permission to construct the intended
(Print Applicant Name)

_____
(Project Description; example: Pier, Boathouse, etc.)

Within a distance of less than ten feet (10') of my adjacent property line as shown in the signed, attached diagram*.

Signature: _____
ADJACENT PROPERTY OWNER

Print Name	Applicant Name
Print Address	Applicant Address
City, State and Zip Code	Applicant City, State and Zip Code
Phone Number	Applicant Phone Number

* Adjacent property owner must sign diagram of proposed project.

Date: _____ DMR# _____
(For Office Use Only)

To Department of Marine Resources:

_____ Has my permission to construct the intended
(Print Applicant Name)

_____
(Project Description; example: Pier, Boathouse, etc.)

Within a distance of less than ten feet (10') of my adjacent property line as shown in the signed, attached diagram*.

Signature: _____
ADJACENT PROPERTY OWNER

Print Name	Applicant Name
Print Address	Applicant Address
City, State and Zip Code	Applicant City, State and Zip Code
Phone Number	Applicant Phone Number

* Adjacent property owner must sign diagram of proposed project.

APPENDIX C

STORMWATER CONSTRUCTION GENERAL PERMIT FORMS

INFORMATIONAL COPY – NOT FOR COVERAGE

State of Mississippi
Mississippi Department of Environmental Quality (MDEQ)
Office of Pollution Control (OPC)
Water Pollution Control
STORM WATER
CONSTRUCTION GENERAL PERMIT

TO DISCHARGE STORM WATER IN ACCORDANCE WITH THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

THIS CERTIFIES THAT

PROJECTS ISSUED A CERTIFICATE OF PERMIT COVERAGE UNDER THIS PERMIT ARE GRANTED PERMISSION TO DISCHARGE

STORM WATER ASSOCIATED WITH CONSTRUCTION ACTIVITY

INTO

STATE WATERS

in accordance with effluent limitations, inspection requirements and other conditions set forth in Parts I through VII hereof. This permit is issued in accordance with the provisions of the Mississippi Water Pollution Control Law (Section 49-17-1 et seq., Mississippi Code of 1972), and the regulations and standards adopted and promulgated thereunder, and under authority granted pursuant to Section 402(b) of the Federal Water Pollution Control Act.

MISSISSIPPI ENVIRONMENTAL QUALITY PERMIT BOARD

_____

AUTHORIZED SIGNATURE

MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY

Permit Issued: March 28, 2000 **Permit No. MSR10**

Permit Expires: March 27, 2005

CONSTRUCTION STORM WATER
GENERAL NPDES PERMIT

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Part I. Coverage Under this Permit

A. **Permit Area.** The permit covers all areas of the State of Mississippi.

B. **Eligibility.** For discharges composed entirely of storm water from construction activity including clearing, grading, excavation and other land disturbance activities disturbing 5 or more acres.

C. **Authorization.** Owners and/or prime contractors must submit a Construction Notice of Intent (CNOI) in accordance with the requirements of Part II. Owners or operators are authorized to discharge storm water associated with construction activity under the terms and conditions of this permit only upon receipt of written notification of approval of coverage by the Mississippi Department of Environmental Quality (MDEQ), Office of Pollution Control (OPC) staff. Upon review of the CNOI, the staff may deny coverage and require an alternate permit. The OPC staff decisions may be brought before the MDEQ Permit Board for review and reconsideration at a regularly scheduled meeting. Discharge of storm water without written notification of coverage or issuance of an individual National Pollutant Discharge Elimination System (NPDES) Storm Water Permit is a violation of state law.

D. **Requiring an Individual Permit or Alternative General Permit**

1. The OPC may require any coverage recipient to apply for and obtain either an individual or an alternative general NPDES permit. Any interested person may petition the OPC to take action under this paragraph. The OPC may require any coverage recipient to apply for an individual NPDES permit only if the owner or operator has been notified in writing. This notice shall include reasons for this decision, an application form and a filing deadline. The OPC may grant additional time upon request. If a coverage recipient fails to submit a requested application in a timely manner, coverage under this permit is automatically terminated at the end of the day specified for application submittal.

2. Any coverage recipient may request to be excluded from permit coverage by applying for an individual permit or coverage under another general permit. The person shall submit an individual application (Form 1 and the narrative requirements of 40 CFR 122.26(c)(1)(ii)) or appropriate NOI to the Office of Pollution Control.

3. Coverage under this permit is automatically terminated on the issuance or coverage date of the respective alternate individual or general NPDES permit. When an alternate individual or general NPDES permit is denied, coverage under this permit continues unless terminated on the date of such denial by the OPC.

Part II. Construction Notice of Intent

A. **Deadlines for Notification.** Persons desiring coverage for a storm water discharge associated with construction activity under this general permit shall submit a CNOI form at least 30 days prior to the commencement of construction, or 15 days if the storm water pollution prevention plan has previously been approved. CNOI forms may be obtained from the MDEQ at the address on the following page or by calling 601/961-5171. CNOI forms, as well as the general permit and guidance manual, may also be found on the MDEQ web site at www.deq.state.ms.us. Coverage under this permit will not be granted until all other required MDEQ permits are satisfactorily addressed.

B. **Deadlines for Notification for Previously Exempted Municipalities.** Storm water discharges from construction activities greater than or equal to 5 acres, owned or operated by a municipality with a population of less than 100,000, are exempted from NPDES permitting by the Intermodal Surface Transportation Efficiency Act of 1991. By existing federal regulations, this exemption ends March 10, 2003. Projects submitted after March 10, 2003 will require a CNOI and SWPPP 30 days prior to construction.

C. **Submission by Owner and/or Prime Contractor.** The owner or prime contractor may submit the CNOI. The owner may submit the CNOI and later, prior to actual construction, the prime contractor may submit the CNOI certification accepting responsibility for permit compliance. Otherwise the initial applicant is solely responsible for permit compliance.

D. **Where to Submit the Construction Notice of Intent.** Complete and appropriately signed CNOI Forms must be submitted to:

Chief, Environmental Permits Division
MS Dept of Environmental Quality, Office of Pollution Control
P.O. Box 10385
Jackson, Mississippi 39289-0385

E. **Additional Notification.** The covered owner or prime contractor must notify the OPC at least thirty days before any planned changes of ownership or whenever there are any other changes in information previously submitted to the OPC in the CNOI.

F. **Renotification.** Coverage recipients under the previous permit will receive re-coverage forms with a letter of instruction. If a coverage recipient wishes to be covered by the current Construction Storm Water Permit this form must be completed and returned to the OPC within 30 days. If the project has been completed, and no significant water quality problems exist, the OPC will terminate permit coverage. If the covered project is still active, monthly reporting and termination procedures shall continue in accordance with Part IV. E. and H. A resubmittal of the SWPPP is not required. After this permit expires (see Part V.B), and when this permit is reissued, re-notification must be made in accordance with the requirements of the reissued permit.

G. **Failure to Notify.** Persons who fail to submit a CNOI and discharge storm water associated with construction activity to waters of the State without an NPDES permit are in violation of state law.

Part III. Storm Water Pollution Prevention Plan (SWPPP)

A. **SWPPP Development.** A SWPPP shall be developed by each owner or prime contractor subject to this permit. A SWPPP shall be prepared in accordance with sound engineering practices and shall identify potential sources of pollution, which may reasonably be expected to affect the quality of storm water discharges associated with construction activity. The SWPPP shall describe and ensure the implementation of practices, which will reduce pollutants in storm water discharges and assure compliance with the terms and conditions of this permit.

1. The SWPPP shall be submitted to the OPC, with a copy retained at the permitted site or locally available. A copy of the SWPPP must be made available to the OPC inspectors for review at the time of an on-site inspection.

2. The SWPPP and a United States Geological Survey (USGS) quad map, or photocopy, extending at least one-half mile beyond the facility property boundaries with the site location outlined or highlighted shall be submitted with the CNOI.

3. The SWPPP shall provide for compliance with the terms of the plan upon commencement of construction.

4. The OPC may notify the covered owner or prime contractor at any time that the SWPPP does not meet the minimum requirements of this Part. After notification, the covered owner or prime contractor shall amend the SWPPP and certify in writing to the OPC that the requested changes have been made. Unless otherwise provided by the OPC, the requested changes shall be made within 15 days.

5. The owner or prime contractor shall amend the SWPPP whenever there is a change in design, construction, operation, or maintenance, which may potentially effect the discharge of pollutants to State waters or the SWPPP proves to be ineffective in controlling storm water pollutants, and shall submit it to the OPC within 30 days of amendment.

B. **Compliance with Local Storm Water Ordinances.**

1. The SWPPP shall be in compliance with all local storm water ordinances. Approved SWPPPs that conform to local storm water ordinances shall receive expedited review from the OPC (notification from local authority is required).

2. When storm water discharges into a municipal storm sewer system, the owner or prime contractor shall make the SWPPP available to the municipal authority upon request.

C. **SWPPP Details.**

1. **Erosion and Sediment Controls.** The owner or prime contractor shall list and describe controls appropriate for the construction activities and procedures for implementing such controls. The controls should: (1) divert up-slope water around disturbed areas of the site; (2) limit the exposure of disturbed areas to the shortest amount of time as possible; (3) minimize the amount of surface area that must be disturbed; (4) implement best management practices to mitigate adverse impacts from storm water runoff; and (5) remove sediment from storm water before it leaves the site. **As a minimum, the controls must be in accordance with the standards set forth in " Planning and Design Manual for the Control of Erosion, Sediment & Stormwater," MDEQ, MSSWCC, U. S. Dept. of Agriculture SCS, Jackson, MS, 1994, or other recognized manual of design.** The description shall address the following minimum components.

   a. **Vegetative practices** shall be designed to preserve existing vegetation where possible and re-vegetate disturbed areas as soon as practicable after grading or construction. Such practices may include surface roughening, temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffer strips, and protection of trees. When a disturbed area will be left undisturbed for thirty days or more, the appropriate temporary or permanent vegetative practices shall be implemented within seven calendar days.

   b. **Structural practices** shall divert flows from exposed soils, store flows or otherwise limit runoff from exposed areas. Such practices may include construction entrance/exit, straw bale dikes, silt fences, earth dikes, brush barriers, drainage swales, check dams, subsurface drain, pipe slope drain, level spreaders, drain inlet protection, outlet protection, detention/retention basins, sediment traps, temporary sediment basins or equivalent sediment controls.

      For drainage locations (a drainage point at boundary of land disturbing activity) that serve an area with 10 or more disturbed acres at one time, a temporary (or permanent) sediment basin providing at least 1800 cubic feet (67 cubic yards) of storage per acre drained shall be provided until final stabilization of the site. Sediment basins must be installed before major site grading. When sediment basins can not be installed, a written rationale explaining why must be included in the SWPPP.

   c. **Post construction control measures** shall be installed to control pollutants in storm water after construction is complete. These controls include, but are not limited to, one or more of the following: on-site infiltration of runoff, flow attenuation using open vegetated swales, exfiltration trenches and natural depressions, constructed wetlands and retention/detention structures. Where needed, velocity dissipation devices shall be placed at detention or retention pond outfalls and along the outfall channel to provide a non-erosive flow. Justification may be required where control measures are not used.

   d. **Controls for individual lots in subdivisions and commercial developments** shall be required for lots that are less than five acres. Plans for subdivisions and commercial developments shall require that builders or lot owners take measures to prevent or mitigate sediment from leaving individual lots. This can be accomplished through, covenants and/or lot purchase contract language. A copy of the chosen option must be submitted with the SWPPP.

2. **Housekeeping Practices.** The owner or prime contractor shall describe and list practices appropriate to prevent pollutants from entering storm water from construction sites because of poor housekeeping. The owner or prime contractor shall designate areas for equipment maintenance and repair; concrete chute wash off; provide waste receptacles at convenient locations and provide regular collection of waste; provide protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and provide adequately maintained sanitary facilities.

3. **Prepare Scaled Site Map(s).** The owner or prime contractor shall prepare a scaled site map showing original and proposed contours (if practicable), drainage patterns, adjacent receiving water bodies, north arrow, all erosion & sediment controls (vegetative and structural), post construction control measures as described in Part III.C. and location of housekeeping practices. If the construction project is a linear construction project (e.g., pipeline, highway, etc.), a scaled site map is not required, however standard diagrams (e.g., cross sections showing dimensions and labeled components) of erosion and sediment controls to be used must be submitted.

4. **Implementation Sequence.** The owner or prime contractor shall prepare an orderly listing which coordinates the timing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for the project.

5. **Implementation of Controls.** The SWPPP shall require the owner or prime contractor, in disturbing an area, to implement controls as needed to prevent erosion and adverse impacts to receiving streams (see Part IV.C.1. & 2.).

6. **Maintenance and Weekly Inspections.** Describe procedures to maintain vegetation, erosion and sediment controls and other protective measures. Procedures shall provide that all erosion controls are inspected at least once every seven-calendar days (see Part IV.D. and E.).

Part IV. Limitations and Requirements

A. **Non-Numeric Limitations. Storm water discharges shall be free from:**

1. debris, oil, scum, and other floating materials other than in trace amounts;

2. eroded soils and other materials that will settle to form objectionable deposits in receiving waters;

3. suspended solids, turbidity and color at levels inconsistent with the receiving waters;

4. chemicals in concentrations that would cause violation of State Water Quality Criteria in the receiving waters.

B. **Public Notice Requirements.** The coverage recipient shall display proof of coverage at a conspicuous place accessible by the public on or at the edge of the construction site. Information on the "Proof of Coverage Form" shall include permit coverage number, project contact name, project contact phone number, project description and SWPPP location (only necessary if the site is inactive or does not have an on-site location) and MDEQ's phone number. A form is provided in Part X for this purpose and must be protected from weather while posted.

C. **Implementation Requirements. Coverage recipient shall:**

1. install needed erosion controls even if they may be located in the way of subsequent activities, such as utility installation, grading or construction. It shall not be an acceptable defense that controls were not installed because subsequent activities would require their replacement or cause their destruction;

2. install additional and/or alternative erosion and sediment controls when existing controls prove to be ineffective in preventing sediment from leaving the site;

3. minimize off-site vehicle tracking of sediments;

4. comply with applicable State or local waste disposal, sanitary sewer or septic system regulations;

5. have daily access to nearby rain gage data or set up a rain gage on-site during construction to comply with Part IV.D.;

6. maintain all erosion controls. As a minimum all accumulated sediment shall be removed from controls when it reaches 1/3 to 1/2 the height of the control and properly disposed. Non-functioning controls shall be repaired, replaced or supplemented with functional controls within 24 hours of discovery or as soon as field conditions allow.

D. **Inspection Requirements.** Inspection of all erosion controls and other SWPPP requirements shall be performed during permit coverage using a copy of the form provided in Part VII. Inspections shall be performed:

1. at least once every seven calendar days;

2. within 24 hours after commencement of a rainfall event greater than or equal to a two year 24 hour storm event, 6 inches on the Gulf Coast to 4 inches at the Tennessee State border;

3. as often as is necessary to ensure that appropriate erosion and sediment controls have been properly constructed and maintained and determine if additional or alternative control measures are required.

E. **Reporting.** The inspections described in D. must be documented on copies of the Report and Certification Form provided in Part VII. The completed inspection forms must be kept with the SWPPP until such time the project is ready for termination of reporting and permit coverage as described in Part IV.H.

F. **Retention of Records.** All records, reports and information resulting from activities required by this permit shall be retained for a period of at least three years from the date of the CNOI, inspection or report.

G. **Noncompliance Reporting.**

1. **Anticipated Noncompliance.** The owner or operator shall give at least 10 days advance notice, if possible, before any planned noncompliance with permit requirements.

2. **Unanticipated Noncompliance.** The owner or operator shall notify the OPC orally within 24 hours from the time he or she becomes aware of unanticipated noncompliance. A written report shall be provided to the OPC within 5 working days of the time he or she becomes aware of the circumstances. The report shall describe the cause, the exact dates and times, steps taken or planned to reduce, eliminate, or prevent reoccurrence and, if the noncompliance has not ceased, the anticipated time for correction.

H **Termination of Reporting and Permit Coverage.**

1. Upon successful completion of all permanent erosion and sediment controls for a covered project a completed Notice of Termination (NOT) of Coverage form (provided in Part VIII.) shall be submitted to the OPC. All monthly inspection forms described in Part IV.E. and provided in Part VII. must be attached. Upon receiving the completed NOT and associated inspection forms the OPC will inspect the site. If no sediment and erosion control problems are identified and adequate permanent controls are established the owner or prime contractor will receive a termination letter from the OPC. Coverage is not terminated until done so in writing by the OPC.

2. Upon reissuance of this permit, if the owner or prime contractor does not submit a re-coverage CNOI form in accordance with Part II.F., coverage will terminated.

Part V. Other Permit Conditions

A. **Duty to Comply.** Any permit noncompliance constitutes a violation of the Mississippi Water Pollution Control Law and is grounds for enforcement action or coverage termination and requiring reapplication in accordance with Part I.D.1. It shall not be a defense in an enforcement action that it would have been necessary to halt or reduce the regulated activity in order to maintain compliance with the conditions of this permit.

B. **Continuation of the Expired General Permit and Coverages Under the Permit.** An expired general permit and coverages under the permit continues in force and effect until a new general permit is issued.

C. **Duty to Mitigate.** The owner or operator shall take all reasonable steps to minimize or prevent any discharge in violation of this permit, which is likely to adversely affect human health or the environment.

D. **Duty to Provide Information.** The owner or operator shall furnish to the OPC, within a reasonable time, any information that the OPC may request to determine compliance with this permit.

E. **Signatory Requirements.** All CNOIs, SWPPPs, reports, certifications or information submitted to the OPC shall be signed as follows or by the duly authorized representative (see F.).

1. **For a corporation** by a responsible corporate officer. For this permit, a responsible corporate officer means: a) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or b) the manager of one or more manufacturing, production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25,000,000 (in second-quarter 1980 dollars) if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

2. **For a partnership or sole proprietorship** by a general partner or the proprietor, respectively; or

3. **For a municipal, State, Federal, or other public agency** by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes: a) the chief executive officer of the agency, or b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

F. **Duly Authorized Representative.** A person is duly authorized to sign submissions to the Office of Pollution Control if:

1. the authorization is made in writing by a person described in E., above, and submitted to the OPC;

2. the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated activity, such as manager, operator, superintendent or one having overall environmental responsibility (a duly authorized representative may be a named individual or any individual occupying a named position).

G **Changes to Authorization**. If an authorization is no longer accurate because a different individual or position has permit responsibility, a new authorization satisfying the above requirements must be submitted to the OPC prior to or together with any reports, information or applications signed by the representative.

H. **Certification.** Any person signing documents under this section shall make the following certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I. **Oil and Hazardous Substance Liability.** Nothing in this permit shall relieve the owner or operator from responsibilities, liabilities, or penalties under Section 311 of the CWA.

J. **Property Rights.** The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

K. **Severability.** The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

L. **Transfers.** Coverage under this permit is not transferable to any person except after notice to and approval by the OPC. The OPC may require the permittee to obtain another NPDES permit as stated in Part I.D. Transfer of coverage requests shall be submitted to the OPC using the form provided in Part IX.

M. **Proper Operation and Maintenance.** The owner or operator shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the owner or operator to achieve compliance with the conditions of this permit including the storm water pollution prevention plan. Proper operation and maintenance includes adequate laboratory controls with appropriate quality assurance procedures and requires the operation of backup or auxiliary facilities when necessary to achieve compliance with permit conditions.

N. **Bypass Prohibition.** Bypass (see 40 CFR 122.41(m)) is prohibited and enforcement action may be taken against a owner or operator for a bypass, unless: **a)** The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; **b)** There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This conditions is not satisfied if the owner or operator should, in the exercise of reasonable engineering judgement, have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and **c)** The owner or operator submitted notices per Part IV.G.

O. **Upset Conditions.** An upset (see 40 CFR 122.41(n)) constitutes an affirmative defense to an action brought for noncompliance with technology-based permit limitations if a permittee shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence, that: **1)** An upset occurred and the permittee can identify the specific cause(s) of the upset, **2)** The permitted facility was at the time being properly operated, **3)** The permittee submitted notices per Part IV.G.2., and **4)** The permittee took remedial measures as required under Part V.C. In any enforcement proceeding, the permittee has the burden of proof that an upset occurred. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

P. **Inspection and Entry.** The owner or operator shall allow the OPC or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to;

1. enter upon the owner or operator's premises where a regulated activity is located or conducted or where records must be kept under the conditions of this permit;

2. have access to and copy at reasonable times any records that must be kept under the conditions of this permit; and

3. inspect at reasonable times any facilities or equipment.

Q. **Permit Actions.** This permit may be modified, revoked and reissued, or terminated for cause. A request by the owner or operator for permit or coverage modification, revocation and reissuance, or termination, or a certification of planned changes or anticipated noncompliance does not stay any permit condition.

Part VI. Reopener Clause

A. **Requirement to Obtain Individual or Alternative General Permit.** If there is evidence indicating potential or realized impacts on water quality due to storm water discharge covered by this permit, the owner or operator may be required to obtain individual permit or an alternative general permit in accordance with Part I.D. or the permit may be modified to include different limitations and/or requirements.

B. **Permit Modification.** Permit modification or revocation will be conducted according to 40 CFR 122.62, 122.63, 122.64 and 124.5.

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Part VII.

MONTHLY INSPECTION REPORT AND CERTIFICATION FORM FOR EROSION AND SEDIMENT CONTROLS

Inspections must be done weekly and after a Two-Year, 24-Hour Rainfall (4 inches at the Tenn. Border to 6 inches on the Gulf Coast)

Construction Storm Water General NPDES Permit No. MSR10 _ _ _ _ County: _____

(Fill in your Certificate of Coverage Number & County where Project is Located)

(Please Print)

Owner and/or Prime Contractor: _____

Project Name: _____

Street Address: _____

City: _____

Startup Date: _____

Inspection Log

Date and Time	After a 2-Year, 24-Hour Rain?	Rain Gauge Measurement (inches)	Any Deficiencies Observed?	Inspector(s)
_____	Yes or No	_____	Yes or No	_____
_____	Yes or No	_____	Yes or No	_____
_____	Yes or No	_____	Yes or No	_____
_____	Yes or No	_____	Yes or No	_____
_____	Yes or No	_____	Yes or No	_____

Deficiencies Noted During any Inspection (give date(s); attach additional sheets if necessary):

_____

_____

Corrective Action Taken or Planned (give date(s)); (attach additional sheets if necessary):

_____

_____

Based upon this inspection which I or personnel under my direct supervision conducted, I certify that all erosion and sediment controls have been implemented and maintained, except for those deficiencies noted above, in accordance with the Storm Water Pollution Prevention Plan filed with the Office of Pollution Control and sound engineering practices as required by the above referenced permit.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

_____ _____ _____

Authorized Name (Print) Signature Date

These reports shall be submitted as required in the permit, to:

Chief, Environmental Permits Division
MS Department of Environmental Quality, Office of Pollution Control
P.O. Box 10385
Jackson, Mississippi 39289-0385

Note: This page is intentionally blank

Part VIII.

Notice of Termination (NOT) of Coverage

(Use this form to request coverage termination, after construction or disturbance activities have ceased and upon successful completion of all permanent erosion and sediment controls. All monthly inspection forms must be attached.)

Construction Storm Water General NPDES Permit No. MSR10 __ __ __ __ County: _____
(Fill in your Certificate of Coverage Number & County where Project is Located)

Owner Name (please print): _____

Company Name: _____

Mailing Address: (Street/P.O. Box)_____

(City): _____, **(State)**_____ **(Zip)**_____

Tel. # _____

Prime Contractor Name (please print): _____

Company Name: _____

Mailing Address: (Street/P.O. Box)_____

(City): _____, **(State)**_____ **(Zip)**_____

Tel. # _____

Project Name (please print): _____

Physical Project Location: **Street:** _____

City: _____ **County:** _____

Date of successful completion of all permanent erosion and sediment controls (site stabilized): _____

Based upon inspection(s) of the permitted site which I or personnel under my direct supervision conducted, I certify under penalty of law that construction or disturbance activities have ceased, all erosion and sediment controls have been implemented and maintained, that disturbed soils have been stabilized, all temporary erosion and sediment control measures have been removed and all permanent erosion and sediment controls have been successfully completed. I understand that by submitting this notice of termination, that I am no longer authorized to discharge storm water associated with construction activity by Mississippi's Construction NPDES Storm Water General Permit, and that discharging pollutants in storm water associated with construction activity, not authorized by coverage under Mississippi's Construction NPDES Storm Water General Permit, to waters of the United States is unlawful under the Clean Water Act. I also understand that the submittal of this notice of termination does not release an operator from liability for any violations of Mississippi's Construction NPDES Storm Water General Permit or the Clean Water Act. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

_____	_____	_____	_____
(Permittee/Authorized Name [Print])	**(Telephone Number)**	**(Signature)**	**(Date Signed)**

These form shall be submitted, as required in the permit, to: Chief, Environmental Permits Division, Mississippi Department of Environmental Quality, Office of Pollution Control, P.O. Box 10385, Jackson, Mississippi 39289-0385

Note: This page is intentionally blank

Part IX.

Environmental Permits for Industrial Facilities
Request for Transfer of Permit, General Permit Coverage and/or Name Change

Instructions: For Ownership Change-Complete all Items on Page 1 (except Item VIII) and Page 2 (reverse side).
For Name Change Only-Complete Items I, II, V, VI, VII, VIII, and Page 2 (reverse side).
Note-This form should be submitted to MDEQ when a transferal date is finalized but prior to the actual transfer.

Item I.

Facility Name: _____

Location: (Do Not Use P.O. Box)

Street: _____

City: _____ State: MS Zip: _____

County: _____

Telephone: (_____)_____

Item II.

Responsible official after transfer or name change:

Name: _____

Title: _____

Mailing Address:
Street/P.O. Box: _____

City: _____ State: _____ Zip: _____

Telephone (_____)_____

Item III.

Previous Permittee[1]: _____

Mailing Address:

Street/P.O. Box:_____

City: _____ State: _____ Zip: _____

Telephone: (_____)_____

Item IV.

New Permittee[1]: _____

Mailing Address:

Street/P.O. Box:_____

City: _____ State: _____ Zip: _____

Telephone: (_____)_____

Item V.

Industrial Activity SIC Code: _____

Brief Description:

Item VI.

Will Facility Operations Change? Yes _____ No _____

If yes, the appropriate applications and permits may required modification prior to change.

Item VII.

Will Facility Name Change? Yes_____ No_____

If Yes, Provide New Name for Permit Coverage.

New Name:_____

Item VIII.

Signature for Name Change

Print Name: _____

Authorized Signature[2]: _____

Title: _____ Date: _____

Item IX.

We the undersigned requests transfer of permit(s) and/or permit coverage(s) listed on the backside of this form.

From:_____

To:_____ Acquisition Date:_____

By signature below, the recipient certifies that they are aware of the requirements of the permit(s) and agrees to accept responsibility and liability for the permit(s) listed on the back of this document. By signature below, the previous permittee is requesting that the permit(s) and/or permit coverage(s) be transferred to the recipient. The transfer of the permit(s) or permit coverage(s) will be by written notification from the Office of Pollution Control (OPC). The OPC may require submittal of information regarding financial capability and past compliance history of the recipient.

_____ _____
Print New Permittee[1] Name Print Previous Permittee[1] Name

_____ _____
New Authorized Signature[2] Previous Authorized Signature[2]

_____ _____ _____ _____
Title Date Title Date

[1]A Permittee is a company or individual that has been issued an individual permit or coverage under a general permit.
[2]Authorized Signature must be owner or in the case of a corporation, a corporate officer as defined in Regulations APC-S-2 and WPC-1.

Mississippi Department of Environmental Quality/Office of Pollution Control
P.O. Box 10385
Jackson, Mississippi 39289-0385
(601) 961-5171

Item X. Storm Water	Item XI. Hazardous Waste ID Number
(Check One) ___A Storm Water Pollution Prevention Plan (SWPPP) is not required for the site. ___The recipient certifies that they have received a copy of the Office of Pollution Control approved SWPPP from the original owner. ___The recipient is submitting a new SWPPP, which is attached to this form. ___A copy of the SWPPP cannot be obtained from the original owner.	EPA ID No. _____ (Check One) ___An EPA Hazardous Waste ID Number is not required for the site. ___The site's EPA ID Number is listed above. There is no change in the type or amount of hazardous waste generated on site. ___There is a change in the type or amount of hazardous waste generated and a Notification of Regulated Waste Activity Form is attached.

Item XII. Permit(s) and/or Coverage(s) to be Transferred

Permit Type: _____ Permit/Coverage No.: _____ Permit Issuance Date: _____ Date of General Permit Coverage: _____ Permit Expiration Date: _____	Permit Type: _____ Permit/Coverage No.: _____ Permit Issuance Date: _____ Date of General Permit Coverage: _____ Permit Expiration Date: _____
Permit Type: _____ Permit/Coverage No.: _____ Permit Issuance Date: _____ Date of General Permit Coverage: _____ Permit Expiration Date: _____	Permit Type: _____ Permit/Coverage No.: _____ Permit Issuance Date: _____ Date of General Permit Coverage: _____ Permit Expiration Date: _____
Permit Type: _____ Permit/Coverage No.: _____ Permit Issuance Date: _____ Date of General Permit Coverage: _____ Permit Expiration Date: _____	Permit Type: _____ Permit/Coverage No.: _____ Permit Issuance Date: _____ Date of General Permit Coverage: _____ Permit Expiration Date: _____
Permit Type: _____ Permit/Coverage No.: _____ Permit Issuance Date: _____ Date of General Permit Coverage: _____ Permit Expiration Date: _____	OTHER INFORMATION:

Part X.

Proof of Coverage Under the
State of Mississippi's
Storm Water Construction Permit

Use this form to display proof of coverage under Mississippi's Storm Water Construction Permit at a conspicuous site (accessible to the public) on or at the edge of the construction site. If the construction project is a linear construction project (e.g., pipeline, highway, etc.), the proof of coverage must be placed in a publicly accessible location near where construction is actively underway and moved as necessary. If exposed to the weather please laminate before posting.

Construction Storm Water General NPDES Permit No. MSR10 __ __ __ __

(Print all Information)

Project Contact Name: _____

Company Name: _____

Tel. # _____

Project Name: _____

Project Description: _____

_____

_____

Storm Water Pollution Prevention Plan Location: _____

_____

To report complaints concerning sediment, trash or other pollutants call:

Mississippi Department of Environmental Quality

601-961-5171

or write:

Environmental Compliance and Enforcement Division, Office of Pollution Control, P.O. Box 10385, Jackson, Mississippi 39289-0385

MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY

CONSTRUCTION NOTICE OF INTENT (CNOI)

FOR COVERAGE UNDER CONSTRUCTION STORM WATER GENERAL NPDES PERMIT MSR10 __ __ __ __

(NUMBER TO BE ASSIGNED BY STATE)

FILE AT LEAST 30 DAYS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION; 15 DAYS IF A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) IS ALREADY ON FILE. DISCHARGE OF STORM WATER FROM A CONSTRUCTION SITE WITHOUT WRITTEN NOTIFICATION OF COVERAGE IS A VIOLATION OF STATE LAW

INSTRUCTIONS

SUBMITTALS WITH THIS CNOI MUST INCLUDE: A USGS QUAD MAP (OR A COPY) SHOWING SITE LOCATION AND STORM WATER OUTFALLS AND STORM WATER POLLUTION PREVENTION PLAN (SWPPP). SEE CONSTRUCTION GENERAL PERMIT PART III.

ADDITIONAL SUBMITTALS MAY INCLUDE DOCUMENTATION OF SWPPP APPROVAL WITH LOCAL ORDINANCES (CONSTRUCTION GENERAL PERMIT PART III. B.); APPROPRIATE SECTION 404 DOCUMENTATION FROM CORPS OF ENGINEERS (IF REQUIRED); APPROPRIATE DOCUMENTATION FROM HEALTH DEPARTMENT AND/OR MDEQ/OPC FOR FUTURE DISPOSAL OF SANITARY SEWAGE AND SEWAGE COLLECTION SYSTEM; APPROPRIATE DOCUMENTATION FROM MDEQ/OFFICE OF LAND & WATER, FOR DAM CONSTRUCTION AND LOW FLOW REQUIREMENTS.

APPLICANT MUST BE OWNER OR PRIME CONTRACTOR. THE APPLICANT RECEIVES COVERAGE AND IS RESPONSIBLE FOR PERMIT COMPLIANCE. OWNER MAY APPLY AND AT A LATER DATE REQUIRE PRIME CONTRACTOR TO ASSUME PERMIT COMPLIANCE (SEE PRIME CONTRACTOR CERTIFICATION)..

All QUESTIONS MUST BE ANSWERED (Answer "NA" if the question is not applicable)

IS APPLICANT THE OWNER OR PRIME CONTRACTOR? (CIRCLE ONE OR BOTH)

OWNER INFORMATION

OWNER CONTACT PERSON: _____

OWNER COMPANY NAME: _____

OWNER STREET (P.O. BOX): _____

OWNER CITY: _____ **STATE:** _____ **ZIP:** _____

OWNER PHONE # (INCLUDE AREA CODE): _____

PRIME CONTRACTOR INFORMATION

PRIME CONTRACTOR CONTACT PERSON: _____

PRIME CONTRACTOR COMPANY: _____

PRIME CONTRACTOR STREET (P.O. BOX): _____

PRIME CONTRACTOR CITY: _____ **STATE:** _____ **ZIP:** _____

PRIME CONTRACTOR PHONE # (INCLUDE AREA CODE): _____

Revised June 12, 2002

PROJECT INFORMATION

PROJECT NAME: _____

DESCRIPTION OF CONSTRUCTION ACTIVITY: _____

_____

_____

PROPOSED DESCRIPTION OF PROPERTY USE AFTER CONSTRUCTION HAS BEEN COMPLETED (INCLUDE STANDARD INDUSTRIAL CLASSIFICATION CODE (SIC) IF KNOWN): _____

_____ SIC Code ___ ___ ___ ___

PHYSICAL SITE ADDRESS (IF NOT AVAILABLE INDICATE THE NEAREST NAMED ROAD - FOR LINEAR PROJECTS INDICATE BEGINNING OF PROJECT. IN ADDITION, IDENTIFY ALL COUNTIES THAT LINERAR PROJECT TRAVERSES.):

STREET: _____

CITY: _____, COUNTY: _____

ZIP: _____

NEAREST NAMED RECEIVING STREAM: _____

ARE THERE ANY WETLANDS, RECREATIONAL STREAMS, PRIVATE/PUBLIC PONDS OR LAKES WITHIN ½ MILE DOWNSTREAM OF PROJECT BOUNDRY? _____

TOTAL ACREAGE THAT WILL BE DISTURBED[1]: _____

EST. START DATE: _____ EST. COMPLETION DATE: _____

TYPE SOIL ON SITE: _____

[1]Acreage for subdivision development includes areas disturbed by construction of roads, utilities and drainage. Additionally, a housesite of at least 10,000 ft^2 per lot (entire lot, if smaller) shall be included in calculating acreage disturbed.

DOCUMENTATION OF COMPLIANCE WITH OTHER REGULATIONS/REQUIREMENTS

IS THIS NOTICE FOR A FACILITY THAT WILL REQUIRE OTHER PERMITS (Yes or No)? _____. If so, circle which one(s): AIR, HAZARDOUS WASTE, PRETREATMENT, STATE OPERATING, INDIVIDUAL NPDES, CORPS OF ENGINEERS SECTION 404 (If so, provide appropriate documentation from the Corps), other(s):

_____

_____

IS A LAKE REQUIRING THE CONSTRUCTION OF A DAM BEING PROPOSED (Yes or No)? _____ IF SO, PROVIDE APPROPRIATE APPROVAL DOCUMENTATION FROM MDEQ, OFFICE OF LAND AND WATER, DAM SAFETY.

IF THE PROJECT IS A SUBDIVISION, INDUSTRIAL PARK OR LARGE APARTMENT COMPLEX HOW WILL SANITARY SEWAGE BE DISPOSED? Circle one of the following and attach the pertinent documents.

1. **Existing Municipal or Commercial System. Please attach a copy of the letter from MDEQ that the plans and specifications for the collection system have been submitted and approved.**
2. **Collection and Treatment System will be Constructed. Please attach a copy of the cover of the NPDES discharge permit from MDEQ or indicate the date the application was submitted to MDEQ (Date: _____.)**
3. **Individual Onsite Wastewater Disposal Systems for Subdivisions Less than 35 Lots. Please attach a copy of the Letter of General Acceptance from the Mississippi State Department of Health or certification from a registered professional engineer that the platted lots should support individual onsite wastewater disposal systems.**
4. **Individual Onsite Wastewater Disposal Systems for Subdivisions Greater than 35 Lots. A determination of the feasibility of installing a central sewage collection and treatment system must be made by MDEQ. A copy of the response from MDEQ concerning the feasibility study must be attached. If a central collection and wastewater system is not feasible, then please attach a copy of the Letter of General Acceptance from the State Department of Health or certification from a registered professional engineer that the platted lots should support individual onsite wastewater disposal systems.**

IF THE PROJECT IS NOT ONE OF THE ABOVE, HOW WILL SANITARY SEWAGE BE DISPOSED?

_____

_____

INDICATE ANY LOCAL STORM WATER ORDINANCE WITH WHICH THE PROJECT MUST COMPLY AND SUBMIT ANY DOCUMENTATION OF APPROVAL. (APPROVED PLANS WILL RECEIVE EXPEDITED REVIEW):

_____

_____

STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND USGS QUAD MAP REQUIREMENT

ATTACH A CONSTRUCTION SWPPP THAT INCLUDES THE MINIMUM COMPONENTS FOUND IN PART III.C. OF THE CONSTRUCTION PERMIT.

INDICATE ANY ASSOCIATION OR GENERIC SWPPP – ADDITIONALLY ATTACH SITE MAP WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS LOCATED ON THE PROJECT SITE MAP. FOR LINEAR PROJECTS (ROAD AND PIPELINE PROJECTS) PROVIDE DRAWINGS OF TYPICAL CONTROLS USED (SEE PERMIT): _____

_____

ATTACH A USGS QUAD MAP OR COPY OF QUAD MAP EXTENDING AT LEAST ONE-HALF OF A MILE BEYOND THE SITE'S PROPERTY BOUNDRY OUTLINING THE SITE LOCATION. (QUAD MAPS CAN BE OBTAINED FROM THE OFFICE OF GEOLOGY: 601-961-5523).

IF A COPY IS SUBMITTED PROVIDE THE NAME OF THE QUAD MAP (FOUND IN UPPER RIGHT HAND CORNER OF MAP)

_____

I CERTIFY UNDER PENALTY OF LAW THAT THIS DOCUMENT AND ALL ATTACHMENTS WERE PREPARED UNDER MY DIRECTION OR SUPERVISION IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHERED AND EVALUATED THE INFORMATION SUBMITTED. BASED ON MY INQUIRY OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM, OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR GATHERING THE INFORMATION, THE INFORMATION SUBMITTED IS, TO THE BEST OF MY KNOWLEDGE AND BELIEF, TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS.

_____ _____

Signature[1] (Must be signed by operator when different than owner) **Date Signed**

_____ _____

Printed Name[1] **Title**

[1]This application shall be signed according to the General Permit, Part V.E., as follows:
- **For a corporation, by a responsible corporate officer.**
- **For a partnership, by a general partner.**
- **For a sole proprietorship, by the proprietor.**
- **For a municipal, state or other public facility, by principal executive officer, mayor, or ranking elected official.**
- **Duly Authorized Representative.**

PRIME CONTRACTOR CERTIFICATION

The prime contractor, if different from original applicant, will take responsibility for permit compliance by filing this certification prior to the commencement of construction. This certification is unnecessary when the prime contractor has already completed, signed, and submitted pages 1, 2, 3 and 4 of the CNOI. By completing and submitting this certification to MDEQ, the prime contractor accepts full responsibility for permit compliance and meeting all permit conditions. Otherwise the initial applicant (applicant who filed pages 1, 2, 3 and 4 of the CNOI) is solely responsible for permit compliance. Notwithstanding any permit condition to the contrary, the coverage recipient and any person who causes pollution of waters of the state or places waste in a location where they are likely to cause pollution of any waters of the state shall remain responsible under applicable federal and state laws and regulations, and applicable permits.

PRIME CONTRACTOR INFORMATION

PRIME CONTRACTOR CONTACT PERSON: _____ **PHONE NUMBER:** _____

PRIME CONTRACTOR COMPANY: _____

PRIME CONTRACTOR STREET (P.O. BOX): _____

PRIME CONTRACTOR CITY: _____ **STATE:** _____ **ZIP:** _____

OWNER INFORMATION

OWNER CONTACT PERSON: _____ **PHONE NUMBER:** _____

OWNER COMPANY NAME: _____

PROJECT INFORMATION

CONSTRUCTION STORM WATER GENERAL PERMIT COVERAGE NUMBER: MSR10 __ __ __ __

PROJECT NAME: _____

DESCRIPTION OF CONSTRUCTION ACTIVITY: _____

_____

PHYSICAL SITE ADDRESS (IF NOT AVAILABLE INDICATE THE NEAREST NAMED ROAD - FOR LINEAR PROJECTS INDICATE BEGINNING OF PROJECT. IN ADDITION, IDENTIFY ALL COUNTIES THAT LINERAR PROJECT TRAVERSES.):

STREET: _____

CITY: _____, **COUNTY:** _____

I CERTIFY THAT I AM THE PRIME CONTRACTOR FOR THIS PROJECT AND WILL COMPLY WITH ALL THE REQUIREMENTS IN THE ABOVE REFERENCED GENERAL NPDES PERMIT.

I CERTIFY UNDER PENALTY OF LAW THAT THIS DOCUMENT AND ALL ATTACHMENTS WERE PREPARED UNDER MY DIRECTION OR SUPERVISION IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHERED AND EVALUATED THE INFORMATION SUBMITTED. BASED ON MY INQUIRY OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM, OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR GATHERING THE INFORMATION, THE INFORMATION SUBMITTED IS, TO THE BEST OF MY KNOWLEDGE AND BELIEF, TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS.

_____ _____

Prime Contractor Signature[1] **Date Signed**

_____ _____

Printed Name[1] **Title**

[1]This application shall be signed according to the General Permit, Part V.E., as follows:
- For a corporation, by a responsible corporate officer.
- For a partnership, by a general partner.
- For a sole proprietorship, by the proprietor.
- For a municipal, state or other public facility, by principal executive officer, mayor, or ranking elected official.
- Duly Authorized Representative.

REVISION 0
OCTOBER 2004

Erosion, Sediment, and Stormwater Control Plan Report

for

Site 8 – Herbicide Orange Storage Area

and

Off-Base Area of Contamination

Naval Construction Battalion Center

Gulfport, Mississippi

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0272

October 2004

REVISION 0
OCTOBER 2004

EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN REPORT
for
SITE 8 – HERBICIDE ORANGE STORAGE AREA
and
OFF-BASE AREA OF CONTAMINATION

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0272

OCTOBER 2004

PREPARED UNDER THE SUPERVISION OF:

ROBERT FISHER
TASK ORDER MANAGER
TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA

APPROVED FOR SUBMITTAL BY:

DEBRA M. HUMBERT
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

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APPENDICES

A CHECKLIST FOR EROSION, SEDIMENT, AND STORMWATER CONTROL
B EROSION, SEDIMENT, AND STORMWATER CONTROL CALCULATIONS

FIGURES

NUMBER

1-1 Vicinity Map
1-2 Installation Map
2-1 On-base Drainage Channel Excavation/Restoration Areas
2-2 Soils Map

ACRONYM LIST

AOC	Area of Contamination
ARAR	Applicable or Relevant and Appropriate Requirement
cfs	cubic feet per second
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	Contract Task Order
ECM	Erosion control matting
FFS	Focused Feasibility Study
HLA	Harding Lawson Associates
HO	Herbicide orange
MDEQ	Mississippi Department of Environmental Quality
MSWCC	Mississippi Soil and Water Conservation Commission
MSWPPP	Mississippi Stormwater Pollution Prevention Plan
µg/kg	Microgram per kilogram
NCBC	Naval Construction Battalion Center
OPC	Office of Pollution Control
PRG	Preliminary remediation goal
QC	Quality Control
RA	Remedial Action
ROICC	Resident Officer in Charge of Construction
SCS	Soil Conservation Service
Site 8	Site 8 – Herbicide Orange Storage Area
SRT	Sediment recovery trap
TBC	To Be Considered
TtNUS	Tetra Tech NUS, Inc.
USAF	United States Air Force
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
VSAP	Verification Sampling and Analysis Plan

1.0 INTRODUCTION

This Erosion, Sediment, and Stormwater Control Plan Report was prepared under Contract Task Order (CTO) No. 0272 under Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62467-94-D-0888. Under this CTO, Tetra Tech NUS, Inc. (TtNUS) is performing engineering and design services for the remedial action (RA) at Site 8 – Herbicide Orange Storage Area (Site 8) and contiguous on-base drainage channels at the Naval Construction Battalion Center (NCBC or "base"), and associated off-base Area of Contamination (AOC) in Gulfport, Mississippi.

NCBC Gulfport is located in the southeastern corner of Mississippi, approximately 2 miles north of the Gulf of Mexico. The base is located in the western part of the City of Gulfport in Harrison County. Figure 1-1 shows the location of the base in relation to the City of Gulfport and the Gulf of Mexico. The off-base AOC is located north of NCBC, across 28th Street near Outfall 3. The base occupies 1,100 acres with an average elevation of approximately 30 feet above sea level. A map of NCBC Gulfport is provided as Figure 1-2.

1.1 SITE HISTORY

Prior to 1968, Site 8 was used as an equipment storage and staging area. Around 1961, the surface soils were stabilized with Portland cement to provide a hardened surface for heavy equipment operation and storage. Between 1968 and 1977, Site 8 was used by the United States Air Force (USAF) as a storage area for drums containing herbicide orange (HO). In 1977, the HO drums were removed from Site 8, transported to port by railroad, and placed on a ship for destruction by incineration in the south Pacific. The release of dioxins at Site 8 from the HO was confirmed in 1977, and the site was fenced and left inactive until 1985 (TtNUS, 2003). It was originally believed that 13 acres of Site 8 stored approximately 850,000 gallons of HO. This 13-acre area is currently referred to as Site 8A (HLA, 2000).

In 1985, the USAF began operations to clean up the dioxin-contaminated soils that remained on site following the removal of the drums of HO. The dioxin contamination of soils resulted from several spills and leaks during the 10 years that HO was stored on Site 8. Through a Research, Development and Demonstration permit obtained through the United States Environmental Protection Agency (USEPA) Region 4, the USAF conducted test burns to demonstrate that incineration was capable of reducing the dioxin concentrations to 1.0 microgram per kilogram (µg/kg), the USEPA criterion at that time. During the test burns, two additional areas outside the original 13 acres were identified and verified as previous storage locations for drums containing HO. These two areas were designated as Sites 8B and 8C. Following USEPA acceptance of the test burn data, full-scale incineration of dioxin-contaminated soils from Sites 8A, 8B, and 8C was conducted. The incineration process was conducted within the

boundaries of Site 8A and was completed in 1988. The ash that remained from the incineration process was stored and currently remains on Site 8A. Although the soils within Sites 8A, 8B, and 8C were incinerated, the drainage channels that carry surface water and sediment from these sites to the lower reaches of the local drainage basin were not addressed during this remedial effort (HLA, 2000).

From 1988 when the USAF remedial effort was completed through 2000, access to Site 8A was restricted and no base operations were conducted within site boundaries. In January 2001, a new rail-loading ramp was constructed on the south side of Site 8A in anticipation of using the site as a storage and staging area (TtNUS, 2003). For additional details on the site history, refer to Section 1.3 of the Remediation Planning Document (HLA, 2000).

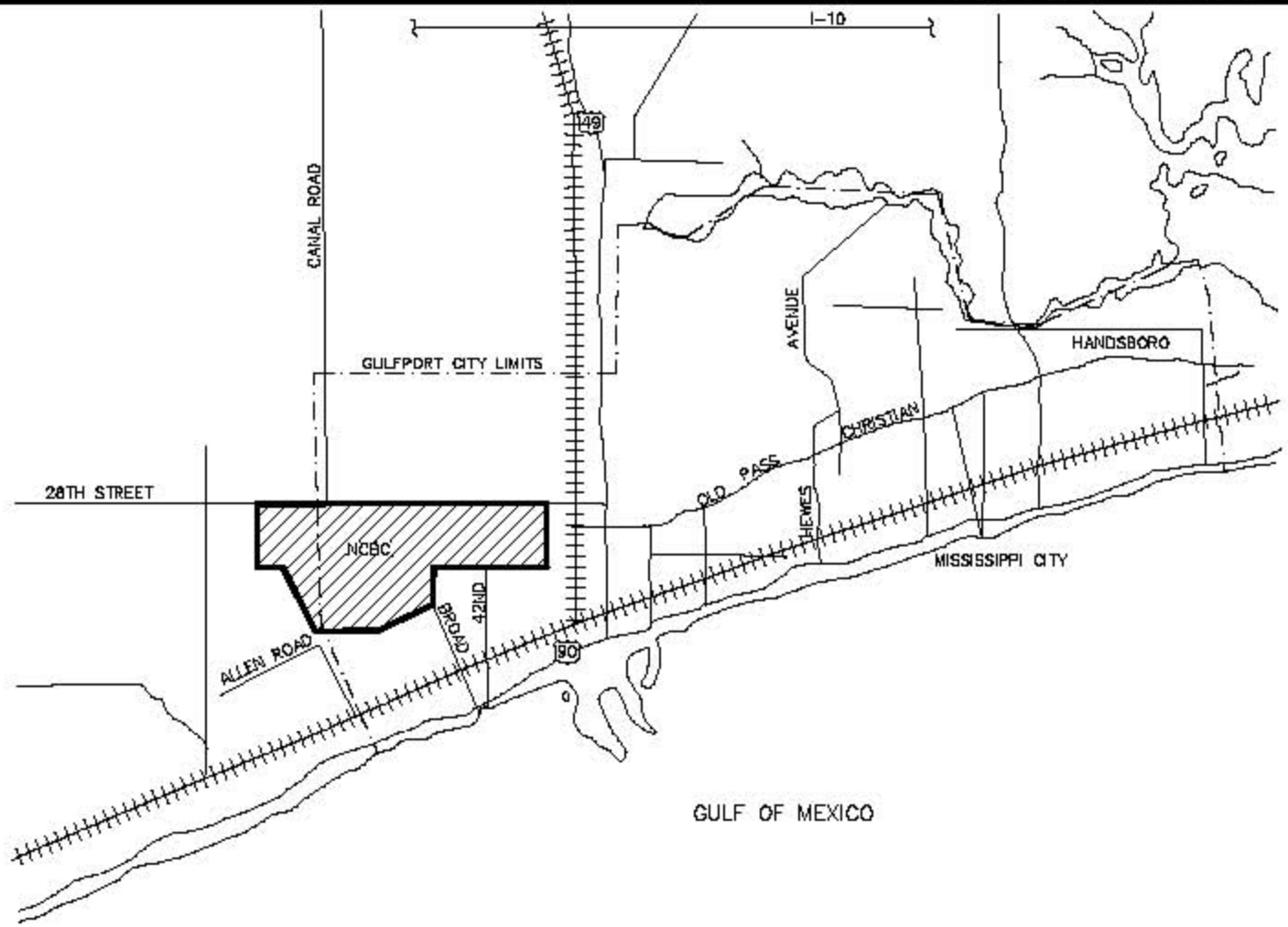
1.2 REPORT OBJECTIVE

The objective of this report is to describe the project and present the erosion, sediment, and stormwater control measures that will be used during implementation of the remedial action at Site 8 and the off-base AOC.

1.3 REPORT FORMAT

Section 2.0 presents a response to the narrative requirements for Erosion, Sediment, and Stormwater Control Plans in the State of Mississippi. Section 3.0 presents a generalized sequence of construction. Section 4.0 presents conclusions. A copy of the completed Mississippi Checklist for Erosion, Sediment, and Stormwater Control Plans is presented in Appendix A. Calculations are presented in Appendix B. Design drawings, including the erosion, sediment, and stormwater control plan design drawings and technical specifications, are provided under separate cover.

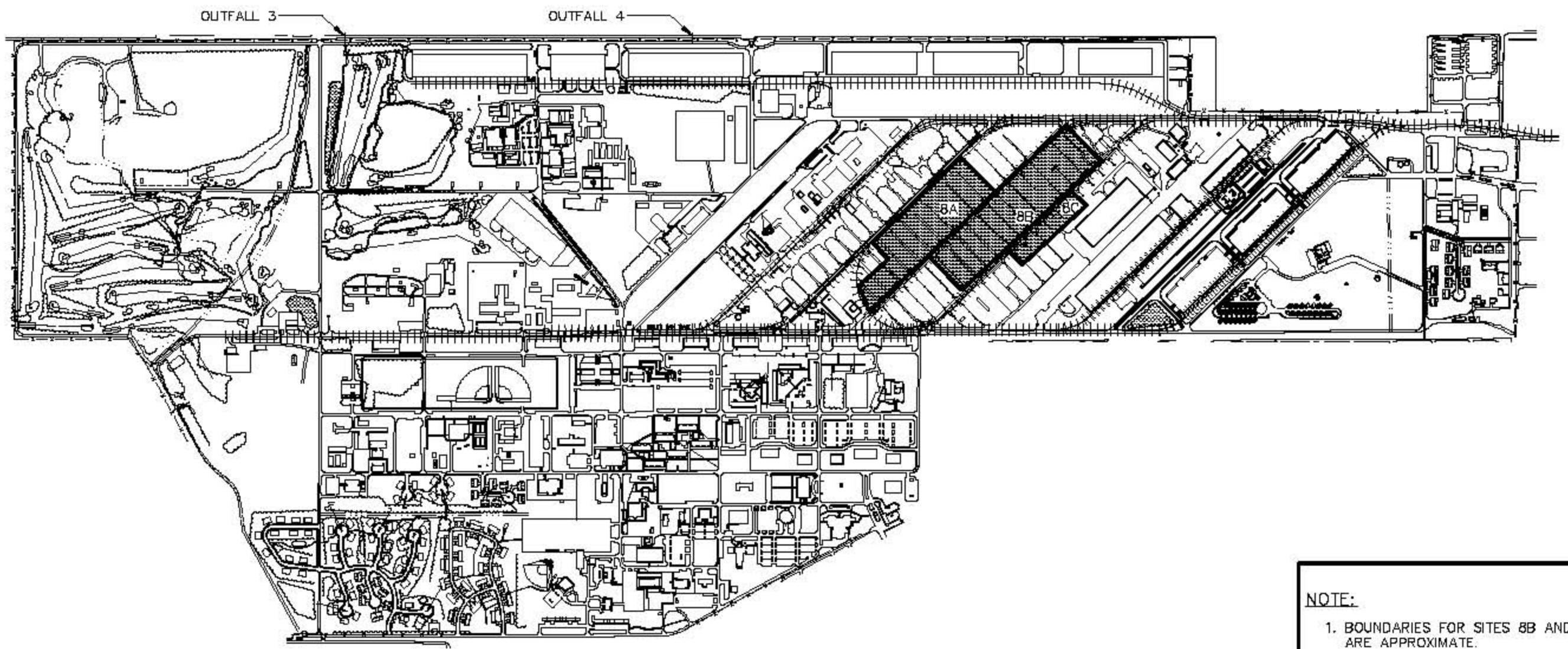
ACAD: 7379CM03.dwg 09/29/04 HJB PIT



DRAWN BY MF DATE 11/14/02	VICINITY MAP SITE B EROSION, SEDIMENT AND STORMWATER CONTROL PLAN NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 7379	
CHECKED BY JJB DATE 5/13/03		APPROVED BY DATE	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE NONE		DRAWING NO. FIGURE 1-1	REV. 0

FORM CADD NO. SDIV_AHJDWG - REV 0 - 1/20/98

ACAD: 7379DM27.dwg 09/29/04 HJB PIT



NOTE:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.

0 1000 2000
SCALE IN FEET

SOURCE: BASEMAP.DWG, PUBLIC WORKS DEPARTMENT, NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MS, JUNE 2001

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 11/14/02
CHECKED BY JJB DATE 5/13/03
COST/SCHED–AREA
SCALE AS NOTED

INSTALLATION MAP
SITE 8
EROSION, SEDIMENT AND STORMWATER CONTROL PLAN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 1–2
REV. 0

FORM CADD NO. 5DIV_8HJ.DWG - REV 0 - 1/20/98

2.0 NARRATIVE CHECKLIST REQUIREMENTS

This section presents the State of Mississippi's narrative checklist requirements for erosion, sediment, and stormwater control plans. A copy of the completed Erosion, Sediment, and Stormwater Control Plan checklist is provided in Appendix A. Erosion, sediment, and stormwater quality control (QC) personnel will have completed the Mississippi Erosion, Sediment, and Stormwater Control Course for Contractors or equivalent before construction or placement of erosion, sediment, and stormwater controls for this project.

2.1 PROJECT DESCRIPTION

As part of the RA for Site 8, the Navy will:

- Excavate dioxin-contaminated sediment from on-base drainage channels contiguous to Site 8 and from an associated off-base AOC located north of the base and excavate soil ash located at Site 8.
- Consolidate, blend, and stabilize soil ash and contaminated sediment within a portion of Site 8.
- Construct a 12-inch roller-compacted concrete cap over the stabilized material.
- Perform verification sampling of excavated areas
- Restore the on-base drainage channels and off-base AOC affected by excavation activities.
- Implement land-use controls.
- Perform long-term monitoring.

The RA is expected to impact the 13-acre area of Site 8A, 18 acres of on-base drainage channels, and 19 acres of off-base wetland.

This report summarizes the design basis for the remedial alternative selected in the Focused Feasibility Study (FFS) for Site 8 (TtNUS, 2003). This alternative was selected to protect public health, welfare, and the environment from exposure to dioxins that are degradation products of the HO formerly stored at Site 8. The Navy's goal is to begin the RA at Site 8 and affected on-base drainage channels and off-base AOC as quickly as possible to protect human health and the environment and to comply with Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) criteria.

2.2 EXISTING SITE CONDITIONS

Site 8 consists of three contiguous storage areas located in the north-central portion of NCBC Gulfport (Figure 1-2). The three storage areas comprising Site 8, designated as Site 8A, 8B, and 8C, varied in the level of storage of HO. The main former HO drum storage area, Site 8A, which encompasses

approximately 13 acres, has an undulating surface due to previous remedial activities and is covered with light vegetation (Design Drawings C-4 and C-5). The surface soil in non-stabilized areas is typically a fine- to medium-grained sand. Approximately one-third of Site 8A consists of stabilized areas where HO drums were stored.[1] Site 8A includes the upper reaches of the drainage areas for the eastern two-thirds of the base. Surface drainage from Site 8A flows to the northwest, exiting the base at Outfall 3 into a drainage system that feeds Canal No. 1, which flows north to Turkey Creek (TtNUS, 2003). Prior to 1995, the surface water that exited the base via Outfall 3 discharged to wetland that is a part of the Turkey Creek drainage basin (HLA, 2000).

Sites 8B and 8C contain the majority of the on-base drainage channels that require restoration (contaminated sediments previously removed). Sites 8B and 8C encompass approximately 18 acres, are relatively flat, and have almost no vegetation (Design Drawings C-1 and C-2). Sites 8B and 8C were also used for storage of drums containing HO. The Site 8B and 8C surface soils consist of fine- to medium-grained sand, and approximately one-third of these areas are stabilized with Portland cement. Sites 8B and 8C are also located at the head of local drainage basins. Surface water from Site 8B flows north, exiting the base at Outfall 4, and then to the Turkey Creek drainage basin. Surface water from Site 8C drains to the southeast, exiting the base at Outfall 2 into Brickyard Creek (TtNUS, 2003).

The on-base drainage channels scheduled for excavation and restoration are shown on Figure 2-1. Two types of dioxin-contaminated sediment have been observed in the on-base drainage channels (TtNUS, 2001). In the upper reaches of the drainage channel 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 channel 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.

The off-base AOC consists of impacted drainage channels contained within property currently owned by Mr. G.E. Arndt (the Arndt property) and Mr. P.W. Bennett (the Bennett property). Within this drainage channel reach, dioxin-contaminated sediment has also been deposited outside the banks of the drainage channels as a result of high-flow conditions during major storm events. Design Drawing C-3 presents the extent of contamination within the off-base AOC.

The primary transport mechanism of dioxin-contaminated sediment in the off-base AOC drainage channels is the high-velocity surface flow associated with major storm events. These storm events are responsible for the downstream migration of dioxin-contaminated sediment; however, the deposition of

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[1] The surface soil in storage areas at NCBC is typically stabilized using Portland cement to improve the load-bearing

these sediments is influenced by the elevation changes associated with three terraces identified along the drainage patterns. These terraces, with unique depositional patterns, soil types, and vegetation, are as follows:

- Terrace 1 is located at the lowest elevation, or level, and forms the main channel. The soil surface consists mainly of organic rich silts and clays, and soil becomes increasingly sandy below this surface layer. This terrace supports very little understory vegetation due to frequent flooding and poor drainage. This terrace was identified to be the most likely to contain significant levels of dioxin contamination.

- Terrace 2 forms a margin that surrounds the Terrace 1 main channel but at elevations slightly higher than Terrace 1. The organic-rich surface soil layer is thinner than Terrace 1 and contains some sand. Terrace 2 supports more understory vegetation, which visually distinguishes it from Terrace 1.

- Terrace 3 occurs along the highest elevations in the study area. The soils are well-drained, dark brown, fine to medium sands that support abundant understory vegetation. These coarser-grained soils were the main distinguishing feature between Terrace 3 and Terrace 2.

2.3 OFF-SITE AREAS

Areas not within the limits of remediation include uncontaminated on-base drainage channels and areas downgradient of and adjacent to the off-base AOC. Each of these areas is located within the limits of disturbance for this remedial design. The erosion, sediment, and stormwater control devices required to protect these areas and to prevent the migration of contaminants to Turkey Creek are presented on Design Drawings C-6 through C-10 and are described in this report.

The borrow area(s) is selected by the Contractor and will not be located within the limits of disturbance noted in this remedial design. The Contractor will submit a supplemental erosion, sediment, and stormwater control plan to the Navy addressing any and all off-site borrow source(s) if an approved erosion, sediment, and stormwater control plan for the off-site source(s) does not exist.

2.4 SOILS

The Soil Survey of Harrison County, Mississippi produced by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) in 1975 (USDA, 1975) is provided as Figure 2-2. The

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capacity and thus provide a surface suitable for equipment storage and staging.

approximate locations of Site 8 and the associated AOC are indicated on the map. The soil types present within Site 8 and the on-base drainage channels include:

At	Atmore silt loam
HIA	Harleston fine sandy loam, 0 to 2 percent slopes
Oc	Ocilla loamy sand
Pm	Plummer loamy sand

A description of these soil types, obtained from the Soil Survey of Harrison County, Mississippi (USDA, 1975), is provided below.

Atmore silt loam - This is a poorly drained soil on broad flats and in drainageways with slopes of 0 to 2 percent. This Atmore soil is strongly acidic to extremely acidic, and permeability is moderate in the upper part and slow in the lower part. The available water capacity is medium to high. The water table is at the surface during wet periods, and runoff is slow.

Harleston fine sandy loam, 0 to 2 percent slopes - This is a strongly or very strongly acidic, moderately well drained soil on ridgetops. Permeability is moderate and available water capacity is medium. Runoff is slow.

Ocilla loamy sand - This is a somewhat poorly drained soil on broad flats with slopes of 0 to 2 percent. This soil is strongly acidic or very strongly acidic. Permeability is moderate and available water capacity is low to medium. Runoff is slow.

Plummer loamy sands - Plummer loamy sand is a poorly drained soil on wet flats and in drainageways. Slopes are 0 to 2 percent. This soil is strongly acid or very strongly acid. Permeability of the surface and subsurface layers is rapid, and permeability of the subsoil is moderate. The available water capacity is low, and runoff is slow or very slow.

The soil types present within the off-base AOC include:

HIB	Harleston fine sandy loam, 2 to 5 percent slopes
Hy	Hyde silt loam
Ps	Ponzer and Smithton soils
Pm	Plummer loamy sand

Descriptions of the soil types not described above, obtained from the Soil Survey of Harrison County, Mississippi (USDA, 1975), are provided below. The descriptions for the soils were.

Harleston fine sandy loam, 2 to 5 percent slopes - This moderately well-drained soil is on ridgetops, around heads of drainageways, and on side slopes. This soil is strongly acidic or very strongly acidic. Permeability is moderate and available water capacity is medium. Runoff is slow to medium.

Hyde silt loam - This is a very poorly drained soil in depressions and drainageways with slopes of 0 to 2 percent. This soil is strongly acidic or very strongly acidic. Permeability is moderately slow and available water capacity is high. Runoff is slow or very slow.

Ponzer and Smithton soils - These soils located along minor streams and intermittent drainageways and are subject to flooding and are covered by standing water for long periods. Slopes are 0 to 2 percent. The soil ranges from very poorly to poorly drained and strongly acidic to extremely acidic. Available water capacity is medium.

2.5 CRITICAL AREAS

Critical areas are those areas that have potentially serious erosion problems due to steep slopes, poor vegetation cover, or runoff channels or have been identified as wetlands. Critical areas associated with Site 8 include the streams that carry stormwater runoff from the site to Outfall 3 and the wetland areas in the off-base AOC. Through the process of excavating contaminated soils and through the process of constructing erosion, sediment, and stormwater controls, portions of the wetlands located within the area of disturbance for the RA will be impacted. These areas will be protected where possible by using erosion, sediment, and stormwater controls. However, the wetland areas that cannot be protected (i.e., wetlands within excavation areas) will be restored upon completion of the RA. The erosion, sediment, and stormwater controls proposed for the protection of critical areas and for the prevention of sediment transport are described further in Section 2.6. No other critical areas have been identified for Site 8 and its associated on- and off-base remediation areas.

2.6 EROSION, SEDIMENT, AND STORMWATER CONTROL MEASURES

Unless otherwise noted in this plan or in the construction documents, erosion, sediment, and stormwater control measures will be implemented, installed, and maintained according to the standards and specifications of the Mississippi Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater (MPDMCESS) produced in April 1994. The MPDMCESS was produced with the cooperation of the USDA Natural Resources Conservation Service, the Mississippi Department of Environmental Quality (MDEQ), and the Mississippi Soil and Water Conservation Commission (MSWCC) (USDA, 1994).

The required erosion, sediment, and stormwater control measures are shown on Design Drawings C-6 through C-10 and are as follows:

- Construction entrance(s)/exit(s) will be provided off Greenwood Avenue, Holtman Avenue, Brown Avenue, and Eighth Street for work to be performed on base and off 28th Street for work to be performed off base. These construction entrance(s)/exit(s) will be protected with silt fencing or super silt fencing.

- Silt fencing will be placed along the downslope sides of access roads, construction entrance(s)/exit(s), support facilities [i.e., the decontamination pad(s), staging area(s), and materials handling pad], and around identified excavation areas.

- Super silt fence will be installed along the limit of stabilized material blend, or cap, to decrease runoff velocities and protect certified clean stabilized drainage channels.

- A temporary diversion, stabilized immediately after installation, will be placed along the upslope side of the temporary access road that will be constructed to access the off-base AOC. The diversion will collect stormwater runoff and divert the flow to controlled locations.

- Sediment recovery traps (SRTs) will be constructed to segregate excavation areas within the off-base AOC.

2.6.1 Structural Practices

The following structural practices will be used during and/or following construction activities at Site 8 to control erosion and sedimentation.

1. Construction Entrance(s)/Exit(s) - Temporary construction entrance(s)/exits(s) will be installed to provide access to Site 8A from Greenwood Avenue, to Site 8B from Holtman Avenue, to on-base drainage channels from Brown Avenue and Eighth Street, and to the off-base AOC from 28th Street. Construction vehicles will be cleaned before exiting the site.

2. Silt Fence - Silt fencing will be installed along the downslope sides of access roads, construction entrance(s)/exit(s), support facilities, and excavation areas.

3. Super Silt Fence - Super silt fencing will be installed around the Site 8A cap area.

4. Sediment Tank - A sediment tank will be available on site for use in dewatering excavation areas and for collecting decontamination waters. Water from excavations may be collected in a temporary holding tank, tested, and disposed at an appropriate off-site facility, if necessary. In the event that a determination is made to allow discharge of the collected water onto the ground surface, water will first be cleaned of sediment and then broadcast over an approved vegetated area or designated drainage channel. Water from the decontamination pad will be collected in a temporary holding tank, tested, and disposed at an appropriate off-site facility, if necessary.

5. Surface Roughening - The surface of regraded areas will be roughened to reduce runoff velocity and to aid in the establishment of vegetative cover.

6. Temporary Seeding - All regraded areas that will be left dormant for extended periods of time shall be seeded with fast-germinating temporary vegetation immediately following grading. Seeding will be performed dependent on the time of year, in accordance with the Seeding Chart in the Mississippi Stormwater Pollution Prevention Plan (MSWPPP) Guidance Manual for Construction Activities produced by the General Permits Branch of the Office of Pollution Control (OPC) in the MDEQ (OPC, 2000).

7. Permanent Seeding - All regraded areas not receiving roller-compacted concrete or wetland plantings will be permanently seeded with a seed mixture that will minimize erosion and provide suitable food and cover for wildlife. The permanent seed mixture for this RA is presented in Section 2.7 and on Design Drawing C-12.

8. Mulching - All areas receiving permanent seeding will be mulched with an organic material that prevents erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow.

9. Diversion - A temporary diversion will be constructed along the off-base AOC temporary access road. The diversion will be used to collect stormwater runoff and convey it around the excavation.

10. Culverts - Culverts placed periodically below the temporary access road constructed along the off-base AOC will allow the diversions to collect stormwater runoff at selected locations (depending on the severity of the storm). The off-base AOC end of each culvert will be covered with filter fabric to prevent the migration of contaminated sediments from the off-base AOC to the diversion.

11. Sediment Recovery Traps - SRTs will be constructed to segregate areas of excavation within the off-base AOC. The SRTs, which are constructed using gabions and filter fabric, will prevent the

migration of contaminated sediments into uncontaminated areas during rainfall events or storm surges. These SRTs will be removed after the off-base area is stabilized with vegetation.

12. Sheet Piling - Sheet piling will be placed within the on-base drainage channels to divide on-base drainage channels into manageable channel segments. After insertion of the sheet piles, water within the channels will be pumped and contaminated sediment excavated. Concurrently disturbed channel segments should be limited to three and the segments should be adjacent to each other.

2.6.2 Management Strategies

The following management strategies will be utilized during the RA.

1. Unstabilized, disturbed areas will be minimized and construction activities will be staged.

2. Seeding or other stabilization measures will follow immediately after grading.

3. Areas that are not to be disturbed will be clearly marked by flags, signs, etc.

4. The construction superintendent will be responsible for ensuring the installation and maintenance of all erosion, sediment, and stormwater control practices.

5. Erosion, sediment, and stormwater control structures will be installed and/or constructed before the start of any earth-disturbance activities.

6. Temporary erosion, sediment, and stormwater control features will remain in place until permanent vegetation is established over disturbed surfaces, as described in the revegetation notes on Design Drawing C-12.

7. Drainage channel segregation devices should be used to divide on-base drainage channels into manageable areas; excavation should not occur in subsequent areas until the preceding area has been segregated.

2.7 PERMANENT STABILIZATION

All areas disturbed by RA activities will be stabilized with permanent seeding as soon as possible following final grading but no later than 14 calendar days after establishment of final grade (as noted on the design drawings). Permanent seeding will be done in accordance with the Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater (USDA, 1994) and as indicated on Design

Drawing C-12. The seed mixture selected is recommended in the Mississippi SWPPP Guidance Manual for Construction Activities for Mississippi's Southern Zone (OPC, 2000). The seed mixture consists of common bermudagrass when planting occurs between March 1 and July 15 or September 1 through November 30. When planting occurs between November 30 and March 1, annual ryegrass will be mixed with the common bermudagrass. Planting between July 15 and September 1 should be avoided. However, if grades are finalized during this period, temporary seeding can be used.

2.8 STORMWATER RUNOFF CONSIDERATIONS

Following completion of the RA, Site 8A will be covered with roller-compacted concrete, and the excavated channels and off-base AOC will be returned to grassed or natural conditions. Because existing conditions on Site 8A consist of stabilized soil with light vegetation and future conditions will have a roller-compacted concrete cap, pre- and post-construction runoff calculations have been prepared for Site 8A. Because remediation activities at Site 8A have been underway since the drums of HO were removed from the site in the late 1970s, pre-construction conditions will be representative of when Site 8A was used as a storage area with Portland cement-stabilized soil. The pre- and post-construction runoff calculations are provided in Appendix B.

Due to the inclusion of over-sized drainage channels within the limits of Site 8A, the post-construction runoff peak discharge [109 cubic feet per second (cfs)] only slightly exceeds the pre-construction runoff peak discharge (108.5 cfs). Although the post-construction runoff from Site 8A exceeds the pre-construction runoff, the widening of the downstream channels during the RA will provide adequate storage for this increased flow. Therefore, other than the proposed drainage channels on site 8A, no permanent stormwater features are required.

2.9 MAINTENANCE

In general, during the RA, all erosion, sediment, and stormwater control measures will be checked daily and after each runoff-producing rainfall event. Any required repairs will be made immediately. The following items will be checked:

- The construction entrance(s)/exit(s) will be maintained in a condition that will minimize tracking sediment onto roads, including the addition of stone or other repairs.

- The silt fencing and super silt fencing will be checked regularly for undermining or deterioration of the fabric. Sediment will be removed when the level of sediment deposition causes "bulging" or reaches one-half of the fabric height.

- SRTs will be checked for sediment accumulation. Sediment will be removed when it reaches one-half the original height of the SRT. Erosion caused by high-velocity flows around the edges of the SRTs will be corrected immediately.

- Immediately following the establishment of a temporary diversion, the diversion will be stabilized using the permanent or temporary seed mixture. After grass has been established, the diversion will be checked periodically to determine whether the grass is withstanding flow velocities without damage. Any damage identified will be repaired immediately and the diversion reseeded.

- The seeded areas will be checked regularly to ensure that a good stand of vegetation is maintained. Areas will be fertilized and reseeded as needed. The contractor is responsible for maintenance until formal acceptance of the RA by the Resident Officer in Charge of Construction (ROICC).

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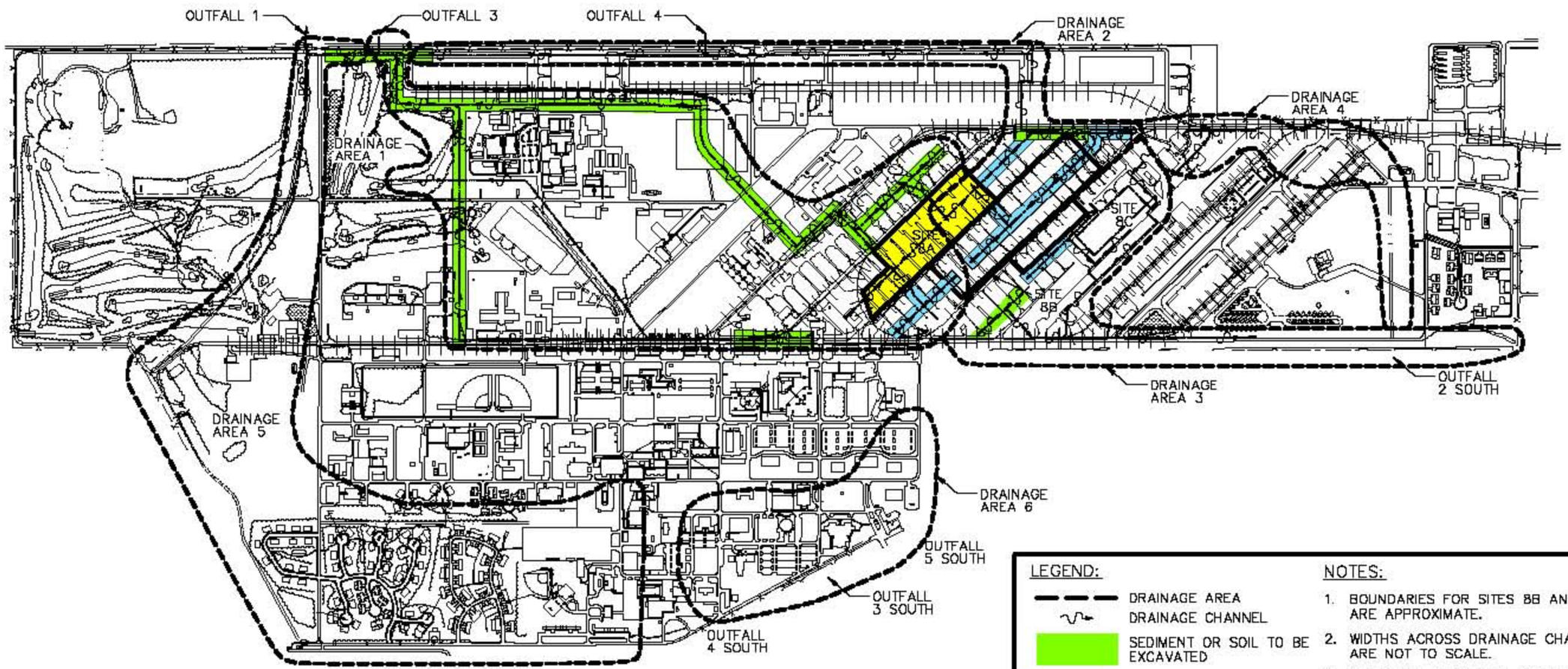

LEGEND:

- DRAINAGE AREA
- DRAINAGE CHANNEL
- SEDIMENT OR SOIL TO BE EXCAVATED
- BOUNDARY OF CAP (SITE 8A)
- SEDIMENT OR SOIL EXCAVATED (CCI, 2003)

NOTES:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.
2. WIDTHS ACROSS DRAINAGE CHANNELS ARE NOT TO SCALE.
3. SEDIMENTS IN SITE 8A DRAINAGE CHANNELS WILL ALSO BE EXCAVATED FOR STABILIZATION PURPOSES.

0 1000 2000
SCALE IN FEET

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 4/24/03
CHECKED BY JJB DATE 5/13/03
COST/SCHED-AREA
SCALE AS NOTED

ON-BASE DRAINAGE CHANNEL EXCAVATION/ RESTORATION AREAS
SITE 8
EROSION, SEDIMENT AND STORMWATER CONTROL PLAN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-1
REV. 0

FORM CADD NO. SDIV_8H.DWG - REV 0 - 1/20/98

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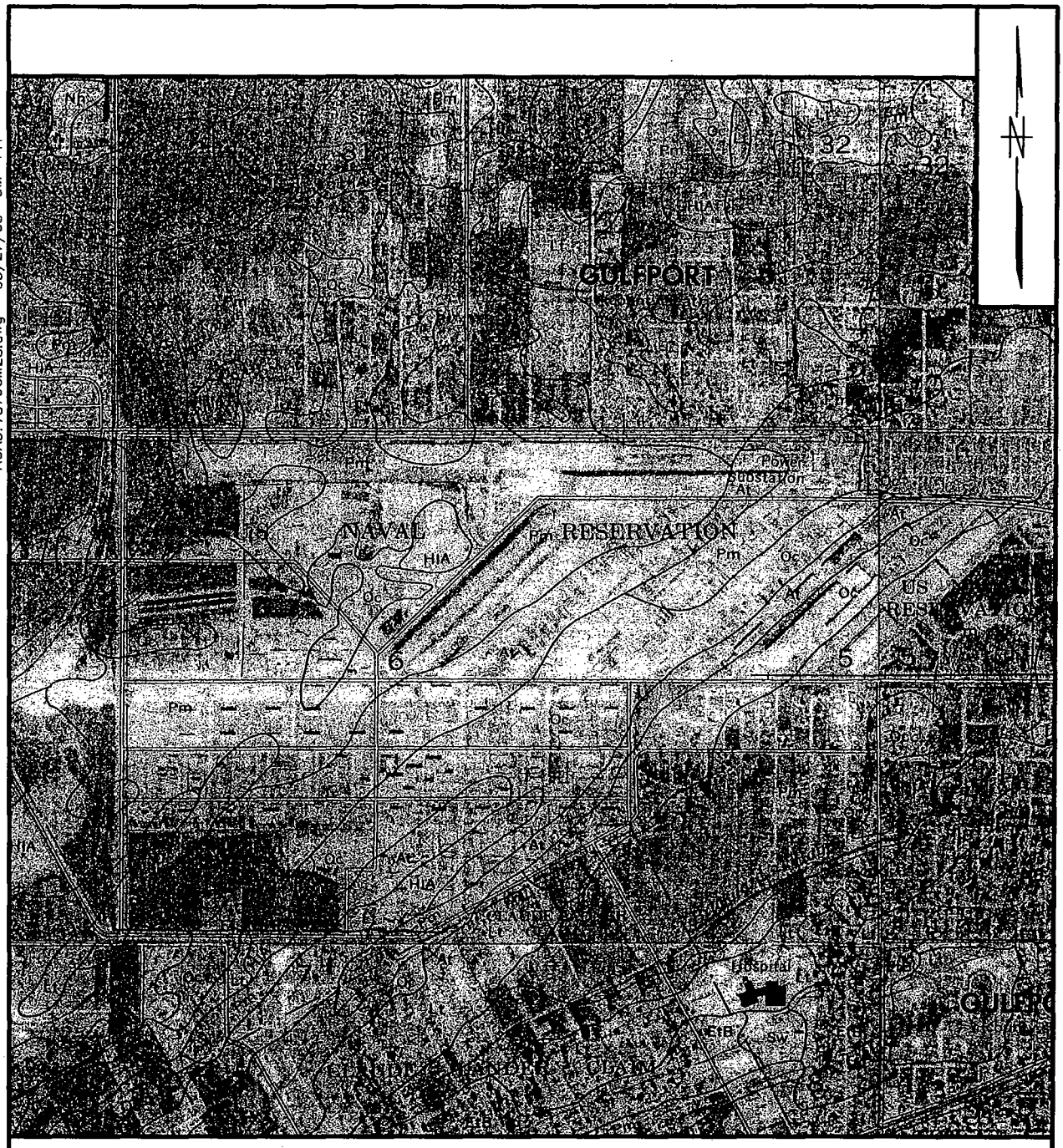

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SCALE IN FEET

SOURCE: SOIL CONSERVATION SERVICE, U.S. DEPARTMENT OF AGRICULTURE, 1975

DRAWN BY DM DATE 5/27/03	DEPARTMENT OF THE NAVY SOUTHERN DIV FACILITIES ENGINEERING COMD	SOILS MAP SITE 8 EROSION, SEDIMENT AND STORMWATER CONTROL NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 7379
CHECKED BY JJB DATE 5/27/03			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

3.0 SEQUENCE OF CONSTRUCTION

The time to perform the required construction activities is estimated to be approximately 12 months. However, the project may be conducted in phases, as determined by the Navy. The following sequence of construction assumes that all of the work will be performed in one construction period. In the event that the project is conducted in phases, area-specific erosion, sediment, and stormwater controls can be constructed at the time RA activities are conducted in a specific area. The generalized sequence of construction activities are as follows. Upon approval of the ROICC, sequence items may be conducted concurrently.

1. Hold pre-construction meeting with the ROICC.

2. Inspect the site prior to construction to verify existing site conditions and underground utility locations.

3. Establish horizontal and vertical control for construction. Stake the location of all areas to be excavated or disturbed prior to actual work.

4. Install perimeter controls for the construction entrance(s)/exit(s). Construct the construction entrance(s)/exit(s). Install remaining perimeter controls as indicated on Design Drawings C-6 through C-10 and additional construction entrance(s)/exit(s) if approved by the ROICC prior to any earth-disturbance activities. All perimeter controls will conform to MDEQ standards, unless otherwise specified. The perimeter controls to be installed include, but are not limited to, the following:

   - Placement of silt fencing around the construction entrance(s)/exits(s), material handling pad, decontamination pad(s), and construction laydown, storage and staging/processing area(s).

   - Placement of SRTs within the off-base AOC.

   - Temporary security fence and/or gates shall be installed along the site perimeter as necessary to restrict access.

   - Additional controls as may be required by the ROICC and/or warranted by site conditions and best construction practices.

5. Install the access road and temporary diversion along the excavation area in the off-base AOC. Install culverts and additional SRTs as indicated on Design Drawing C-8 or where appropriate subject to approval of the ROICC.

6. Clear and grub areas for material handling pad, decontamination pad(s), and construction laydown, storage and staging/processing area(s), unless indicated otherwise.

7. Construct material handling pad, decontamination pad(s), and storage and staging/processing area(s).

8. Restore channels excavated during 2002 on Sites 8B and 8C by placing 6 inches of topsoil and temporary erosion control matting (ECM) and seeding with the permanent seed mixture indicated on Design Drawing C-12.

9. Remove items identified on Design Drawings C-18 and C-19 from Site 8A and abandon the permanent monitoring wells on Site 8A and the temporary monitoring wells within the off-base AOC, as indicated on the design drawings and in the specifications.

10. Clear but do not grub all areas where excavation will occur (i.e., off-base AOC, on-base drainage channels, and Site 8A). Only clear the areas that are scheduled for excavation during the current construction period.

11. Excavate contaminated sediments from the off-base AOC and transport sediment to the material handling pad located on Site 8B. The Navy will collect soil and groundwater verification samples from the off-base AOC in accordance with the Verification Sampling and Analysis Plan (VSAP) (TtNUS, 2003). Verification sampling and analysis will follow visual confirmation that all contaminated material has been excavated. If verification results indicate contaminants are either completely removed or at levels less than the preliminary remediation goal (PRG) for dioxin, excavation of contaminated sediment is complete. If the initial verification results indicate that sediment remains on site with dioxin concentrations greater than the PRG, continue excavation in accordance with the VSAP and the Navy will conduct additional verification sampling and analysis. Continue the excavation process until contaminants are removed and the PRG is achieved.

12. Upon approval by the ROICC, restore the off-base AOC area of disturbance by placing common fill as required, placing 6 inches of topsoil, and revegetating using the wetland plant schedule and wetland seed mixture presented on Design Drawing C-22. Following stabilization and after

approval of stabilization from the ROICC and MDEQ, remove SRTs (installed and existing) within the off-base AOC. Following the restoration of the off-base AOC remove the temporary access road to the timber used for subgrade.

13. Install required haul roads along the on-base drainage channel excavation areas. Sequentially excavate on-base sediment from the drainage channels using channel segregation devices and pumps to restrict the disturbed channel to manageable lengths. Excavate contaminated sediment from indicated drainage channels and associated culverts. Transport the sediment to the material handling pad located on Site 8B. The Navy will collect verification samples in accordance with the VSAP, and as outlined in Sequence Item 11. Upon approval by the ROICC, restore drainage channel segments by placing 6 inches of topsoil and ECM and applying the permanent seed mixture indicated on Design Drawing C-12. Restrict the number of concurrently disturbed drainage channel segments to three.

14. Excavate soil ash from piles within Site 8A and transport soil ash to the material handling pad located at Site 8B. Establish the perimeter channels and stabilize with the placement of 6 inches of topsoil and ECM and by seeding with the permanent seed mixture indicated on Design Drawing C-12. Modify the existing Site 8A culverts as required and install the new culvert. Dewater the existing channels and compact the remaining soil at Site 8A, where required, to achieve a suitable subgrade for the consolidated/stabilized material.

15. Sequentially excavate sediment from the drainage channels within the boundaries of Site 8A using channel segregation devices and pumps to restrict the disturbed channel to manageable lengths. Excavate contaminated sediment from indicated drainage channels and associated culverts. Transport the sediment to the material handling pad located on Site 8B. The Navy will collect verification samples in accordance with the VSAP, and as outlined in Sequence Item 11. Restrict the number of concurrently disturbed drainage channel segments to three.

16. Consolidate contaminated off-base sediment, contaminated on-base sediment, and soil ash to achieve the desired material blend. Transport to Site 8A and spread the material blend, in lifts where required, to achieve the interim grade (12 inches below final grade). Stabilize the material blend. Compact each lift of consolidated/stabilized material in accordance with the design drawings and specifications.

17. Following the placement of the consolidated/stabilized material blend (including sediment removed from perimeter controls), install the 12-inch-thick roller-compacted concrete cap in accordance with the design drawings and specifications.

18. Following the placement of the roller-compacted concrete, remove the material handling pad, decontamination pad(s), and construction laydown, storage and staging/processing area(s). Transport and dispose off site all required materials from these temporary features. The Navy will collect verification samples from the soil below the material handling pad and all decontamination pads in accordance with the VSAP and as outlined in Sequence Item 11.

19. Stabilize all remaining areas of disturbance with the permanent seed mixture indicated on Design Drawing C-12.

20. When upstream areas and all on-base drainage channels have been stabilized and approval of stabilization has been received from the ROICC and MDEQ, remove all remaining temporary perimeter controls and all remaining on-base SRTs on Sites 8A, 8B, and 8C and from all downstream drainage channels.

4.0 CONCLUSIONS

This RA will result in the improvement of the site over the long term. Contaminated sediments will be excavated, consolidated, and stabilized on Site 8A and then capped. Disturbed areas will then be restored. Appropriate steps will be implemented during construction to control runoff from the site and reduce the impacts of erosion and sedimentation.

Runoff quality during the RA will be addressed via temporary and permanent erosion, sediment, and stormwater control devices around the perimeter of the disturbed areas.

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APPENDIX A

CHECKLIST FOR EROSION, SEDIMENT, AND STORMWATER CONTROL PLANS

CHECKLIST
FOR EROSION, SEDIMENT, AND STORMWATER CONTROL PLANS
STATE OF MISSISSIPPI

___X___ Minimum Standards - All applicable Minimum Standards must be addressed.

NARRATIVE

___X___ Project description - Briefly describes the purpose and location of the land-disturbing activity, and the area (acres) to be disturbed.

Refer to Section 2.1 of Erosion, Sediment, and Stormwater Control Plan Report.

___X___ Before and after site description - A description of the topography, principal drainageway for the site, land cover condition, percent of impervious area, and the associated increase of runoff volume from a 25-year 24-hour storm event.

Refer to Section 2.2 and Appendix B of Erosion, Sediment, and Stormwater Control Plan Report and Design Drawings C-1 through C-5 and C-20 through C-24 (provided under separate cover).

___X___ Adjacent property - A description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the land disturbance. This also includes the identification of land use and cover conditions.

Refer to Sections 2.2 and 2.3 of Erosion, Sediment, and Stormwater Control Plan Report.

___X___ Soils descriptions - A brief description of the soils on the site giving such information as soil name, mapping unit, erodibility, permeability, depth, texture and soil structure.

Refer to Section 2.4 of Erosion, Sediment, and Stormwater Control Plan Report.

BEST MANAGEMENT PRACTICES (BMPs)

___X___ Date of construction activities - Provide beginning and completions dates of construction activities.

Beginning and completion dates of construction activities are to be determined. The duration of construction activities is expected to be 12 months.

___X___ Sequence of Construction - The sequence of construction-related BMP and vegetative activities. Include any winter shut-downs.

Refer to Section 3.0 of Erosion, Sediment, and Stormwater Control Plan Report and Design Drawing C-11 for sequence of construction.

___X___ Preconstruction Conference - Recommended and should be scheduled one week prior to land disturbance to orient contractors to the erosion, sediment, and Stormwater

control plan. Notice of the preconstruction conference date should be provided to the Mississippi Office of Pollution Control one week prior to the meeting.

Refer to Section 3.0 of Erosion, Sediment, and Stormwater Control Plan Report and Design Drawing C-11. Date of preconstruction conference is to be determined.

___X___ Erosion and sediment BMPs - Provide listing of erosion and sediment BMPs to minimize pollution during construction along with location and installation schedule for each.

Refer to Section 2.6 of Erosion, Sediment, and Stormwater Control Plan Report for BMPs. Refer to Section 3.0 and Design Drawing C-11 for schedule.

___X___ Stormwater pollution control BMPs - Provide listing of Stormwater pollution control BMPs to minimize pollution after construction has ended along with location and installation schedule for each.

Refer to Sections 2.7 and 2.8 of Erosion, Sediment, and Stormwater Control Plan Report.

OPERATION AND MAINTENANCE (O&M) PLAN

___X___ Temporary measures - A plan for the schedule of maintenance during construction along with any operational criteria.

Refer to Section 2.9 of Erosion, Sediment, and Stormwater Control Plan Report and Design Drawing C-11.

___X___ Permanent measures - A plan for the long term maintenance and operation including entities responsible, financial obligations for continued O&M, designated access for maintenance, and schedule of O&M activities.

Refer to Section 2.7 of Erosion, Sediment, and Stormwater Control Plan Report and Design Drawing C-11.

___X___ Maintenance - During and after construction. May include practice reestablishment, repair, sediment removal, mowing, etc.

Refer to Section 2.7 of Erosion, Sediment, and Stormwater Control Plan Report and Design Drawing C-11.

DRAWINGS AND SPECIFICATIONS

___X___ Detailed drawings - Detailed drawings in manual can be utilized along with standard

engineering drawings of structures and measures so long as site specific elevations, dimensions, etc., are shown on drawings.

Refer to Design Drawings (provided under separate cover).

___X___ Support data and calculations - Should be sufficient to allow reviewers to reproduce design procedure of structures and measures. Sources of information should be cited.

Refer to Appendix B of this Erosion, Sediment, and Stormwater Control Plan Report.

___X___ Benchmark - One permanent benchmark will be clearly labeled on drawings if needed to plan measures. If elevations are tied to USGS benchmark, description and elevation of benchmark will be provided.

Refer to Design Drawings C-3 through C-5 for benchmarks.

UNITED STATES GEOLOGICAL SERVICE (USGS) QUAD MAP

___X___ Land disturbing activity - Provide a map identifying the limits of disturbance.

Refer to Figure 2-2 of Erosion, Sediment, and Stormwater Control Plan Report and Design Drawings C-6 through C-10.

___X___ Site Stormwater discharge - Indicate location(s) of stormwater discharges.

Refer to Figure 2-5 and Appendix B of Erosion, Sediment, and Stormwater Control Plan

MAPS

___X___ Site topographic map - This will provide preconstruction site topography while locating drains, property lines, construction work limits, and any utilities. Scale will be no less than 111=601. Trees to be preserved will be located on this map.

Refer to Design Drawings C-3 through C-5 for site topography.

___X___ Site development map - This map should identify the location of buildings and associated paved areas, raw materials or finish product stock pile areas, equipment storage areas, processing areas, construction entrances, access or haul roads, and finished grades on a duplicate of the site topographic map.

Refer to Design Drawings.

CHECKLIST
FOR EROSION, SEDIMENT, AND STORMWATER CONTROL PLANS
STATE OF MISSISSIPPI

___X___ Site erosion, sediment, and stormwater control map - This map should identify the location of all the BMPs (temporary and permanent) on a duplicate of the site topographic map along with the location of all permanent construction and associated paved areas and finished grades.

Refer to Design Drawings C-6 through C-10 for BMPs.

RESPONSIBLE PERSONNEL

___X___ Contact personnel - List name, address, and telephone number of the contact person responsible for developing and implementing the plan

The personnel responsible for developing and implementing the plan will be the Contractor (to be determined).

CONTINUING EDUCATION

___X___ Erosion, sediment, and stormwater control plan - As work progresses and various subcontractors and/or new employees are brought into the work site, each should be familiarized with the plan. At the beginning of each work week, scheduled items of the plan to be implemented during that week should be brought to the attention of the impacted work force.

Refer to Design Drawing C-11.

___X___ O&M - Training will be provided to personnel responsible for continued operation of the completed project. This should include an annual review of schedule for maintenance activities.

Refer to Design Drawing C-11.

APPENDIX B

EROSION, SEDIMENT, AND STORMWATER CONTROL CALCULATIONS

B.1 PRE-CONSTRUCTION RUNOFF CALCULATION

B.2 POST-CONSTRUCTION RUNOFF CALCULATION

B.1 PRE-CONSTRUCTION RUNOFF CALCULATION

CLIENT:	Naval Construction Battalion Center Gulfport, Mississippi	JOB NUMBER:	7379-130140
SUBJECT:	Pre-Construction Runoff, Site 8A - Herbicide Orange Storage Area		
BASED ON:	TR-55 (Haestad Methods PondPack v. 8.0)	DRAWING NUMBER:	
BY: T.W.S. Date: 08-May-03	CHECKED BY: JKW Date: 5-27-03	APPROVED BY:	DATE:

OBJECTIVE:

To calculate the 25-year pre-construction peak discharge at Site 8A - Herbicide Orange Storage Area.

APPROACH:

1. Delineate the drainage areas for pre-development conditions and measure the surface area with a planimeter.

2. Use the Haestad Method PondPack Ver. 8 computer program to calculate the weighted runoff curve number, time of concentration, and peak 25-year discharge for the Site 8A drainage areas.

REFERENCES

1) Haestad Method PondPack Users Guide, Version 8.
2) USDA, 1994. Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater, First Edition. A cooperative effort by the USDA Natural Resources Conservation Service, the Mississippi Department of Environmental Quality, and the Mississippi Soil and Water Conservation Commission, April.
3) SCS TR 55 Users Guide, Release 5.0
4) USDA, 1975. Soil Survey of Harrison County, Mississippi. Published cooperatively by the USDA Soil Conservation Service, the Forest Service, and the Mississippi Agricultural and Forestry Experiment Station, June.

CALCULATIONS

1. Drainage Areas:

The remediation for Site 8A has been on-going since 1977 when the United States Air Force (USAF) removed drums of Herbicide Orange that had been stored at Site 8A since 1968. Therefore, the pre-construction conditions for the purpose of calculating the pre-construction runoff will be the conditions at Site 8A in 1977 following the removal of the drums. With the elimination of the perimeter drainage channel, Design Drawings C-15 and C-16 provide an idea of how the grades at Site 8A appeared prior to the remedial action implemented by the USAF in 1977.

Based on photographs of the site while it was being used as a drum storage area, the site can be described as a dirt parking area in an urban setting.

CLIENT:	Naval Construction Battalion Center Gulfport, Mississippi	JOB NUMBER:	7379-130140
SUBJECT:	Pre-Construction Runoff, Site 8A - Herbicide Orange Storage Area		
BASED ON:	TR-55 (Haestad Methods PondPack v. 8.0)	DRAWING NUMBER:	
BY: T.W.S. Date: 08-May-03	CHECKED BY: [illegible] Date: 5-27-03	APPROVED BY:	DATE:

Using the figure provided on page 5 of 17 the drainage areas for Site 8A are as follows.

Drawing Scale: 1" = 250 feet

Drainage Area	Description	Planimeter Reading (si)	Area (sf)	Area (acres)
1	Discharge at Culvert 1 (Drainage Area 1)	5.518	344,875	7.92
2	Discharge at Culvert 2 (Drainage Area 2)	2.730	170,625	3.92
3	Discharge at Culvert 3 (Drainage Area 3)	1.008	62,969	1.45

Total Acres 13.29

2. Runoff Curve Numbers:

The United States Department of Agriculture (USDA) soil survey for Harrison county (Reference 4) described the natural surface soils of Site 8A as belonging to hydrologic soil groups (HSG) B-D and C. Using these soil groupings, and a site description that is equivalent to dirt roads in urban areas (see page 17), it is judged that a pre-construction runoff curve number (CN) of 87 is appropriate for Site 8A. However, when considering the amended soil (soil/Portland cement mixture performed in 1961 over 30% of Site 8A), it is appropriate to consider the surface as harder and more likely to shed rainfall rather than absorb the rainfall over 30% of the Site 8A area. Therefore, it is appropriate to use an adjusted CN of 98 (urban areas with impervious surface, see page 17) for the portions of Site 8A that have be amended with Portland cement.

Site Soil Types (USDA):

Soil Types	Description	Corresponding HSG	CN*
At	Atmore Loamy Sand	B-D	87
Oc	Ocilla Loamy Sand	C	87

Site Soil Types (Adjusted):

Soil Types	Description	Corresponding HSG	CN*
At	Soil/Portland Cement Mixture	D	98
Oc	Soil/Portland Cement Mixture	D	98

* CN Table 6-6C: Runoff Curve Numbers for Urban Areas (Reference 2).

As indicated above, approximately 30% of Site 8A has been amended with Portland cement. Therefore the composite CN number will be calculated assuming 70% of the area is USDA soil and the remaining 30% will be the adjusted soil. The PondPack CN input information is provided on calculation pages 8, 11, and 14 of 17.

CLIENT:	Naval Construction Battalion Center Gulfport, Mississippi	JOB NUMBER:	7379-130140
SUBJECT:	Pre-Construction Runoff, Site 8A - Herbicide Orange Storage Area		
BASED ON:	TR-55 (Haestad Methods PondPack v. 8.0)	DRAWING NUMBER:	
BY: T.W.S. Date: 08-May-03	CHECKED BY: [illegible] Date: 5-27-03	APPROVED BY:	DATE:

Composite CN

Drainage Area	Area (acres)	Composite CN
Drainage Area 1	7.92	90
Drainage Area 2	3.92	90
Drainage Area 3	1.45	90

3. Time of Concentration:

Multiple Tc flow paths were evaluated for each of the three drainage areas. The flow paths considered are illustrated on page 5 of 17. The following is a description of the flow path with the greatest Tc for each drainage area. Tc calculations use the 2-year 24-hour storm occurrence. The storm frequency information for Harrison County, Mississippi is provided on page 6 of 17.

Drainage Area 1

The flow path with the greatest Tc within the watershed being analyzed is illustrated on page 5 of 17. Sheet flow shall begin at 32 ft msl and extend 195 ft to 28 ft msl, resulting in a slope equal to 0.0205 ft/ft. The surface description for sheet flow is bare soil. According to Table 3-1 in the SCS TR-55 manual, the roughness coefficient (n) is 0.011. Shallow concentrated flow begins at 28 ft msl and extends 530 ft to 26 ft msl, resulting in a slope equal to 0.0038 ft/ft. The surface for shallow concentrated flow is described as paved (cement amended soil). Channel flow begins at 26 ft msl and extends 250 ft to 25.8 ft msl, resulting in a slope equal to 0.0008 ft/ft. According to Appendix 19.A in the SCS TR-55 manual, the roughness coefficient (n) for natural channel in good condition is 0.025. The flow path ends at the two 18 inch culverts that drain toward the northwest. Channel dimensions for this flow path are provided on page 7 of 17.

The Tc for the flow path described above is equal to 0.17 hrs. The PondPack output data is provided on page 9 of 17.

Drainage Area 2

The flow path with the greatest Tc within the watershed being analyzed is illustrated on page 5 of 17. Sheet flow shall begin at 31 ft msl and extend 300 ft to 27.1 ft msl, resulting in a slope equal to 0.013 ft/ft. The surface description for sheet flow is bare soil. According to Table 3-1 in the SCS TR-55 manual, the roughness coefficient (n) is 0.011. Channel flow begins at 27.1 ft msl and extends 425 ft to 25.9 ft msl, resulting in a slope equal to 0.0028 ft/ft. According to Appendix 19.A in the SCS TR-55 manual, the roughness coefficient (n) for natural channel in good condition is 0.025. The flow path ends at the 24 inch culvert that drains toward the northwest. Channel dimensions for this flow path are provided on page 7 of 17.

The Tc for the flow path described above is equal to 0.08 hrs. The PondPack output data is provided on page 12 of 17.

CLIENT:	Naval Construction Battalion Center Gulfport, Mississippi	JOB NUMBER:	7379-130140
SUBJECT:	Pre-Construction Runoff, Site 8A - Herbicide Orange Storage Area		
BASED ON:	TR-55 (Haestad Methods PondPack v. 8.0)	DRAWING NUMBER:	
BY: T.W.S. Date: 08-May-03	CHECKED BY: JLM Date: 5-27-03	APPROVED BY:	DATE:

Drainage Area 3

The flow path with the greatest Tc within the watershed being analyzed is illustrated on page 5 of 17. Sheet flow shall begin at 32 ft msl and extend 300 ft to 27.1 ft msl, resulting in a slope equal to 0.0163 ft/ft. The surface description for sheet flow is bare soil. According to Table 3-1 in the SCS TR-55 manual, the roughness coefficient (n) is 0.011. Channel flow begins at 27.1 ft msl and extends 235 ft to 26.9 ft msl, resulting in a slope equal to 0.0009 ft/ft. According to Appendix 19.A in the SCS TR-55 manual, the roughness coefficient (n) for natural channel in good condition is 0.025. The flow path ends at the two 15 inch culverts that discharge toward the north. Channel dimensions for this flow path are provided on page 7 of 17.

The Tc for the flow path described above is equal to 0.08 hrs. The PondPack output data is provided on page 15 of 17.

4. Peak Discharges:

The peak discharges from each drainage area, for the 25-year 24-hour storm event, under pre-construction conditions, were calculated using PondPack ver. 8 (Haestad Methods). The inputs include the drainage area size, corresponding weighted runoff curve number and Tc, as well as the 25-year, 24-hour precipitation equal to 10.5-inches (refer to precipitation charts provided on page 6 of 17).

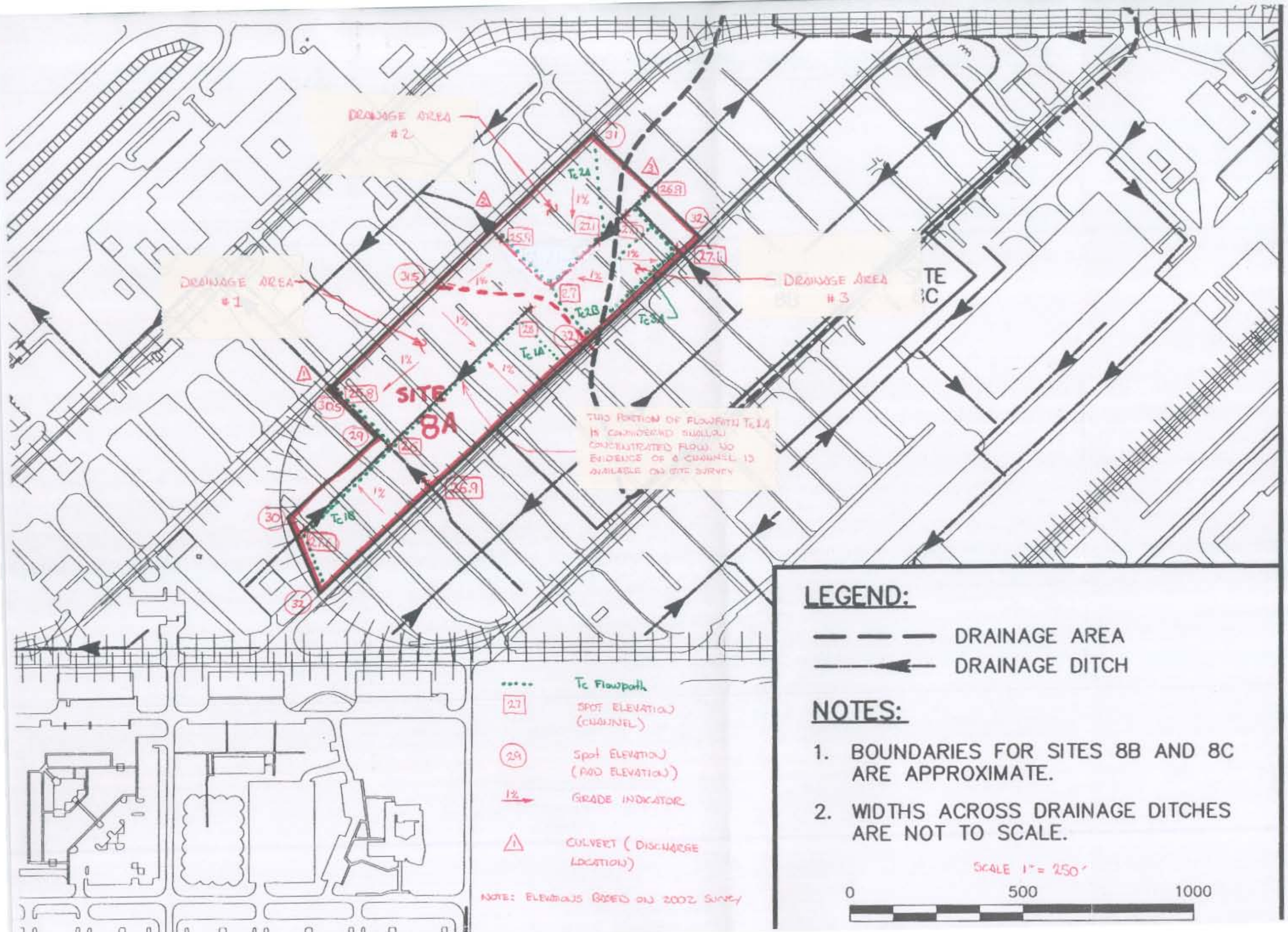
The PondPack peak discharge output for each drainage area is provided on pages 10, 13, and 16 of 17.

CONCLUSIONS

The following is a summary table of the pre-construction runoff associated with drainage areas 1, 2, and 3 for the 25-year, 24-hour storm event calculated for Site 8A.

Drainage Area	Precipitation* (in)	Run-Off (cfs)
Drainage Area 1	10.5	62.41
Drainage Area 2	10.5	33.64
Drainage Area 3	10.5	12.44
	Total Runoff =	**108.49**

* Precipitation of 25-year, 24-hour storm event.



CHK'D JAM
5-27-03

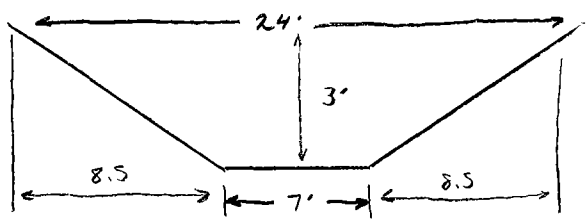
County	Storm Frequency 1 yr.	2 yr.	5 yr.	10 yr.	25 yr.	50 yr.	100 yr.
ADAMS	4.0	4.8	6.3	7.0	8.4	9.1	10.3
ALCORN	3.3	3.9	4.8	5.6	6.5	7.1	7.7
AMITE	4.2	4.8	6.4	7.4	8.6	9.4	10.6
ATTALA	3.7	4.3	5.4	6.3	7.2	8.1	8.8
BENTON	3.4	4.0	4.9	5.7	6.6	7.2	7.8
BOLIVAR	3.6	4.3	5.3	6.2	7.0	7.8	8.6
CALHOUN	3.5	4.1	5.2	5.9	6.9	7.6	8.3
CARROLL	3.6	4.2	5.3	6.2	7.1	6.2	8.6
CHICKASAW	3.5	4.1	5.1	5.9	6.8	7.6	8.3
CHOCTAW	3.6	4.2	5.3	6.2	7.0	7.9	8.6
CLAIBORNE	3.9	4.6	6.0	6.9	7.8	8.8	9.6
CLARKE	3.9	4.7	6.0	6.9	7.9	8.9	9.8
CLAY	3.5	4.1	5.2	6.0	6.9	7.7	8.4
COAHOMA	3.5	4.2	5.2	6.0	6.9	7.7	8.4
COPIAH	3.9	4.6	6.0	6.9	7.9	8.8	9.7
COVINGTON	4.0	4.7	6.2	7.1	8.2	9.2	10.2
DESOTO	4.0	4.1	5.0	5.8	6.7	7.2	8.1
FORREST	4.2	4.9	6.5	7.7	8.8	10.0	11.2
FRANKLIN	4.0	4.8	6.3	7.0	8.3	9.0	10.1
GEORGE	4.4	5.4	7.3	8.5	9.7	11.1	12.3
GREENE	4.2	4.9	6.7	7.8	8.9	10.4	11.5
GRENADA	3.6	4.2	5.2	6.0	6.9	7.7	8.5
HANCOCK	4.7	5.8	7.5	8.7	10.5	11.4	12.5
HARRISON	4.7	5.8	7.5	8.8	10.5	11.4	12.6
HINDS	3.9	4.4	5.8	6.7	7.7	8.6	9.4
HOLMES	3.7	4.3	5.4	6.3	7.2	8.1	8.8
HUMPHREYS	3.7	4.4	5.4	6.4	7.3	8.2	8.8
ISSAQUENA	3.8	4.3	5.6	6.6	7.5	8.4	9.1
ITAWAMBA	3.4	3.9	5.1	5.8	6.6	7.3	8.0
JACKSON	4.7	5.9	7.7	9.0	10.5	11.5	13.0
JASPER	3.9	4.6	6.0	6.8	7.9	8.8	9.7
JEFFERSON	4.0	4.7	6.1	7.0	8.0	8.9	9.9
JEFF DAVIS	4.0	4.6	6.2	7.0	8.2	9.0	10.0
JONES	4.0	4.8	6.2	7.2	8.2	9.3	10.5
KEMPER	3.7	4.4	5.6	6.5	7.4	8.2	9.0
LAFAYETTE	3.5	4.1	5.1	5.8	6.8	7.4	8.2
LAMAR	4.2	4.9	6.5	7.6	8.6	9.8	11.0
LAUDERDALE	3.8	4.6	5.7	6.7	7.6	8.5	9.4
LAWRENCE	4.0	4.6	6.2	7.0	8.2	9.0	10.0
LEAKE	3.8	4.3	5.5	6.5	7.4	8.3	9.0
LEE	3.4	4.0	5.0	5.8	6.7	7.4	8.1
LEFLORE	3.6	4.3	5.3	6.2	7.1	7.9	8.6
LINCOLN	4.0	4.7	6.2	7.0	8.2	9.0	10.0
LOWNDES	3.6	4.2	5.3	6.1	7.0	7.8	8.5

Table 6-3. Rainfall frequency values (estimated precipitation for 24-hour period expressed in inches)

CLIENT		JOB NUMBER	
SUBJECT			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY fRM 5-27-03	APPROVED BY	DATE

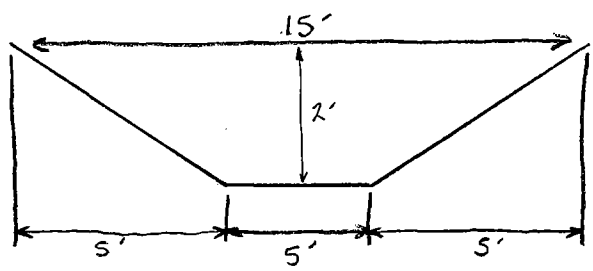
CHANNEL DESCRIPTIONS

DRAINAGE AREA 1 (TYP.)



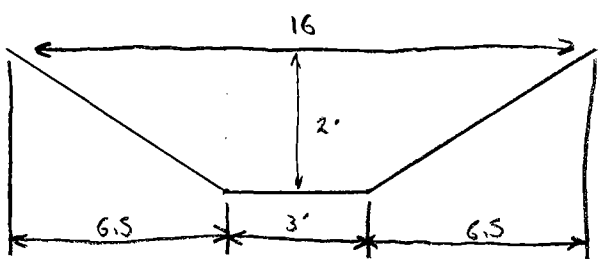
A = 46.50 ft²
WP = 25.03 ft

DRAINAGE AREA 2 (TYP.)



A = 20.00 sf
W.P = 15.77 ft

DRAINAGE AREA 3 (TYP.)



A = 19.00 sf
WP = 16.60 ft

CHANNEL MEASUREMENTS TAKEN FROM DESIGN DRAWINGS C-4 and C-5

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (PRE).PPW

RUNOFF CURVE NUMBER DATA

::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Native Soil (Soil Types At & Oc)	87	5.544			87.00
Portland Cement Amended Soil	98	2.376			98.00
COMPOSITE AREA & WEIGHTED CN --->		7.920			90.30 (90)

::

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (PRE).PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	195.00	ft
2yr, 24hr P	5.8000	in
Slope	.020500	ft/ft
Avg.Velocity	2.14	ft/sec

Segment #1 Time: .0253 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	530.00	ft
Slope	.003800	ft/ft
Paved		
Avg.Velocity	1.25	ft/sec

Segment #2 Time: .1175 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	46.5000	sq.ft
Wetted Perimeter	25.03	ft
Hydraulic Radius	1.86	ft
Slope	.000800	ft/ft
Mannings n	.0250	
Hydraulic Length	250.00	ft
Avg.Velocity	2.55	ft/sec

Segment #3 Time: .0273 hrs

==========
Total Tc: .1701 hrs
==========

Type.... Executive Summary (Nodes) Page 2.01
Name.... Watershed Event: 25 yr
File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (PRE).PPW
Storm... TypeIII 24hr Tag: GP 25

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport, MS

Storm Tag Name = GP 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DRAINAGE AREA 1	AREA	6.121		12.1500	62.41	
Outfall OUT FALL	JCT	6.121		12.1500	62.41	

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 2 (PRE).PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Native Soil (Soil types At & Oc)	87	2.744			87.00
Portland Cement Amended Soil	98	1.176			98.00
COMPOSITE AREA & WEIGHTED CN --->		3.920			90.30 (90)

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 2 (PRE).PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	300.00	ft
2yr, 24hr P	5.8000	in
Slope	.013000	ft/ft
Avg.Velocity	1.94	ft/sec

Segment #1 Time: .0429 hrs

Segment #2: Tc: TR-55 Channel

Flow Area	20.0000	sq.ft
Wetted Perimeter	15.77	ft
Hydraulic Radius	1.27	ft
Slope	.002800	ft/ft
Mannings n	.0250	
Hydraulic Length	425.00	ft
Avg.Velocity	3.70	ft/sec

Segment #2 Time: .0319 hrs

==========
Total Tc: .0749 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .0833 hrs
==========

Type.... Executive Summary (Nodes) Page 2.01
Name.... Watershed Event: 25 yr
File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 2 (PRE).PPW
Storm... TypeIII 24hr Tag: GP 25

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport, MS

Storm Tag Name = GP 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DRAINAGE AREA 2	AREA	3.030		12.1000	33.64	
Outfall OUT FALL	JCT	3.030		12.1000	33.64	

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 3 (PRE).PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Native Soil (Soil types At & Oc)	87	1.015			87.00
Portland Cement Amended Soil	98	.435			98.00
COMPOSITE AREA & WEIGHTED CN --->		1.450			90.30 (90)

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 3 (PRE).PPW

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	300.00	ft
2yr, 24hr P	5.8000	in
Slope	.016300	ft/ft
Avg.Velocity	2.13	ft/sec

Segment #1 Time: .0392 hrs

Segment #2: Tc: TR-55 Channel

Flow Area	19.0000	sq.ft
Wetted Perimeter	16.60	ft
Hydraulic Radius	1.14	ft
Slope	.000900	ft/ft
Mannings n	.0250	
Hydraulic Length	235.00	ft
Avg.Velocity	1.96	ft/sec

Segment #2 Time: .0334 hrs

Total Tc: .0726 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .0833 hrs

Type.... Executive Summary (Nodes) Page 2.01
Name.... Watershed Event: 25 yr
File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 3 (PRE).PPW
Storm... TypeIII 24hr Tag: GP 25

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport, MS

Storm Tag Name = GP 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DRAINAGE AREA 3	AREA	1.121		12.1000	12.44	
Outfall OUT FALL	JCT	1.121		12.1000	12.44	

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

B.2 POST- CONSTRUCTION RUNOFF CALCULATION

CLIENT:	NCBC Gulfport, Site 8A	JOB NUMBER:	7379
SUBJECT:	Post-Construction Hydrology, Site 8A - Herbicide Orange Storage Area		
BASED ON:	TR-55	DRAWING NUMBER:	
BY: T.W.S. Date: 06-Jul-04	CHECKED BY: Date: JJB 7/7/04	APPROVED BY:	DATE:

OBJECTIVE

To compare the pre-construction and post-construction peak discharge at Site 8A - Herbicide Orange Storage Area (Site 8A), and determine if permanent stormwater structures are required as a result of the changes proposed for Site 8A.

APPROACH

1. Delineate the drainage areas for post-development conditions and measure the surface area with a planimeter.

2. Use the Haestad Method PondPack Version 9 computer program to calculate the weighted runoff curve number, time of concentration, and peak 25-year discharge for the drainage area.

REFERENCES

1) Haestad Method PondPack Users Guide, Version 9.
2) USDA, 1994. Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater, First Edition. A cooperative effort by the USDA Natural Resources Conservation Service, the Mississippi Department of Environmental Quality, and the Mississippi Soil and Water Conservation Commission, April.
3) SCS TR 55 Users Guide, Release 5.0
4) USDA, 1975. Soil Survey of Harrison County, Mississippi. Published cooperatively by the USDA Soil Conservation Service, the Forest Service, and the Mississippi Agricultural and Forestry Experiment Station, June.

CALCULATIONS

1. Drainage Area:

The post-development drainage areas (DAs) are delineated on pages 5 and 6 of 15. The drainage area calculations and flowpath slope calculations are provided below. With regard to the land covers in each drainage area, this information is presented in the runoff curve number calculations according to hydrologic soil group (HSG). The soil types and runoff numbers have been adjusted to account for the proposed Site 8A post-construction conditions.

2. Runoff Curve Numbers:

The United States Department of Agriculture (USDA) soil survey for Harrison county (Reference 4) described the natural surface soils of Site 8A as belonging to hydrologic soil groups (HSG) B-D and C. The natural soil types are listed below. The proposed plan for Site 8A includes the installation of roller compacted concrete pavement over Site 8A and construction of grass lined channels around the perimeter of Site 8A. Therefore the adjusted soil types that reflect post-construction conditions include pavement and HSG C soils. These conditions are presented in the table below.

CLIENT:	NCBC Gulfport, Site 8A	JOB NUMBER:	7379
SUBJECT:	Post-Construction Hydrology, Site 8A - Herbicide Orange Storage Area		
BASED ON:	TR-55	DRAWING NUMBER:	
BY: T.W.S. Date: 06-Jul-04	CHECKED BY: Date:	APPROVED BY:	DATE:

Site Soil Types: (Natural)

Soil Types	Description	Corresponding HSG
At	Atmore Loamy Sand	B-D
Oc	Ocilla Loamy Sand	C

Site Soil Types: (Post-Construction)

Soil Types	Description	Corresponding HSG
--	Roller Compacted Concrete	A-D
--	Topsoil	C

Using the surface descriptions provided in Reference 3, the CN numbers for the two surface types under post-construction conditions are as follows:

Impervious Areas and HSG = A-D CN = 98
Open space, grass covered, good condition, and HSG = C CN = 74

Discharge Areas:

Drawing Scale: 1" = 50 feet*

Drainage Area 1

Soil Type	HSG	Surface Description	Planimeter Reading (si)	Area (sf)	Area (acres)	CN *
Pavement	A-D	Paved	95.682	239,204	5.49	98
Topsoil	C	Grass Covered	19.623	49,058	1.13	74
				Total Acres	**6.62**	

Drainage Area 2

Soil Type	HSG	Surface Description	Planimeter Reading (si)	Area (sf)	Area (acres)	CN *
Pavement	A-D	Paved	98.053	245,133	5.63	98
Topsoil	C	Grass Covered	18.848	47,120	1.08	74
				Total Acres	**6.71**	

* Measurements taken from Design Drawings C-23 and C-24. Half-size versions of these drawings are provided in this calculation on pages 5 and 6 of 15.

The composite CNs for Site 8A (under post-construction conditions) are equal to 94 for both Drainage Areas. The PondPack printouts are provided on pages 8 and 12 of 15.

3. Time of Concentration:

Two Tc flowpaths were evaluated for each Drainage Area. The following is a description of the flowpaths with the greatest Tc in each area. Tc calculations use the 2-year 24-hour storm occurrence. A graphic of the 2-year 24-hour storm events for Harrison County Mississippi is provided on page 7 of 15.

CLIENT:	NCBC Gulfport, Site 8A		JOB NUMBER:	7379
SUBJECT:	Post-Construction Hydrology, Site 8A - Herbicide Orange Storage Area			
BASED ON:	TR-55		DRAWING NUMBER:	
BY: T.W.S. Date: 06-Jul-04		CHECKED BY: Date:	APPROVED BY:	DATE:

Drainage Area 1 (Tc DA1)

The flowpath with the greatest Tc within the watershed being analyzed is illustrated on page 5 of 15. Sheet flow shall begin at 36.65 ft msl and extends 165 ft to 35 ft msl, resulting in a slope equal to 0.01 ft/ft. The surface description for sheet flow is paved. According to Table 3-1 in the SCS TR-55 manual, the roughness coefficient (n) is 0.011. Sheet flow continues from elevation 35 ft msl and extends 30 ft to 32 ft msl, resulting in a slope equal 0.1 ft/ft. The surface description is paved and according to Table 3-1 in the SCS TR-55 Manual has a roughness coefficient is 0.011.

Channel flow begins at 32 ft msl and extends 515 ft to elevation 26.9 ft msl, resulting in a slope equal to 0.0099 ft/ft. The channels is grass lined, has a 4 foot base and 3H:1V sideslopes, and an average depth of 2.75 feet. Using Appendix 19.A in the SCS TR-55 manual the roughness coefficient is 0.025. Channel flow continues in a 24 inch diameter RCP culvert at elevation 26.9 ft msl extending 190 ft to elevation 26.5 ft msl, resulting in a slope equal to 0.0021 ft/ft. The culvert has a roughness coefficient of 0.017. Channel flow continues from elevation 26.5 and extends 195 ft to elevation 25.8 ft msl, resulting in a slope equal to 0.0036 ft/ft. The channel is grass lined, has a 4 foot base and 3H:1V sideslopes, and an average depth of 3 feet. The roughness coefficient is 0.025. The flow path ends at two existing 18 inch diameter culverts.

The Tc for the flowpath described above is equal to 0.0770 hrs. The PondPack output data is provided on page 10 of 15.

Drainage Area 2 (Tc DA2)

The flowpath with the greatest Tc within the watershed being analyzed is illustrated on pages 5 and 6 of 15. Sheet flow shall begin at 36.65 ft msl and extends 165 ft to 35 ft msl, resulting in a slope equal to 0.01 ft/ft. The surface description for sheet flow is paved. According to Table 3-1 in the SCS TR-55 manual, the roughness coefficient (n) is 0.011. Sheet flow continues from elevation 35 ft msl and extends 30 ft to 32 ft msl, resulting in a slope equal 0.1 ft/ft. The surface description is paved and according to Table 3-1 in the SCS TR-55 Manual has a roughness coefficient is 0.011.

Channel flow begins at 32 ft msl and extends 550 ft to elevation 26 ft msl, resulting in a slope equal to 0.0109 ft/ft. The channels is grass lined, has a 4 foot base and 3H:1V sideslopes, and an average depth of 3 feet. Using Appendix 19.A in the SCS TR-55 manual the roughness coefficient is 0.025. Channel flow continues from elevation 26 ft msl and extends 825 ft to elevation 25.9 ft msl, resulting in a slope equal to 0.0001 ft/ft. The channel is grass lined, has a 4 foot base and 3H:1V sideslopes, and an average depth of 6 feet. The roughness coefficient is 0.025. The flow path ends at one existing 24 inch diameter culvert.

The Tc for the flowpath described above is equal to 0.23 hrs. The PondPack output data is provided on page 14 of 15.

CLIENT:	NCBC Gulfport, Site 8A	JOB NUMBER:	7379
SUBJECT:	Post-Construction Hydrology, Site 8A - Herbicide Orange Storage Area		
BASED ON:	TR-55	DRAWING NUMBER:	
BY: T.W.S. Date: 06-Jul-04	CHECKED BY: Date:	APPROVED BY:	DATE:

4. Peak Discharges:

The peak discharges for the 25-year 24-hour storm events under post-construction conditions were calculated by PondPack. The inputs include the drainage area size, corresponding weighted runoff curve number and Tc, as well as the 25-year precipitation equal to 10.5-inches (refer to precipitation rates provided on page 7 of 15).

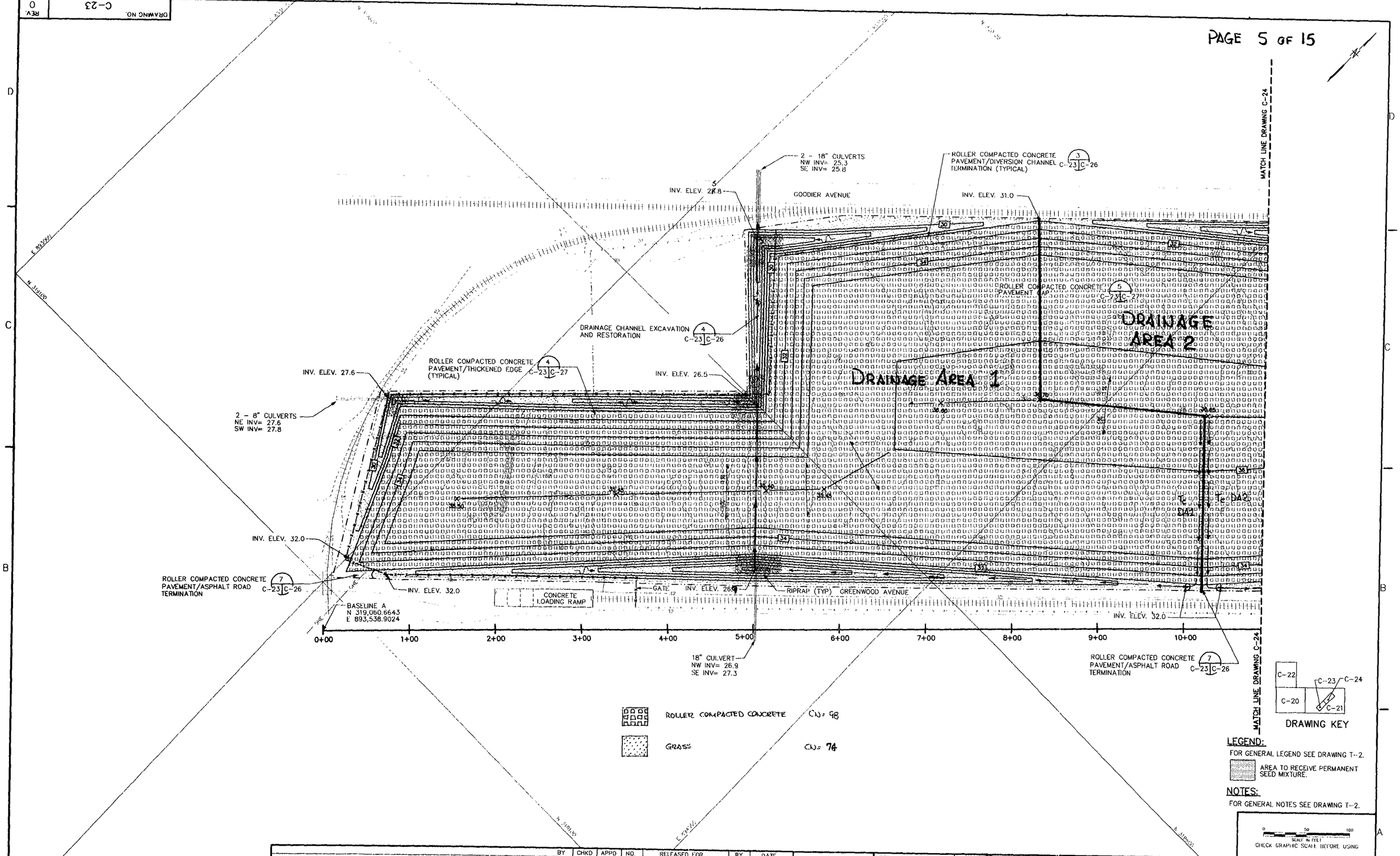
The PondPack peak discharge for Drainage Area 1 equals 57.91 cfs, and the peak discharge for Drainage Area 2 equals 51.12 cfs. Output is provided on pages 11 and 15 of 15.

CONCLUSIONS

The following is a summary table of the pre- and post-construction run-off associated with the 25-year, 24-hour storm reoccurrence calculated for the watershed at Site 8A.

Storm Event	Precipitation (in)	Pre-Const. Runoff (cfs)	Post-Const. Runoff (cfs)
25-Year	10.5	108.49	109.03

Due to the widening of channels within the foot print of Site 8A, the post-construction runoff volume only slightly exceeds the pre-construction runoff volume. Due to the widening of on base channels downgradient of Site 8A it is not anticipated that the post construction runoff from NCBC Gulfport will exceed pre-construction runoff. Therefore, no permanent stormwater structures (other than the Site 8A channels) are required.



LEGEND:

FOR GENERAL LEGEND SEE DRAWING T-2.

AREA TO RECEIVE PERMANENT SEED MIXTURE.

NOTES:

FOR GENERAL NOTES SEE DRAWING T-2.

SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

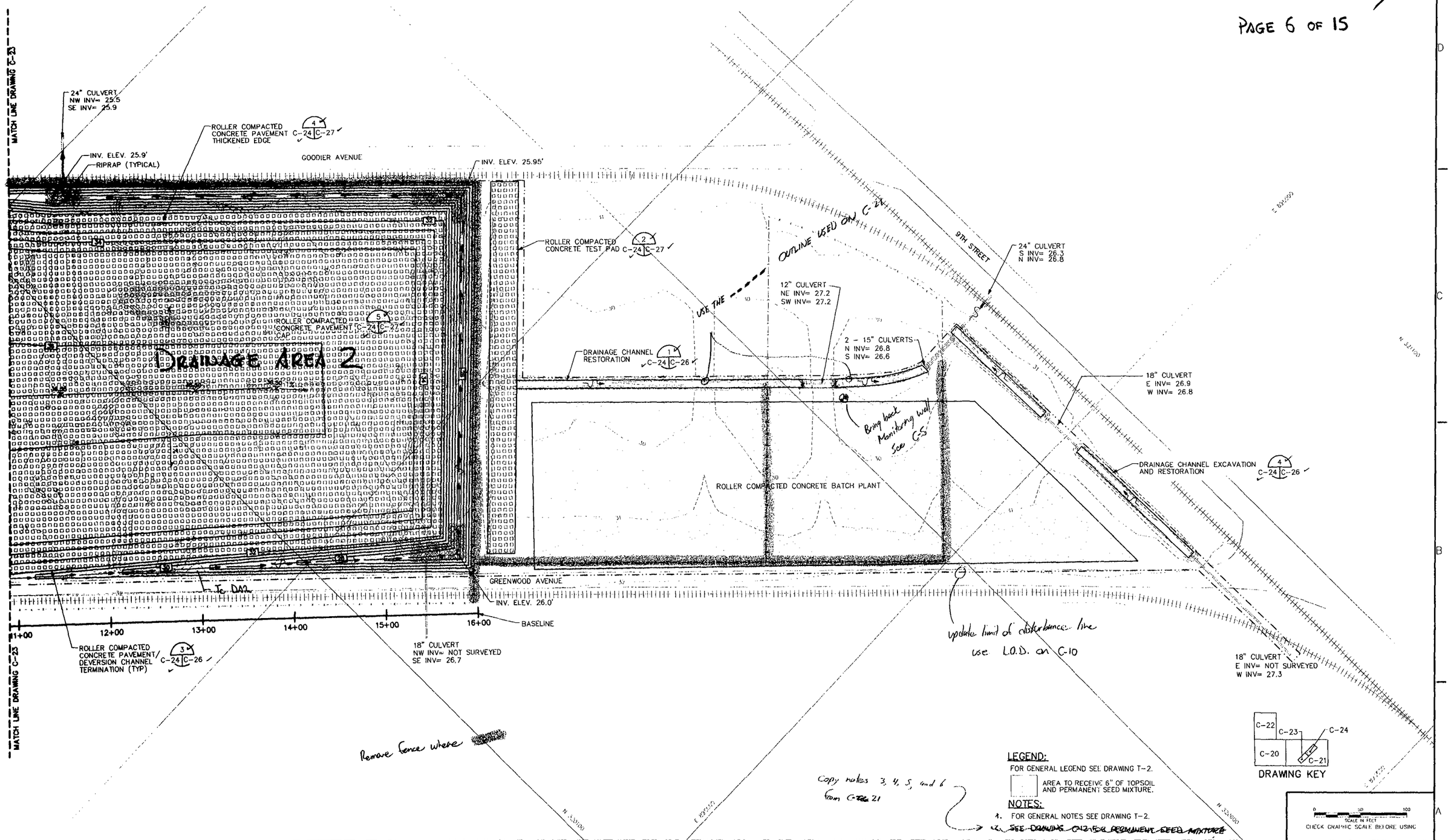
SEAL AREA

DRAWN BY MF	DATE 3/6/03
CHECKED BY TWS	DATE 5/12/03
REVISED BY	DATE
SCALE AS NOTED	

FINAL GRADING PLAN
(SHEET 4 OF 5)
60% REMEDIAL DESIGN
SITE 8 - HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO.	
APPROVED BY	DATE
DRAWING NO. C-23	REV. 0

ACAD: 7379DP12.DWG 05/18/03 MF PT



BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY MF	DATE 3/06/03
CHECKED BY TWS	DATE 5/12/03
REVISED BY	DATE
SCALE AS NOTED	

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND — SOUTHERN DIVISION

FINAL GRADING PLAN
(SHEET 5 OF 5)
60% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO.	
APPROVED BY	DATE
DRAWING NO. C-24	REV. 0

DRAWING NO. C-24 REV. 0

ACAD: 7379CP13.DWG 05/27/03 MF PIT

County	Storm Frequency 1 yr.	2 yr.	5 yr.	10 yr.	25 yr.	50 yr.	100 yr.
ADAMS	4.0	4.8	6.3	7.0	8.4	9.1	10.3
ALCORN	3.3	3.9	4.8	5.6	6.5	7.1	7.7
AMITE	4.2	4.8	6.4	7.4	8.6	9.4	10.6
ATTALA	3.7	4.3	5.4	6.3	7.2	8.1	8.8
BENTON	3.4	4.0	4.9	5.7	6.6	7.2	7.8
BOLIVAR	3.6	4.3	5.3	6.2	7.0	7.8	8.6
CALHOUN	3.5	4.1	5.2	5.9	6.9	7.6	8.3
CARROLL	3.6	4.2	5.3	6.2	7.1	6.2	8.6
CHICKASAW	3.5	4.1	5.1	5.9	6.8	7.6	8.3
CHOCTAW	3.6	4.2	5.3	6.2	7.0	7.9	8.6
CLAIBORNE	3.9	4.6	6.0	6.9	7.8	8.8	9.6
CLARKE	3.9	4.7	6.0	6.9	7.9	8.9	9.8
CLAY	3.5	4.1	5.2	6.0	6.9	7.7	8.4
COAHOMA	3.5	4.2	5.2	6.0	6.9	7.7	8.4
COPIAH	3.9	4.6	6.0	6.9	7.9	8.8	9.7
COVINGTON	4.0	4.7	6.2	7.1	8.2	9.2	10.2
DESOTO	4.0	4.1	5.0	5.8	6.7	7.2	8.1
FORREST	4.2	4.9	6.5	7.7	8.8	10.0	11.2
FRANKLIN	4.0	4.8	6.3	7.0	8.3	9.0	10.1
GEORGE	4.4	5.4	7.3	8.5	9.7	11.1	12.3
GREENE	4.2	4.9	6.7	7.8	8.9	10.4	11.5
GRENADA	3.6	4.2	5.2	6.0	6.9	7.7	8.5
HANCOCK	4.7	5.8	7.5	8.7	10.5	11.4	12.5
HARRISON	4.7	5.8	7.5	8.8	10.5	11.4	12.6
HINDS	3.9	4.4	5.8	6.7	7.7	8.6	9.4
HOLMES	3.7	4.3	5.4	6.3	7.2	8.1	8.8
HUMPHREYS	3.7	4.4	5.4	6.4	7.3	8.2	8.8
ISSAQUENA	3.8	4.3	5.6	6.6	7.5	8.4	9.1
ITAWAMBA	3.4	3.9	5.1	5.8	6.6	7.3	8.0
JACKSON	4.7	5.9	7.7	9.0	10.5	11.5	13.0
JASPER	3.9	4.6	6.0	6.8	7.9	8.8	9.7
JEFFERSON	4.0	4.7	6.1	7.0	8.0	8.9	9.9
JEFF DAVIS	4.0	4.6	6.2	7.0	8.2	9.0	10.0
JONES	4.0	4.8	6.2	7.2	8.2	9.3	10.5
KEMPER	3.7	4.4	5.6	6.5	7.4	8.2	9.0
LAFAYETTE	3.5	4.1	5.1	5.8	6.8	7.4	8.2
LAMAR	4.2	4.9	6.5	7.6	8.6	9.8	11.0
LAUDERDALE	3.8	4.6	5.7	6.7	7.6	8.5	9.4
LAWRENCE	4.0	4.6	6.2	7.0	8.2	9.0	10.0
LEAKE	3.8	4.3	5.5	6.5	7.4	8.3	9.0
LEE	3.4	4.0	5.0	5.8	6.7	7.4	8.1
LEFLORE	3.6	4.3	5.3	6.2	7.1	7.9	8.6
LINCOLN	4.0	4.7	6.2	7.0	8.2	9.0	10.0
LOWNDES	3.6	4.2	5.3	6.1	7.0	7.8	8.5

Table 6-3. Rainfall frequency values (estimated precipitation for 24-hour period expressed in inches)

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (POST).PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Grassed Area	74	1.130			74.00
Roller Compacted Concrete	98	5.490			98.00
COMPOSITE AREA & WEIGHTED CN --->		6.620			93.90 (94)

::

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (POST).PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	165.00	ft
2yr, 24hr P	5.8000	in
Slope	.010000	ft/ft
Avg.Velocity	1.55	ft/sec

Segment #1 Time: .0295 hrs

Segment #2: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	30.00	ft
2yr, 24hr P	5.8000	in
Slope	.100000	ft/ft
Avg.Velocity	2.77	ft/sec

Segment #2 Time: .0030 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	33.6875	sq.ft
Wetted Perimeter	21.39	ft
Hydraulic Radius	1.57	ft
Slope	.009900	ft/ft
Mannings n	.0250	
Hydraulic Length	515.00	ft
Avg.Velocity	8.03	ft/sec

Segment #3 Time: .0178 hrs

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (POST).PPW

Segment #4: Tc: TR-55 Channel

Flow Area	3.1420	sq.ft
Wetted Perimeter	6.28	ft
Hydraulic Radius	.50	ft
Slope	.002100	ft/ft
Mannings n	.0130	
Hydraulic Length	190.00	ft

Avg.Velocity 3.31 ft/sec

Segment #4 Time: .0159 hrs

Segment #5: Tc: TR-55 Channel

Flow Area	39.0000	sq.ft
Wetted Perimeter	22.97	ft
Hydraulic Radius	1.70	ft
Slope	.003600	ft/ft
Mannings n	.0250	
Hydraulic Length	195.00	ft

Avg.Velocity 5.09 ft/sec

Segment #5 Time: .0106 hrs

==========
Total Tc: .0770 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .0833 hrs
==========

Type.... Executive Summary (Nodes) Page 2.09
Name.... Watershed Event: 25 yr
File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 1 (POST).PPW
Storm... TypeIII 24hr Tag: 25

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport Mississ

Storm Tag Name = 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DRAINAGE AREA 1	AREA	5.390		12.1000	57.91	
Outfall OUT FALL	JCT	5.390		12.1000	57.91	

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 2 (POST).PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Grassed Area	74	1.080			74.00
Roller Compacted Concrete	98	5.630			98.00
COMPOSITE AREA & WEIGHTED CN --->		6.710			94.14 (94)

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 2 (POST).PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	165.00	ft
2yr, 24hr P	5.8000	in
Slope	.010000	ft/ft

Avg.Velocity 1.55 ft/sec

Segment #1 Time: .0295 hrs

Segment #2: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	30.00	ft
2yr, 24hr P	5.8000	in
Slope	.100000	ft/ft

Avg.Velocity 2.77 ft/sec

Segment #2 Time: .0030 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	39.0000	sq.ft
Wetted Perimeter	22.97	ft
Hydraulic Radius	1.70	ft
Slope	.010900	ft/ft
Mannings n	.0250	
Hydraulic Length	550.00	ft

Avg.Velocity 8.86 ft/sec

Segment #3 Time: .0173 hrs

File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 2 (POST).PPW

Segment #4: Tc: TR-55 Channel

Flow Area	132.0000	sq.ft
Wetted Perimeter	41.95	ft
Hydraulic Radius	3.15	ft
Slope	.000100	ft/ft
Mannings n	.0250	
Hydraulic Length	825.00	ft

Avg.Velocity 1.28 ft/sec

Segment #4 Time: .1791 hrs

==========
Total Tc: .2289 hrs
==========

Type.... Executive Summary (Nodes) Page 2.01
Name.... Watershed Event: 25 yr
File.... C:\Program Files\Haestad\PPKW\Sample\GULFPORT SITE 8A AREA 2 (POST).PPW
Storm... TypeIII 24hr Tag: GP 25

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = Gulfport, MS

Storm Tag Name = GP 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 10.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DRAINAGE AREA 2	AREA	5.464		12.1500	51.12	
Outfall OUT FALL	JCT	5.464		12.1500	51.12	

REVISION 0
OCTOBER 2004

Stormwater Pollution Prevention Plan

for

Site 8 – Herbicide Orange Storage Area

and

Off-Base Area of Contamination

Naval Construction Battalion Center

Gulfport, Mississippi

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0272

October 2004

REVISION 0
OCTOBER 2004

STORMWATER POLLUTION PREVENTION PLAN
for
SITE 8 – HERBICIDE ORANGE STORAGE AREA
and
OFF-BASE AREA OF CONTAMINATION

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0272

OCTOBER 2004

PREPARED UNDER THE SUPERVISION OF:

ROBERT FISHER
TASK ORDER MANAGER
TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA

APPROVED FOR SUBMITTAL BY:

DEBRA M. HUMBERT
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

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APPENDIX

A CHECKLISTS

FIGURES

NUMBER

1-1 Vicinity Map
1-2 Installation Map
2-1 On-base Drainage Channel Excavation/Restoration Areas

ACRONYM LIST

AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
cfs	cubic feet per second
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	Contract Task Order
ECM	Erosion control matting
FFS	Focused Feasibility Study
HO	Herbicide Orange
LLDPE	linear low density polyethylene
MDEQ	Mississippi Department of Environmental Quality
MSWCC	Mississippi Soil and Water Conservation Commission
µg/kg	Microgram per kilogram
NCBC	Naval Construction Battalion Center
NPDES	National Pollutant Discharge Elimination System
OPC	Office of Pollution Control
PRG	Preliminary remediation goal
RA	Remedial Action
ROICC	Resident Officer in Charge of Construction
Site 8	Site 8 – Herbicide Orange Storage Area
SRTs	Sediment recovery trap
SWPPP	Stormwater Pollution Prevention Plan
TBC	To be considered
TtNUS	Tetra Tech NUS, Inc.
USAF	United States Air Force
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
VSAP	Verification Sampling and Analysis Plan

1.0 INTRODUCTION

This Stormwater Pollution Prevention Plan (SWPPP) was prepared under Contract Task Order (CTO) No. 0272 under Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62467-94-D-0888. Under this CTO, Tetra Tech NUS, Inc. (TtNUS) is performing engineering and design services for the remedial action (RA) at Site 8 - Herbicide Orange Storage Area (Site 8) and contiguous on-base drainage channels at the Naval Construction Battalion Center (NCBC or "base"), and associated off-base Area of Contamination (AOC) in Gulfport, Mississippi.

NCBC Gulfport is located in the southeastern corner of Mississippi, approximately 2 miles north of the Gulf of Mexico. The base is located in the western part of the City of Gulfport in Harrison County. Figure 1-1 shows the location of the base in relation to the City of Gulfport and the Gulf of Mexico. The off-base AOC is located north of NCBC, across 28th Street near Outfall 3. The base occupies 1,100 acres with an average elevation of approximately 30 feet above sea level. A map of NCBC Gulfport is provided as Figure 1-2.

1.1 SITE HISTORY

Prior to 1968, Site 8 was used as an equipment storage and staging area. Around 1961, the surface soils were stabilized with Portland cement to provide a hardened surface for heavy equipment operation and storage. Between 1968 and 1977, Site 8 was used by the United States Air Force (USAF) as a storage area for drums containing Herbicide Orange (HO). In 1977, the HO drums were removed from Site 8, transported to port by railroad, and placed on a ship for destruction by incineration in the South Pacific. The release of dioxins at Site 8 from the HO was confirmed in 1977, and the site was fenced and left inactive until 1985 (TtNUS, 2003). It was originally believed that 13 acres of Site 8 stored approximately 850,000 gallons of HO. This 13-acre area is currently referred to as Site 8A (HLA, 2000).

In 1985, the USAF began operations to clean up the dioxin-contaminated soils that remained on site following the removal of the drums of HO. The dioxin contamination of soils resulted from several spills and leaks during the 10 years that HO was stored on Site 8. Through a Research, Development and Demonstration permit obtained through the United States Environmental Protection Agency (USEPA) Region 4, the USAF conducted test burns to demonstrate that incineration was capable of reducing the dioxin concentrations to 1.0 microgram per kilogram (µg/kg), the USEPA criterion at that time. During the test burns, two additional areas outside the original 13 acres were identified and verified as previous storage locations for drums containing HO. These two areas were designated as Sites 8B and 8C. Following USEPA acceptance of the test burn data, full-scale incineration of dioxin-contaminated soils from Sites 8A, 8B, and 8C was conducted. The incineration process was conducted within the

boundaries of Site 8A and was completed in 1988. The ash that remained from the incineration process was stored and currently remains on Site 8A. Although the soils within Sites 8A, 8B, and 8C were incinerated, the drainage channels that carry surface water and sediment from these sites to the lower reaches of the local drainage basin were not addressed during this remedial effort (HLA, 2000).

From 1988 when the USAF remedial effort was completed through 2000, access to Site 8A was restricted and no base operations were conducted within site boundaries. In January 2001, a new rail-loading ramp was constructed on the south side of Site 8A in anticipation of using the site as a storage and staging area (TtNUS, 2003). For additional details on the site history, refer to Section 1.3 of the Remediation Planning Document (HLA, 2000).

1.2 PROJECT DESCRIPTION

As part of the RA for Site 8, the Navy will:

- Excavate dioxin-contaminated sediment from on-base drainage channels contiguous to Site 8 and from an associated off-base AOC located north of the base and excavate soil ash located at Site 8.
- Consolidate, blend, and stabilize soil ash and contaminated sediment within a portion of Site 8.
- Construct a 12-inch roller-compacted concrete cap over the stabilized material.
- Perform verification sampling of excavated areas.
- Restore the on-base drainage channels and off-base AOC affected by excavation activities.
- Implement land-use controls.
- Perform long-term monitoring.

The RA is expected to impact the 13-acre area of Site 8A, 18 acres of on-base drainage channels, and 19 acres of off-base wetland.

This report summarizes the design basis for the remedial alternative selected in the Focused Feasibility Study (FFS) for Site 8 (TtNUS, 2003). This alternative was selected to protect public health, welfare, and the environment from exposure to dioxins that are degradation products of the HO formerly stored at Site 8. The Navy's goal is to begin the RA at Site 8 and affected on-base drainage channels and off-base AOC as quickly as possible to protect human health and the environment and to comply with Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) criteria.

1.3 REPORT OBJECTIVE AND CONTENT

The objective of this report is to describe the project and to present the stormwater pollution prevention controls that will be used during implementation of the RA at Site 8 and its contiguous on-base drainage channels and off-base AOC.

Section 2.0 presents a description of control measures to be implemented during the RA and the sequence of proposed construction activities. Section 3.0 presents a generalized summary of State and local requirements for stormwater management. Section 4.0 presents the inspection and maintenance program proposed for the RA. Section 5.0 presents a summary of non-stormwater discharges and pollution prevention measures to be employed during the RA. Sections 6.0 and 7.0 present the required plan certifications. Copies of the United States Environmental Protection Agency (USEPA) checklists for Stormwater Pollution Prevention Plans are presented in Appendix A. Calculations are presented in Appendix B of the Erosion, Sediment, and Stormwater Control Plan Report. Design drawings and technical specifications are provided under separate cover.

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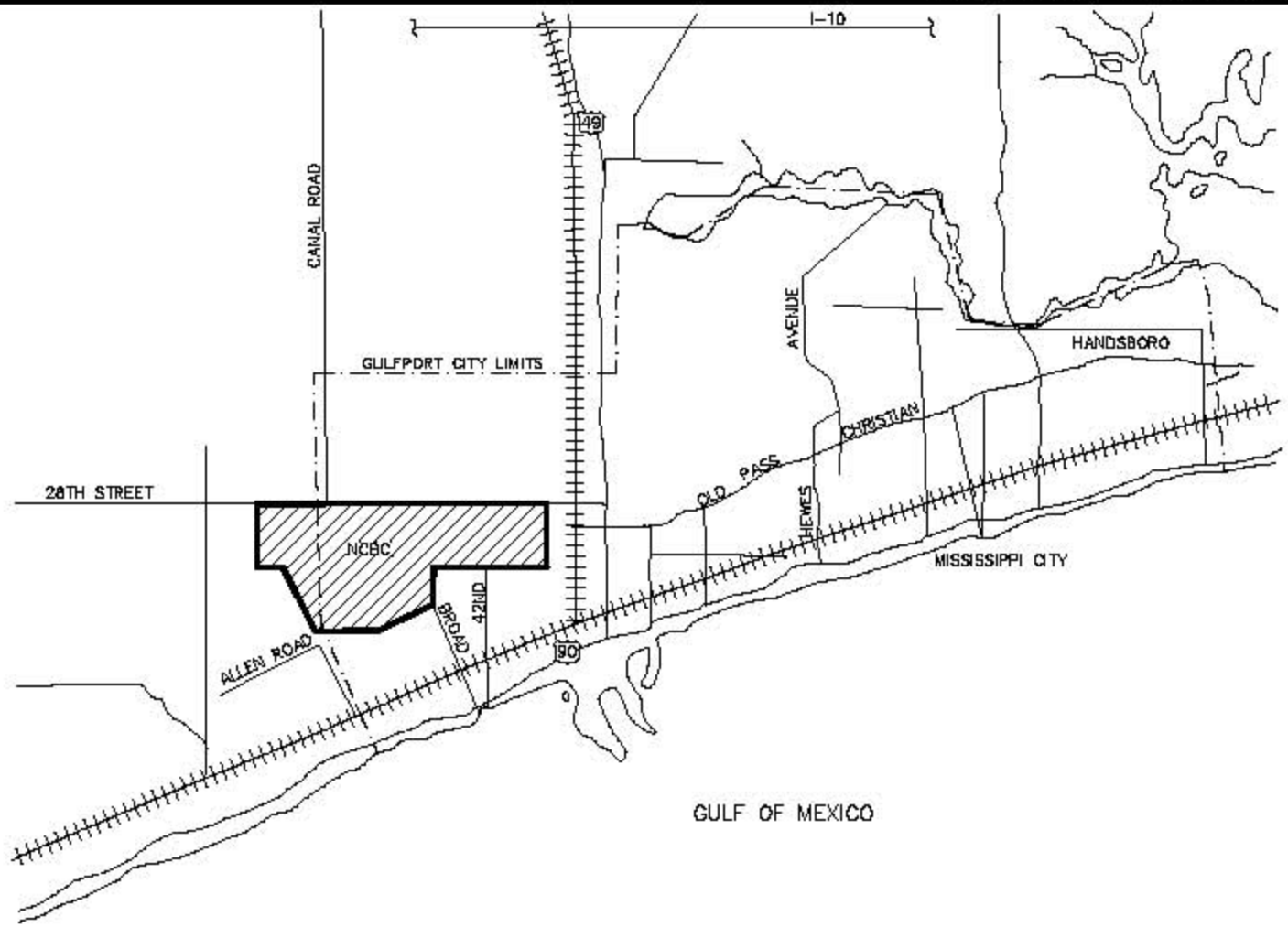

DRAWN BY MF DATE 11/14/02	VICINITY MAP SITE B STORMWATER POLLUTION PREVENTION PLAN NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI	CONTRACT NO. 7379	
CHECKED BY JJB DATE 5/13/03		APPROVED BY DATE	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE NONE		DRAWING NO. FIGURE 1-1	REV. 0

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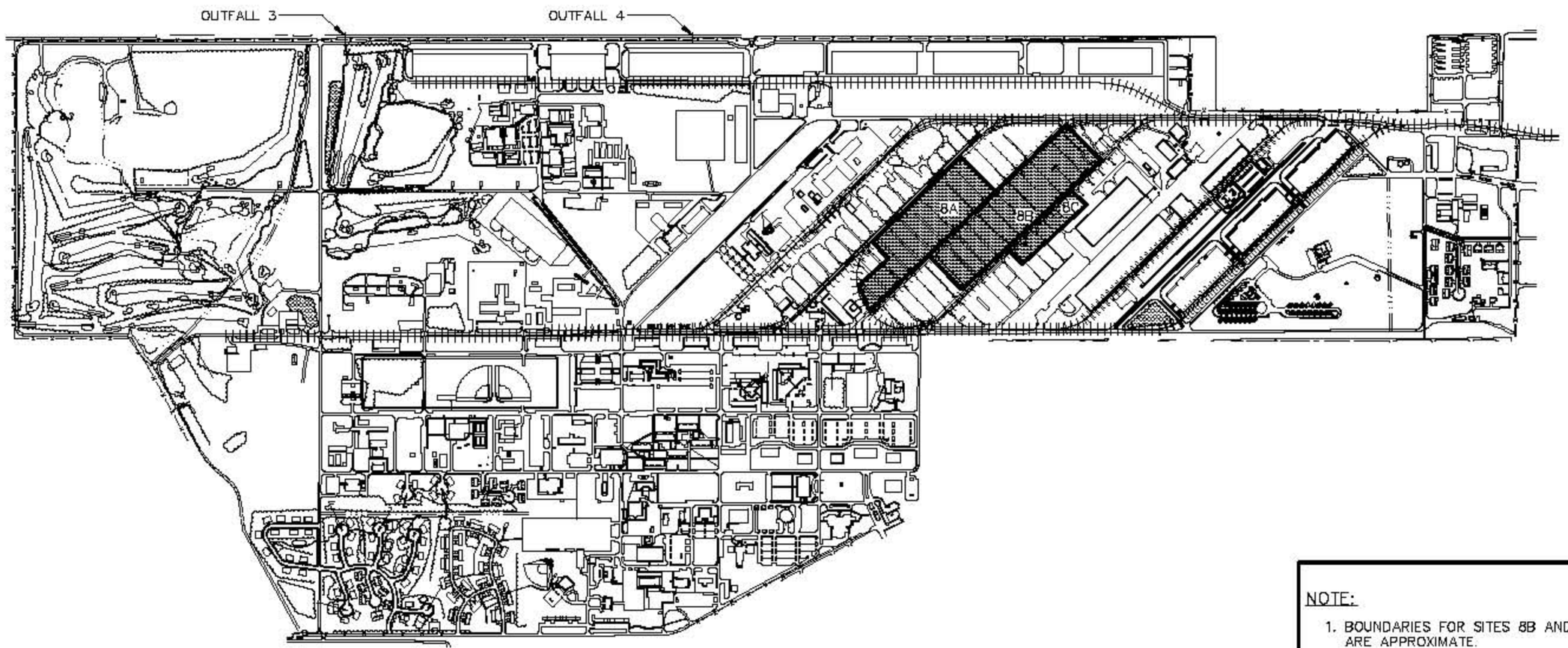

NOTE:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.

0 1000 2000
SCALE IN FEET

SOURCE: BASEMAP.DWG, PUBLIC WORKS DEPARTMENT, NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MS, JUNE 2001

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 11/14/02
CHECKED BY JJB DATE 5/13/03
COST/SCHED-AREA
SCALE AS NOTED

INSTALLATION MAP
SITE 8
STORMWATER POLLUTION PREVENTION PLAN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 1-2
REV. 0

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2.0 DESCRIPTION OF CONTROLS

This section presents a description of stormwater controls, including erosion and sedimentation controls proposed for the RA. A copy of the completed USEPA pre-construction checklist is provided in Appendix A.1. The Stormwater Pollution Prevention Plan Construction/Implementation Checklist is provided in Appendix A.2. These checklists were obtained from the USEPA Stormwater Management for Construction Activities: Summary Guidance on Developing Pollution Prevention Plans and Best Management Practice (USEPA, 1992). Requirements specified in these checklists and documents are incorporated into this SWPPP.

2.1 EXISTING SITE CONDITIONS

Site 8 consists of three contiguous storage areas located in the north-central portion of NCBC Gulfport (Figure 1-2). The three storage areas comprising Site 8 are designated as Sites 8A, 8B, and 8C. The main former HO drum storage area, Site 8A, which encompasses approximately 13 acres, has an undulating surface due to previous remedial activities and is covered with light vegetation (Design Drawings C-4 and C-5). The surface soil in non-stabilized areas is typically a fine- to medium-grained sand. Approximately one-third of Site 8A consists of stabilized areas where HO drums were stored.[1] Site 8A includes the upper reaches of the drainage areas for the eastern two-thirds of the base. Surface drainage from Site 8A flows to the northwest, exiting the base at Outfall 3 into a drainage system that feeds Canal No. 1 which flows north to Turkey Creek (TtNUS, 2003). Prior to 1995, the surface water that exited the base via Outfall 3 discharged to wetland that is a part of the Turkey Creek drainage basin (HLA, 2000).

Sites 8B and 8C contain the majority of the on-base drainage channels that require restoration (contaminated sediments previously removed). Sites 8B and 8C encompass approximately 18 acres, are relatively flat, and have almost no vegetation (Design Drawings C-1 and C-2). Sites 8B and 8C were also used for storage of drums containing HO. The Site 8B and 8C surface soils consist of fine- to medium-grained sand, and approximately one-third of these areas are stabilized with Portland cement. Sites 8B and 8C are also located at the head of local drainage basins. Surface water from Site 8B flows north, exiting the base at Outfall 4, and then to the Turkey Creek drainage basin. Surface water from Site 8C drains to the southeast, exiting the base at Outfall 2 into Brickyard Creek (TtNUS, 2003).

[1] The surface soil in storage areas at NCBC is typically stabilized using Portland cement to improve the load-bearing capacity and thus provide a surface suitable for equipment storage and staging.

The on-base drainage channels scheduled for excavation and restoration are shown on Figure 2-1. Two types of dioxin-contaminated sediment have been observed in the on-base drainage channels (TtNUS, 2001). In the upper reaches of the drainage channel 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 channel 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.

The off-base AOC consists of impacted drainage channels contained within property currently owned by Mr. G.E. Arndt (the Arndt property) and Mr. P.W. Bennett (the Bennett property). Within this drainage channel reach, dioxin-contaminated sediment has also been deposited outside the banks of the drainage channels as a result of high-flow conditions during major storm events. Design Drawing C-3 presents the extent of contamination within the off-base AOC.

The primary transport mechanism of dioxin-contaminated sediment in the off-base AOC drainage channels is the high-velocity surface water flow associated with major storm events. These storm events are responsible for the downstream migration of dioxin-contaminated sediment; however, the deposition of these sediments is influenced by the elevation changes associated with three terraces identified along the drainage patterns. These terraces, with unique depositional patterns, soil types, and vegetation, are as follows:

- Terrace 1 is located at the lowest elevation, or level, and forms the main channel. The soil's surface consists mainly of organic rich silts and clays, and soil becomes increasingly sandy below this surface layer. This terrace supports very little understory vegetation due to frequent flooding and poor drainage. This terrace was identified to be the most likely to contain significant levels of dioxin contamination.

- Terrace 2 forms a margin that surrounds the Terrace 1 main channel but at elevations slightly higher than Terrace 1. The organic-rich surface soil layer is thinner than Terrace 1 and contains some sand. Terrace 2 supports more understory vegetation, which visually distinguishes it from Terrace 1.

- Terrace 3 occurs along the highest elevations in the study area. The soils are well-drained, dark brown, fine to medium sands that support abundant understory vegetation. These coarser-grained soils were the main distinguishing feature between Terrace 3 and Terrace 2.

2.2 EROSION, SEDIMENT, AND STORMWATER CONTROL MEASURES

Unless otherwise noted in this plan or in the construction documents, erosion, sediment, and stormwater control measures will be implemented, installed, and maintained according to the standards and specifications of the Mississippi Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater (MPDMCESS) produced in April 1994. The MPDMCESS was produced with the cooperation of the United States Department of Agriculture (USDA) Natural Resources Conservation Service, the Mississippi Department of Environmental Quality (MDEQ), and the Mississippi Soil and Water Conservation Commission (MSWCC) (USDA, 1994). The required erosion, sediment, and stormwater control measures are shown on Design Drawings C-6 through C-10 and are as follows:

- Construction entrance(s)/exit(s) will be provided off Greenwood Avenue, Holtman Avenue, Brown Avenue, and Eighth Street for work to be performed on base and off 28th Street for work to be performed off base. These construction entrance(s)/exit(s) will be protected with silt fencing or super silt fencing.

- Silt fencing will be placed along the downslope sides of access roads, construction entrance(s)/exit(s), support facilities [i.e., the decontamination pad(s), staging area(s), and material handling pad], and around identified excavation areas.

- Super silt fence will be installed along the limit of stabilized material blend, or cap, to decrease runoff velocities and protect certified clean stabilized drainage channels.

- A temporary diversion, stabilized immediately after installation, will be placed along the upslope side of the temporary access road that will be constructed to access the off-base AOC. The diversion will collect stormwater runoff and divert the flow to controlled locations.

- Sediment recovery traps (SRTs) will be constructed to segregate excavation areas within the off-base AOC.

2.2.1 Structural Practices

The following structural practices will be used during and/or following construction activities at Site 8 to control erosion and sedimentation:

1. Construction Entrance(s)/Exit(s) - Temporary construction entrance(s)/exits(s) will be installed to provide access to Site 8A from Greenwood Avenue, to Site 8B from Holtman Avenue, to on-base

drainage channels from Brown Avenue and Eighth Street, and to the off-base AOC from 28th Street. Construction vehicles will be cleaned before exiting the site.

2. Silt Fence - Silt fencing will be installed along the downslope sides of access roads, construction entrance(s)/exit(s), support facilities, and excavation areas.

3. Super Silt Fence - Super silt fencing will be installed around the Site 8A cap area.

4. Sediment Tank - A sediment tank will be available on site for use in dewatering excavation areas and for collecting decontamination waters. Water from excavations may be collected in a temporary holding tank, tested, and disposed at an appropriate off-site facility, if necessary. In the event that a determination is made to allow discharge of the collected water onto the ground surface, water will first be cleaned of sediment and then broadcast over an approved vegetated area or designated drainage channel. Water from the decontamination pad will be collected in a temporary holding tank, tested, and disposed at an appropriate off-site facility, if necessary.

5. Surface Roughening - The surface of regraded areas will be roughened to reduce runoff velocity and to aid in the establishment of vegetative cover.

6. Temporary Seeding - All regraded areas that will be left dormant for extended periods of time will be seeded with fast-germinating temporary vegetation immediately following grading. Seeding will be performed dependent on the time of year, in accordance with the Seeding Chart in the Mississippi Stormwater Pollution Prevention Plan Guidance Manual for Construction Activities produced by the General Permits Branch of the Office of Pollution Control (OPC) in the MDEQ (OPC, 2000).

7. Permanent Seeding - All regraded areas not receiving roller-compacted concrete or wetland plantings will be permanently seeded with a seed mixture that will minimize erosion and provide suitable food and cover for wildlife. The permanent seed mixture for this RA is presented in Section 2.7 and on Design Drawing C-12.

8. Mulching - All areas receiving permanent seeding will be mulched with an organic material that prevents erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow.

9. Diversion - A temporary diversion will be constructed along the off-base AOC temporary access road. The diversion will be used to collect stormwater runoff and convey around the excavation.

10. Culverts - Culverts placed periodically below the temporary access road constructed along the off-base AOC will allow the diversions to collect stormwater runoff at selected locations (depending on the severity of the storm). The off-base AOC end of each culvert will be covered with filter fabric to prevent the migration of contaminated sediments from the off-base AOC to the diversion.

11. Sediment Recovery Traps - SRTs will be constructed to segregate areas of excavation within the off-base AOC. The SRTs, which are constructed using gabions and filter fabric, will prevent the migration of contaminated sediments into uncontaminated areas during rainfall events or storm surges. These SRTs will be removed after the off-base area is stabilized with vegetation.

12. Sheet Piling - Sheet piling will be placed within the on-base drainage channels to divide on-base drainage channels into manageable channel segments. After insertion of the sheet piles, water within the channels will be pumped and contaminated sediment excavated. Concurrently disturbed channel segments should be limited to three and the segments should be adjacent to each other.

2.2.2 Management Strategies

The following management strategies will be utilized during the RA:

1. Unstabilized, disturbed areas will be minimized and construction activities will be staged.

2. Seeding or other stabilization measures will follow immediately after grading.

3. Areas that are not to be disturbed will be clearly marked by flags, signs, etc.

4. The construction superintendent will be responsible for ensuring the installation and maintenance of all erosion, sediment, and stormwater control practices.

5. Erosion, sediment, and stormwater control structures will be installed and/or constructed before the start of any earth-disturbance activities.

6. Temporary erosion, sediment, and stormwater control features will remain in place until permanent vegetation is established over disturbed surfaces, as described in the revegetation notes on Design Drawing C-12.

7. Drainage channel segregation devices should be used to divide on-base drainage channels into manageable areas; excavation should not occur in subsequent areas until the preceding area has been segregated.

2.3 SEQUENCE OF CONSTRUCTION

The time to perform the required construction activities is estimated to be approximately 12 months. However, the project may be conducted in phases, as determined by the Navy. The following sequence of construction assumes that all of the work will be performed in one construction period. In the event that the project is conducted in phases, area-specific erosion, sediment, and stormwater controls can be constructed at the time RA activities are conducted in a specific area. The generalized sequence of construction activities are as follows. Upon approval of the Resident Officer in Charge of Construction (ROICC), sequence items may be conducted concurrently.

1. Hold pre-construction meeting with the ROICC.

2. Inspect the site prior to construction to verify existing site conditions and underground utility locations.

3. Establish horizontal and vertical control for construction. Stake the location of all areas to be excavated or disturbed prior to actual work.

4. Install perimeter controls for the construction entrance(s)/exit(s). Construct the construction entrance(s)/exit(s). Install remaining perimeter controls as indicated on Design Drawings C-6 through C-10 and additional construction entrance(s)/exit(s) if approved by the ROICC prior to any earth-disturbance activities. All perimeter controls will conform to MDEQ standards, unless otherwise specified. The perimeter controls to be installed include, but are not limited to, the following:

   - Placement of silt fencing around the construction entrance(s)/exits(s), material handling pad, decontamination pad(s), and construction laydown, storage and staging/processing area(s).

   - Placement of SRTs within the off-base AOC.

   - Temporary security fence and/or gates shall be installed along the site perimeter as necessary to restrict access.

   - Additional controls as may be required by the ROICC and/or warranted by site conditions and best construction practices.

5. Install the access road and temporary diversion along the excavation area in the off-base AOC. Install culverts and additional SRTs as indicated on Design Drawing C-8 or where appropriate subject to approval of the ROICC.

6. Clear and grub areas for material handling pad, decontamination pad(s), and construction laydown, storage and staging/processing area(s), unless indicated otherwise.

7. Construct material handling pad, decontamination pad(s), and storage and staging/processing area(s).

8. Restore channels excavated during 2002 on Sites 8B and 8C by placing 6 inches of topsoil and temporary erosion control matting (ECM) and seeding with the permanent seed mixture indicated on Design Drawing C-12.

9. Remove items identified on Design Drawings C-18 and C-19 from Site 8A and abandon the permanent monitoring wells on Site 8A and the temporary monitoring wells within the off-base AOC, as indicated on the design drawings and in the specifications.

10. Clear but do not grub all areas where excavation will occur (i.e., off-base AOC, on-base drainage channels, and Site 8A). Only clear the areas that are scheduled for excavation during the current construction period.

11. Excavate contaminated sediments from the off-base AOC and transport sediment to the material handling pad located on Site 8B. The Navy will collect soil and groundwater verification samples from the off-base AOC in accordance with the Verification Sampling and Analysis Plan (VSAP) (TtNUS, 2003). Verification sampling and analysis will follow visual confirmation that all contaminated material has been excavated. If verification results indicate contaminants are either completely removed or at levels less than the preliminary remediation goal (PRG) for dioxin, excavation of contaminated sediment is complete. If the initial verification results indicate that sediment remains on site with dioxin concentrations greater than the PRG, continue excavation in accordance with the VSAP and the Navy will conduct additional verification sampling and analysis. Continue the excavation process until contaminants are removed and the PRG is achieved.

12. Upon approval by the ROICC, restore the off-base AOC area of disturbance by placing common fill as required, placing 6 inches of topsoil, and revegetating using the wetland plant schedule and wetland seed mixture presented on Design Drawing C-22. Following stabilization and after approval of stabilization from the ROICC and MDEQ, remove SRTs (installed and existing) within the off-base

AOC. Following the restoration of the off-base AOC remove the temporary access road to the timber used for subgrade.

13. Install required haul roads along the on-base drainage channel excavation areas. Sequentially excavate on-base sediment from the drainage channels using channel segregation devices and pumps to restrict the disturbed channel to manageable lengths. Excavate contaminated sediment from indicated drainage channels and associated culverts. Transport the sediment to the material handling pad located on Site 8B. The Navy will collect verification samples in accordance with the VSAP, and as outlined in Sequence Item 11. Upon approval by the ROICC, restore drainage channel segments by placing 6 inches of topsoil and ECM and applying the permanent seed mixture indicated on Design Drawing C-12. Restrict the number of concurrently disturbed drainage channel segments to three.

14. Excavate soil ash from piles within Site 8A and transport soil ash to the material handling pad located at Site 8B. Establish the perimeter channels and stabilize with the placement of 6 inches of topsoil and ECM and by seeding with the permanent seed mixture indicated on Design Drawing C-12. Modify the existing Site 8A culverts as required and install the new culvert. Dewater the existing channels and compact the remaining soil at Site 8A, where required, to achieve a suitable subgrade for the consolidated/stabilized material.

15. Sequentially excavate sediment from the drainage channels within the boundaries of Site 8A using channel segregation devices and pumps to restrict the disturbed channel to manageable lengths. Excavate contaminated sediment from indicated drainage channels and associated culverts. Transport the sediment to the material handling pad located on Site 8B. The Navy will collect verification samples in accordance with the VSAP, and as outlined in Sequence Item 11. Restrict the number of concurrently disturbed drainage channel segments to three.

16. Consolidate contaminated off-base sediment, contaminated on-base sediment, and soil ash to achieve the desired material blend. Transport to Site 8A and spread the material blend, in lifts where required, to achieve the interim grade (12 inches below final grade). Stabilize the material blend. Compact each lift of consolidated/stabilized material in accordance with the design drawings and specifications.

17. Following the placement of the consolidated/stabilized material blend (including sediment removed from perimeter controls), install the 12-inch-thick roller-compacted concrete cap in accordance with the design drawings and specifications.

18. Following the placement of the roller-compacted concrete, remove the material handling pad, decontamination pad(s), and construction laydown, storage and staging/processing area(s). Transport and dispose off site all required materials from these temporary features. The Navy will collect verification samples from the soil below the material handling pad and all decontamination pads in accordance with the VSAP and as outlined in Sequence Item 11.

19. Stabilize all remaining areas of disturbance with the permanent seed mixture indicated on Design Drawing C-12.

20. When upstream areas and all on-base drainage channels have been stabilized and approval of stabilization has been received from the ROICC and MDEQ, remove all remaining temporary perimeter controls and all remaining on-base SRTs on Sites 8A, 8B, and 8C and from all downstream drainage channels.

2.4 PERMANENT STABILIZATION

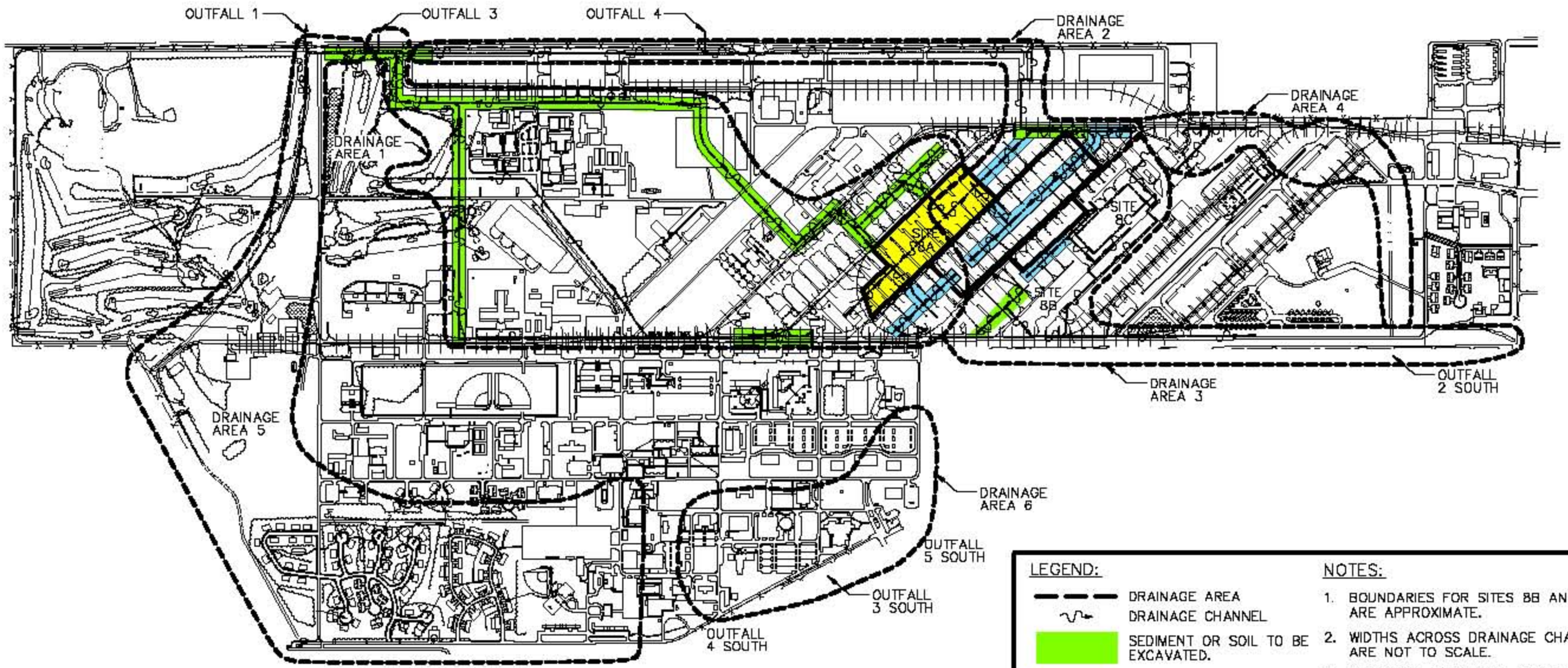
All areas disturbed by RA activities will be stabilized with permanent seeding as soon as possible following final grading but no later than 14 calendar days after establishment of final grade (as noted on the design drawings). Permanent seeding will be done in accordance with the Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater (USDA, 1994) and as specified on Design Drawing C-12. The seed mixture selected is recommended for Mississippi's Southern Zone in the Mississippi SWPPP Guidance Manual for Construction Activities (OPC, 2000). The seed mixture consists of common bermudagrass when planting occurs between March 1 and July 15 or September 1 through November 30. When planting occurs between November 30 and March 1, annual ryegrass will be mixed with the common bermudagrass. Planting between July 15 and September 1 should be avoided. However, if grades are finalized during this period, temporary seeding can be used.

2.5 STORMWATER RUNOFF CONSIDERATIONS

Following completion of the RA, Site 8A will be covered with roller-compacted concrete, and the excavated channels and off-base AOC will be returned to grassed or natural conditions. Because existing conditions on Site 8A consist of stabilized soil with light vegetation and future conditions will have a roller-compacted concrete cap, pre- and post-construction runoff calculations have been prepared for Site 8A. Because remediation activities at Site 8A have been underway since the drums of HO were removed from the site in the late 1970s, pre-construction conditions will be representative of when Site 8A was used as a storage area with Portland cement-stabilized soil. The pre- and post-construction runoff calculations are provided in Appendix B of the Erosion, Sediment, and Stormwater Control Plan Report provided under separate cover.

Due to the inclusion of over-sized drainage channels within the limits of Site 8A, the post-construction runoff peak discharge [109 cubic feet per second (cfs)] only slightly exceeds the pre-construction runoff peak discharge (108.5 cfs). Although the post-construction runoff from Site 8A exceeds the pre-construction runoff, the widening of the downstream channels during the RA will provide adequate storage for this increased flow. Therefore, other than the proposed drainage channels on Site 8A, no permanent stormwater features are required.

ACAD: 7379CM28.dwg 08/28/04 HJB PIT



LEGEND:

- DRAINAGE AREA
- DRAINAGE CHANNEL
- SEDIMENT OR SOIL TO BE EXCAVATED.
- BOUNDARY OF CAP (SITE 8A)
- SEDIMENT OR SOIL EXCAVATED (CCI, 2003)

NOTES:

1. BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.
2. WIDTHS ACROSS DRAINAGE CHANNELS ARE NOT TO SCALE.
3. SEDIMENTS IN SITE 8A DRAINAGE CHANNELS WILL ALSO BE EXCAVATED FOR STABILIZATION PURPOSES.

0 1000 2000
SCALE IN FEET

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 4/24/03
CHECKED BY JJB DATE 5/13/03
COST/SCHED-AREA
SCALE AS NOTED

ON-BASE DRAINAGE CHANNELS
EXCAVATION/RESTORATION AREAS
SITE 8
STORMWATER POLLUTION PREVENTION PLAN
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-1
REV. 0

FORM CADD NO. SDIV_B4.DWG - REV 0 - 1/20/98

3.0 STATE AND LOCAL REQUIREMENTS

This plan was prepared in accordance with the Mississippi Stormwater Pollution Prevention Plan Guidance Manual for Construction Activities (OPC, 2000) and erosion, sediment, and stormwater control program requirements in accordance with the Mississippi Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater (USDA, 1994) and Mississippi regulations.

No local requirements for stormwater management plans exist other than those developed by the Navy. These requirements also refer to federal requirements and guidance.

State permits are required to discharge stormwater from construction activities and to excavate sediment from the off-base wetland. Refer to Section 3.0 of the Environmental Permits Report provided under separate cover.

4.0 INSPECTION AND MAINTENANCE PROCEDURES

In general, during the RA, all erosion, sediment, and stormwater control measures will be checked daily and after each runoff-producing rainfall event. Any required repairs will be made immediately. The following items will be checked:

- The construction entrance(s)/exit(s) will be maintained in a condition that will minimize tracking sediment onto roads, including the addition of stone or other repairs.

- The silt fence and super silt fence will be checked regularly for undermining or deterioration of the fabric. Sediment will be removed when the level of sediment deposition causes “bulging” or reaches one-half of the fabric height.

- SRTs will be checked for sediment accumulation. Sediment will be removed when it reaches one-half the original height of the SRT. Erosion caused by high-velocity flows around the edges of the SRTs will be corrected immediately.

- Immediately following the establishment of a temporary diversion, the diversion will be stabilized using the permanent or temporary seed mixture. After grass has been established, the diversion will be checked periodically to determine whether the grass is withstanding flow velocities without damage. Any damage identified will be repaired immediately and the diversion reseeded.

- The seeded areas will be checked regularly to ensure that a good stand of vegetation is maintained. Areas will be fertilized and reseeded as needed. The contractor is responsible for maintenance until formal acceptance of the RA by the ROICC.

5.0 NON-STORMWATER DISCHARGES AND POLLUTION PREVENTION

This section presents a description of non-stormwater discharges and pollution prevention measures that will be employed during the proposed RA.

5.1 NON-STORMWATER DISCHARGES

The non-stormwater discharges anticipated during construction activities will be water resulting from draining of the excavated soils, dewatering of excavations, and decontamination efforts associated with field equipment and vehicle wash waters. Water resulting from the draining of excavated soils will be containerized and tested. If a determination is made to allow the discharge of collected water, water will be pumped to sediment tanks to remove sediment and will then be pumped to a permeable area within the limits of the site where it will be discharged and allowed to infiltrate or flow to downstream reaches of the drainage channel.

Due to the presence of existing SRTs within the on-base drainage channels, water resulting from excavation dewatering will be pumped to downgradient channel segments. For the last on-base channel segment (the most downgradient segment), water resulting from excavation dewatering will be containerized and tested. If a determination is made to allow the discharge of collected water, water will be pumped to sediment tanks to remove sediment and will then be pumped to a permeable area within the limits of the site where it will be discharged and allowed to infiltrate or flow to downstream reaches of the drainage channel.

All decontamination water will be collected in a specifically designed, lined decontamination pad area and transported to an approved off-site treatment facility. All sediment will be removed from the wastewater prior to treatment.

5.2 POLLUTION PREVENTION MEASURES

The following is a list of materials or substances that are anticipated to be stored on site during the proposed RA:

- Detergents for decontamination efforts
- Diesel fuel and other vehicle maintenance substances
- Fertilizer for use as a soil amendment to promote vegetative growth
- Small quantities of laboratory chemicals, paints, and other flammable substances

Detergents and small containers or drums of oil, grease, antifreeze, hydraulic fluids, etc., if any, will be stored within an enclosed, lined, and diked area and any diesel fuel will be stored in tanks. The storage area will be bermed and lined with 60 mil linear low density polyethylene (LLDPE) geomembrane. It will be designed to contain at least 10 percent of the total contents of all materials stored in the area plus an allowance for precipitation. A small sump or low point will be designed to serve as a monitoring point for any leaks or spills from the containers. Inspection of the area and management of substances collected in this area were addressed previously in Section 4.0.

Small quantities of herbicides, laboratory chemicals, paints, and other flammable substances may be stored on site during the RA. These materials, when not in use, will be stored in a flammable storage cabinet located in the office trailer. Practices that will be followed to reduce risks associated with these materials are as follows:

- Products will be kept in original containers unless they are not resealable.
- Original labels and material safety data sheets will be retained.
- If surplus product must be disposed, manufacturers' or local- and State- recommended methods for proper disposal will be followed.

The following paragraphs describe specific spill prevention and material management practices that will be employed during the proposed RA.

Good Housekeeping

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff.

- An effort will be made to store only enough product required to accomplish the task.
- All materials stored on site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
- Products will be kept in their original containers with the original manufacturers' labels.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Whenever possible, all of a product will be used before disposing of the container.
- Manufacturers' recommendations for proper use and disposal will be followed.
- The assigned individuals will inspect areas daily to ensure proper use and disposal of materials on site.

Spill Control Practices

In addition to the good housekeeping and material management practices discussed above, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted, and site personnel will be made aware of cleanup procedures and the location of the cleanup information and supplies.

- Materials and equipment necessary for spill cleanup will be kept in the material storage area on site. Equipment and materials will include but will not be limited to brooms, dust pans, mops, rags, gloves, goggles, absorbent material, and plastic and metal containers specifically designed for this purpose.

- All spills will be cleaned immediately after discovery.

- The spill area will be kept well ventilated, and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.

- Spills of toxic or hazardous material will be reported to the appropriate State or local government agency, as required.

- If a spill of toxic or hazardous material occurs, this Stormwater Pollution Prevention Plan will be modified to include measures to prevent this type of spill from reoccurring and information about how to clean the spill if there is a recurrence. A description of the spill, what caused it, and the cleanup measures will also be included in the revised plan.

- The on-site construction superintendent responsible for day-to-day site operations will be the spill prevention and cleanup coordinator. He will designate at least three other site personnel who will receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage areas and in the office trailers located on site.

6.0 POLLUTION PREVENTION PLAN CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____

Date: 10/4/04

7.0 CONTRACTOR'S CERTIFICATION

I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit, if any, that authorizes the stormwater discharges associated with construction activity at the site identified as part of this certification.

Signature	For	Responsible for
_____ Contractor Date:_____	Company Name and Address	Contractor
_____ Contractor Date:_____	Company Name and Address	Contractor
_____ Subcontractor Date:_____	Company Name and Address	Subcontractor

REFERENCES

Harding Lawson Associates (HLA), 2000. *Remediation Planning Document, Naval Construction Battalion Center, Gulfport, Mississippi.* Prepared for Southern Division Naval Facilities Engineering Command, Charleston, South Carolina. August.

Tetra Tech NUS, Inc. (TtNUS), 2003. *Focused Feasibility Study, Site 8, Herbicide Orange Storage Area at Naval Construction Battalion Center, Gulfport, Mississippi.* Prepared for Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. March.

TtNUS, 2001. *Report for Bench-Scale Soil/Sediment Treatability Study, Site 8, Herbicide Orange Study Area, Naval Construction Battalion Center, Gulfport, Mississippi.* Prepared for Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. March.

TtNUS, 2003. *Verification Sampling and Analysis Plan for Site 8 – Herbicide Orange Study Area and Off-base Area of Contamination, Naval Construction Battalion Center, Gulfport, Mississippi.* Prepared for Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. May.

Office of Pollution Control (OPC), 2000. *Mississippi Stormwater Pollution Prevention Plan (SWPPP) Guidance Manual for Construction Activities*. General Permits Branch, OPC, Department of Environmental Quality, March.

United States Department of Agriculture (USDA), 1994. *Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater*, *First Edition*. A cooperative effort by the United States Department of Agriculture Natural Resources Conservation Service, the Mississippi Department of Environmental Quality, and the Mississippi Soil and Water Conservation Commission, April.

United States Environmental Protection Agency (USEPA), 1992. *Storm Water Management for Construction Activities: Summary Guidance on Developing Pollution Prevention Plans and Best Management Practice*, EPA 832-R-92-001, October.

APPENDIX A

A.1 USEPA CONSTRUCTION GENERAL PERMIT REQUIREMENTS PRECONSTRUCTION CHECKLIST

A.2 STORMWATER POLLUTION PREVENTION PLAN CONSTRUCTION/IMPLEMENTATION CHECKLIST

A.1 USEPA CONSTRUCTION GENERAL PERMIT REQUIREMENTS PRECONSTRUCTION CHECKLIST

EPA CONSTRUCTION GENERAL PERMIT REQUIREMENTS
PRECONSTRUCTION CHECKLIST

Stormwater Pollution Prevention Plans

1. A site description, including:

   ☒ The nature of the activity.

   Refer to Section 1.2 of the Stormwater Pollution Prevention Plan.

   ☒ Intended sequence of major construction activities.

   Refer to Section 2.3 of the Stormwater Pollution Prevention Plan.

   ☒ The total area of the site.

   Refer to Section 2.1 of the Stormwater Pollution Prevention Plan.

   ☒ The area of the site that is expected to undergo excavation.

   Refer to Figure 2-1 of the Stormwater Pollution Prevention Plan.

   ☒ The runoff coefficient of the site after construction is complete.

   Refer to the Post-Construction Runoff Calculation provided in Appendix B of the Erosion, Sediment, and Stormwater Control Plan Report.

   ☒ Existing soil or Stormwater data.

   Refer to the Pre-Construction Runoff Calculation provided in Appendix B of the Erosion, Sediment, and Stormwater Control Plan Report.

A site map with:

   ☒ Drainage patterns.

   Refer to the Pre-Construction Runoff Calculation and the Post-Construction Runoff Calculation provided in Appendix B of the Erosion, Sediment, and Stormwater Control Plan Report.

   ☒ Approximate slopes after major grading.

   Refer to Design Drawings C-20 through C-24.

   ☒ Area of soil disturbance.

   Refer to Design Drawings C-6 through C-10.

   ☒ Outline of areas which will not be disturbed.

   Refer to Design Drawings C-6 through C-10.

☒ Location of major structural and non-structural controls.

Refer to Design Drawings C-6 through C-10.

☒ Areas where stabilization practices are expected to occur.

Refer to Design Drawings C-20 through C-24.

☒ Surface waters.

Refer to Figures 2-1 of the Stormwater Pollution Prevention Plan.

☒ Stormwater discharge locations.

Refer to Figure 2-1 of the Stormwater Pollution Prevention Plan.

☒ The name of the receiving water(s).

Refer to Figure 2.1 of the Stormwater Pollution Prevention Plan.

2. A description of controls:

2.1 Erosion and sediment controls, including:

☒ Stabilization practices for all areas disturbed by construction.

Refer to Section 2.2, Section 2.2.1, and Section 2.4 of the Stormwater Pollution Prevention Plan.

☒ Structural practices for all drainage/discharge locations.

Refer to Section 2.2 and Section 2.2.1 of the Stormwater Pollution Prevention Plan.

2.2 Stormwater management controls, including:

☒ Measures used to control pollutants occurring in Stormwater discharges after construction activities are complete.

Refer to Section 2.2 and 2.4 of the Stormwater Pollution Prevention Plan.

☒ Velocity dissipation devices to provide nonerosive flow conditions from the discharge point along the length of any outfall channel.

Refer to Section 2.2.1 of the Stormwater Pollution Prevention Plan and Design Drawings C-6 through C-10.

2.3 Other controls including:

☒ Waste disposal practices which prevent discharge of solid materials to waters of the U.S.

Refer to Section 5.0 of the Stormwater Pollution Prevention Plan.

☒ Measures to minimize offsite tracking of sediments by construction vehicles.

Refer to Section 2.2.1 of the Stormwater Pollution Prevention Plan.

☒ Measures to ensure compliance with State or local waste disposal, sanitary sewer, or septic system regulations.

N/A.

2.4 ☒ Description of the timing during the construction when measures will be implemented.

Refer to Section 2.3 of the Stormwater Pollution Prevention Plan.

3. ☒ State or local requirements incorporated into the plans.

Refer to Sections 2.0, 2.2.1 and 3.0 of the Stormwater Pollution Prevention Plan.

4. ☒ Inspection and maintenance procedures for control measures identified in the plan.

Refer to Section 4.0 of the Stormwater Pollution Prevention Plan.

5. ☒ Identification of allowable non-Stormwater discharges and pollution prevention measures.

Refer to Section 5.0 of the Stormwater Pollution Prevention Plan.

6. ☒ Contractor certification.

Refer to Section 7.0 of the Stormwater Pollution Prevention Plan.

7. ☒ Plan certification.

Refer to Section 6.0 of the Stormwater Pollution Prevention Plan.

A.2 STORMWATER POLLUTION PREVENTION PLAN CONSTRUCTION/IMPLEMENTATION CHECKLIST

EPA CONSTRUCTION GENERAL PERMIT CHECKLIST

Stormwater Pollution Prevention Plan
Construction/Implementation Checklist

1. Maintain Records of Construction Activities, including:

   - ☐ Dates when major grading activities occur
   - ☐ Dates when construction activities temporarily cease on a portion of the site
   - ☐ Dates when construction activities permanently cease on a portion of the site
   - ☐ Dates when stabilization measures are initiated on the site

2. Prepare Inspection Reports summarizing:

   - ☐ Name of inspector
   - ☐ Qualifications of inspector
   - ☐ Measures/areas inspected
   - ☐ Observed conditions
   - ☐ Changes necessary to the SWPPP

3. Report Release of Reportable Quantities of Oil or Hazardous Materials (if they occur);

   - ☐ Notify National Response Center 800/424-8802 immediately
   - ☐ Notify permitting authority in writing within 14 days
   - ☐ Modify the pollution prevention plan to include:
     - The date of release
     - Circumstances leading to the release
     - Steps taken to prevent reoccurrence of the release

4. Modify Pollution Prevention Plan as necessary to:

   - ☐ Comply with minimum permit requirements when notified by EPA that the plan does not comply.
   - ☐ Address a change in design, construction, operation, or maintenance which has an effect on the potential for discharge of pollutants
   - ☐ Prevent reoccurrence of reportable quantity releases of a hazardous material or oil.

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE
NORTH CHARLESTON, SC 29406

SPECIFICATION NO:

CONTRACT NO:

SITE 8 - HERBICIDE ORANGE STORAGE AREA

at the

NAVAL CONSTRUCTION BATTALION CENTER

GULFPORT, MISSISSIPPI

DESIGN BY:

TETRA TECH NUS, INC.
661 ANDERSEN DRIVE
PITTSBURGH, PENNSYLVANIA 15220

SPECIFICATION PREPARED BY:

Architectural:	Civil:	Structural:
N/A	Robert Martin	N/A
Electrical:	**Mechanical:**	**Submitted by:**
N/A	N/A	

October 2004

SPECIFICATION APPROVED BY: _____ DATE: _____

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SITE 8 - HERBICIDE ORANGE STORAGE AREA, NCBC, GULFPORT, MS

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SECTION 02160A

SOLIDIFICATION/STABILIZATION (S/S) OF CONTAMINATED MATERIAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 150	(2002a) Portland Cement
ASTM C 171	(2003) Sheet Materials for Curing Concrete
ASTM C 618	(2003) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 979	(1999) Pigments for Integrally Colored Concrete
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 558	(1996) Moisture-Density Relations of Soil-Cement Mixtures
ASTM D 559	(1996) Wetting and Drying Compacted Soil-Cement Mixtures
ASTM D 1140	(2000) Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve
ASTM D 1196	(1993; R 1997) Nonrepetitive Static Plate Load Tests of Soils and Flexible Pavement Components, for Use in Evaluation and Design of Airport and Highway Pavements
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
ASTM D 1632	(1996) Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory

ASTM D 1633	(2000) Compressive Strength of Molded Soil-Cement Cylinders
ASTM D 2216	(1998) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2974	(2000) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS CCC-C-467	(Rev. C) Cloth, Burlap, Jute (or Kenaf)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846	(1986) Evaluating Solid Waste (Physical/Chemical Methods)
EPA 625/3-89/016	(1989) Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxins and -Dibenzofurans (CDDs and CDFs) and 1989 Update

U. S. ARMY CORPS OF ENGINEERS

TM 5-822-7	(1987) Standard Practice for Concrete Pavements
TM 5-822-14	(1994) Soil Stabilization for Pavements

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 81-123	(1988) Occupational Health Guideline for Chemical Hazards, (Vol. 3) January

1.2 DEFINITIONS

1.2.1 Cementitious Material

Portland cement, pozzolan, and fly ash.

1.2.2 Stabilizing Agents

Reagents and cementitious materials.

1.2.3 Coverage

C as used herein:

$C = (Af/Ad) \times N \times 100\%$

where N = number of passes of the compaction equipment over a given point;

Af = sum of the end contact areas of the feet on the drums of the compaction equipment; and,

Ad = average surface area of the drum itself based on the average of the diameter over feet and diameter over drum.

Note that the coverage provided by a one-directional pass of a steel wheeled roller with full width front and rear drums is 200 percent.

1.3 SYSTEM DESCRIPTION

An in situ or ex-situ S/S system shall be used which provides a safe, reliable method to treat the material blend so that the stabilized material blend conforms to paragraph entitled "Performance Requirements". A system or procedure, other than described in this section, may be used if the approved submittals demonstrate equivalent capabilities. Such approval does not relieve the Contractor of responsibility for meeting specified requirements for safety, reliability, and performance.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with standard Navy submittal procedures and the Contract.

SD-01 Preconstruction Submittals

Bench-Scale Treatability Study Work Plan; G A/E

Within 10 days after notice to proceed. A period of 10 days shall be allowed in the schedule for Government review and approval of the Bench-Scale Treatability Study Work Plan.

SD-03 Product Data

S/S Work Plan; G A/E

A draft S/S Work Plan within 65 days after notice to proceed. A period of 15 days shall be allowed in the schedule for Navy review and approval of the draft S/S Work Plan. A final S/S Work Plan within 10 days after receipt of Navy and regulatory review comments on the draft S/S Work Plan. No field demonstration or full-scale S/S of material blend shall be performed until the final S/S Work Plan is approved. The S/S Work Plan shall address the technical requirements listed in this section and shall include, but is not limited to the following:

a. Contractor Experience: Information to demonstrate that the S/S Contractor meets the qualification requirements outlined in paragraph entitled "Qualifications".

b. Mix Design: The proposed mix design based on bench-scale treatability study and method of mixing to be used in treating the

material blend. The proposed source of water to be used for the S/S process shall also be identified.

c. Equipment: Specifications for the proposed homogenization and mixing equipment, batching equipment, and process control instrumentation. Process flow diagrams, mixing times, and processing rates shall be included. Anticipated pretreatment of the material blend shall be identified.

d. Drawings: Drawings indicating dimensions and layout of the S/S system on the site. Drawings shall be to scale.

e. Emissions: Air emissions, dust, and noise from the system shall be identified and estimated. Control systems required to maintain compliance with local, state, and federal regulations shall be described as appropriate. Air emissions, dust, and noise testing protocol to be performed during the field demonstration and full scale operations shall also be described.

f. Quality Control: A quality control plan which addresses control and documentation of batch proportions, water content of mixture, mixing time, mixing speed, compaction, sample collection, sample curing, and post-treatment testing.

g. Demobilization: A post-treatment cleanup and sampling plan for the treatment area.

h. Stockpile Design: A proposed stockpile design which meets the criteria outlined in this section.

Equipment

Qualifications

Key Personnel

Resumes of key personnel at least 10 working days prior to the personnel assuming duties on site.

Batch Proportions

Daily batch proportion and mixing quality control data.

SD-06 Test Reports

Bench-Scale Treatability Study Report; G A/E

Within 45 days after receipt of Government comments on the Bench-Scale Treatability Study Work Plan. A period of 10 days shall be allowed in the schedule for Government review and approval of the Bench-Scale Treatability Study Report.

Field Demonstration Report; G OIC

Within 45 days after approval of the Final S/S Work Plan. A period of 10 days shall be allowed in the schedule for Government review and approval of the Field Demonstration Report. The field demonstration report shall include pre-treatment and post-treatment test results, and shall document other relevant

field demonstration data including but not limited to: batch proportions, water content of mixture, uniformity of mixture, mixing time, mixing speed, lift thickness, compaction equipment, speed of travel, and coverage. Off-gas, dust, and noise test results shall also be included.

Sieve analysis
Liquid limit
Plasticity index
Compressive strength
Field Moisture-Density
Laboratory Moisture-Density
SPLP test

SD-07 Certificates

Stabilizing agents

Stabilizing agent composition, certificates of analysis, and MSDS documentation. A confidentiality agreement may be requested if proprietary reagents are being used.

1.5 PERFORMANCE REQUIREMENTS

The material blend shall be tested in accordance with Table 1 as described herein during the bench-scale treatability study, field demonstration, and full-scale construction field testing.

Table 1. PRE-TREATMENT TESTING

TEST	TEST VALUE	METHOD
Grain Size Analysis		ASTM D 422
Atterberg Limits		ASTM D 4318
Organic Content	pH$\geq$ 12 (1)	ASTM D 2974 TM 5-822-14, Appendix B
Sulfates (2)	$\leq$1%	TM 5-822-14, Appendix C

NOTES:

(1) pH of stabilized material blend when Portland cement is used as a stabilizing agent

(2) When Portland cement is used as a stabilizing agent

The stabilized material blend shall meet the physical and chemical testing criteria listed in Table 2. The tests listed in Table 2 shall be performed on samples that have been cured for 3 days unless otherwise indicated.

Table 2. POST-TREATMENT TEST CRITERIA

TEST	TEST VALUE	METHOD
Moisture-Density	NA	ASTM D 1557 (1) ASTM D 558
Unconfined Compressive Strength, (min) 50 psi at 90 days for subbase (2) 500 psi at 90 days for base course		ASTM D 1633 (3)(4)
Modulus of Subgrade Reaction (K) (5)	500 psi/in (pci)	ASTM D 1196
Maximum Allowable Weight Loss after 12 Wet-Dry Cycles (6)	14% of initial specimen weight	ASTM D 559 (3)
Dioxin	30 pg/L (7)	EPA SW-846 Method 1312 EPA SW-846 Method 8290 (8)(9)

NOTES:

(1) Prepare stabilized material blend in accordance with ASTM D 558. Conduct the moisture-density testing accordance with ASTM D 1557.

(2) Unconfined compressive strength shall be determined at 3, 7, 14, 28, and 90 days. 90- day results may be submitted as an addendum to the indicated report. Criteria may be achieved in a shorter period so as not to delay construction.

(3) Prepare samples to 95 percent of maximum dry density in accordance with Note 1, with moisture contents at optimum, optimum plus 2 percent, and optimum minus 2 percent.

(4) Mold a minimum of three cylinders of each stabilized material blend, at each moisture content, in accordance with ASTM D 1632, except that test specimen molds shall be 4 inches in diameter by 4.6 inches high. Cure and test specimens in accordance with ASTM D 1633 with the following exceptions: 1) cure specimens in a moist room at 100 percent humidity, and 2) after curing, cap specimens and immerse in water at room temperature for a period of 4 hours prior to testing.

(5) Test only the uppermost layer of subbase during field demonstration only.

(6) For base course only.

(7) The Toxicity Equivalent (TEQ) concentration of the Synthetic Precipitation Leaching Procedure (SPLP) extract should be less than the Mississippi Department of Environmental Quality Tier 1 Target Risk Goal and EPA MCL of 30 picograms per liter (pg/L).

(8) Dioxin testing on SPLP extract.

(9) For each sample analyzed for dioxins, the laboratory shall report dioxin TEQ concentrations in accordance with EPA 625/3-89/016.

1.5.1 Disposal of Stabilized Material Blend

The stabilized material blend, upon meeting the physical and chemical testing criteria, shall be consolidated beneath the RCC pavement limits as indicated.

1.5.2 Emission Controls

For visible dust (2 mg/m^3), employ dust suppression (area wetting) methods when handling dry materials which have a tendency to become airborne to minimize overexposure to the primary contaminant of concern (dioxins).

1.5.3 Noise Control

The S/S system shall not exceed 85 decibels at any site boundary.

1.6 QUALIFICATIONS

1.6.1 Contractor Experience

The Contractor shall have successfully completed at least 5 S/S projects of comparable size and scope in accordance with local, state, and federal requirements using the proposed system or a similar system.

1.6.2 Key Personnel

Key personnel shall have a minimum of 3 years of S/S field experience. Key personnel shall include system operators, quality control personnel, and supervisory engineering and technical staff involved with the S/S system operation.

1.7 PROJECT/SITE CONDITIONS

The physical conditions indicated on the drawings and in the specifications are the result of site investigations. While the site investigation data is representative of subsurface conditions at a specific location, variations in the materials are expected to exist.

1.8 REFERENCE REPORTS

The following reference reports and drawings are available for examination at the offices of the Contracting Officer and are intended only to show the existing site conditions. The reports and drawings are the property of the Government and shall not be used for any purpose other than that intended by the specification.

a. Ash and Ground-water Sampling and Analysis Plan, Delisting Petition Support, NCBC Gulfport, Mississippi, EG&G Idaho, Inc. Versar Inc., October 1991.

b. Letter Report, Interim Removal Action - 28th Street Road Construction, NCBC Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. ABB Environmental Services, Inc., September 1995.

c. Soil and Sediment Dioxin Triplicate Study, NCBC Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. ABB Environmental Services, Inc., February 1996.

d. Results of Community Survey and Exposure Assessment, NCBC Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. ABB Environmental Services, Inc., May 1997.

e. Addendum to Delisting Petition 0759, Area A, Former Herbicide Orange Storage Area, NCBC Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. ABB Environmental Services, Inc., August 1997.

f. Phase I Summary Report for Onsite and Off-site Delineation Activities, NCBC Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. ABB Environmental Services, Inc., January 1998.

g. Onsite Interim Corrective Measures Report, NCBC Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. ABB Environmental Services, Inc., April 1998.

h. Surface Water and Sediment Dioxin Delineation, NCBC, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. ABB Environmental Services, Inc., June 1999.

i. Groundwater Monitoring Report NCBC, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. Harding Lawson Associates, December 1999.

j. Agreed Order Dioxin Delineation Studies, NCBC, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. ABB Environmental Services, Inc., 2000.

k. Remediation Planning Document NCBC, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. Harding Lawson Associates, August 2000.

l. Human Health Risk Assessment and Screening Level Ecological Risk Assessment of Dioxins and Furans Associated with Former Herbicide Orange Storage at NCBC, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. Harding Lawson Associates, March 2001.

m. Report for Bench-Scale Soil/Sediment Treatability Study, Site 8, Herbicide Orange Study Area, Naval Construction Battalion Center, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. Tetra Tech NUS, Inc., March 2001.

n. Pilot-Scale Soil/Sediment Treatability Study, Site 8, Herbicide Orange Storage Area at Naval Construction Battalion Center, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. Tetra Tech NUS, Inc., December 2001.

o. Draft Human Health Risk Assessment of Groundwater Associated with Site 8 Former Herbicide Orange Storage Area, Naval Construction Battalion Center, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. Tetra Tech NUS, Inc., February 2003.

p. Focused Feasibility Study, Site 8 Herbicide Orange Storage Area at Naval Construction Battalion Center, Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. Tetra Tech NUS, Inc., March 2003.

q. Draft Site Tier 3 Ecological Risk Evaluation, Steps 1 through 3, for Off-base Area of Contamination Associated with Site 8 - Herbicide Orange Storage Area at NCBC Gulfport, Mississippi, Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina. Tetra Tech NUS, Inc., June 2004.

1.9 EQUIPMENT

1.9.1 Mixing Equipment

The mixing equipment shall have the capacity, at a minimum, to meet performance and schedule requirements and shall be equipped with positive means for controlling the mix proportions, maintaining the time of mixing constant, and maintaining the appropriate speed of rotation of the mixer.

1.9.2 Stabilizing Agent Feed Units

Satisfactory means, incorporating weighing, metering or volumetric measurement shall be provided to separately batch the required amount of each stabilizing agent. Silos and feeders shall be equipped and operated so that no caking of material or variation in feed occurs. Provision shall be made so that each stabilizing agent can be easily sampled.

1.9.3 Accuracy of Measurement Equipment

Scales, meters, and volumetric measuring devices used for measuring soil ash, contaminated sediment, and incidental soil for S/S processing shall be accurate to plus or minus 5 percent of the quantity being measured and, reagents, Portland cement, fly ash and pozzolan and water for S/S processing shall be accurate to plus or minus 0.1 percent of the quantity being measured. A check of calibration of measuring equipment shall be performed once every 5 working days.

1.10 MIX DESIGN

The Contractor shall select a mix design which meets the performance criteria listed in Table 2 for use during full-scale treatment. Contractor shall prepare a Treatability Study Work Plan including bench-scale treatability study and S/S Work Plan. Mix design shall be performed in accordance with, but not limited to TM 5-822-14. Bench-scale and pilot-scale treatability studies were performed on the soil ash and contaminated sediment. Results of these studies are available for examination at the offices of the Contracting Officer for information only.

1.11 DELIVERY AND STORAGE

1.11.1 Cement

Store cement immediately upon receipt. Store cement in bags on pallets in an airtight and weatherproof structure. Elevate pallets above surface a distance sufficient to prevent the absorption of moisture. Stack bags close together to reduce circulation of air, but do not stack against outside walls. The manner of storage shall permit easy access for inspection and identification of each shipment. Transfer bulk cement to elevated airtight and weatherproof bins. Cement shall be free-flowing and free of lumps. Test cement that has been in storage longer than 6 months by standard mortar tests or loss on ignition test and use such cement only with approval of the Contracting Officer. Show the date of receipt of shipment on each bag of cement.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Water

Water shall not contain concentrations of oil, acid, salt, alkali, organic matter, or other deleterious substances which will be detrimental to the successful execution of the S/S treatment process. Potable water shall be used where available. The Government may require the Contractor to perform chemical analyses on representative water samples if the water appears to be of questionable quality.

2.1.2 Stabilizing Agents

2.1.2.1 Reagents

The chemical composition of reagents used shall be provided to the Government. A certificate of analysis supplied by the vendor shall accompany each shipping unit of reagent. Reagents shall be shipped in properly labeled containers with instructions for handling and storage. The instructions shall be strictly adhered to.

2.1.2.2 Cement

ASTM C 150, Type I or Type II. Low-alkali cement shall be furnished for all types. Use one manufacturer for each type of cement. A certificate of analysis supplied by the vendor shall accompany each shipping unit of cement.

2.1.2.3 Fly Ash and Pozzolan

ASTM C 618, Type C or F. Add with cement. The pozzolan or fly ash content shall not replace more than 25 percent by weight of the cement. Use one manufacturer for each type of fly ash and pozzolan. A certificate of analysis supplied by the vendor shall accompany each shipping unit of fly ash or pozzolan.

2.1.3 Colorant

ASTM C 979. Pure mineral type, color-resistant to alkalis, nonfading. Color as required to produce material visually distinct from the roller compacted concrete (RCC) pavement.

2.2 CURING MATERIALS

2.2.1 Burlap

FS CCC-C-467.

2.2.2 Polyethylene-Coated Burlap

White, opaque, 4 mil thick film, impregnated into, extruded on, or permanently affixed to surface of one side of burlap weighing not less than 9 ounces per square yard prior to coating. Water retention requirements shall be in accordance with ASTM C 171.

PART 3 EXECUTION

3.1 BENCH-SCALE TREATABILITY STUDY

Prior to field demonstration, a bench-scale treatability study shall be performed. The study shall include detailed information on testing requirements, test methods, and detection limits and shall include the following:

a. Estimation/verification of soil ash, contaminated on-base sediments, and contaminated off-base AOC sediments quantities to be excavated, as well as quantities of incidental soil resulting from over-excavation and size-reduced vegetative material.

b. Determination of soil ash, contaminated on-base sediments, contaminated off-base AOC sediments, incidental soil resulting from over-excavation, and size-reduced vegetative material blend proportions to be treated.

c. Preparation of material blend using sediment with the highest expected contamination. Split sample for Table 1 and Table 2 testing.

d. Perform pre-treatment testing on material blend as listed on Table 1.

e. Determination of mix ratio of material blend, binders, additives, stabilizing agents, and mix water to satisfy the post-treatment criteria of Table 2.

f. Sensitivity analysis of mix design consisting of, but not limited to, varying the percentage of sediment, moisture content, binders, additives, and stabilizing agents.

g. Determination of the field mix to be used for field demonstration and full-scale stabilized material blend taking into consideration consistency and variations in feeds of soil ash, sediment, binders, additives, stabilizing agents, and water to assure the field mix design satisfies the post-treatment criteria in Table 2.

Provide a detailed Bench-Scale Treatability Study Report including all results.

3.2 STOCKPILES

Stockpiles shall be constructed for storing soil ash, contaminated sediment, incidental soil and vegetative material prior to treatment. Stockpiles shall be constructed to include:

a. For stockpiles located outside of the area to be capped, a geomembrane liner with a minimum thickness of 40 mils. The geomembrane shall be protected from vehicles by a minimum 16 ounce/square yard geotextile and a traffic surface layer consisting of gravel, concrete, or other material which will not damage the geomembrane. The ground surface on which the geomembrane is placed shall be smooth and free of rocks greater than 0.5 inches in diameter or any other object that could damage the geomembrane.

b. For stockpiles located outside of the area to be capped, the geomembrane liner shall be sloped to a low point to allow leachate to be collected. Leachate collected from the stockpile shall be analyzed and, if necessary, treated to meet applicable local, state, and federal regulations. Leachate collected from the stockpile may be used in the S/S process provided the treated material to which the leachate was added meets the physical and chemical post-treatment test criteria.

c. For all stockpiles, a geomembrane cover with a minimum thickness of 10 mils to prevent precipitation from entering the stockpile.

d. For all stockpiles, berms surrounding the stockpile that are a minimum of 12 inches in height.

3.3 OPERATION

3.3.1 Weather Conditions

Stabilization shall not take place in an ambient temperature below 40 degrees F without approval. Provisions shall be made to maintain the temperature of the stabilized material blend and treated subgrade material above freezing while curing. Soil ash, contaminated sediments, incidental soil, and vegetative material shall not be treated if it contains any frozen material. The temperature of the stabilized material blend immediately after treatment shall not exceed 90 degrees F without approval. Stabilization shall not be performed during periods of heavy rainfall if this will result in the addition of excess water to the mixture.

3.3.1.1 Ice

Ice may be used as part of the mixing water provided the ice is completely melted by the time mixing is complete. The amount of water and ice shall not exceed the total requirements for the mixing water.

3.3.2 Dissimilar Materials

Dissimilar materials that testing has indicated need different mix ratios, shall not be mixed together.

3.3.3 Oversize Material

Material blend components that exceed the maximum allowable particle size of the mixing unit and that are amenable to treatment shall be reduced to a size that the mixing unit can accept. Oversized material blend components

that cannot be reduced to an allowable size for the unit shall be characterized and transported to an off-site disposal facility. Removed oversized material may be disposed at an approved Subtitle D landfill provided characterization testing demonstrates that the material is nonhazardous. Oversized material found to be hazardous shall be disposed in accordance with applicable local, state, and federal regulations.

3.3.4 Vegetative Matter

Vegetative matter that exceeds the maximum allowable particle size of the mixing unit shall either be reduced to a size that the mixing unit can accept or the removed vegetative matter shall be disposed at an approved TSD facility in accordance with applicable local, state, and federal regulations. Removed vegetative matter may be disposed at an approved Subtitle D landfill provided characterization testing demonstrates that the material is nonhazardous. Vegetative matter found to be hazardous shall be disposed in accordance with applicable local, state, and federal regulations.

3.4 FIELD DEMONSTRATION

At least 20 days but not more than 60 days prior to full-scale construction of the base course and subbase, a test section shall be constructed as indicated. The Contractor shall notify the Contracting Officer at least 5 days in advance of the date of test section construction. The test section shall consist of not less than 3,000 cubic yards of stabilized material blend placed and compacted in two subbase lifts and one base course lift. Leave 1/3 of subbase area exposed (i.e., not covered by base course) to allow ASTM D 1196 testing. The width of each paving lane, thickness of subbase lifts and base course lifts, and mixture proportions shall be the same as those proposed for use in the project. The test section shall develop and demonstrate, to the satisfaction of the Contracting Officer, the proposed techniques of mixing, hauling, placing, compacting, finishing and curing. Additionally, the Contractor shall demonstrate the laydown method and rate and rolling pattern, start-up and finishing procedures, testing methods, and plant operations. Compaction equipment type will be selected by the Contractor. Variable amplitudes of the roller shall be used as approved in different areas to identify the optimum amplitude. Initial mixture proportions shall be based on the quantity of each waste product and the results of the Bench-Scale Treatability Study. The mixture shall be tested in accordance with Table 1. Variations in mixture proportions other than water may be made subject to the approval of the Contracting Officer. The test section shall be placed in portions subject to the approval of the Contracting Officer. The Contractor shall vary the water content, as necessary, to arrive at the appropriate content. The mixing plant shall be operated and calibrated prior to placing the test section. The Contractor shall use the same equipment, materials, and construction techniques on the test section as will be used in all subsequent work. Stabilized material blend production, placing, compacting, and curing, and all testing shall be in accordance with applicable provisions of this section. The Contractor shall construct a test section acceptable to the Contracting Officer in all aspects. Failure to construct an acceptable test section will necessitate construction of additional test sections. Test sections unacceptable to the Contracting Officer shall be removed.

For both subbase and base course, determine optimum number of passes with vibratory roller to achieve maximum density in accordance with TM 5-822-7 Appendix D-7b procedure unless otherwise noted. Field dry density and

moisture content shall be determined at 2-inch depth intervals for full depth of individual lifts in accordance with ASTM D 2922 and ASTM D 3017. Repeat vibratory roller compaction and subsequent field density testing until there is less than a 1 percent change in successive density readings at full depth of lift. Four complete vibratory passes minimum unless field density data is used in conjunction with laboratory density data to determine the minimum number of passes required to meet the minimum dry density specified in the paragraph entitled "Compaction" subject to Contracting Officer approval.

After determination of optimum number of passes, determine correlation between laboratory dry density, field ASTM D 2922 dry density and core dry density in accordance with TM 5-822-7 Appendix D-7c procedure unless except otherwise noted. Determine correlation between 10 minimum field ASTM D 2922 density locations and density obtained by weighing in air and water two minimum core samples obtained within a 1- to 3-foot radius from the hole after 7 days of curing or by ASTM D 1556 and ASTM D 2216. Obtain core samples or perform ASTM D 1556 on either side of the corresponding nuclear gage holes. All holes left in the stabilized material blend as a result of nuclear density testing or coring shall be filled with compacted stabilized material blend.

Determine correlation between compressive strength, weight loss after wet-dry cycles, and density at two locations. For base course, total of nine 4-inch diameter by 4.6-inch cores at each location (three compressive strength ASTM D 1633 samples after 7 days, three compressive strength ASTM D 1633 samples after 90 days of curing and three wet-dry ASTM D 559 samples). For subbase, total of eight 4-inch diameter by 4.6-inch cores at each location (three compressive strength ASTM D 1633 samples and one dioxin test sample after 7 days and three compressive strength ASTM D 1633 samples and one dioxin test sample after 90 days of curing). ASTM D 1633, ASTM D 559, and dioxin samples at locations within a 1- to 3-foot radius from the nuclear gage holes. Refilling of core holes shall be performed with compacted stabilized material blend.

3.4.1 Full-Scale Processing Equipment

The full-scale processing equipment shall be used for the field demonstration. Stabilizing agents, mix ratios, mixing procedures, lift thickness, and compaction methods (i.e., equipment, coverage, speed of travel) used during the field demonstration shall be documented.

3.4.2 Sampling Locations

Soil ash, contaminated sediment, incidental soil and vegetative materials used for the field demonstration shall be obtained from within the limits of disturbance. Prior to performing the field demonstration, contaminated sediment to be used for the field demonstration shall be tested to verify it contains the following minimum levels of contamination:

on-base sediment: 500 ng/Kg
off-base sediment: 250 ng/Kg

3.4.3 Testing

Testing shall be performed to verify that the stabilized material blend from the field demonstration meets the specified physical and chemical criteria. If the stabilized material blend produced during the field demonstration does not pass the testing requirements, an equal quantity of

the same type of material which failed shall be treated using a new mix design or procedure.

3.4.4 Volume Increase

The estimated increase in volume resulting from treatment shall be determined and reported with the field demonstration test results. Volume increase shall be determined by comparing the weight, water content, wet and dry density and volume of each material blend component to the weight, water content, wet and dry density and volume of stabilized material blend both by calculation and by field measurements.

3.4.5 Field Demonstration Test Results

After completion of the field demonstration, material blend may continue to be processed. However, if test results from the field demonstration do not pass the criteria listed in Table 1, the material blend treated with the failing mix design shall be reprocessed with a working mix design.

3.5 SUBGRADE PREPARATION

Site 8A native soil subgrade shall be proof-rolled after removal of soil ash and contaminated sediment with 600 percent coverage of a rubber-tired roller with large size tires with pressures of 40 to 50 psi.

Proof-rolled areas within Site 8A limits that show evidence of movement, rutting or shoving as determined by the Contracting Officer; historic drainage ditches; and abandoned culverts shall be dewatered, modified with a minimum of 7 percent Portland cement by weight to a minimum depth of 1-foot, and compacted to achieve 95 percent ASTM D 1557 maximum dry density or structural fill placed and compacted in accordance with Section 02315N, "Excavation and Fill."

3.6 STORAGE AREA REPAIR

The Portland cement stabilized native soil ground surface shall be modified with 20 percent Portland cement by weight to a minimum depth of 1-foot and compacted in areas that have deteriorated as determined by the Contracting Officer.

3.7 MIXING AND PLACING OF FULL SCALE OPERATIONS

3.7.1 Mixing

Mix stabilizing agents and material blend following mixing procedure established in the S/S Work Plan as modified by the field demonstration. Proportion stabilizing agents by weight in accordance with bench-scale treatability study and field demonstration. Provide necessary moisture content for specified compaction by addition of water by weight or by volume. Mixing operations shall produce uniform color and the method of discharging shall not produce segregation.

3.7.2 Placing

Compacted thickness of individual layers shall not exceed thickness as established by the field demonstration. For stabilized material blend, not more than 60 minutes shall elapse between start of moist mixing and start of compaction of treated layer. For other stabilizers, time interval shall be as established by the S/S Work Plan as modified by the field

demonstration. Layers are to be uniform in thickness.

3.7.3 Compaction

With the exception of materials placed by ex-situ method, thoroughly loosen material blend to full depth by disks or scarifiers and determine moisture content of material blend and compare with laboratory optimum moisture content. Begin material blend compaction when moisture content is within plus or minus 2 percentage points of optimum moisture content. Compact layers of base and subbase material blend using the compaction methods (i.e., equipment, coverage, speed of travel) as established by the field demonstration. Continue compaction until layer or layers are compacted through full depth. Begin rolling at outside edge of a minimum one half the width of the roller. Subsequent rolled strips shall be slightly different lengths. In places not accessible to rolling equipment, compact the material by mechanical tamping. Continue blading, rolling and tamping until surface is smooth and free from waves and irregularities. Determine in-place density of compacted stabilized material blend in accordance with ASTM D 2922 with minimum compaction of 95 percent of maximum density in accordance with ASTM D 1557. Scarify between lifts of subbase.

3.7.4 Construction Joints

At the end of each work day, form a straight transverse construction joint by cutting back into completed work to form a true vertical face free of loose or shattered material. Remove improperly compacted material along construction joints and replace with stabilized material blend that is mixed, moistened, and compacted in accordance with this specification.

3.8 FINISHING OF BASE COURSE

3.8.1 Finishing

After compaction, moisten surface if necessary, and shape to required lines, grades and cross section. Lightly scarify surface to eliminate imprints made by the compacting or shaping equipment. Thoroughly compact surface to specified density with rubber-tired rollers and smooth-wheel tandem rollers to provide a smooth, dense, uniform surface free of surface checking, ridges or loose material and conforming to crown, grade and line indicated. Complete finishing operations within 2 hours after completion of mixing operations. In places not accessible to finishing and shaping equipment, compact mixture with mechanical tampers to density specified; shape and finish by hand methods. Reprocess with additional cement, the portion of the compacted mix with density less than that specified, or that has not properly hardened, or that is improperly finished.

3.8.2 Edges of Stabilized Course

Place stabilized material blend along edges of the base course in a quantity that will compact to thickness of course being constructed. Allow in each operation, a minimum width of one foot of the shoulder to be rolled and compacted simultaneously with each layer of the stabilized base course.

3.8.3 Thickness Control

Where average measured thickness of base course is more than 1/2 inch deficient in thickness, conduct additional tests and correct deficiencies as directed by the Contracting Officer. Correct excesses in thickness if so directed by the Contracting Officer. Average job thickness is the

average of the job measurements determined as specified in paragraph entitled "Thickness Test," in this section, but within 1/2 inch of the thickness indicated. Replace material removed for test holes or for deficient thickness reconstruction and compact with new stabilized material blend.

3.9 CURING AND PROTECTION OF BASE COURSE

3.9.1 Curing, Protection and Cover

Immediately after completion of finishing operations, but no later than the end of each days stabilization work, protect the surface against rapid drying for seven days by one of the methods specified. In addition, protect the stabilized area from freezing during the curing period or until hardened, whichever period is longer.

3.9.2 Burlap or Cotton Mats

Burlap covers consisting of two or more layers of burlap having a minimum combined weight of 14 ounces per square yard in a dry condition. Burlap may be either new or have been used only for curing concrete. Cotton mats and burlap strips shall have a length, after shrinkage, at least one foot greater than required to cover the entire width and edges of finished stabilized area. Mats shall overlap each other at least 6 inches. Thoroughly wet mats before placing and keep them continuously wet and in intimate contact with surface and edges of finished stabilized area during entire curing period.

3.10 MAINTENANCE AND TRAFFIC CONTROL

3.10.1 Maintenance

After stabilization is completed, maintain base course and subbase except where succeeding course is under construction. Maintenance shall include drainage and watering as required to maintain course in proper condition. Correct deficiencies in thickness, composition, construction, smoothness or density which develop during maintenance to conform to requirements specified. Maintain surface moisture by lightly sprinkling with water to prevent dust.

3.10.2 Traffic Control

Completed portions of the base course may be opened to light traffic provided the curing process is not impaired and to other traffic after curing period has elapsed, provided that the base course has hardened sufficiently to prevent surface marring or distortion by equipment or traffic. Do not permit heavy equipment on the area during protection and curing periods. Necessary stabilizing agent and water may be hauled over the area with pneumatic-tired equipment if approved by the Contracting Officer. Protect finished portions of base course and subbase from traffic of equipment used in constructing adjoining sections in a manner to prevent marring or damaging completed work.

3.11 SAFETY REQUIREMENTS

In addition to Safety Requirements contained within the Contract Clauses; prevent employee respiratory, eye or skin contact with stabilizing agents during wet or dry mixing. Provide and require employee to use and dispose or clean the following in accordance with the pertinent provisions of NIOSH

81-123:

a. Impervious: Clothing, boots and gloves.

b. Splash-proof safety goggles and face shields.

c. Respiratory protection equipment.

3.12 QUALITY CONTROL PROCEDURES

3.12.1 Batch Proportions

Mixing time, mixing speed, and amounts of material blend, reagents, cement, fly ash, and pozzolan and water added to each batch shall be recorded. Mixing time, mixing speed, and batch proportions shall be maintained within the limits specified in the approved S/S Work Plan and as modified during the field demonstration.

3.12.2 Segregation

Stabilized material blend shall be placed directly into the permanent storage site after treatment. Stabilized material blend shall be placed such that the material from specific batches/runs can be defined and removed if it fails post-treatment testing.

3.12.3 Uniformity of Mixing

For ex-situ mixing, uniformity of mixing shall be continuously visually inspected. For in-situ mixing, a visual inspection shall be performed for uniformity of the mixture throughout the treated depth and width; after mixing, a longitudinal trench, minimum of 10 feet long, shall be dug once per acre per lift to the depth of one lift and visually inspected. A mix shall exhibit a uniform color throughout.

3.12.4 Retesting and Reprocessing

Retesting and reprocessing shall be performed for stabilized material blend that does not meet the physical and chemical requirements listed in Table 2.

3.12.4.1 Retesting

Any batch or lift that fails post-treatment quality control or quality assurance testing shall be retested or reprocessed. If the Contractor elects to retest the batch or lift, two additional samples shall be collected and tested for the failed parameter. If both tests pass, reprocessing of the batch or lift will not be required. If either sample fails, the batch or lift shall be reprocessed.

3.12.4.2 Reprocessing

If the Contractor reprocesses a batch or lift of material, the batch or lift shall be sampled and tested as described in the paragraph entitled "Field Sampling and Testing" after reprocessing.

3.12.5 Adjustments to Mix Design

Subject to approval, the mix design may be adjusted based on the characteristics of the material being treated. An additional field demonstration may be required by the Contracting Officer prior to

implementation of the new mix design.

3.13 FIELD SAMPLING AND TESTING OF FULL SCALE OPERATIONS

In addition to provisions set forth elsewhere in this contract, specified sampling and testing shall be conducted by an approved laboratory. Provide duplicate samples to the Contracting Officer on the average of one set of samples per 10 sets of quality control tests performed. Take duplicate samples at the same time and in the same manner as the original. The Contracting Officer may also require additional quality assurance tests due to changes in the mix design or physical appearance of the material blend components.

3.13.1 Sampling

3.13.1.1 Material Blend

Collect samples by taking three incremental specimens at random from source material to make a proportional composite sample of material blend components of a minimum of 150 pounds. Thereafter, during the course of the project, take one random sample from each 7000 tons of material blend. Take the samples at random to make a composite sample of not less than 50 pounds. Repeat the sampling when source of material is changed or when unacceptable deficiencies or variations from specified grading of materials are found in testing.

3.13.1.2 Stabilized Material Blend

Sample the stabilized material blend after stabilizing agent and water have been added and mixed into the material blend and prior to field compaction. Compact moist sample using ASTM D 1557 compaction effort within 60 minutes. Place compacted samples in closed and insulated container and promptly transport to the laboratory.

3.13.1.3 Sample Identification

Place each sample in a clean container and securely close. Identify each sample with a tag containing the following information:

Contract No.:

Sample No.: Quantity:

Date of Sample:

Sampler:

Source:

Intended Use:

For Testing:

3.13.2 Testing

3.13.2.1 Material Blend Testing

Perform the following tests on each sample of the material blend:

a. Sieve analysis of combined material: ASTM C 136 and ASTM D 1140.

b. Liquid limit: ASTM D 4318.

c. Plasticity index: ASTM D 4318.

Perform compressive tests and laboratory moisture-density tests on stabilized material blend once every 10,000 cubic yards and when there is a change of blended materials.

3.13.2.2 Compressive Tests

Test sample of stabilized material blend for compressive strength. Cure and test specimens in accordance with Table 2. Test specimens for compressive strength at 7 and 90 days. Test results shall comply with Table 2.

3.13.2.3 Smoothness Test

Test compacted base course surface continuously with a 10 foot straightedge applied parallel with, and at right angles to center line of paved area, and correct deviations in excess of 1/2 inch.

3.13.2.4 Thickness Test

Measure thickness of the base course using 3 inch diameter test holes through the full depth for each 1000 square yards of completed base course. Refill holes with cement treated material and compact.

3.13.2.5 Field Moisture-Density Tests

Perform one field density test and moisture content for each 2000 square yards for each lift of stabilized material blend placed using ASTM D 2922 and ASTM D 3017, and once per 10,000 square yards using ASTM D 1556 and ASTM D 2216. Test results shall comply with Table 2.

3.13.2.6 Laboratory Moisture-Density Test

Determine optimum moisture content and maximum density relationship in accordance with Table 2.

3.13.2.7 SPLP Test

EPA SW-846 Method 1312 shall be performed on representative samples of stabilized material blend. Samples shall be collected immediately after mixing. Compact moist sample using ASTM D 1557 compaction effort within 60 minutes. Take samples at random once per 5,000 cubic yards. Test method and results shall comply with Table 2.

-- End of Section --

SECTION 02220

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6	(1990; R 1998) Safety Requirements for Demolition Operations

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 4 (EPA, R4)

EPA, R4 EISOPQAM	(2001) Environmental Investigations Standard Operating Procedures and Quality Assurance Manual

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations.Store materials that cannot be removed (disposed or salvaged) daily in areas specified by the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with standard Navy submittal procedures and the Contract.

SD-06 Test Reports

Analytical Results

SD-07 Certificates

Demolition plan; G OIC

Notifications; G OIC

Submit proposed salvage, demolition and removal procedures to the Contracting Officer for approval before work is started.

SD-11 Closeout Submittals

Well abandonment report; G OIC

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform with ANSI A10.6.

1.4.1 Notifications

Furnish timely notification of demolition projects to Federal, State, regional, and local authorities as required. Notify the Contracting Officer in writing 10 working days prior to the commencement of work.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Work

Protect existing work which is to remain in place, be reused, or remain the property of the Government. Repair items which are to remain, and which are damaged during performance of the work to their original condition, or replace with new. Do not overload structural elements that will remain. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.6.3 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.

1.7 BURNING

Burning will not be permitted.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Contracting Officer.

1.9 Required Data

1.9.1 Demolition Plan

The demolition plan shall include procedures for removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.9.2 Analytical Results

Submit reports from Toxic Characteristic Leaching Procedure (TCLP) tests of composite debris.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Structures

Remove existing structures (metal pavilion) as indicated.

3.1.2 Fencing

Remove existing fence, fence post, and accessories as indicated.

3.1.3 Culverts

Remove culvert sections as indicated. Clean culvert sections to ensure removal of all sediment prior to transporting offsite for salvage or disposal as directed by the Contracting Officer.

3.1.4 Well Abandonment

Monitoring wells are to be abandoned as indicated and in accordance with EPA, R4 EISOPQAM.

3.1.5 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and

shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.2.2 Reuse of Materials and Equipment

Remove and store materials and equipment to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.2.3 Salvaged Materials and Equipment

Remove materials and equipment that are indicated to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as directed by the Contracting Officer.

Contractor shall salvage the chain link fabric, top, bottom and cross rails, barbed wire, supports, and frames as directed by the Contracting Officer.

3.2.4 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed offsite at an approved disposal facility.

3.3 CLEANUP

3.3.1 Debris and Rubbish

Remove and transport debris and rubbish in a manner that will prevent spillage on pavements, streets or adjacent areas.

-- End of Section --

SECTION 02315N

EXCAVATION AND FILL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	(2000a) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))
ASTM D 1140	(2000) Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(1996) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846	(1986) Evaluating Solid Waste (Physical/Chemical Methods)
EPA 600/4-79/020	(1983) Methods for the Chemical Analysis of Water and Wastes

STATE HIGHWAY SPECIFICATIONS (SHS)

SHS MSHD	(2004) Mississippi Transportation Commission, Standard Specifications for Road and Bridge Construction

1.2 DEFINITIONS

1.2.1 Regulatory Requirements

Provide work and materials in accordance with applicable requirements of SHS MSHD. Paragraphs in SHS MSHD entitled "Measure of Payment", "Payment Adjustment System", and "Reference System" shall not apply.

1.2.2 Modification of Reference

Where term "Engineer" is used in SHS MSHD it shall be construed to mean Contracting Officer. Where term "Department" is used, it shall mean Government.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with standard Navy submittal procedures and the Contract.

SD-01 Preconstruction Submittals

Excavation and Handling Work Plan

SD-06 Test Reports

Borrow Site Testing; G A/E

Common fill test

Structural fill test

Density tests

1.3.1 Excavation and Handling Work Plan

Provide within 10 days of notice to proceed, and before procurement, fabrication, or mobilization. No work at the site, with the exception of site inspection, clearing and grubbing, and surveys, shall be performed until this Work Plan is approved. Allow 10 days in the schedule for the Government's review.

a. Schedule of activities.

b. Method of excavation, equipment to be used, and detailed sequence.

c. Method of compaction and equipment to be used.

d. Storage methods and locations for liquid and solid contaminated material.

e. Decontamination procedures.

f. Spill contingency plan.

g. Excavation dewatering work plan.

h. Dewatering of excavated contaminated sediments for mixing and stabilization.

i. Method for constructing temporary access road and associated drainage features in off-base AOC.

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Ground water elevations indicated by the boring log and groundwater monitoring well installation logs were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction. Logs are provided in Appendix A of the Basis of Design Report. Drawing elevations reference NAVD88.

d. Stabilized soil will be encountered over approximately 1/3 of the Site 8A surface area. The stabilized soil is found on the existing surface and below the piles of soil ash.

e. Blasting will not be permitted. Remove material in an approved manner.

1.6 REQUIREMENTS FOR OFF SITE SOIL

Soils brought in from off site for use as backfill shall be tested for total petroleum hydrocarbons (TPH), benzene, toluene, ethyl benzene, and xylene (BTEX), and full toxicity characteristic leaching procedures (TCLP) including ignitability, corrosivity and reactivity. Backfill shall contain less than 50 parts per million (ppm) of TPH and less than 1 ppm of the sum of BTEX and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846 Method 5030/8020. TCLP shall be performed in accordance with EPA SW-846 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Material shall not be brought on site until test results have been approved by the Contracting Officer.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and frozen, deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.1 Common Fill

ASTM D 2487, classification GW, GP, GM, GC, SW, SP, SM, or SC with a maximum ASTM D 4318 liquid limit of 35, maximum ASTM D 4318 plasticity index of 12, and a maximum of 25 percent by weight passing ASTM D 1140, No. 200 sieve.

2.1.2 Structural Fill

ASTM D 2487, classification SM, SC or ML with a maximum particle size of 3 inches.

2.1.3 Topsoil

Provide as specified in Section 02953, "Mitigated Wetlands Area, Trees, Herbs, and Grass."

2.1.4 Subbase Material

Provide in accordance with Section 02160A, "Solidification/Stabilization (S/S) of Contaminated Material."

2.1.5 Base Course Material

Provide in accordance with Section 02160A, "Solidification/Stabilization (S/S) of Contaminated Material."

2.1.6 Roller Compacted Concrete Pavement Material

Provide in accordance with Section 02755A, "Roller Compacted Concrete (RCC) Pavement."

2.2 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property.

2.3 MATERIAL FOR RIP-RAP

2.3.1 Geotextile

SHS MSHD, Section 714.13.5, "Geotextile for Use Under Riprap", Type V geotextile.

2.3.2 Rock

Rock fragments sufficiently durable to ensure permanence in the structure Rock conforming to SHS MSHD, Section 705.04, "Stone Riprap" composed of a well-graded mixture such that 50 percent of the mixture by weight shall be larger than the d_{50} size indicated. A well-graded mixture as used herein

is defined as a mixture composed primarily of the large stone sizes but with a sufficient mixture of other sizes to fill the progressively smaller voids between the stone. The diameter of the largest stone size shall be 1.5 times the d_{50} size. Based on rip-rap gradation available in the area, the Contractor shall select the size or sizes which equal or exceed the specified d_{50} size.

2.4 BEDDING MATERIAL

SHS MSHD, Section 603.03.2, "Bedding", Class B bedding.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, and brush within the area of construction. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface unless otherwise indicated. Chip and handle grubbed materials as indicated subject to the approval of the Contracting Officer.

3.1.2 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

3.1.2.1 Proof Rolling

Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Proof roll the Site 8A subgrade after soil ash stockpile removal, prior to placement of structural fill and prior to solidification/stabilization of material blend with a 40,000 pound (minimum) track type tractor with a minimum ground contact pressure of 8 psi. Operate the equipment in a systematic manner to ensure 150 percent coverage is provide over all areas, and at speeds between 2 1/2 to 3 1/2 miles per hour. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer. Rutting or pumping of material shall be undercut as directed by the Contracting Officer and replaced with structural fill.

3.2 PROTECTION

3.2.1 Protection Systems

Provide shoring, bracing, and sheeting in accordance with EM 385-1-1.

3.2.2 Drainage and Dewatering

Provide for the collection, treatment, and disposal when required of surface and subsurface water encountered during construction. Submit a dewatering work plan as part of the Excavation and Fill Work Plan. On-site treatment, when required, shall be the preferred method if economics prove on-site treatment is more cost effective than off-site disposal.

3.2.2.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.2.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval by the Contracting Officer, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in-situ material. While the excavation is open, the water level shall be maintained continuously, at least one feet below the working level or to a depth required to provide a safe excavation, stable working surface, and stable side slopes.

Operate dewatering system continuously until construction work below existing water levels is complete. All water shall be containerized and tested to determine proper disposal requirements.

3.2.3 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall contact the Contracting Officer to arrange for location of station utilities. The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

3.2.4 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils

softened or made unsuitable for subsequent construction due to exposure to weather. Refill with structural fill material and compact to 95 percent of ASTM D 698 maximum density unless indicated otherwise. Unless specified otherwise, refill excavations cut below indicated depth with structural fill material and compact to 95 percent of ASTM D 698 maximum density unless indicated otherwise.

3.3.1 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement.

3.4 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

3.4.1 Common Fill Placement

Provide for general site as indicated. Place in 8 inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

3.4.2 Structural Fill Placement

Place in 6 inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

3.4.3 Subbase Material Placement

Place subbase material where indicated in accordance with Section 02160A, "Solidification/Stabilization (S/S) of Contaminated Material."

3.4.4 Base Course Placement

Place subbase material where indicated in accordance with Section 02160A, "Solidification/Stabilization (S/S) of Contaminated Material."

3.4.5 Roller Compacted Concrete

Place roller compacted concrete where indicated in accordance with Section 02755A, "Roller Compacted Concrete (RCC) Pavement."

3.4.6 Trench Backfilling

Backfill with structural fill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under paved areas in 6 inch lifts to subgrade and in 6 inch lifts to one foot over pipe outside structures and paved areas.

3.4.6.1 Bedding Requirements

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with SHS MSHD, Class B, except as specified herein.

3.5 OFF-SITE DISPOSAL

3.5.1 Materials and Equipment

The Contractor shall furnish all labor, materials, and equipment necessary to transport and dispose of Government and Contractor generated wastes in accordance with applicable federal, state, and local requirements.

3.5.2 Sampling Liquid

Liquid collected from excavations, storage areas and decontamination facilities shall be sampled at a frequency as required by the treatment, storage and disposal (TSD) facility if disposed off-site. On-site treatment shall be the preferred method if economics prove on-site treatment is more cost effective than off-site disposal. Analyses for contaminated liquid to be taken to an off-site TSD facility shall conform to local, state, and federal criteria as well as to the requirements of the TSD facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analysis to the extent required by the approved off-site TSD facility receiving the material shall be the responsibility of the Contractor and shall be subject to approval by the Contracting Officer.

3.5.3 Records

The Contractor shall originate, use, and maintain the waste shipment records/manifests as required by the Mississippi Department of Environmental Quality.

3.5.4 Decontamination

The Contractor shall be solely responsible for complying with all federal, state, and local requirements for decontamination of vehicles, equipment, and containers and shall bear all responsibility and cost for any noncompliance. In addition to those requirements, the Contractor shall perform the following.

a. Visually inspect all vehicles, equipment, and containers leaving the work site for proper decontamination.

b. Prepare and maintain a written decontamination log.

c. Decontamination log shall remain on site at all times for inspection purposes.

3.5.5 Transportation

The Contractor shall be solely responsible for complying with all federal, state, and local requirements for transporting contaminated materials through the applicable jurisdictions and shall bear all responsibility and cost for any noncompliance. In addition to those requirements, the Contractor shall perform the following:

a. Inspect and document all vehicles and containers for proper operation and covering.

b. Inspect all vehicles and containers for proper markings, manifest documents, and other requirements for waste shipment.

c. Perform and document decontamination procedures prior to leaving the worksite and again before leaving the disposal site.

3.5.6 Disposal

All contaminated materials removed from the site shall be disposed at a TSD facility permitted to accept such materials.

3.6 COMPACTION

Expressed as a percentage of maximum density.

3.6.1 General Site

Compact underneath areas designated for vegetation to 90 percent of ASTM D 698.

3.6.2 Trench and Bedding

Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density.

3.6.3 Wetland Restoration Areas

Compact common fill material with excavation equipment by "track-walking" 100 percent of the area or with bucket of the hydraulic excavator subject to the approval of the Contracting Officer.

3.7 FINISH OPERATIONS

3.7.1 Grading

Finish grades as indicated within one-tenth of one foot. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

3.7.2 Seed and Other Vegetation

Provide as specified in Section 02953, "Mitigated Wetlands Area, Trees, Herbs, and Grass."

3.7.3 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.8 DISPOSITION OF MATERIALS

Transport soil ash, contaminated sediments, and incidental soil and vegetation resulting from contaminated sediment excavation to the designated materials handling pad to be blended in accordance with Section 02160A, "Solidification/Stabilization (S/S) of Contaminated Material."

3.9 FIELD QUALITY CONTROL

3.9.1 Sampling

Take the number and size of samples required to perform the following tests.

3.9.2 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

3.9.2.1 Fill Material Testing

Test common fill and structural fill materials in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 4318 for liquid limit and for plastic limit; ASTM D 698 or ASTM D 1557 for moisture density relations, as applicable.

3.9.2.2 Density Tests

Test density in accordance with ASTM D 1556, or ASTM D 2922 and ASTM D 3017. When ASTM D 2922 and ASTM D 3017 density tests are used, verify density test results by performing an ASTM D 1556 density test at a location already ASTM D 2922 and ASTM D 3017 tested as specified herein. Perform an ASTM D 1556 density test at the start of the job, and for every 10 ASTM D 2922 and ASTM D 3017 density tests thereafter. Test each lift of common and structural fill at randomly selected locations every 2500 square feet. Density testing of topsoil and common fill within the off-base AOC is not required.

-- End of Section --

SECTION 02630N

STORM DRAINAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	(1988) Concrete Pipe Handbook
ACPA 01-103	(1995; Republished 1999) Concrete Pipe Installation Manual

ASTM INTERNATIONAL (ASTM)

ASTM C 76	(2002) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 150	(2002a) Portland Cement
ASTM C 443	(2002) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with standard Navy submittal procedures and the Contract.

SD-03 Product Data

Concrete piping including fittings and jointing materials

SD-04 Samples

Pipeline materials

SD-07 Certificates

Pipeline and fittings, including factory-applied linings and joint materials

Submit certificates attesting that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the frequency or intervals specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of

certificates on the same type, class, grade, and size of material as is being provided for the project.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

1.3.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.3.2 Handling

Handle pipe, fittings, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Carry, do not drag pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

2.1.1 Concrete Piping

2.1.1.1 Concrete Pipe and Fittings

Storm drainage pipe shall be reinforced concrete pipe conforming to ASTM C 76, Class III. Fittings and specials shall conform to the applicable requirements specified for the pipe and shall be of the same strength as the pipe. Cement used in manufacturing pipe and fittings shall be Type II low alkali cement conforming to ASTM C 150.

2.1.1.2 Jointing Materials for Concrete Piping

Gaskets and pipe ends for rubber gasket joint shall conform to ASTM C 443. Gaskets shall be suitable for use with sewage.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to pipeline installation except where specific exception is made under paragraph entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall be as indicated on the drawings.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02315N, "Excavation and Fill."

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; remove those found defective from site and replace with new. Provide proper facilities for lowering sections of pipe into place. Lay pipe with the bell ends in the upgrade direction. Adjust spigots in bells to produce a uniform space. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions any pipe or fitting that does not allow sufficient space for proper calking or installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.

3.1.2 Special Requirements

3.1.2.1 Installation of Concrete Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the provisions for rubber gasket jointing and jointing procedures of ACPA 01-103 or of ACPA 01-102, Chapter 9. Make joints with the gaskets previously specified for joints with this piping. Clean and dry surfaces receiving lubricants, cements, or adhesives. Affix gaskets to pipe not more than 24 hours prior to the installation of the pipe. Protect gaskets from sun, blowing dust, and other deleterious agents at all times. Before installation of the pipe, inspect gaskets and remove and replace loose or improperly affixed gaskets. Align each pipe section with the previously installed pipe section, and pull the joint together. If, while pulling the joint, the gasket becomes loose and can be seen through the exterior joint recess when the pipe is pulled up to within one inch of closure, remove the pipe and remake the joint.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed properly in accordance with the drawings and specifications.

3.2.2 Pipeline Testing

Check each straight run of pipeline for gross deficiencies by holding a light at one end; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

-- End of Section --

SECTION 02755A

ROLLER COMPACTED CONCRETE (RCC) PAVEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991; R 1996) Burlap Cloth Made from Jute or Kenaf

ACI INTERNATIONAL (ACI)

ACI 207.5R	(1999) Roller Compacted Mass Concrete
ACI 214	(1977; R1997) Evaluation of Strength Test Results of Concrete

ASTM INTERNATIONAL (ASTM)

ASTM C 31/C 31M	(2003) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2002a) Concrete Aggregates
ASTM C 39	(2001) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(2002) Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C 109/C 109M	(2002) Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
ASTM C 117	(1995) Materials Finer than 75-Micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	(1998) Lightweight Particles in Aggregate
ASTM C 131	(2001) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1997) Clay Lumps and Friable Particles in Aggregates
ASTM C 150	(2002a) Portland Cement
ASTM C 171	(2003) Sheet Materials for Curing Concrete
ASTM C 174/C 174M	(1997) Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C 192/C 192M	(2002) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 566	(1997) Total Evaporable Moisture Content of Aggregate by Drying
ASTM C 618	(2003) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 1040	(1993; R 2000) Density of Unhardened and Hardened Concrete In Place by Nuclear Methods
ASTM C 1176	(1992; R 1998) Making Roller-Compacted Concrete in Cylinder Molds Using a Vibrating Table
ASTM C 1260	(2001) Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM D 1557	(2002) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 100	(1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing
COE CRD-C 114	(1997) Test Method for Soundness of Aggregates by Freezing and Thawing of Concrete Specimens
COE CRD-C 130	(1989) Scratch Hardness of Coarse

	Aggregate Particles
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
TM 5-822-7	(1987) Standard Practice for Concrete Pavements

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards

STATE HIGHWAY SPECIFICATIONS (SHS)

SHS MSHD	(2004) Mississippi Transportation Commission, Standard Specifications for Road and Bridge Construction

1.2 DEFINITIONS

1.2.1 Cementitious Material

Portland cement, pozzolan, and fly ash.

1.2.2 Lot

2,000 cubic yards of concrete but no less than the amount of concrete produced in one shift of operation.

1.2.3 Lane

Width of the paver.

1.3 WORK DESCRIPTION

The work covered by this section consists of furnishing all plant, material, and equipment, and performing all labor for the testing, manufacturing, transporting, placing, compacting, finishing, jointing, and curing of roller-compacted concrete (RCC) pavement.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with standard Navy submittal procedures and the Contract.

SD-03 Product Data

Admixtures

Bedding mortar

Mixing Plant

Details and data on the concrete mixing plant, prior to plant assembly, including manufacturer's literature on the cementitious

material and aggregate feed equipment, water controls, and pug mill mixers, showing that the equipment meets all specified requirements.

Equipment

A description of the equipment proposed for transporting concrete mixture from the central mixing plant to the placing equipment.

A description of the equipment proposed for the laydown or placing of the concrete, method of control, and manufacturer's literature on the laydown machine (paver). The manufacturer's written instructions on adjustments and operating procedures necessary to assure a tight, smooth surface on the RCC pavement, free of tears and other surface imperfections, including surface pitting shall be included.

A description of the rollers proposed for use. The description shall include manufacturer's literature and manufacturer's certified results of tests made on the rollers to be used, showing the frequency and amplitude of vibration, operating weight, drum dimensions, and pounds per inch of the vibratory roller(s); and the number of wheels, tire pressures, and gross weight of the rubber-tired roller(s). Documentation certifying that the frequency and amplitude requirements have been tested and met, within 4 months of the commencement of RCC pavement construction.

Nuclear Density Gauge

A description of the nuclear density gauge apparatus proposed for use. Description shall include manufacturer's literature and the latest manufacturer's calibration results of the nuclear density gauge.

Placing and Spreading

If concrete is to be placed in or exposed to hot or cold weather conditions, a description of the placing and protection methods proposed, prior to construction of the test section.

Joints
Curing and protection

A detailed plan of the proposed paving pattern showing all planned construction joints and curing water runoff control. The curing media and methods to be used. Unless otherwise directed or approved, placing shall begin along the low side of sloped areas.

Paving Operations

Schedule of paving operations, at least 7 days prior to start of paving unless otherwise specified.

SD-05 Design Data

Mixture Proportioning Study; G A/E

At least 30 days prior to test section construction. Furnish a complete list of materials including type, brand, source and

amount of Portland cement; fly ash; fly ash test results; admixtures, aggregates, and applicable reference specifications. Obtain acknowledgement of approvals prior to concrete placement. Submit a new mixture proportioning study for each material source change. The approval of fly ash test results shall have been within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

SD-06 Test Reports

Mixture Proportioning Study
Portland cement
Fly ash
Coarse aggregate
Fine aggregate
Moisture-Density testing
Field density and moisture testing
Flexural strength testing
Compressive strength testing
Pavement thickness tests
Surface-smoothness tests
Control charts

1.5 TEST SECTION

At least 20 days but not more than 60 days prior to full-scale construction of the RCC pavement, a test section shall be constructed as indicated. The Contractor shall notify the Contracting Officer at least 5 days in advance of the date of test section construction. The test section shall consist of not less than three adjacent paving lanes with length, thickness, and number of lifts indicated. The width of each paving lane shall be the same as that proposed for use in the project. The test section shall contain at least one fresh longitudinal construction joint, one cold transverse joint, and one longitudinal cold construction joint which has stood overnight before completion. Two separate days shall be used for construction of the test section. The test section shall develop and demonstrate, to the satisfaction of the Contracting Officer, the proposed techniques of mixing, hauling, placing, compacting, finishing and curing, and preparation of the construction joints. Additionally, the Contractor shall demonstrate the laydown method and rate, rolling pattern, joint preparation, and rolling method for both fresh and cold construction joints, start-up and finishing procedures, testing methods, and plant operations. Variable amplitudes of the roller shall be used as approved in different areas to identify the optimum amplitude. Rolling pattern of the vibratory and rubber-tired rollers may be varied as approved to determine the best pattern. Variations in mixture proportions other than water may be made subject to the approval of the Contracting Officer. The test section shall be placed in portions subject to the approval of the Contracting Officer. The Contractor shall vary the water content, as necessary, to arrive at the appropriate content. The mixing plant shall be operated and calibrated prior to placing the test section. The Contractor shall use the same equipment, materials, and construction techniques on the test section as will be used in all subsequent work. Base course preparation, concrete production, placing, compacting, curing, construction of joints, and all testing shall be in accordance with applicable provisions of this section. The Contractor shall construct a test section acceptable to the Contracting Officer in all aspects, including surface texture. Failure to construct an acceptable test section will necessitate construction of additional test sections. Test sections unacceptable to the Contracting Officer shall be

removed.

Determine optimum number of passes with vibratory roller to achieve maximum density in accordance with TM 5-822-7 Appendix D-7b procedure unless otherwise noted. Field wet density shall be determined at 2-inch depth intervals for full depth of individual lifts and full depth of completed RCC pavement at same location in accordance with ASTM C 1040. Repeat vibratory roller compaction and subsequent field density testing until there is less than a 1 percent change in successive density readings at full depth of lift or full depth of completed RCC pavement as applicable. Four complete vibratory passes minimum unless field wet density data is used in conjunction with laboratory density data to determine the minimum number of passes required to meet the minimum wet density specified in the paragraph entitled "Compaction" subject to Contracting Officer approval.

After determination of optimum number of passes, determine correlation between laboratory wet density, field ASTM C 1040 wet density and core wet density in accordance with TM 5-822-7 Appendix D-7c procedure unless otherwise noted. Determine correlation between 10 minimum field ASTM C 1040 wet density locations and density obtained by weighing in air and water two minimum core samples obtained within a 1- to 3-foot radius from the hole after 7 days of curing. Obtain core samples on either side of the corresponding nuclear gage holes. All holes left in the RCC as a result of nuclear density testing shall be filled with a non-shrink grout.

Determine correlation between compressive strength and flexural strength at two locations. Total ASTM C 39 twelve 6-inch diameter cores and ASTM C 78 six beams 6 inches by 32 inches by full depth or twelve beams 6 inches by 20 inches by full depth, three each location after 7 days and three each location after 90 days of curing. Refilling of core holes shall be performed with a non-shrink grout.

1.6 MATERIALS, DELIVERY, STORAGE, AND HANDLING

1.6.1 Bulk Cementitious Materials

Cementitious material shall be furnished in bulk. The temperature of the cementitious material, as delivered to storage at the site, shall not exceed 150 degrees F.

1.6.1.1 Transportation

When bulk cementitious material is not unloaded from primary carriers directly into weather-tight hoppers at the batching plant, transportation from the railhead, mill, or intermediate storage to the batching plant shall be accomplished in adequately designed weather-tight trucks, conveyors, or other means that will completely protect the cementitious material from exposure to moisture.

1.6.1.2 Storage of Cementitious Materials

Immediately upon receipt at the site of the work, cementitious materials shall be stored in a dry and properly ventilated structure. All storage facilities shall be subject to approval and shall permit easy access for inspection and identification. Sufficient cementitious materials shall be in storage to sustain continuous operation of the concrete mixing plant while the concrete is being placed. To prevent cementitious materials from becoming unduly aged after delivery, any cementitious materials that has been stored at the site for 60 days or more shall be used before using

cementitious materials of lesser age.

1.6.1.3 Separation of Materials

Separate facilities shall be provided for unloading, transporting, storing, and handling of each type of cementitious material.

1.6.2 Aggregate Materials

1.6.2.1 Storage

Aggregate shall be stored at the site of the mixing plant, avoiding breakage, segregation, or contamination by foreign materials. Each size of aggregate from each source shall be stored separately in free-draining stockpiles. Aggregate shall remain in free-draining storage for at least 24 hours immediately prior to use. Sufficient aggregate shall be maintained at the site at all times to permit continuous uninterrupted operation of the mixing plant at the time concrete is being placed.

1.6.2.2 Handling

Aggregate shall be handled preventing segregation or degradation. Vehicles used for stockpiling or moving aggregate shall be kept clean of foreign materials. Stockpiles shall be worked preventing different sizes of aggregate from being mixed during storage or batching.

1.7 EQUIPMENT

All plant, equipment, tools, and machines used in the work shall be maintained in satisfactory working conditions at all times.

1.7.1 Mixing Plant

1.7.1.1 Location of Mixing Plant

The mixing plant shall be located onsite as indicated or no more than 15 minutes haul time from the placing site.

1.7.1.2 Type of Mixing Plant

The mixing plant shall be designed and operated to produce a concrete mixture within the specified tolerances. The plant shall be a stationary-type plant having a twin-shift pug mill mixer and may be either weigh-batch type or continuous type and shall have a minimum capacity of 250 tons per hour. The plant shall be equipped with positive means for controlling and adjusting the mixing time (amount of mixing), maintaining the time of mixing constant, and maintaining the speed of rotation of the pug mill shafts constant.

1.7.1.3 Cementitious Material Feed Unit

Satisfactory means, incorporating either weighing or volumetric measurements, shall be provided to separately batch or feed the required percentage of each cementitious material in the mixture within tolerances specified. Silos and feeders shall be equipped and operated so that no caking of material or variation in feed will occur, including use of any necessary air pressure or vacuum vents on the silos. Provision shall be made whereby each cementitious material can be readily sampled.

1.7.1.4 Aggregate Bins

Aggregate bins shall be provided for aggregate storage, one for each size group. Each bin shall be of sufficient capacity to supply the mixer continuously operating at full capacity. The bins shall be arranged to ensure separate storage of appropriate fractions of aggregate. Each compartment shall be provided with some means of preventing spilling of material into other bins. Unless the aggregate in the bin is readily visible to operating personnel, each aggregate bin shall be equipped with mechanical or electrical telltales to indicate when the aggregate in the bin is below level to permit accurate proportioning to mixing unit. Each bin shall be constructed or equipped so that a representative sample may be readily and safely obtained from each bin discharge during plant operations. Appropriate means shall be provided for storing, metering, and feeding blending material, as defined in paragraph entitled "Materials, Delivery, Storage, and Handling", as a separate material when use of blending material is necessary.

1.7.1.5 Water Control Units

Satisfactory means incorporating either weighing, metering, or volumetric measurements shall be provided to batch or feed the required quantity of water in the mixture within tolerances specified. Adjusting controls shall be convenient to and capable of easy and accurate operation by the mixer operator. When the quantity of water is controlled by metering, provision shall be made whereby a fixed quantity of water delivered through the meter can be readily checked by weight or volume. A water storage tank shall be provided to prevent surge drawdown effect.

1.7.1.6 Batching or Feeding Tolerances

Batching or feeding shall conform to the mixture proportions directed within the following tolerances:

TABLE I

BATCHING OR FEEDING TOLERANCES

Material	Plant (1)
Each cementitious material	plus or minus 2.0
Water	plus or minus 2.0
Admixtures	(2)
Each individual aggregate size group	plus or minus 2.0
Total aggregate	plus or minus 3.0

(1) For batch-type plants, the variation is in percent by weight from batch weight of each material based on the mixture proportions directed. For continuous feeding and mixing plants, the variation is in percent by weight from the mixture proportions of each material designed to be in a total timed sample obtained from a designated location in the plant.

(2) Determine based on manufacturer's recommendations and mixture proportioning study subject to the approval of the Contracting Officer.

1.7.1.7 Additional Requirements for Batching and Mixing Plants

a. Plant Scales: Plant scales shall conform to requirements of NRMCA CPMB 100, with modifications as follows: Plant scales for any weigh box or

hopper shall be of either beam or springless-dial type and shall be sensitive to 0.5 percent of maximum load required. Beam-type scales shall have a separate beam for each size aggregate, with a single pointer actuated for each beam and a tare beam for balancing hopper.

b. Weigh Box or Hopper for Aggregates: Weigh box or hopper for aggregates shall conform to requirements of NRMCA CPMB 100, with modifications as follows: Equipment shall include means for weighing each bin size of aggregate in a weigh box or hopper suspended on scales, ample in size to hold a full batch without running over. The gates on both the bins and the hoppers shall prevent leakage of aggregate when closed. On manually or semi-automatically operated plants, an interlocking device shall be provided to prevent opening more than one gate at a time. The interlocking device shall not be required on automatic plants designed for simultaneous weighing of all sizes of aggregate while the plant is operating under automatic control.

c. Weigh Hoppers for Cementitious Materials: Weigh hoppers for cementitious materials shall conform to requirements of NRMCA CPMB 100, with modifications as follows: The weigh hopper shall have sufficient capacity to hold not less than 10 percent in excess of the weight of the cementitious material required for one batch. Portland cement and pozzolan may both be weighed cumulatively in the same hopper on the same scale, provided the Portland cement is weighed first, or the Portland cement and pozzolan may be weighed in separate hoppers on separate scales. The hopper shall be suspended on dial or beam scales equipped with a pointer so the tare weight of the hopper will be shown for each weighing; net weight of each cementitious material shall be measured within 1 percent of the weight required.

d. Mixer Unit: The mixer for batch method shall be a stationary mixer of the twin pug mill-type capable of producing a uniform mixture within tolerances specified. The mixer shall have a time lock, accurate within 5 seconds, to control operation of the complete mixing cycle by locking the weigh hopper gate after mixer is charged until closing of mixer gate throughout dry- and wet-mixing periods. The dry-mixing period is defined as the interval of time between the opening of the weigh hopper and the application of water. The wet-mixing period is the interval between application of water and the opening of the mixer gate. Control of mixing time shall be flexible and capable of being set at intervals of not more than 5 seconds throughout cycles up to 3 minutes. A mechanical batch counter shall be installed as part of the timing device and shall be designed to preclude register of dry batches or of any material run through during operation of pulling bins.

1.7.1.8 Additional Requirements for Continuous-Mixing Plants

a. Aggregate Feed: Each bin shall have the feed rate controlled by a variable speed belt or gate remotely operated from the central control panel calibrated to accurately deliver any specified quantity of material within the required tolerance. The feed rate from each bin shall be readily adjustable from the control panel to change aggregate proportions or to compensate for changes in moisture content. The feed rate controls shall automatically maintain the established proportions of aggregate from each bin when the combined aggregate delivery is increased or decreased. The combined aggregate belt feeding the mixer shall be equipped with an approved belt scale. The belt scale shall operate automatic controls, either electronic or mechanical, which will maintain the established proportion of each cementitious material and water as ratios of the total

aggregate, with provisions for readily changing the proportions at the control panel. Approved means shall be provided for storing, metering, and feeding blend material as a separate material when use of blending material is necessary.

b. Cementitious Material Control: Approved means shall be provided to separately meter the required amount of each cementitious material in the mix within the tolerance specified. Metering shall be by readily adjustable vane feeders or other approved positive metering devices. Metering and feed shall be designed and controlled so that the cementitious material is uniformly fed into the mixer or into the stream of aggregate on the feeder belt, all with necessary controls to prevent loss of cementitious material as dust or in any other form. Control of the quantity of each cementitious material shall be automatically linked to the aggregate belt scales, as specified herein. Provision shall be made so the amount of each cementitious material delivered can be readily sampled and checked by weight.

c. Mixer Unit: The mixer for the continuous method shall be a stationary mixer of the twin-shaft pug mill type capable of producing a uniform and homogeneous mixture within tolerances specified. Blades shall be adjustable for angular position on shafts and reversible to retard flow of the mixture. The mixer shall bear a manufacturer's plate indicating net volumetric contents of mixer at several heights permanently inscribed on the wall and the rate of feed of aggregate per minute at plant-operating speed.

d. Discharge Hopper: The pug mill shall be equipped with a discharge hopper having a capacity of at least one ton. The hopper shall be equipped with dump gates to assure rapid and complete discharge without segregation.

1.7.2 Pavers

Pavers shall be heavy-duty, self-propelled track-equipped machines, similar to laydown machines (pavers) used for asphalt concrete or soil-cement construction. The pavers shall be equipped with hoppers, distributing screws, vibrating screen and/or at least one tamping bar, adjustable screeds capable of being operated both manually and automatically, and equalizing devices. The paver shall be of suitable weight and stability to spread and finish the concrete to the indicated thickness, smoothness, and surface texture requirements. The paver shall produce a finished surface conforming to surface smoothness and surface texture requirements specified herein. The paver shall confine edges of lanes to true lines without use of stationary side forms and shall place the concrete to the required thickness, free from segregation. Each side of the paver shall be equipped with interchangeable side forms (shoes) which will form the edge of the pavement lane either vertically or 15 degrees from vertical. Pavers shall be designed to operate forward at variable speeds and in reverse. The pavers shall automatically control both line and grade by means of electronic controls operating from stationary stringlines on both sides of the paver; slope control devices shall not be used. However, as appropriate, a short ski riding on an adjacent paved lane may be used in lieu of one of the stringlines. Laser control devices may be used in lieu of a stringline provided the entire process is approved.

1.7.3 Vibratory Rollers

Vibratory rollers shall be self-propelled, double-drum, steel-wheeled vibratory rollers having an average operating weight per drum of at least

150 pounds per lineal inch of drum. The rollers shall transmit a dynamic impact to the surface through the drums by means of revolving weights, eccentric shafts, or other equivalent methods. The roller shall have a vibrating frequency of at least 1,500 cycles per minute. The amplitude shall be between 0.015 and 0.040 inch at the operating frequency used. Controls shall permit ready variation of the amplitude at a minimum of two settings over at least 50 percent of the above range. The roller drum shall be between 48 and 66 inches in diameter and 66 to 96 inches in width. The roller shall be operated at speeds not exceeding 1.5 miles per hour. Within the range of the operational capability of the equipment, the Contracting Officer may direct or allow variations within the specified range to the frequency, amplitude, and speed of operation which result in the required density and satisfactory surface texture at the fastest production rate. At least one self-propelled vibratory roller, in good operating condition and meeting these requirements, shall be used full time for each paver used full time. The roller shall be equipped with some means of keeping the drums damp during operation. Each drum shall be equipped with an operating scraper and pad. Any rollers which pick up material from the surface of the RCC pavement shall be adjusted, modified, or replaced.

1.7.4 Rubber-Tired Roller

The rubber-tired roller shall have smooth tires, nonoscillating wheels and a tire pressure adjustable between a minimum of 50 and a maximum of 90 psi and with a total load between 3,000 and 4,500 pounds per wheel. The roller shall have 2 axles with at least 3 wheels per axle, offset so the front and back tires do not track in the same path.

1.7.5 Finish Roller

The smooth-wheeled tandem roller shall weigh 5 to 10 tons. The vibratory roller may be used without vibration as a finish roller to remove surface blemishes.

1.7.6 Other Compaction Equipment

Light, walk-behind, or similar sized vibratory rollers and mechanical tampers shall be furnished for use in compacting areas inaccessible to the vibratory, rubber-tired and finish rollers.

1.7.7 Straightedge

One 12 foot straightedge shall be furnished for each paving spreader for testing the finished surface. Straightedges shall be made available for Government use upon request. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to ensure rigidity and accuracy. Straightedges shall have handles to facilitate movement on the RCC pavement.

1.7.8 Nuclear Density Gauge

One operable and properly calibrated nuclear density gauge shall be furnished for each paver. The nuclear density gauge shall be made available for Government use upon request. The nuclear density apparatus shall conform to ASTM C 1040, Method A, and shall be of a single-probe type.

1.8 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall be provided access at all times to all parts of the mixing and paving plant for checking adequacy of equipment in use; for inspecting operation of the plant; and for verifying weights, proportions and character of materials.

1.9 SAMPLING AND TESTING INGREDIENT MATERIALS

1.9.1 Sources and Pre-construction Samples for Aggregates

Only a single source for each fractional size group of aggregates shall be used. At the same time sample results are submitted, a list of at least 3 Portland cement concrete paving projects where each aggregate has been in successful service for at least 5 years shall be submitted. If no service record is available, the aggregates shall conform to the requirements for alkali-aggregate reactivity and resistance to freezing and thawing specified herein. To expedite construction, mix proportioning samples shall be submitted and mix design shall begin before the aggregates acceptance testing is completed.

1.9.2 Samples for Mixture Proportioning Studies

Representative samples of materials proposed for use in the concrete mixture shall be obtained in the presence of the Contracting Officer in accordance with COE CRD-C 100. Material test results shall be submitted 30 days prior to constructing the test section showing that the samples have been tested and meet the specified requirements.

1.9.3 Aggregate Samples

Samples of aggregates during paving shall be obtained at the point of batching. Additional tests and analyses of aggregates at various stages in the processing and handling operations shall be made by the Contractor at the request of the Contracting Officer.

1.9.4 Cement Samples

Cement shall be sampled at the mill or shipping point, and at the worksite, and tested. If tests indicate that a cement that has been delivered is unsatisfactory, it shall not be used in the work. Cement that has not been used within 6 months after testing shall be retested and will be rejected if test results are not satisfactory.

1.9.4.1 Prequalified Cement Sources

Cement shall be delivered and used directly from a mill of a producer designated as a qualified source provided a certification is delivered with each lot of cement. Samples of cement for check testing shall be taken at the project site or the concrete production plant. A list of prequalified cement sources is available from the Commander and Director, U.S. Army Engineer Waterways Experiment Station (ATTN: CEWES), P.O. Box 631, Vicksburg, Mississippi 39180.

1.9.4.2 Other Cement Sources

The sampling, testing, and shipping inspection from the point of sampling when the point of sampling is other than at the site of the work shall be made by the Contractor. Cement meeting all other requirements may be

accepted before the required 7-day strength is achieved when the 3-day strength is equal to or greater than the 7-day strength requirement. In the event of failure, the cement shall be resampled and tested. When the point of sampling is other than at the site of the work, the fill gate or gates of the sampled bin shall be sealed and kept sealed until shipment from the bin has been completed. Sealing of the fill gate or gates and of conveyances used in shipment including transfer points shall be done by the Contractor under the supervision of the Contracting Officer. Conveyances shall not be accepted at the site of the work unless received with all seals intact.

1.9.5 Pozzolan Sampling

1.9.5.1 Pozzolan Requirements

Pozzolan will be sampled at the source and at the site and shall be stored in sealed bins pending completion of certain tests. Release for shipment and approval for use shall be based on compliance with 7-day lime-pozzolan strength requirements and other physical, chemical, and uniformity requirements for which tests can be completed by the time the 7-day lime-pozzolan strength test is completed as well as on continuing compliance with the other requirements of the specifications. If the samples from a bin fail, the contents of the bin shall be resampled and tested. In this event, pozzolan shall be sampled as it is loaded into cars or trucks, provided they are kept at the source until released for shipment. Unsealing and resealing of bins and sealing of shipping conveyances shall be done by the Contractor under the supervision of the Contracting Officer. Shipping conveyances will not be accepted at the site of the work unless they are received with all seals intact. If pozzolan is damaged in shipment, handling, or storage, it shall not be used in the work. Pozzolan not used within 6 months after testing shall be retested, and shall be rejected if the test results are not satisfactory.

1.9.5.2 Prequalified Pozzolan Sources

Pozzolan shall be delivered and used directly from a producer designated as a qualified source provided a certification is delivered with each lot of pozzolan. Samples of pozzolan for check testing shall be taken at the project site or at the concrete production plant. A list of prequalified pozzolan sources is available from the Commander and Director, U.S. Army Engineer Waterways Experiment Station (ATTN: CEWES), P.O. Box 631, Vicksburg, Mississippi 39180.

1.10 ACCEPTABILITY OF WORK

Mixture proportioning studies and testing for acceptability of work shall be performed by the Contractor. Visual examination of the final surface texture shall be made by the Contractor. Testing of cementitious materials, aggregates for evaluation of sources, and RCC pavement density, flexural strength, compressive strength, smoothness (straightedge), and thickness shall be performed by the Contractor. The Contractor shall sample and test aggregates and concrete during construction to determine compliance with the specifications as specified herein and as otherwise considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples if requested by the Contracting Officer. The Contractor shall make the nuclear density gauge and operator available to the Government when requested. The Government shall be provided access at all times to all parts of the paving operation for checking adequacy of equipment in use;

inspecting operation of plant; and verifying weights, proportions, and characteristics of materials. Testing performed by the Government shall not relieve the Contractor from the testing requirements specified.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

2.1.1 Portland Cement

ASTM C 150 Type I with maximum alkali content (i.e., equivalent sodium oxide) of 0.060 percent. ASTM C 150 Type II with maximum alkali content of 0.040 percent if potentially reactive aggregates are used. Cement certificates shall include test results in accordance with ASTM C 150, including Equivalent Alkalies indicated in the Optional Chemical Requirements.

2.1.2 Pozzolan

ASTM C 618 Class F except that the maximum allowable loss on ignition shall be 6.0 percent, maximum calcium oxide shall be 8.0 percent (maximum of 10.0 percent calcium oxide if 30 percent or more of the Portland cement by weight is replaced with pozzolan), and maximum available alkalies of 1.5 percent. Fly ash certificates shall include test results in accordance with ASTM C 618, including available alkalies indicated in the Supplemental Optional Chemical Requirements.

2.1.3 Bedding Mortar

SHS MSHD, Section 714.11.5, with SHS MSHD, Section 703.18 mortar sand, set-retarding admixture and sufficient water to produce a bedding mortar with a minimum ASTM C 109/C 109M unconfined compressive strength 50 percent greater than the RCC at the same age, and a 7-inch to 9-inch slump.

2.1.4 Non-Shrink Grout

SHS MSHD, Section 714.11.6.

2.2 WATER

Water shall conform to the requirements of COE CRD-C 400 and shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, and other substances deleterious to the hardening of concrete, and shall be subject to approval of the Contracting Officer.

2.3 CURING MATERIALS

Burlap shall conform to AASHTO M 182.

2.4 AGGREGATES

Coarse and fine aggregates not having a demonstrable service record as required by the paragraph entitled "Sources and Pre-Construction Samples for Aggregates" shall be evaluated and tested for alkali-aggregate reactivity in accordance with ASTM C 1260. The coarse and fine aggregates shall be evaluated separately, in accordance with ASTM C 1260, and in combination, which match the Contractor's proposed mix design proportioning, including fly ash. Test results of the combination shall have a measured expansion of less than 0.08 percent at 16 days. Should the

test data indicate an expansion of greater than 0.08 percent, the aggregate(s) shall be rejected and the Contractor shall submit new aggregate sources for retesting or may submit additional test results incorporating additional fly ash or lithium nitrate for consideration.

ASTM C 1260 shall be modified by utilizing the Contractor's proposed low alkali Portland cement and Class F fly ash in combination for the test proportioning. The laboratory shall use the Contractor's proposed percentage of Portland cement and fly ash.

2.4.1 Coarse Aggregate

Coarse aggregate shall consist of 3/4 inch maximum hard and durable crushed gravel, crushed stone, or a combination thereof. Crushed gravel shall contain not less than 60 percent by weight of crushed particles having at least one freshly fractured face, in each sieve.

2.4.1.1 Quality

Coarse aggregates shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33 and as otherwise specified. Dust and other coatings shall be removed from the coarse aggregate by washing.

2.4.1.2 Particle Shape

Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by ASTM D 4791.

2.4.1.3 Deleterious Substances

The total of all deleterious substances shall not exceed 3.0 percent by weight of the coarse aggregate. The percentage of material finer than No. 200 sieve shall not be included in this total. The limit for material finer than No. 200 sieve will be increased to 1.5 percent for crushed aggregates consisting of crusher dust that is essentially free from clay or shale. The amount of deleterious substances in each size group of coarse aggregate shall not exceed the limits shown below.

TABLE II

LIMITS OF DELETERIOUS SUBSTANCES FOR COARSE AGGREGATE

Substance	Percentage by Weight
Clay lumps and friable particles (ASTM C 142)	2.0
Material finer than No. 200 sieve (ASTM C 117)	1.0
Lightweight particles (ASTM C 123, using a separation medium with a specific gravity of 2.0)	1.0

TABLE II

LIMITS OF DELETERIOUS SUBSTANCES FOR COARSE AGGREGATE

Substance	Percentage by Weight
Other soft particles (COE CRD-C 130)	2.0

2.4.1.4 Resistance to Freezing and Thawing

Coarse aggregate not having a demonstrable service record as required by paragraph entitled "Sources and Pre-Construction Samples for Aggregates" shall have a durability factor of 50 or more when subjected to freezing and thawing in accordance with COE CRD-C 114 using conventional concrete test specimens.

2.4.1.5 Resistance to Abrasion

Coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131.

2.4.2 Fine Aggregate

Fine aggregate shall consist of hard and durable natural sand, manufactured sand, or a combination of the two meeting the requirements of ASTM C 33. Where necessary to meet grading requirements, a fine blending material may also be used.

2.4.2.1 Particle Shape (Fine Aggregate)

Particles of the fine aggregate shall be generally spherical or cubical in shape.

2.4.2.2 Deleterious Substances in Fine Aggregate

The amount of deleterious substances in the fine aggregate shall not exceed the limits shown below.

TABLE III

LIMITS OF DELETERIOUS SUBSTANCES FOR FINE AGGREGATE

Substance	Percentage by Weight
Clay lumps and friable particles (ASTM C 142)	1.0
Material finer than No. 200 sieve (ASTM C 117)	5.0

TABLE III

LIMITS OF DELETERIOUS SUBSTANCES FOR FINE AGGREGATE

Substance	Percentage by Weight
Lightweight particles (ASTM C 123, using a separation medium with a specific gravity of 2.0)	0.5

2.4.2.3 Resistance to Freezing and Thawing (Fine Aggregate)

Fine aggregate not having a demonstrable service record as required by paragraph entitled "Sources and Pre-Construction Samples for Aggregates" shall have a durability factor of 50 or more when subjected to freezing and thawing in accordance with COE CRD-C 114 using conventional concrete test specimens.

2.4.2.4 Blending Material

Additional fines (minus No. 100 and No. 200 sieve size material), if necessary, shall be provided by adding to the aggregates a fine blending sand or pozzolan (fly ash). If pozzolan is used, it shall be the same material as furnished for cementitious material as required by paragraph entitled "Cementitious Materials". Pozzolan, if used for this purpose, shall be batched or fed together with pozzolan used as cementitious material. Blending sand, if used, shall be a clean, hard, siliceous material meeting all quality requirements specified herein for fine aggregate and shall be furnished to the mixer as a separate material.

2.5 ADMIXTURES

Retarding admixture, if used, shall conform to ASTM C 494/C 494M, Type B or Type D.

2.6 MIXTURE PROPORTIONING

2.6.1 Contractor-Furnished Mixture Proportioning Study

Mixture proportioning study in accordance with ACI 207.5R except as modified herein. Minimum flexural strength of 550 psi at 90 days. Mixture proportioning study shall include varying the total cementitious material content, percentage of Portland cement replacement, and water to cementitious material ratio. For each trial mixture, at least three test beams for each test age shall be made and cured in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 78 at a minimum of 3 ages including 7 and 90 days with the third test age selected by the Contractor and at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 1176 using a rigid mold and tested in accordance with ASTM C 39 at a minimum of 3 ages including 7 and 90 days with the third test age selected by the Contractor. From those results, curves shall be plotted showing the relationship between total cementitious material content, water-cementitious material ratio, percentages of Portland cement replacement, flexural strength, and compressive strength. For the selected mix, fabricate companion set of test specimens with the lowest wet density allowed by the specifications to establish wet density

and strength relationship. Provide minimum 115 percent over design for flexural strength. The fly ash content shall not exceed 40 percent by weight of the total cementitious material. Approved admixtures shall be used in proportions recommended by the manufacturer to obtain the optimum effect, with seasonal atmospheric and job conditions considered. If modifications to the mix are required, a new mix shall be submitted for approval.

2.6.2 Composition

Concrete shall be composed of cementitious material, water, and fine and coarse aggregates, including any necessary fine blending material. The cementitious materials shall be Portland cement in combination with pozzolan. A retarding admixture may be used, if approved. Other admixtures shall not be used unless demonstrated by the Contractor to be beneficial, approved in writing, and used in the mixture proportioning study.

2.6.3 Control

The Contractor shall provide initial proportions determined from the mixture proportioning study to the Contracting Officer. The water content shall be varied by the Contractor, as necessary, to provide a consistency that is most conducive to effective placing and compaction and that will assure that the required densities in the RCC pavement and required surface texture are attained. The aggregate weights shall be changed by the Contractor, as necessary, to compensate for varying aggregate moisture.

2.6.4 Cementitious Material Content

The Contractor shall determine total cementitious material content expressed as equivalent Portland cement content by weight.

2.6.5 Aggregate Content

The proportions of aggregate shall be as determined by the mixture proportioning study.

2.6.6 Flexural Strength

The Contractor shall determine initial mixture proportions and vary mixture proportions during construction as necessary to achieve the specified flexural strength.

2.6.7 Water Content

After startup, the total water content of the mix shall be controlled by the Contractor as necessary to meet all requirements stated herein.

PART 3 EXECUTION

3.1 SURFACE-SMOOTHNESS, SURFACE TEXTURE, AND THICKNESS REQUIREMENTS

3.1.1 Surface Smoothness

RCC pavements shall be smooth and true to grade and cross section (except for grade changes).

3.1.2 Final Surface Texture

The final surface texture of the RCC pavement, after all rolling and curing, shall be smooth and uniform over the whole area of the RCC pavement and shall be totally free of any surface pitting, voids or indentations, pockmarks, surface tears, check cracking, segregation or rock pockets, pumped areas, aggregate drag marks, areas loosened by construction operations, and areas where fines have been washed away during the curing process.

The surface texture of each lot shall be visually examined by the Contracting Officer immediately after construction to determine compliance with the surface texture requirements. The classification of the surface texture of any area of the pavement as acceptable or deficient shall be made on the basis of comparison with a selected portion of the test section which has been chosen and marked as having an acceptable surface texture as determined by the Contracting Officer.

Portions of any lot areas with 10 percent or more deficient surface area or any area of any size of extremely poor surface texture as determined by the Contracting Officer shall be removed and replaced full depth with suitable RCC pavement.

3.1.3 Thickness

RCC pavements shall be constructed to the minimum thicknesses indicated.

3.2 GRADE CONTROL

Lines and grades indicated shall be established and maintained by means of line and grade stakes. Finished RCC pavement gradeline and elevations shown shall be established and controlled at the site of work by the Contractor. The surface of the underlying material shall be finished to the necessary grade such that when the required thickness of concrete is placed, the surface will meet the indicated grade. Finished and completed RCC pavement shall conform to the lines, grades, cross section, and dimensions indicated.

3.3 CONDITIONING OF UNDERLYING MATERIAL (BASE COURSE)

Previously constructed underlying material shall be conditioned as specified in Section 02160A, "Solidification/Stabilization (S/S) of Contaminated Material." In all cases prior to placing concrete, deficiencies in the underlying material shall be corrected, and the surface shall be cleaned and moistened, as directed. The surface of the underlying material shall be inspected by the Contractor.

3.4 BATCHING, MIXING, AND TRANSPORTING

The plant shall be operated to produce a uniform and homogeneous mixture. All materials used in the mixture shall be batched or fed separately, except that fly ash used as aggregate fines shall be batched or fed with fly ash used as cementitious material.

3.4.1 Mixing

The aggregates and cementitious materials shall be conveyed to the mixer in proportions, as required. In batch mixing, aggregates and cementitious materials shall be charged into the mixer and dry-mixed at least 15

seconds. Water shall be added, and mixing shall be continued as required to obtain a homogeneous mixture. When a continuous mixer is employed, mixing time shall be not less than 35 seconds and as much longer as may be required to obtain a homogeneous mixture. The paddles of the pug mill shall be adjusted, as necessary, to provide the required mixing time and to provide a thorough scrubbing action to the mixture. Shaft speed of the pug mill shall be maintained at the speed recommended by the manufacturer. Concrete shall not extend above the tips of the paddles of the pug mill mixer when paddles are in vertical position. Mixer and mixer paddle surfaces shall be kept free of hardened concrete and other contamination. Mixer paddles worn down more than 10 percent from new paddles of the same type and manufacture shall be replaced.

3.4.2 Transporting

RCC shall be hauled from the mixer to the placing site in dump trucks equipped with protective covers. The trucks shall dump directly into the hopper of the paver or into an approved secondary material distribution system which deposits material into the paver hopper. Dumping concrete directly on the underlying course will not be permitted except at start-up of a lane. Deliveries shall be scheduled so that concrete will be spread and rolled within the time limit specified in paragraph entitled "Compaction" and spreading and rolling of all mixture prepared for 1 day's run can be completed during daylight unless adequate artificial lighting is provided. Loads that have crusts of partially hardened material or have become wet by rain will be rejected. Hauling over freshly placed RCC will not be permitted, except as approved by the Contracting Officer on the lower compacted lift of multilift-pavements.

3.5 PLACING AND SPREADING

3.5.1 General Requirements for Use of Paver

Except as specified below for certain extremely small odd-shaped isolated areas, all concrete shall be placed and spread with the paver. The level of concrete in the paver hopper shall not be allowed to approach empty between loads, and concrete shall be maintained above the auger shaft during paving. The paver shall be adjusted and the speed regulated so that segregation is prevented and the surface shall meet all requirements of paragraph entitled "Surface-Smoothness, Surface Texture, and Thickness Requirements", and of such depth that, when compacted, the surface will conform with cross section, grade, and contour indicated. First lift uncompacted thickness shall be 2/3 of the total uncompacted design thickness or the maximum lift thickness the paver can handle, whichever is smaller. Minimum lift thickness shall be 4 inches. Each edge of each lane shall be constructed with a vertical or a 15 degrees from vertical configuration, as directed. Mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet and a maximum width of 20 feet, except when edge lanes require strips less than 10 feet to complete an area. If more than 60 minutes should elapse between placement in adjacent lanes, the construction joint shall be considered a "cold joint" and treatment as specified herein for cold joints shall be provided. Not more than 60 minutes shall elapse between placement of lifts on multilift construction. Surface of lower lift on multilift construction shall be kept moist and clean until the upper lift is placed. During extremely hot weather, both of these limits will be decreased by the Contracting Officer as specified in paragraph entitled "Placing During Hot Weather" or as otherwise considered appropriate. Each lane placed before a succeeding lane shall be of such length that, where practical, the succeeding lane can be

placed without the use of a cold joint. Pavers shall be used in sufficient numbers and operated in staggered formation to assist in achieving the above requirement and to produce multilane construction in one construction operation to minimize cold construction joints. Otherwise, the joint shall be constructed as a cold joint. In multilift construction, a separate paver shall be required for placement of each lift of pavement. The length of a lane that is to be followed by another lane shall be approved and shall be decreased or increased as required by air temperatures, wind, and other climatic conditions existing at the time of placement. Longitudinal joints and edges shall be constructed to true line markings. Lines parallel to the center line of an area to be paved shall be established, and stringlines shall be placed coinciding with established lines for the paver to follow. Placing of mixture shall be as nearly continuous as possible, with an absolute minimum of stops and starts; speed of placing shall be controlled to permit proper rolling. The timing of placement shall be controlled so that all RCC mixture shall be placed and rolled within the time limit specified in paragraph entitled "Compaction". Placing shall be discontinued during rain except for light mists which do not cause intermixing of cement and water slurry on the surface. Placing shall be done in a pattern so that curing water from previous placements will not pose a runoff problem on the fresh surface or base course. The pavers shall at all times be controlled by automatic electronic controls operating from two stringlines or from a stringline on one side and a ski on the adjacent previously paved lane, or from a laser system, all as specified in paragraph entitled "Pavers."

3.5.2 Placing Adjacent Lanes

Fresh longitudinal construction joints between separate lanes of concrete shall be completed within the time limitations in the paragraph entitled "Placing and Spreading". Other longitudinal joints shall be treated as "cold joints." Joints shall be made to assure continuous bond between old and new sections of pavement. Extra passes of the vibratory roller and other compaction and hand finishing shall be used as necessary to assure specified full depth compaction and surface finish.

3.5.3 Special Requirements for Placing Lanes Succeeding Initial Lanes

For longitudinal construction joints the screed of the paver shall overlap the previously placed lane 1 to 2 inches and shall be sufficiently high so that compaction will produce a smooth, dense joint, without offset. The concrete placed on the edge of the previously placed lane by the paver shall be carefully pushed back by hand by using a lute to the edge of the lane being placed, so none will remain on the surface of the previously placed lane. If necessary, when the quantity of concrete on the edge of the previously placed lane plus uncompacted material in the lane being placed exceeds that required to produce a smooth, dense joint, the excess concrete shall be removed by approved methods and wasted.

3.5.4 Handwork

Any paving operations that require significant handwork, other than as specified above, shall be stopped and the problems corrected before restarting. Broadcasting or fanning of concrete mixture over areas being compacted will not be permitted. When segregation occurs in the concrete during placement, the spreading operation shall be suspended until the cause is determined and corrected. Segregated coarse aggregate shall be removed from the surface prior to compaction. Irregularities in alignment of the pavement left by the mechanical spreader shall be corrected by hand

trimming directly behind the spreader before rolling. Distortion of pavement during edge trimming will not be permitted.

3.5.5 Placing Odd-Shaped Areas

In isolated instances involving very small, odd-shaped areas where use of machine spreading is impractical, concrete shall be spread by hand. Spreading shall be in a manner to prevent segregation. Mixture shall be spread uniformly with shovels in a loose layer of thickness that, when compacted, shall conform to density, grade, thickness, and surface texture requirements.

3.5.6 Placing During Cold Weather

Placement shall be discontinued when the air temperature reaches 40 degrees F and is falling and shall not be resumed until the air temperature reaches 35 degrees F and is rising. No concrete shall be placed on any surface containing frost or frozen material. Provision shall be made to protect the RCC from freezing during the specified curing period. Mixing water and/or aggregates shall be heated, as necessary, to produce concrete having a temperature between 50 and 85 degrees F as placed. Methods and equipment for heating shall be as approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the RCC at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the 14-day curing period. RCC damaged by freezing shall be removed and replaced as directed.

3.5.7 Placing During Hot Weather

During periods of hot weather when the maximum daily air temperature is likely to exceed 85 degrees F, the following precautions shall be taken. The maximum period between placing succeeding lifts or lanes shall be 45 minutes. The base course shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and the temperature of the concrete when placed shall not exceed 90 degrees F. The aggregates and/or mixing water shall be cooled as necessary. The finished surfaces of the newly laid pavement shall be kept damp by applying a waterfog or mist, not streams of water, with approved spraying equipment until the RCC is covered by the curing medium. When heat or wind is determined excessive by the Contracting Officer, the Contractor shall immediately take additional measures, as necessary, to protect the RCC surface. Such measures shall consist of wind screens, more effective fog sprays, and similar measures commencing immediately behind the paver. If these measures are not effective, paving operations shall be immediately stopped until satisfactory placement conditions exist.

3.6 COMPACTION

Compaction shall be accomplished by self-propelled, vibratory, steel-wheeled rollers and rubber-tired rollers. Rolling shall begin within 10 minutes of spreading and, except for fresh joints, rolling shall be completed within 45 minutes of start of mixing, except during hot or dry weather conditions. In hot or dry weather, rolling shall begin within 5 minutes of spreading and, except for joints, rolling shall be completed within 30 minutes of start of mixing. Delays in rolling freshly laid concrete will not be permitted. Initial rolling shall consist of a minimum of 4 complete vibratory passes of the vibratory roller. Initial static

passes may be necessary before the vibratory rolling to "set" the pavement surface before vibratory compaction is started. A round trip over the same material shall count as 2 complete passes (i.e., from point A to point B and return to point A by the same route are 2 complete passes). Rollers shall not be operated in the vibratory mode when not moving. The frequency and amplitude of vibration shall be varied, as needed or directed, within the range specified in paragraph entitled "Equipment". After initial vibratory rolling, preliminary tests and examination of density, crown, grade, smoothness, and surface texture shall be made by the Contractor in the presence of the Contracting Officer. Before rolling is continued, deficiencies shall be corrected so that the finished surface conforms to requirements for grade, surface texture, and smoothness specified herein. Further smoothness checks shall be as directed by the Contracting Officer. Rolling shall be continued with the vibratory roller in vibratory mode, if necessary, until wet field density of not less than 98.5 percent of the "Target Density," maximum wet density per ASTM D 1557, is attained in the lane interior and at fresh joints or until 96.5 percent of the "Target Density," maximum wet density per ASTM D 1557, at a cold joint is attained. Nuclear density testing shall be performed in accordance with paragraph entitled "Contractor Quality Control". Once at least 4 passes of the vibratory roller operating in the vibratory mode have been made and the specified density is attained, rolling with the vibratory roller shall stop. Surfaces of roller drums and wheels shall be kept clean at all times. Vibratory rolling beyond that specified above will not be permitted. As soon as rolling with the vibratory roller is complete, the final lift of the RCC surface shall receive at least 2 complete passes of the rubber-tired roller with tire pressure and loading per wheel at the midpoint of the range previously specified, unless otherwise directed. These passes shall be followed by 2 complete passes of the finish roller.

3.6.1 Operation of Rollers and Tampers

Speed of rollers shall be slow enough at all times to avoid displacement of the concrete but not more than 1.5 mph. Displacement of concrete resulting from reversing direction of roller or from any other cause shall be immediately corrected. Alternate passes of roller shall be varied slightly in length and shall overlap sufficiently to provide full coverage over the surface. Additional rollers shall be furnished if RCC density specified is not attained and/or if paving operations are getting ahead of rolling. The Contractor shall not allow paving operations to be altered to accommodate a lack of rollers. Places inaccessible to large vibratory rollers shall be thoroughly compacted with walk-behind rollers and hand-tampers to the required density, using multiple thin lifts, as necessary. Additional field density tests shall be made for those areas by the Contractor.

3.6.2 Rolling Pattern

Rolling shall commence at the outer edge of the lane, followed by the other edge, and then the center. On subsequent adjacent lanes, rolling shall begin at the outer edge. The first pass along each edge shall extend to within approximately 18 inches of the edge except as otherwise approved or directed. If there will be a subsequent lane placed along an edge and the joint will be constructed as a "fresh" joint, the roller shall go no closer to the outer edge until the subsequent lane is placed. If there will be a subsequent lane and the joint will be treated as a "cold" construction joint, or if the edge will be the final edge of the pavement, the outer 18 inches shall be rolled after rolling of the center of the lane. If the edge abuts a previously placed strip, either as a "fresh" joint or as a "cold" joint, the uncompacted joint area shall be rolled after the center

of the lane. This joint area shall be given additional passes of the vibratory roller and rubber-tired roller, as necessary, to produce the specified compaction in the joint area. Approved hand-finishing operations shall be used as necessary to produce a tight surface at the joint, meeting the tolerances specified in the paragraph entitled "Surface Smoothness". The rolling pattern shall be used consistently throughout production.

3.7 JOINTS

Joints shall conform to the details indicated and shall be perpendicular to the finished grade of the pavement. Joints shall be straight and continuous from edge to edge of the pavement. Construction joints shall be made to ensure continuity in smoothness and grade between old and new sections of pavement, as specified hereinafter. All joints shall have the same texture, full-depth density, and smoothness as specified for other sections of pavement. Regardless of age, contact surfaces of previously constructed strips that have become coated with dust, sand, or other objectionable material shall be cleaned by brushing or cut back with approved power saw, as directed.

3.7.1 Longitudinal Construction Joints

Any construction joints in which the edge of the initial strip has exceeded the time requirements given in paragraph entitled "Placing and Spreading" shall be considered "cold joints" and shall be trimmed by sawing the edge of the hardened concrete with a power concrete saw, not earlier than 12 hours age. The sawcut shall be at least 6 inches from the original edge, and more if necessary to produce an acceptable joint. The sawcut shall be full depth of the pavement and shall produce a face within 15 degrees of vertical, free of all loose or uncompacted material. The outer portion shall be removed carefully to prevent any damage to the sawed face. If damage occurs, the edge shall be resawed. If necessary, additional rolling shall be used to assure that full depth density and surface texture is attained.

3.7.2 Transverse Construction Joints

When a transverse construction joint is required, the roller shall pass over the end of the freshly placed concrete. In these cases, the previously placed RCC shall be cut with a power concrete saw to full depth of the lift, as specified in the paragraph entitled "Longitudinal Construction Joints", and the excess material removed. In continuing placement of the lane, the paver shall be positioned on the transverse joint so that sufficient fresh concrete will be spread to obtain a joint, after rolling, which will conform to required full-depth density and smoothness specified. When necessary, the fresh mixture shall be hand finished at the joints. Additional rolling shall be used to assure that specified full-depth density and surface finish is attained.

3.7.3 Joints in Multilift Construction

The top lift shall be placed so that longitudinal joints in that lift will coincide with joints in the lower lifts of the pavement. Transverse joints in the top lift shall coincide with transverse joints in the lower lifts of the pavement. All portions of the lower lift that are to be covered by the upper lift shall be covered with a bedding mortar layer 1/4 inch to 3/8 inch thick within 15 minutes of placing the upper lift if the time between successive lifts exceeds 60 minutes. During hot or dry conditions bedding mortar shall be placed immediately before placing the upper lift. Bedding

mortar shall be a mixture of Portland cement, fly ash, fine aggregate, retarding admixture, and water and shall be spread evenly over the lower lift.

3.7.4 Slip Joints

Slip joints shall be constructed between roller-compacted and conventional Portland cement concrete (PCC) where no expansion joint is required and as indicated. The edge of the initial placement, either RCC or PCC, shall be coated with a bituminous product a minimum of 1/8 inch thick prior to placing the next material. If RCC is placed prior to conventional concrete, the RCC shall be sawcut full depth at the joint line and excess RCC removed.

3.7.5 Sawing of Contraction Joints

Transverse contraction joints shall be sawed at 40 feet spacing or as otherwise indicated. Joint sawing shall be accomplished where indicated by using a 1/8 inch blade to the depth indicated. The time of sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence when the RCC has hardened sufficiently to prevent ravelling or flaking along the edges of the saw cut. After expiration of the curing period, the upper portion of the groove shall be widened by sawing to the width and depth indicated to form a reservoir for the joint sealer. The sawed faces of joints shall be inspected for undercutting or washing of the RCC due to the early sawing, and sawing shall be delayed if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. The sawing operation shall be performed, as required, during both day and night regardless of weather conditions. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. A chalkline or other suitable guide shall be used to mark the alignment of the joint. The saw cut shall not vary more than 1/2 inch from the true joint alignment from edge to edge of the pavement area, and shall have no abrupt offsets. Before sawing a joint, the RCC shall be examined closely for cracks, and the joint shall not be sawed if a crack has occurred within 10 feet from the planned joint location. Sawing shall be discontinued when a crack develops ahead of the saw cut. Immediately after the joint is sawed, the saw cut and adjacent RCC surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. Water-curing systems shall be discontinued only in small areas to facilitate sawing. The sawing equipment shall be adequate in the number of units and the power to complete the sawing at the required rate. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operation.

3.7.6 Routing Cracks

Thirty to 45 days after placement of concrete, all cracks which have been opened to 1/8 inch or more shall be routed as indicated. Longitudinal construction joints between lanes which have opened to 1/8 inch or more shall be saw cut to form a reservoir for joint sealant in the same manner as specified in the paragraph entitled "Sawing of Contraction Joints." Routing shall be done minimizing spalling, using a vertical spindle type rotary router mounted on a rigid chassis so that the spindle will caster.

3.7.7 Sealing Joints and Cracks

Joints and cracks shall be sealed immediately following routing of cracks or sawing of joint reservoir or as soon thereafter as weather conditions permit. Joints and cracks shall be sealed as specified in Section 02762N "Joints, Reinforcement, and Mooring Eyes in Concrete Pavement."

3.8 CURING AND PROTECTION

Commencing immediately after rolling is complete in each area of each lane, the surface of the pavement shall be kept continuously wet by means of a water spray truck and/or wet burlap. After the initial 12 hours of curing, the pavement shall be cured for 14 days by a sprinkler system and/or wet burlap covering.

3.8.1 Water Spray

3.8.1.1 Trucks

Water trucks shall be used, as necessary, to keep pavement surfaces wet at all times until the sprinkler system and/or wet burlap covering is implemented. The water truck shall be supplemented, as necessary, by mists from hand-held hoses. The truck operator shall be positioned to see the spray at all times. The spray shall be capable of easy direction, either by attachment to the front of the truck so it can be directed by steering the truck or by other approved means. All spray nozzles both on the trucks and the hand held hoses shall be of a type that produces a true fog spray without any concentrated streams of water. The mist shall not be applied in a channelized or pressurized manner that causes erosion of the pavement surface. The mist application rate shall not cause ponding at the surface. Trucks shall not be allowed to drop visible oil or other contaminants on the surface. If trucks must leave the pavement, the tires shall be washed free of dirt or other foreign material before returning to the pavement. Water truck wheel loads shall not exceed 4,500 pounds and shall cause no cracking or other damage to the pavement.

3.8.1.2 Sprinkler Systems

An approved sprinkler system, consisting of pipe lines and rotating or other approved type of sprinklers, shall be used. Sprinklers shall deliver a fine mist of water and shall not cause any erosion to the RCC surface. The sprinkler system shall be in place within 12 hours of placing each area of RCC, cover all portions of the pavement area, and keep the pavement wet at all times.

3.8.2 Burlap

Burlap covers shall consist of 2 or more layers of burlap having a combined minimum dry weight of 14 ounces per square yard. Burlap shall be either new or shall have been used only for curing concrete. Burlap strips shall have a length after shrinkage of at least 1 foot greater than necessary to cover the entire width and edges of the pavement. Mats shall overlap each other at least 6 inches. Mats shall be thoroughly wetted before placing and shall be kept continuously wet and in intimate contact with the surface and edges of the pavement area for the entire curing period.

3.8.3 Cure Water Runoff Control

Any water applied to the surface of the RCC pavement or burlap during

curing, that is in excess of the amount needed to keep the surface of the RCC continuously wet, shall be controlled from running onto the base course and causing ponding on the base course or saturation of the base material.

3.8.4 PROTECTION OF PAVEMENT

After final rolling of the concrete, no vehicular traffic, except for pneumatic-tired water spray trucks or other curing equipment having wheel loads not exceeding 4,500 pounds, shall be permitted on the RCC pavement until the end of the curing period. No traffic or equipment shall be allowed on the surface that will cause any damage to the surface. Plastic sheeting meeting the requirements of ASTM C 171 shall be provided and kept readily available to cover RCC pavement less than 12 hours old if rainfall occurs.

3.9 DISPOSAL OF UNSATISFACTORY MATERIALS

Any RCC that is removed for the required correction of defective areas, waste material, and debris shall be disposed as directed.

3.10 CONTRACTOR QUALITY CONTROL

3.10.1 Tests and Inspections

The following tests and inspections shall be the responsibility of the Contractor and shall be performed by an approved commercial testing laboratory or by approved Contractor personnel:

a. Calibration of mixing plant.

b. Sampling, gradation, and quality testing of aggregates during construction.

c. Aggregate moisture tests.

d. Moisture-density testing.

e. Field density and moisture testing.

f. Surface-smoothness determinations (straightedge testing).

g. Coring to determine pavement thickness, including filling the core holes as directed.

h. Inspection during placing.

i. Flexural strength testing.

j Compressive strength testing.

Based upon the results of these tests, the Contractor shall take the action and submit reports as required below, and any additional tests to ensure that the requirements of these specifications are met. Any test results requested by the Government for review shall be provided to the Government immediately, and all results of every test by the Contractor shall be furnished to the Government on a daily basis, not later than the day after the test or inspection is made. All core drilling and all surface-smoothness determinations shall be performed by skilled personnel experienced in such work. Verification tests of materials, RCC, and

pavements, if made by the Government, shall not relieve the Contractor from the specified testing requirements.

3.10.2 Inspection Details and Frequency of Testing

The following number of tests will be the minimum acceptable for each type of operation:

3.10.2.1 Calibration of Mixing Plant

a. Batch-Mixing Plants: Accuracy of the batching equipment shall be checked for each type of cementitious material and aggregate at the beginning of operations and at least once for every 10 shifts in the presence of the Contracting Officer. Such checks shall also be made whenever there are variations in properties of the fresh concrete which could be the result of batching errors. Standard test weights accurate to plus or minus 0.1 percent shall be provided for checking plant scales.

b. Continuous-Mixing Plants: Accuracy of proportioning of the continuous-mixing plant shall be checked for each cementitious material every day at the beginning of operations and for each aggregate at the beginning of construction and after every 10 shifts. The accuracy of proportioning shall be checked by simultaneously securing timed samples of the cementitious materials and the combined aggregate as they are fed to the mixer and weighing each as appropriate.

c. Mixing Time: Mixing time of the pugmill shall be checked at the direction of the Government. Unless otherwise required, determination of mixing time shall be by weight method using the following formula:

Mixing time in seconds = pugmill dead capacity in pounds; pugmill output in pounds per second

3.10.2.2 Sampling, Sieve Analysis, and Quality of Aggregate

a. Sampling: Sampling and testing of aggregates during construction shall be performed by an approved commercial testing laboratory using appropriate Corps of Engineers and ASTM test methods.

b. Sieve Analysis: ASTM C 136 and ASTM C 117 on the fine and coarse aggregates as delivered to the mixer before starting work and a minimum of one analysis for each 500 cubic yard or portion thereof of concrete placed each shift. The aggregate shall not be used unless results verify that the aggregate complies with the specified gradation and tolerances. When deficiencies are found, the rate of testing shall be increased as directed by the Contracting Officer. When two consecutive tests show the aggregate to be deficient in grading, the mixing operation shall be stopped until acceptable material is furnished for delivery to the mixer.

c. Aggregate Quality Tests: During construction, the Contractor shall test for quality of coarse and fine aggregates used for RCC construction. Tests shall consist of Los Angeles abrasion, magnesium sulfate soundness, clay lumps and friable particles, lightweight pieces, other soft particles, and specific gravity determination. Tests for quality shall be performed at least once for each 5,000 cubic yards of pavement and otherwise when there may be a visual change in the aggregate.

3.10.2.3 Aggregate Moisture Tests

At the beginning of the day and as otherwise directed by the Contracting Officer, the Contractor shall perform moisture content tests on the coarse and fine aggregates in accordance with ASTM C 566.

3.10.2.4 Moisture-Density Testing

ASTM D 1557 moisture-density tests shall be conducted from samples obtained from a representative portion of the test section (i.e.,initial lot) and thereafter at the start of each subsequent lot of construction. Moisture-density tests shall be performed to determine the "target density". A minimum of two moisture-density test curves shall be developed for the initial lot and a minimum of one moisture-density test curve for each lot thereafter. If the maximum wet densities for successive moisture-density tests are not within 2 percent additional moisture-density tests shall be performed until the laboratory maximum wet densities attained from two successive moisture-density tests are within 2 percent. The maximum wet densities of the two successive tests shall be averaged to obtain the "target density" for that lot. This averaging procedure for determining the "target density" shall be repeated for each lot using the moisture-density tests for the subject lot and preceding lot. ASTM D 1557 moisture-density tests shall be performed whenever the mixture proportions or materials change. Since the "target density" for a lot will not be known until after the beginning of construction of the lot, the "target density" of the previous lot shall be used for quality control until the new "target density" is obtained. During construction, samples for moisture-density tests shall be taken from the discharge of the plant mixer. The samples shall be compacted in accordance with ASTM D 1557 within 1 hour of the beginning of mixing for the lot. Density results shall be reported and used on the basis of wet density, although dry density shall be reported for information only.

3.10.2.5 Field Density Testing

a. Calibration Block for the Nuclear Density Gauge: A calibration block shall be fabricated by the Contractor with concrete materials and proportions representative of those to be used during construction. The block shall be used each day before paving begins to calibrate the full-depth readings of the nuclear density gauges. The block shall be fabricated before the test section construction begins. The block size shall be 18 by 18 inches by the maximum thickness of one lift, plus 1 inch. The block shall be compacted to between 98 and 100 percent of the maximum wet density in accordance with ASTM D 1557. The moisture content of the concrete used to fabricate the block may be increased just enough to facilitate compaction of the mixture, as long as the proportions of the dry materials remain constant and the required wet density is achieved. The block shall be measured and weighed to determine the actual density (unit weight) and shall be used to check the calibration of the nuclear density gauge. After drilling a hole in the block to accommodate the nuclear density gauge probe, three full depth nuclear density gauge tests shall be performed in the direct transmission mode and the results averaged. This average nuclear density gauge reading shall be compared with the measured unit weight of the block and the difference used as a correction factor for all readings taken that day. All measuring and weighing of the test block and all calibration checking of the density gauge shall be performed in the presence of the Contracting Officer. Calibration checks of the density gauge shall be made at the beginning of pavement construction every day. The calibration block shall be available for use by the Government as

needed.

b. Field Density and Moisture Testing: Field density tests shall be performed on the RCC pavement in accordance with ASTM C 1040 as soon as possible, but within 30 minutes, after the completion of vibratory rolling. Only wet density shall be used for evaluation. The test shall be performed using a single probe nuclear density gauge operating in the direct transmission mode so density of the full depth of the RCC pavement can be measured. Each test shall include readings at depths corresponding to the bottom of the initial and final lifts; however, only the deepest reading shall be used to evaluate the wet density. Both wet and dry densities shall be reported, and all individual readings shall be reported. The moisture content shall be determined in accordance with ASTM D 3017. The wet field density shall also be reported as a percentage of the "Target Density," maximum laboratory wet density as determined for that sublot. All holes left in the RCC as a result of nuclear density testing shall be filled with a non-shrink grout.

c. Frequency of Field Density and Moisture Testing: At least one field density test shall be performed for each 100 feet of paving lane of each lift of RCC and at least one for each 100 linear feet of longitudinal and traverse construction joint. Additional tests shall be made as directed, particularly during start-up and when problems with attaining required density occur.

3.10.2.6 Surface-Smoothness Determination (Straightedge Testing)

Immediately after rolling is complete in each area, but not later than 1 hour after the concrete has been placed, the surface of the RCC pavement shall be tested with an approved straightedge or other approved device that will reveal all surface irregularities varying from the testing edge exceeding 3/8 inch. Straightedge testing shall be performed after any reduction of high spots or removal and replacement. The entire area of the RCC pavement involved shall be tested in both the longitudinal and a transverse direction on parallel lines 10 feet or less apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. Straightedge lines shall be carried continuously across joints. The testing shall be performed by the Contractor in the presence of the Contracting Officer.

3.10.2.7 Coring Specimens to Determine Pavement Thickness

ASTM C 174/C 174M. Cores shall be drilled from points in the pavement within 7 days after placement of the RCC pavement. A minimum of three cores per lot shall be taken from locations within a 1- to 3-foot radius of nuclear density test holes selected in a random fashion by the Contracting Officer. Cores shall be 6 inch diameter. Refilling of core holes shall be performed with non-shrink grout.

When the measurement of any core indicates that the pavement is deficient in thickness by 1/4 inch or more, additional cores shall be drilled parallel to the center line of the lane at 25 foot intervals on each side of the deficient core until the cores indicate that the deficiency in thickness is less than 1/4 inch. When the deficiencies in thickness for a series of cores are between 1/4 and 1/2 inch, the average thickness shall be established from an average of all core thicknesses, considering any core less than 1/4 inch deficient as being full depth. Any areas 1/2 inch or more deficient in thickness shall be removed and replaced with pavement

of the indicated thickness. The area represented by the core shall be bound by the full paving lane width and a transverse line midway between the cores adjacent to the core in question, or the regularly scheduled transverse joint should such a joint fall between the cores. When surface grinding is required that results in thickness deficiencies, the final surface shall be considered in evaluation for thickness.

3.10.2.8 Inspection During Placing

The placing foremen shall supervise all placing operations and shall be responsible for measuring and recording concrete temperatures, ambient temperature, weather conditions, time of placement, yardage placed, and method and location of placement.

a. Cold-Weather Placing: At least once during each shift, an inspection shall be made of all areas subject to cold-weather protection. Deficiencies shall be noted. During removal of protection, the concrete and ambient temperature shall be measured at least hourly.

b. Hot-Weather Placing and Initial Curing at All Times: When the maximum daily air temperature is likely to exceed 85 degrees F, the Contractor shall take and record the temperature of the concrete mixture at 30-minute intervals during hot-weather placement. The surface of the base course shall be inspected to ensure that it is sprinkled with water immediately before the concrete is placed and any deficiencies noted. Regardless of ambient temperature, the finished concrete shall be inspected to ensure that it is kept damp until the curing medium is applied and any deficiencies noted and immediately brought to the attention of the Contracting Officer. Immediate steps shall be taken to correct any deficiencies.

c. Curing Operation: The curing operation shall be inspected to assure that the surface of the pavement is kept very moist (or wet) continuously until the end of the curing period.

3.10.2.9 Flexural Strength Testing

During progress of work verify flexural strength by testing beams made from concrete taken from the delivery vehicle at intervals specified herein. Mold beams in a single layer, consolidate on a vibrating table and cure in accordance with ASTM C 31/C 31M. Perform flexural strength tests in accordance with ASTM C 78. Mold at least eight beams each day from concrete placed that day. Select one group of four beams near the beginning of the work and a second group of four beams from the final third of concrete to be placed that day. An approved laboratory shall furnish necessary labor, concrete and facilities for molding, handling, and storing the beams at the site of the work and testing beams. Perform tests at 7 days and 90 days. Earlier tests may be performed at the Contractor's request. Concrete shall meet the following requirements:

(1) From each group of four beams, three beams tested at the end of 90 days shall have an average flexural strength equal to or greater 550 psi. Specimens obviously defective shall not be considered in the determination of the strengths.

(2) No individual beam of the three beams tested shall have a flexural strength less than 495 psi. Discard defective beams.

(3) Test one beam of the group at 7 days. If the ratio of the

7-day strength test to the specified 90-day strength is less than expected make necessary adjustments for conformance.

(4) When a satisfactory relationship between 7-day and 90-day strengths has been established and approved by the Contracting Officer or his authorized representative, the 7-day test results may be used as an indication of the 90-day strengths. If test results of any concrete to be used in the project show that the flexural strength is below the specified limits and does not meet other requirements of this specification, the Contractor shall make necessary adjustments, as approved by the Contracting Officer. Concrete which at the end of 90 days does not meet the specified strength shall be removed or otherwise corrected, with corrective methods subject to the approval of the Contracting Officer.

(5) If the 90 day strength test results do not meet the requirements specified herein, the Contractor shall take a minimum of three ASTM C 42/C 42M core samples from the in-place work represented by the low strength test results and test, as long as compressive strength test results were performed at the same time as flexural strength tests and were submitted with the original mix design. Concrete represented by core tests shall be considered structurally adequate if the average of the three cores is equal to at least 100 percent of the minimum compressive strength determined based on the relationship between flexural and compressive strength and approved by the Contracting Officer. Remove concrete not meeting the compressive strength criteria and provide new, acceptable concrete. Repair core holes with non-shrink grout.

Control Charts: Maintain control charts for concrete flexural strength in accordance with ACI 214, Appendix, except as otherwise modified herein. Post copies of charts at the job site. Indicate specified strength and average strength determined by the mix design. Each control chart shall consist of the following plots:

(1) Test Results: At the same location, plot each individual test strength (the beam tested at 7 days and the average results of three beams tested at 90 days).

(2) Moving Average for Strength: Moving average of five consecutive tests ACI 214.

3.10.2.10 Compressive Strength Testing

During progress of the work verify compressive strength (i.e.,fc) by testing cylinders made from concrete taken from the delivery vehicle at intervals specified herein. Make six test cylinders for each set of tests in accordance with ASTM C 1176. Precautions shall be taken to prevent evaporation and loss of water from the specimen. Test three cylinders at 7 days and three cylinders at 90 days. Samples for compressive strength tests for concrete placed each day shall be taken from some delivery vehicle at intervals as specified in the paragraph entitled "Flexural Strength Testing", and not less than once for each 2,000 cubic yards of concrete. For the entire project, take no less than five sets of samples and perform compressive strength tests for each mix design of concrete placed. Each compressive strength test result shall be the average of three cylinders from the same concrete sample tested at 90 days. If the

average of any three consecutive compressive strength test results is less than fc or if any compressive strength test result falls below fc by more than 10 percent, take a minimum of three ASTM C 42/C 42M core samples from the in-place work represented by the low test cylinder results and test. RCC represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85 percent of fc and if no single core is less than 75 percent of fc. Locations represented by erratic core strengths shall be retested. Remove concrete not meeting compressive strength criteria and provide new acceptable concrete. Repair core holes with non-shrink grout.

3.10.3 Action Required

3.10.3.1 Mixing Plant

Whenever it is found that either the weighing or the batching accuracy does not comply with specification requirements, the plant shall be shut down until necessary adjustments or repairs have been made. Discrepancies in recording shall be corrected immediately.

3.10.3.2 Aggregate Grading and Quality

a. Grading: When the amount passing any sieve is outside the specification limits or tolerances, the aggregate shall be immediately resampled and retested. If the second sample fails on the same sieve, that fact shall be reported to the Contracting Officer and immediate steps shall be taken to correct the grading.

b. Quality: When the aggregate fails to meet the specification limits for Los Angeles abrasion, magnesium sulfate soundness, clay lumps and friable particles, lightweight pieces, other soft particles, and specific gravity, the Contracting Officer shall be notified immediately and approved corrective action shall be taken.

3.10.3.3 Field Density and Moisture Testing

If any nuclear density gauge reading is below 97.8 percent for interior or fresh joint or below 95.8 percent for a cold joint, another test shall be performed within a 5 to 8 foot radius of the previous testing location. If this adjacent reading is also below the wet density requirements, the Contracting Officer shall be notified immediately, and additional vibratory roller passes shall be made across the full lane width between the last testing location that produced an acceptable reading and the paver. If additional vibratory roller passes cause the wet density to decrease or cause the surface texture and appearance to deteriorate in the opinion of the Contracting Officer, the paving operation shall be discontinued until appropriate adjustments are made to the moisture content of the mixture, to the operation of the paver, to rolling procedures, or other operations to assure that the specified wet density and surface requirements can be achieved.

3.10.3.4 Surface Smoothness

When straightedge testing indicates any areas where readings exceed 3/8 inch, the Contracting Officer shall be notified immediately, and the paving operation shall be immediately modified to eliminate this.

Any separate joint or interior area surface deviation which exceeds 9/16 inch shall be removed or corrected to meet the 3/8 inch requirement. High

spots indicated by the testing edge in excess of 3/8 inch shall be marked plainly and removed or reduced by rubbing with a carborundum brick and water. Rubbing shall be discontinued as soon as contact with the coarse aggregate is made. If high spots cannot be removed in the above manner because of disturbing the coarse aggregate, the high portion of the pavement shall be corrected by an approved surface-grinding machine after the RCC pavement is 14 days old or the defective pavement shall be removed and replaced. When grinding of 1/2 inch or more would be required, the pavement shall be removed and replaced.

3.10.3.5 Defective Areas

Mixtures that become contaminated or are defective shall be removed. Skin patching of an area that has been rolled shall not be permitted. Holes the full thickness of course shall be cut so that the sides are perpendicular and parallel to the jointing pattern and the edges are vertical. Defective areas shall be replaced by sawing full depth of the pavement around the perimeter of the defective area and removing the defective pavement full depth of the course without damaging the adjacent pavement. No such area of defective pavement that is removed and replaced with a new paving mixture shall have a length or width less than 10 feet, and no adjacent slab or portion of a slab that remains in the pavement abutting the replacement area shall have a length or width less than 8 feet when measured from a joint or edge. Prior to the placement of the fresh concrete, the edge of the existing concrete shall form a clean, vertical face to pave against. Conventional concrete or RCC may be used at the Contractor's option to fill the void. The new slab shall conform to all requirements of smoothness, surface texture, density, thickness, and concrete quality, as stated herein. Longitudinal and transverse joints shall be established in the new slab in accordance with the original plans and shall be sealed, if required for the adjacent slab.

3.10.3.6 Inspection

a. Temperature Protection: The Contracting Officer shall be notified whenever the concrete temperature during the period of protection or protection removal fails to comply with the specifications, and immediate steps shall be taken to correct the situation. Regardless of the ambient temperature, when the temperature of the concrete mixture exceeds 90 degrees F, mixing and placing shall be stopped and the Contracting Officer notified.

b. Curing Operation: The Contracting Officer shall be notified when any pavement surface is allowed to dry before the end of the curing period, and immediate steps shall be taken to correct the situation.

c. Reports: All results of tests conducted at the project site shall be reported daily and shall be delivered to the Contracting Officer. During periods of cold weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failure and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all Contractor quality control records at any time.

-- End of Section --

SECTION 02762N

JOINTS, REINFORCEMENT, AND MOORING EYES IN CONCRETE PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 509	(2002) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 603	(1990; R 1997e1) Extrusion Rate and Application Life of Elastomeric Sealants
ASTM C 639	(2001) Rheological (Flow) Properties of Elastomeric Sealants
ASTM C 661	(1998) Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
ASTM C 679	(1987; R 1997e1) Tack-Free Time of Elastomeric Sealants
ASTM C 719	(1993; R 1998) Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
ASTM C 792	(1993; R 1998) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C 793	(1991) Effects of Accelerated Weathering on Elastomeric Joint Sealants
ASTM D 412	(1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS SS-S-200	(Rev. E; Am. 2) Sealants, Joint,

	Two-Component, Jet-Blast Resistant, Cold-Applied, For Portland Cement Concrete Pavement
FS SS-S-1401	(Rev. C) Sealant, Joint, Non-Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Asphalt Concrete Pavements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with standard Navy submittal procedures and the Contract.

SD-06 Test Reports

Joint sealer

SD-07 Certificates

Equipment list

Submit a list and description of equipment to be used. Equipment for heating, mixing and installing joint seals shall be in accordance with instructions provided by joint seal manufacturer.

Blocking media

Separating tape

Joint seal

SD-08 Manufacturer's Instructions

Joint sealants

Instructions for joint sealants shall include, but not be limited to: storage requirements, ambient temperature and humidity ranges, and moisture condition of joints for successful installation; requirements for preparation of joints; safe heating temperature; mixing instructions; installation equipment and procedures; application and disposal requirements; compatibility of sealant with filler material; curing requirements; and restrictions to be adhered to in order to reduce hazards to personnel or to the environment. Submit instructions at least 30 days prior to use.

SD-11 Closeout Submittals

Joint sealer

Joint filler

A record of joint sealant and filler materials used shall be furnished, in duplicate, to the Contracting Officer in the following format:

MILITARY BASE/AREA	MATERIAL	SPECIFICATION DESIGNATION/TYPE	MANUFACTURER
_____	_____	_____	_____
_____	_____	_____	_____

MATERIAL USED (MFR DESIG)	EXACT ON-SITE LOCATION	QUANTITY OF SEALANT	DATE APPLIED
_____	_____	_____	_____
_____	_____	_____	_____

1.3 DELIVERY, STORAGE, AND HANDLING

Inspect for damage, unload, and store materials delivered to site in accordance with manufacturer's instructions.

1.3.1 Joint Seal Materials

Deliver liquid joint sealants and lubricants in original sealed containers and protect from freezing and high temperatures. Store preformed joint fillers in a manner to maintain straightness and avoid damage.

1.4 ENVIRONMENTAL REQUIREMENTS

Forming of joints or applying joint sealants shall not proceed when the underlying layer or surface is frozen, or when, in the opinion of the Contracting Officer, weather conditions will prevent the proper installation of the joint sealants. During installation, surfaces shall be dry and sealant and bond breakers shall be protected from moisture.

1.5 TRAFFIC CONTROL

Do not permit vehicular or heavy equipment traffic on the pavement in area of the joints being sealed during the protection and curing period of joint sealant. At end of curing period, traffic may be permitted on pavement when approved.

1.6 EQUIPMENT

Maintain machines, tools, and other equipment used in performance of work in proper working conditions at all times. Furnish necessary equipment and accessories to install preformed joint filler, and liquid sealant in hardened concrete in accordance with equipment list. Concrete saws shall be adequate to remove filler and saw grooves for all joints.

1.6.1 Joint and Pavement Cleaning Equipment

1.6.1.1 Sandblasting Equipment

Sandblasting equipment for cleaning joints shall include an air compressor, hose, and nozzles of proper size, shape and opening to produce a clean joint. Equip compressor with traps that will maintain compressed air free of oil and water.

1.6.1.2 Power Saws

Concrete saws shall be self-propelled and capable of sawing joints in

concrete to indicated width, depth and alignment without spalling or ravelling of concrete and at a production rate to avoid uncontrolled cracking.

1.6.1.3 Vacuum Sweeper

Self-propelled, vacuum pickup sweeper capable of removing saw cuttings, loose sand, water, joint material, and debris from pavement surface.

1.6.2 Joint Sealing Equipment

Joint sealing equipment shall be of a type required by joint seal manufacturer's installation instructions. Equipment shall be capable of installing sealant to depths, widths and tolerances indicated. Inspect equipment periodically during installation of sealant as required but not less than once each work day, to ensure the equipment is functioning properly. If malfunctions are noted, joint sealing shall not proceed until they are corrected.

1.6.2.1 Hot-Poured Liquid Sealant

Unit applicators used for heating and installing hot-poured sealant materials shall be mobile and equipped with a double-wall agitator-type kettle with an oil medium in outer space for heat transfer, a direct-connected pressure-type extruding device with nozzle or nozzles shaped for insertion in the joints to be filled, and a positive device for controlling temperature of oil and sealant. Applicator shall be so designed that sealer will circulate through delivery hose and return to kettle when not sealing joint.

1.6.2.2 Preformed Joint Seal

Install seals with equipment recommended in writing by sealant manufacturer. Equipment shall be capable of installing joint seal to indicated depth without damaging, distorting, or stretching seal material.

1.6.2.3 Equipment for Silicone Sealant

Equipment for silicone sealant shall be air-powered pump, components, and hoses as recommended by the sealant manufacturer. Hoses and seals shall be lined to prevent moisture penetration and withstand pumping pressures. Equipment shall be free of contamination from previously used to other type sealant.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Joint Filler

2.1.1.1 For Contraction Joints

Preformed joint filler, ASTM D 1751, ASTM D 1752, Type II or Type III. Filler must be compatible with joint sealer material.

2.1.2 Bond Breakers

2.1.2.1 Blocking Media

Compressible, non-shrinkable, nonreactive with joint sealant and nonabsorption type such as plastic rod, free of oils or bitumens. Blocking media shall have a water absorption of not more than 5 percent by weight when tested in accordance with ASTM C 509. Blocking media shall be consistent with joint seal manufacturer's installation instructions and be at least 25 percent larger in diameter than width of joints as shown.

2.1.2.2 Separating Tape

Polyethylene or polyester tape, 3 mil minimum thickness, or masking tape, nonreactive, nonabsorptive, adhesive back tape, width equal to width of joints as indicated. Separating tape shall be consistent with joint seal manufacturer's installation instructions.

2.1.3 Joint Sealants

2.1.3.1 Sealant, Joint, Non-Jet Fuel Resistant, Hot-Applied

FS SS-S-1401, for portland cement and asphalt concrete pavements.

2.1.3.2 Single Component Cold-Applied Silicone

Silicone sealant shall be self-leveling, non-acid curing, and meet the following requirements.

TEST	TEST METHOD	REQUIREMENTS
Weight Loss	ASTM C 792 Modified (See Note 1)	10 percent max.
Flow	ASTM C 639 (Type I)	Smooth and level
Extrusion Rate	ASTM C 603	30 sec. max.
Tack Free Time	ASTM C 679	5 hours max.
Hardness (Shore 00) (See Note 2)	ASTM C 661	30 - 80
Tensile Stress at 150 Percent Elongation (See Note 2)	ASTM D 412 (Die C)	30 psi max.
Percent Elongation (See Note 2)	ASTM D 412 (Die C)	700 min.
Accelerated Weathering	ASTM C 793	Pass 5000 hours
Bond and Movement Capability	ASTM C 719	Pass 10 cycles at ±50 percent movement (no adhesion or cohesion failure)
Flame Resistant	FS SS-S-200	Pass

NOTES:

1. Percent weight loss of wet (uncured) sample after placing in forced-draft oven maintained at 158 degrees F $\pm$ 1 degree F for two hours.

2. Specimen cured 21 days at 73 degrees F $\pm$ 1 degree F and 50 percent.

ACCELERATED WEATHERING FACTORY TEST REPORT. For Accelerated Weathering test, in lieu of testing of actual joint sealant to be used on the project, a report of a factory test, performed within two years of contract award, may be submitted.

2.1.3.3 Primers

Select concrete primer recommended by manufacturer of proposed liquid joint sealant.

PART 3 EXECUTION

3.1 PREPARATION OF SEALANTS

3.1.1 Liquid Sealants

Prior to use, inspect liquid joint seal to ensure product has not become damaged during shipping and storage, material is of proper lot number and has not reached its shelf life retest date.

3.1.2 Preformed Joint Fillers

Prior to installing inspect preformed joint fillers to ensure they are straight, without damage, and resilient.

3.1.3 Hot-Applied Liquid Sealants

Do not heat sealing materials in excess of the safe heating temperature as shown in manufacturer's instructions. Do not expose sealant to direct heat or flame. Remove and waste sealant which has been over-heated, heated in excess of three hours, or has remained in application equipment at end of day's operation.

3.2 JOINTS

Joints shall be type shown and shall form a regular rectangular pattern. Joints shall conform to details shown. Seal joints by procedures indicated. Wherever curved pavement edges occur, make joints to intersect tangents to curve at right angles. Joints shall be in a continuous straight line extending from edge to edge of pavement. Do not stagger joints in abutting pavements except where shown. Protect joints from curing compounds by covering with tape or rope. Take necessary precautions to ensure proper curing at joints.

3.2.1 Sawing of Joints

Sawing shall be conducted when RCC has hardened sufficiently to prevent ravelling or flaking along edges of saw cut. Mark alignment of joints by chalk line or other suitable guide. Saw cuts shall not vary from required alignment by more than 1/2 inch in ten feet. Saw cutting shall be carried on both during the day and at night as required. A supply of saw blades and at least one stand-by sawing unit in working condition will be readily

available during sawing operations. Discontinue sawing if a crack develops ahead of a saw cut. If uncontrolled cracking has occurred do not saw cut along the cracks but notify the Contracting Officer immediately.

3.2.2 Protection of Joints

Immediately after each joint is sawed, thoroughly clean saw cut and adjacent concrete surface by flushing with water and blowing with compressed air to remove waste. Protect joints from intrusion of foreign materials by installation of blocking media or separating tape as indicated. Do not seal joints until concrete has cured sufficiently as required by joint sealant manufacturer's instructions.

3.2.3 Contraction Joints

Saw joints to dimensions indicated. Joint lines shall be within specified tolerance, straight, and extend for width of transverse joint, and for entire length of longitudinal joint.

3.2.4 Preparation of Joints

Seal joints unless otherwise indicated. Immediately before installation of sealant, thoroughly clean joints until laitance, curing compound, preformed joint filler, and protrusions of hardened concrete are removed from sides and upper edges of joint space.

3.2.4.1 Cleaning of Sawed Joints

Use a power-driven concrete saw to saw through preformed joint filler and to widen joint to indicated dimensions. Blow loosened materials from joint with compressed air. Clean exposed concrete joint faces and pavement surfaces extending at least one inch from edges of joints by thoroughly sandblasting and air blowing until surfaces are free of dust, dirt, curing compound, preformed joint filler, and other material that might prevent bonding of sealer to concrete.

3.2.5 Disposal of Debris

Remove from joints and pavement surface saw cuttings, excess joint material, dirt, water, sand, and other debris.

3.3 INSTALLATION

Joint preparation, primer and sealant shall be in accordance with joint seal manufacturer's instructions. Install a test section at start of sealing operation for each type sealant to be used. A representative of the joint seal manufacturer shall be on site full time during the installation of test section. Test section shall meet contract requirements. Contracting Officer shall be notified upon completion of test section.

3.3.1 Bond Breakers

Immediately after joints receive final cleaning, install specified bond breaker in the bottom of joint reservoir.

3.3.2 Bonding Agents and Primer

Apply joint seal bonding agents and primer in accordance with joint seal

manufacturer's instructions. When primed joint becomes dusty or otherwise contaminated prior to sealing, re-sandblast, air blow, and re-prime joint.

3.3.3 Installation of Liquid Sealants

Do not install liquid joint seals until test section has been inspected and approved by Contracting Officer. Joints shall be dry and free of debris and contaminants prior to placement of sealant. Fill joints to depths and tolerances indicated without formation of voids or entrapped air. Remove excess or spilled sealant from pavement and discard.

3.4 FIELD QUALITY CONTROL

3.4.1 Joints

Joints which have been cleaned and have backer rods or bond breaking tape installed shall be inspected and approved prior to sealing.

3.4.2 Joint Seal Test Section

Inspect joint seal test section with the joint seal manufacturer's representative. Joint seal manufacturer's representative shall provide written notice of any deficiencies and required corrections or adjustments in joint seal installation procedures. Correct deficiencies and obtain approval of test section by the Contracting Officer prior to installing additional joint seal.

3.4.3 Joint Sealer

Inspect installed joint seals for conformance to contract requirements, joint seal manufacturer's instructions, and test section. Obtain approval for each joint seal installation.

3.5 ACCEPTANCE

Joint sealer that fails to cure properly, or fails to bond to joint walls, or reverts to uncured state or fails in cohesion, or shows excessive air voids, blisters, surface defects, swelling, or other deficiencies, or is not recessed within indicated tolerances shall be rejected. Remove rejected sealer and reclean and reseal joints in accordance with the specifications.

-- End of Section --

SECTION 02953

MITIGATED WETLANDS AREA, TREES, HERBS, AND GRASS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z60.1	(1996) Nursery Stock

U.S. DEPARTMENT OF AGRICULTURE (USDA)

DOA FSA	(January 1985) Federal Seed Act Rules and Regulations of the Secretary of Agriculture
DOA SCS List	(1982) Soil Conservation Service, National List of Scientific Plant Names, (Volume 1-List of Plant Names), Report Number SCS-TP-159

U.S. DEPARTMENT OF INTERIOR (DOI)

DOI List	(1988) National List of Plants Species that Occur in Wetlands: National Summary, Biological Report 88(24), Fish and Wildlife Service

MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY (MDEQ)

MDEQ PDMCESS	(1994) Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater

1.2 DEFINITION

1.2.1 Pesticide

Pesticide means soil fumigants, herbicides, insecticides, and fungicides.

1.2.2 Wetlands Restoration Areas

Refers to all areas designated for establishment of indigenous vegetation as indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with standard Navy submittal procedures and the Contract.

SD-06 Test Reports

Topsoil

SD-07 Certificates

Nursery certifications

Indicate names of plants in accordance with the DOI List or DOA SCS List, including type, quality, and size.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Arrange for delivery of plant material as close as possible to planting. Small deliveries of only that plant material which can be installed the same day are recommended.

1.4.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.4.1.2 Branched Plant Delivery

Deliver with branches tied and exposed branches covered with material which allows air circulation. Prevent damage to root balls and desiccation of leaves.

1.4.1.3 Fertilizer and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and Federal laws. Fertilizer and lime may be furnished in bulk with a certificate indicating the above information.

1.4.1.4 Plant Labels

Deliver plants with durable waterproof labels in weather-resistant ink. Provide labels stating the correct plant name and size as specified in the list of required plants. Attach to plants, bundles, and containers of plants. Groups of plants may be labeled by tagging one plant. Labels shall be legible for a minimum of 60 days after delivery to the planting site.

1.4.1.5 Pesticide Delivery

Deliver to the site in original unopened containers with legible label indicating U.S. Environmental Protection Agency (USEPA) registration number and manufacturer's registered uses.

1.4.2 Storage

1.4.2.1 Plant Storage and Protection

Store and protect plants not planted on the day of arrival at the site as follows:

a. Shade and protect plants in outside storage areas from the wind and direct sunlight until planted.

b. Heel-in bare root plants.

c. Protect balled and burlapped plants from freezing or drying out by covering the balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.

d. Keep plants in a moist condition until planted by watering with a fine mist spray.

1.4.2.2 Lime, Fertilizer, and Mulch Storage

Store in cool, dry locations away from contaminants.

1.4.2.3 Pesticides and Antidesiccants Storage

Do not store with other landscape materials.

1.4.2.4 Seed Storage

Store in cool, dry locations away from contaminants.

1.4.3 Handling

Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle balled and burlapped plants carefully to avoid cracking or breaking the earth ball. Do not handle plants by the trunk. Puddle bare-root plants after removal from the heeling-in bed to protect roots from drying out. Remove damaged plants from the site.

1.5 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.5.1 Planting Dates

From September 1 to July 15 for seed mixtures and November 1 to March 31 for trees. Planting outside these time periods may be acceptable depending on specific conditions at the site. However, planting outside these periods shall be conducted only after the approval by the Contracting Officer.

1.5.2 Restrictions

Do not plant when ground is frozen or when air temperature exceeds 95 degrees F.

1.5.3 Seed

Apply seed within twenty four hours after seed bed preparation.

1.6 GUARANTEE

All plant material shall be guaranteed for one year beginning on the dates of inspection by the Contracting Officer to commence the plant establishment period.

1.7 SUBSTITUTIONS

Authorization shall be obtained from the Contracting Officer before performing work in variance to these specifications including substitutions of plant material in terms of species, size, or form.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Varieties

Botanical names indicated are listed in DOI List. Furnish nursery stock in accordance with ANSI Z60.1, except as otherwise specified or indicated. Each plant or group of planting shall have a "key" number indicated on the nursery certifications of the plant schedule. Furnish plants grown under climatic conditions similar to those in the locality of the project. Spray plants budding into leaf or having soft growth with an antidesiccant before digging. Plants of the same specified size shall be of uniform size and character of growth.

2.1.2 Plant Regulations

ANSI Z60.1, and the following additional requirements.

2.1.3 Shape and Condition

Well-branched, well-formed, sound, vigorous, healthy trees free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having a healthy, normal, and unbroken root system.

2.1.4 Source and Plant Material

All plant material shall be nursery-grown specifically for use in U.S. Department of Agriculture Hardiness Zone 9. Plant material collected from wild settings shall not be used.

2.1.5 Plant Material Used in the Wetland Restoration Area

All species will be planted at or above the elevation indicated. These elevations shall be establish by the Contractor and approved by the Contracting Officer.

a. Splash Pine (*Pinus elliotii*)

b. Bald Cypress (*Taxodium distichum*)

c. Water Tupelo (*Nyssa aquatica*)

d. Water Oak (*Quercus nigra*)

e. Water Hickory (*Carya aquatica*)

2.1.6 Size

Minimum sizes shall be those available from the nursery stock, based on the average width or height of the plant for the species as specified in ANSI Z60.1

2.1.7 Plant Material Standards

All plant material shall meet applicable standards set in ANSI Z60.1.

2.1.7.1 Bareroot Trees

Show good form; be sound and vigorous; be free of disease and insect damage, sunscald, windburn, and abrasion; and have a well-developed fibrous root system. Have an abundance of well-developed terminal buds on the leaders and branches, and the stems and branches shall be turgid and have a healthy cambium. Plants shall not be leafed out at the time of delivery.

a. Container Grown Trees

(1) The root system shall be well distributed throughout the container, but not potbound.

b. Balled and Burlapped Trees

(1) Balls shall be firm natural soil meeting the size criteria in ANSI Z60.1. Balls shall be securely tied using burlap or other strong, biodegradable cloth.

2.2 TOPSOIL

2.2.1 Source

Obtain planting soil used in the wetland restoration areas from an offsite source or as otherwise indicated. Conform to requirements specified in paragraph entitled "Composition." Do not use soils from areas where invasive species are known to occur.

2.2.2 Composition

Soil for use in the upper 6 inches of the restoration areas shall be of medium texture (loam, sandy loam, loamy sand, silt loam, silt) based on USDA designations; and contain 5.0 to 8.0 percent organic matter and have a pH between 6.0 to 7.0 and soluble salts less than or equal to 500 ppm. Soils requiring blending to meet composition requirements shall be blended using a barrel blending method.

2.3 pH AJUSTERS

2.3.1 Lime

As indicated.

2.4 SOIL CONDITIONERS

MDEQ PDMCESS Chapter 5, "Topsoiling" for permissible soil conditioners or as otherwise specified.

2.5 SURFACE TOPDRESSING

Mulches as indicated.

2.6 SEEDS

2.6.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weed and seed content, and inert material. Label in conformance with DOA FSA and MDEQ PDMCESS. Wet, moldy, or otherwise damaged seed will be rejected. Field mixtures will be acceptable when field mixture is performed on site in the presence of the Contracting Officer.

2.6.2 Composition

MDEQ PDMCESS Chapter 5, "Permanent Seeding" or as otherwise specified.

2.6.3 Seed Mixture

2.6.3.1 Permanent Seed Mixtures

The permanent seed mixture shall contain the following seed species.

a. Common Bermuda Grass (*Cynodon dactylon*)

b. Annual Ryegrass (*Lolium multiflorum*)

Annual ryegrass should only be added to the permanent seed mixture when applying permanent seed mixture between December 1st and February 28th.

2.6.3.2 Temporary Seed Mixture

The temporary seed mixture shall contain the following seed species.

a. Annual Ryegrass (*Lolium multiflorum*)

2.6.3.3 Wetland Seed Mixture

The wetland seed mixture shall contain five of the following seed species. The five species shall be selected in order to represent a minimum of three genera.

Genus Scirpus:

a. Olney's Bulrush (*Scirpus olneyi*)
b. Woolgrass (*Scirpus cyperinus*)
c. Common Three-square (*Scirpus pungens*)
d. Soft-stem Bulrush (*Scirpus validus*)

Genus Sparganium:

e. Giant Burreed (*Sparganium eurycarpum*)
f. Eastern Burreed (*Sparganium americanum*)

Genus Rumex:

g. Water Dock (*Rumex verticillatus*)

Genus Juncus:

h. Soft Rush (*Juncus effusus*)
i. Torrey Rush (*Juncus torreyi*)

Genus Glyceria:

j. Fowl Mannagrass (*Glyceria striata*)

Genus Carex:

k. Fox Sedge (*Carex vulpinoidea*)
l. Bottlebrush Sedge (*Carex comosa*)

Genus Panicum:

m. Switchgrass (*Panicum virgatum*)

Genus Leersia:

n. Rice Cutgrass (*Leersia oryzoides*)

Genus Andropogon:

o. Lowland Broomsedge (*Andropogon glomeratus*)

Genus Polygonum:

p. Marsh Smartweed (*Polygonum hydropiperoides*)
q. Pennsylvania Smartweed (*Polygonum pensylvanicum*)
r. Lady's Thumb (*Polygonum persicaria*)

The wetland seed mixture shall not contain the following seed species.

a. Cattails (*Typha sp.*)
b. Fescues (*Festuca sp.*)
c. Reed Canary Grass (*Phalaris arundicacea*)
d. Phragmites (*Phragmites australis*)
e. Yellow Nutsedge (*Cyperus esculentus*)
f. Purple Loosestrife (*Lythrum salicaria*)

2.7 PESTICIDES AND FERTILIZERS

All pesticides and fertilizers proposed for use must be approved by the Contracting Officer prior to application.

2.8 WATER

Suitable quality for irrigation.

2.9 MULCH

All mulch used shall be approved by the Contracting Officer prior to application and shall be comprised of shredded woody material free of stones and other foreign material.

2.10 TRUNK WRAPPING MATERIAL

Two thicknesses crinkled paper cemented together with bituminous material, minimum 4 inch width, with stretch factor of 33 1/3 percent. Tying material shall be 3 ply, lightly tarred medium or coarse sisal yarn twine.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Extent of Work

Provide soil preparation, fertilizing, seeding, and topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.2 Soil Preparation

After areas have been brought to finish subgrade elevation and immediately prior to seeding and planting, thoroughly till to minimum depth of 6 inches by scarifying, discing, harrowing, or other methods approved by the Contracting Officer. Provide topsoil to meet indicated finish grade. Do not spread topsoil when frozen or excessively wet or dry.

After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters and topsoil conditioners as indicated by discing, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than one inch in any dimension remaining on the surface after tillage. Correct irregularities in finished surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.2.1 pH Adjuster Application Rates

Apply pH adjuster at rates as determined by laboratory soil analysis of the topsoil as indicated.

3.1.2.2 Soil Conditioner Application Rates

Apply topsoil conditioners at rates as determined by laboratory soil analysis of the topsoil as indicated.

3.1.2.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the topsoil as indicated.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, thoroughly till, restore topsoil to proper grade and thoroughly moisten topsoil to a depth of 6 inches. Do not seed when ground is muddy, frozen, snow covered or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the indicated seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed

preparation. Sow seed by approved sowing equipment as indicated.

3.2.2 Seed Application Method

As indicated.

3.2.3 Surface Topdressing

For seeding methods other than hydroseeding, spread straw over seed bed area as indicated. Take precautionary measures to prevent topdressing materials from spilling onto pavements, utilities structures, or planter beds. Wood cellulose fiber mulch shall be utilized in conjunction with hydroseeding.

3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3H to 1V with a roller not exceeding 90 pounds for each foot of roller width. If seeding is performed with cultipacker-type seeder or by hydroseeding, rolling may be eliminated.

3.2.5 Erosion Control Matting

Install in accordance with MDEQ PDMCESS Chapter 5, "Mulching" and the manufacturer's instructions.

3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of topsoil to a depth of 6 inches without run-off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

3.5 MAINTENANCE

Maintenance shall begin immediately after planting. Seeded areas shall be protected and maintained until formal acceptance by the Contracting Officer. Maintenance shall consist of watering activities and other necessary operations adequate to insure the survival of the planted materials and seeded areas for the duration of the maintenance period, as specified in MDEQ PDMCESS Chapter 5, "Permanent Seeding" and "Trees, Shrubs, Vines, and Ground Cover."

3.6 PREPARATION - WETLAND RESTORATION AREAS

3.6.1 Layout

Approved plant material locations and bed outlines on the project site will

be staked and flagged before digging plant pits or beds. All plants will be planted at or above the elevation indicated by a field survey of the elevations of naturally occurring specimens in the adjacent wetland. The Contracting Officer will determine the lowest elevations that each species will be planted and reserves the right to adjust plant material locations to meet field conditions.

3.6.2 Transportation

Provide adequate protection, packaging and handling of all plant materials during their transportation to the site to guard against injury or desiccation. All plants injured and plants with root balls broken during planting operation will be rejected. All plant material is to be planted as soon as possible after its arrival on the site. All bare-root plants ("BR") shall be planted or heeled-in immediately upon delivery to the site. All other plant material that can not be planted immediately upon delivery shall be covered with moist soil, mulch, or other material to provide protection from drying winds and sun. All plants shall be watered as necessary until planted.

3.6.3 Excavation, Topsoiling and Planting

Provide minimum of 6 inches of topsoil over the wetland restoration areas or as otherwise indicated. Protect existing adjacent vegetation before excavations are made. Measure depth of pits from finished grade. Depth of excavation shall provide proper relation between top of ball and finished grade as specified in paragraph entitled "Handling."

3.6.4 Root Pruning

Cleanly prune any damaged roots from the bare root seedlings. Prune no more than 25 percent of the original root system to facilitate planting.

3.7 PLANTING

3.7.1 Planting Pits

3.7.1.1 Planting Pits for Bare Root Plants

Planting pits shall be excavated to a depth such that the root system will be just below grade, and to a width accommodating the root system in a natural position.

3.7.1.2 Planting Pits for Balled and Burlapped and Container Grown Plants

Planting pits shall be excavated, to a depth that the top of the rootball (removed from the container, if container grown) will sit approximately 1 to 2 inches above the surrounding grade, and to a width that will leave approximately 9 additional inches on each side of the rootball.

3.7.1.3 Planting Pits for Peat Pot Stock

Planting pits shall be excavated so that the top of the peat pot shall be between 1 and 2 inches below the soil surface.

3.7.2 Setting and Planting

3.7.2.1 Setting Bare Root Plants

Each plant shall be set vertically in its pit such that the uppermost roots are just below grade and that the extended root system does not touch the edge of the pit. All visible damaged roots shall be cleanly pruned above the area of damage prior to setting the plants.

3.7.2.2 Setting Balled and Burlapped and Container Grown Plants

The rootball shall be placed in the center of the pit and backfilled. Tree and shrubs shall not have more than a 10 percent lean following backfilling.

3.7.2.3 Setting Peat Pots

Peat pots shall be set so that the top of the peat pot is between 1 and 2 inches below the topsoil surface.

3.7.3 Backfilling and Tamping

3.7.3.1 Backfilling Bare Root Plants

Backfill shall comprise the soil originally removed from the pit, loose and without clods, but not amended. Backfill shall be loosely added to the pit so as to not crush or compress the roots. Once placed, the backfill shall be gently tamped to pack topsoil around the roots.

3.7.3.2 Backfilling Balled, Container Grown Plants and Peat Pots

Backfill shall be comprised of topsoil originally removed from the pit, loose and without clods, but not amended. Once placed, the backfill shall be gently tamped. Excess backfill shall be loosely raked across the land surface surrounding the pit, but not used to create and saucer to trap rainwater.

3.7.4 Watering

Topsoil around each plant shall be thoroughly watered immediately following planting.

3.7.5 Mulching

After watering, a circular area 30 inches in diameter surrounding each tree shall be mulched to a depth of 2 inches.

3.7.6 Trunk Protection

Trunks of tree saplings shall be wrapped with trunk wrapping material from ground level to the height of initial branching. Wrap shall be removed within one year.

3.7.7 Other

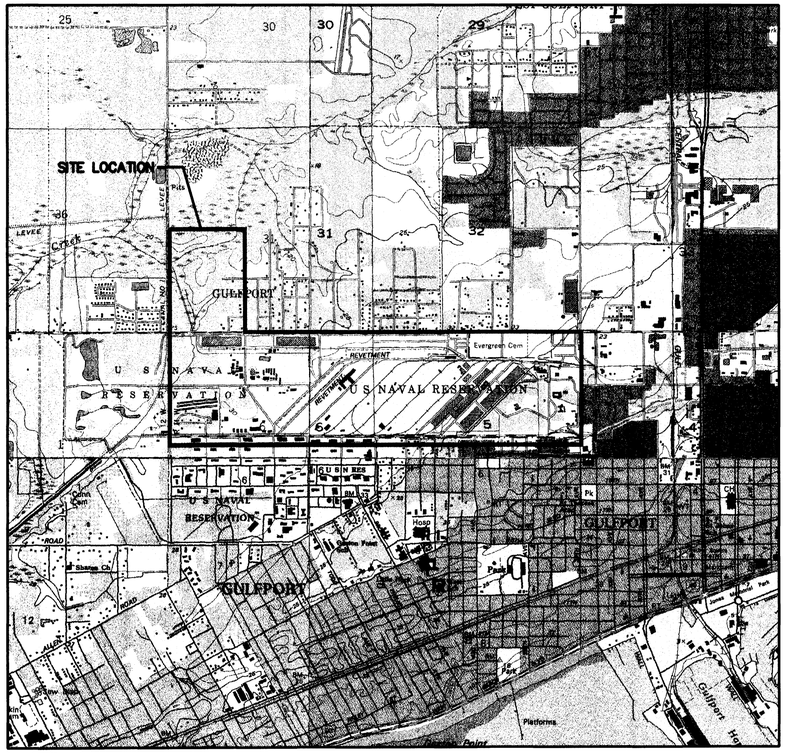
Newly graded areas outside of the limits of the wetland restoration areas shall be topsoiled and seeded as indicated.

3.8 MAINTENANCE PERIOD

Maintenance shall begin immediately after planting and shall be provided for either the replicated wetlands and grasses. New planting and seeded areas shall be protected and maintained for a period of ten (10) weeks after formal acceptance by the Contracting Officer. Maintenance shall consist of watering activities and other necessary operations adequate to insure the survival of the planted materials and seeded areas for the duration of the maintenance period. Remove and replace all dead plants.

-- End of Section --

100% REMEDIAL DESIGN
SITE 8 - HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI



PROJECT LOCATION MAP

0 2000 4000
SCALE IN FEET

DRAWING INDEX

NAVFAC DWG. No.	SHEET No.	SHEET TITLE
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5424662	T–2	GENERAL NOTES AND LEGEND
5424663	T–3	PLAN LOCATION MAP
5424664	C–1	EXISTING CONDITIONS PLAN (SHEET 1 OF 5)
5424665	C–2	EXISTING CONDITIONS PLAN (SHEET 2 OF 5)
5424666	C–3	EXISTING CONDITIONS PLAN (SHEET 3 OF 5)
5424667	C–4	EXISTING CONDITIONS PLAN (SHEET 4 OF 5)
5424668	C–5	EXISTING CONDITIONS PLAN (SHEET 5 OF 5)
5424669	C–6	EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN (SHEET 1 OF 5)
5424670	C–7	EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN (SHEET 2 OF 5)
5424671	C–8	EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN (SHEET 3 OF 5)
5424672	C–9	EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN (SHEET 4 OF 5)
5424673	C–10	EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN (SHEET 5 OF 5)
5424674	C–11	EROSION, SEDIMENT AND STORMWATER CONTROL PLAN NOTES
5424675	C–12	REVEGETATION NOTES
5424676	C–13	EROSION, SEDIMENT AND STORMWATER CONTROL DETAILS (SHEET 1 OF 2)
5424677	C–14	EROSION, SEDIMENT AND STORMWATER CONTROL DETAILS (SHEET 2 OF 2)
5424678	C–15	EXCAVATION AND FILL PLAN (SHEET 1 OF 5)
5424679	C–16	EXCAVATION AND FILL PLAN (SHEET 2 OF 5)
5424680	C–17	EXCAVATION AND FILL PLAN (SHEET 3 OF 5)
5424681	C–18	EXCAVATION AND FILL PLAN (SHEET 4 OF 5)
5424682	C–19	EXCAVATION AND FILL PLAN (SHEET 5 OF 5)
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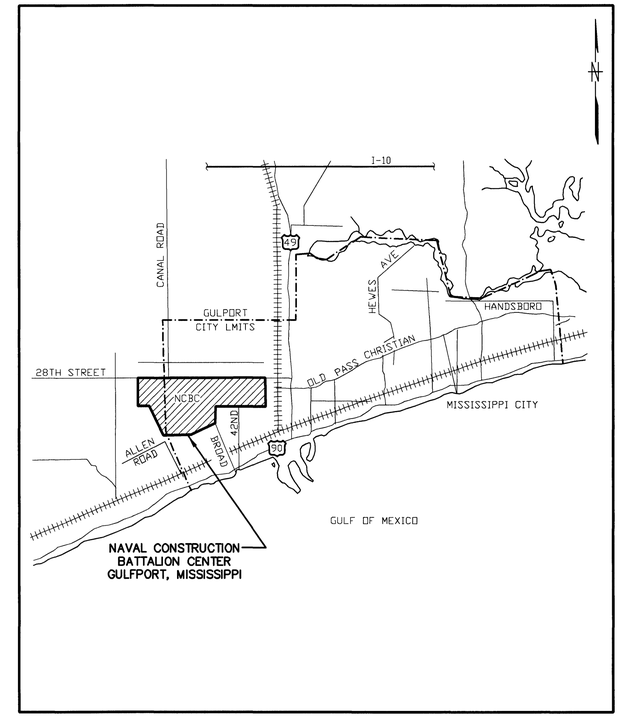
5424687	C–24	FINAL GRADING PLAN (SHEET 5 OF 5)
5424688	C–25	CROSS SECTIONS
5424689	C–26	MISCELLANEOUS DETAILS (SHEET 1 OF 2)
5424690	C–27	MISCELLANEOUS DETAILS (SHEET 2 OF 2)



VICINITY MAP

0 1.5 3.0
APPROXIMATE SCALE IN MILES

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM	DATE 6/29/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS SHOWN	

TITLE SHEET
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424661	
APPROVED BY	DATE 10/6/04
DRAWING NO. T–1	REV. 0

ACAD: 7379T002.dwg 09/28/04 MF PIT

DRAWING NO. T–1 REV. 0

GENERAL NOTES

1. GRID COORDINATES REFERENCE MISSISSIPPI STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD83).

2. ELEVATIONS REFERENCE NORTH AMERICAN VERTICAL DATUM, 1988 (NAVD88).

3. EXISTING TOPOGRAPHY AND FEATURES PRESENTED ON DRAWINGS C–3, C–4, AND C–5, EXCLUDING UTILITIES, WERE PREPARED BY LAND SURVEYING INCORPORATED, GULFPORT, MISSISSIPPI. LAND SURVEYING PERFORMED THE TOPOGRAPHIC SURVEY IN NOVEMBER AND DECEMBER 2002. ADDITIONAL SITE INFORMATION PRESENTED ON DRAWINGS C–1 AND C–2 AND THE UTILITY INFORMATION PRESENTED ON DRAWINGS C–1 THROUGH C–5 WAS OBTAINED FROM THE PUBLIC WORKS DEPARTMENT AT THE NAVAL CONSTRUCTION BATTALION CENTER (NCBC) GULFPORT, MISSISSIPPI.

4. TEMPORARY BENCHMARKS (TBM) REFERENCING HARRISON COUNTY GLOBAL POSITIONING SYSTEM (GPS) REFERENCE MARKERS ARE AS FOLLOWS:

   LOCATION 73RD – N 321,580.35 E 887,225.55 ELEV. 22.86
   LOCATION TOWN – N 321,526.72 E 888,630.71 ELEV. 25.43
   LOCATION 58N – N 322,886.64 E 890,590.33 ELEV. 20.75
   LOCATION 58S – N 321,547.74 E 890,597.58 ELEV. 22.74

5. ONE FOOT CONTOUR INTERVALS UNLESS OTHERWISE INDICATED.

6. FIGURED DIMENSIONS TAKE PRECEDENCE OVER SCALED DIMENSIONS. CHECK GRAPHIC SCALE BEFORE SCALING DRAWING.

7. UNDERGROUND UTILITIES WERE OBTAINED FROM THE NCBC GULFPORT PUBLIC WORKS DEPARTMENT. LOCATIONS SHOWN ARE APPROXIMATE. VERIFICATION OF UTILITY LOCATIONS MUST BE MADE PRIOR TO ANY CONSTRUCTION.

8. ALL WORK FOR THIS PROJECT SHALL BE IN STRICT ACCORDANCE WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS. ALL METHODS OF WORK FOR THIS PROJECT SHALL COMPLY WITH FEDERAL, STATE OF MISSISSIPPI, AND LOCAL ORDINANCES.

9. THE CONTRACTOR SHALL THOROUGHLY INSPECT THE SITE PRIOR TO CONSTRUCTION TO VERIFY EXISTING SITE CONDITIONS.

10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING HORIZONTAL AND VERTICAL CONTROL. SEE DRAWINGS C–3, C–4, AND C–5 FOR EXISTING BENCHMARKS.

11. THE CONTRACTOR SHALL STAKE THE LOCATION OF ALL AREAS TO BE EXCAVATED OR DISTURBED PRIOR TO ACTUAL WORK. THE FIELD LOCATIONS MUST BE REVIEWED AND APPROVED BY THE RESIDENT OFFICER IN CHARGE OF CONSTRUCTION (ROICC).

12. THE CONTRACTOR TEMPORARY STORAGE AND STAGING/PROCESS AREAS ARE TO BE APPROVED BY THE ROICC AND SHALL BE OUT OF THE WAY OF TRAFFIC AND/OR PEDESTRIAN FLOW. ALL TO–BE–DETERMINED TEMPORARY STORAGE AND STAGING/ PROCESSING AREAS OUTSIDE APPROVED LIMITS OF DISTURBANCE SHALL, AT A MINIMUM, BE SURROUNDED WITH SILT FENCE AND HAVE ONLY ONE POINT OF INGRESS/EGRESS AT AN APPROVED CONTRUCTION ENTERANCE/EXIT.

13. LOCATIONS FOR INGRESS AND EGRESS TO CONSTRUCTION AREAS SHALL BE VIA CONSTRUCTION ENTRANCE/EXIT(S) WHICH SHALL BE CONSTRUCTED ACCORDING TO THE APPROVED EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN.

14. THE CONTRACTOR SHALL PROVIDE INGRESS/EGRESS CONTROL INTO DISTURBANCE AREAS AS PART OF MOBILIZATION ACTIVITIES.

15. THE CONTRACTOR SHALL PROVIDE MAXIMUM PROTECTION FOR EXISTING UTILITIES WHICH ARE TO REMAIN IN SERVICE. THE CONTRACTOR SHALL PROVIDE ALL TEMPORARY SERVICES. THE CONTRACTOR SHALL CONTACT MISSISSIPPI ONE–CALL SYSTEM, INC. AT (800) 227–6477 PRIOR TO INTRUSIVE ACTIVITIES. THE CONTRACTOR SHALL ALSO CONTACT THE ROICC AT (228) 871–2943 TO ARRANGE FOR LOCATION OF THE BASE UTILITIES.

16. ON–BASE GROUNDWATER MONITORING WELLS GPT–A–2, GPT–A–3, AND GPT–A–4 AND OFF–BASE TEMPORARY GROUNDWATER MONITORING WELLS WG001, WG002, WG003, WG004, WG005, AND WG006 SHALL BE ABANDONED IN ACCORDANCE WITH THE GUIDANCE DOCUMENT TITLED "ENVIRONMENTAL INVESTIGATIONS STANDARD OPERATING PROCEDURES AND QUALITY ASSURANCE MANUAL (EISOPQAM), NOVEMBER 2001", PREPARED BY U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 4. WELL ABANDONMENT PROCEDURE SHALL CONSIST OF REMOVAL OF STEEL PROTECTIVE CASING AND RISER TO A DEPTH OF 5 FEET BELOW GROUND SURFACE AND COMPLETE REMOVAL OF CONCRETE PAD, AND WELL SCREEN; AND PRESSURE GROUTING FROM BOTTOM TO WITHIN 6 INCHES OF GROUND SURFACE WITH CEMENT/BENTONITE GROUT USING A TREMIE PIPE.

17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LIMITING ALL WORK TO THE IMMEDIATE PROJECT AREA WITHIN THE APPROVED LIMITS OF DISTURBANCE. ALL AREAS DISTURBED BY THE CONTRACTOR THAT ARE OUTSIDE THE LIMITS OF DISTURBANCE SHALL BE RESTORED BY THE CONTRACTOR TO LIKE OR BETTER CONDITION.

18. PRIOR TO INTRUSIVE ACTIVITIES AT THE AREAS DESIGNATED FOR EXCAVATION AND DISTURBANCE, THE CONTRACTOR SHALL COORDINATE WITH SITE PERSONNEL TO ENSURE THAT ALL SECURITY PROCEDURES ARE COMPLIED WITH.

19. THE CONTRACTOR SHALL MAINTAIN ALL WORK AREAS FREE FROM DUST AND ODORS IN A MANNER APPROVED BY THE ROICC.

20. ALL DISTURBED AREAS SHALL BE GRADED TO MAINTAIN POSITIVE DRAINAGE.

21. ALL DISTURBED AREAS SHALL BE STABILIZED (SEEDED AND MULCHED, RIPRAPPED, PAVED, COVERED WITH STONE, OR MODIFIED WITH PORTLAND CEMENT) IMMEDIATELY UPON ESTABLISHING FINAL GRADE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND MAINTAINING THE MEASURES INDICATED ON THE APPROVED EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN.

22. THE NAVY OR THEIR DESIGNEE WILL PERFORM VERIFICATION SAMPLING AND ANALYSIS. THE CONTRACTOR SHALL ESTABLISH SURVEY CONTROL TO FACILITATE SAMPLING. BACKFILLING AND REGRADING ACTIVITIES IN THE AREA OF EXCAVATION SHALL NOT BE PERFORMED UNTIL AUTHORIZED BY THE ROICC.

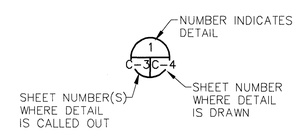
23. UNLESS OTHERWISE INDICATED, CLEARED MATERIAL WILL BE CHIPPED AND STOCKPILED ON SITE FOR USE AS DIRECTED BY THE ROICC.

24. MATERIALS ARE DEFINED AS FOLLOWS FOR THE PURPOSE OF THIS REMEDIAL DESIGN:
   - MATERIAL BLEND IS A MIXTURE OF SOIL ASH, CONTAMINATED ON–BASE SEDIMENTS, CONTAMINATED OFF–BASE AREA OF CONTAMINATION (AOC) SEDIMENTS, INCIDENTAL SOIL RESULTING FROM OVER EXCAVATION, AND SIZE REDUCED VEGETATIVE MATERIAL.
   - STABILIZED MATERIAL BLEND IS A MATERIAL BLEND THAT HAS BEEN AMENDED WITH A STABILIZING AGENT.
   - BASE COURSE IS THE UPPERMOST 6 INCHES OF PLACED STABILIZED MATERIAL BLEND.
   - SUBBASE IS STABILIZED MATERIAL BLEND OTHER THAN THE BASE COURSE.

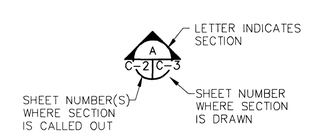
25. THE 28TH STREET ACCESS LOCATION SHALL BE LOCATED TO ALLOW FOR THE PRESERVATION OF AS MANY TREES AS POSSIBLE, AND SUPPORT FACILITIES SHALL BE CONSTRUCTED A MINIMUM OF 50 FEET OFF OF 28TH STREET. TREE REMOVAL ALONG 28TH STREET SHALL BE LIMITED TO TREES WITHIN THE LIMIT OF CONTAMINATION, AND THE TREES REQUIRED FOR THE CONSTRUCTION OF THE ACCESS ROAD.

GENERAL LEGEND

- GPT–A–4 — MONITORING WELL
- GPT–A–2 — MONITORING WELL TO BE ABANDONED
- TBM IR–4 — TEMPORARY BENCHMARK
- WL054 — SOIL BORING
- 0.50 — PROPOSED FINAL SPOT ELEVATION
- 31 — EXISTING CONTOUR
- 34 — PROPOSED FINAL GRADE
- DELINEATED WETLAND LIMITS
- ESTIMATED WETLAND LIMITS
- LIMITS OF CONTAMINATED MEDIA
- LIMITS OF DISTURBANCE
- DRAINAGE CHANNEL
- SITE BOUNDARIES
- SF — SILT FENCE
- SSF — SUPER SILT FENCE
- 1+00 — BASELINE
- TREE LINE
- S — PORTABLE SEDIMENT TANK
- 1% — GRADE AND PITCH
- DRAINAGE CHANNEL FLOW DIRECTION
- EDGE OF PAVEMENT
- EXISTING FENCE
- FENCE TO BE REMOVED
- OHE — OVERHEAD ELECTRICAL LINES
- RAILROAD TRACKS
- PROPOSED SEDIMENT RECOVERY TRAP
- SRT N2 — EXISTING SEDIMENT RECOVERY TRAP
- RIDGE LINE
- SLOPE INDICATOR (BREAK IN GRADE)
- EXISTING WATER LINE
- EXISTING GAS LINE
- SS — EXISTING SANITARY SEWER
- E — EXISTING ELECTRIC LINE
- MH — EXISTING MANHOLE
- LS — EXISTING LIFT STATION
- POWER POLE
- CHANNEL CONTAINING CONTAMINATED SEDIMENT (CHANNEL TO BE RESTORED)
- CHANNEL CONTAINING CONTAMINATED SEDIMENT (CHANNEL NOT RESTORED)
- RIPRAP
- GRAVEL ROAD
- STABILIZED STONE CONSTRUCTION ENTRANCE
- WETLANDS
- ROLLER–COMPACTED CONCRETE
- RESTORED AREA



DETAIL IDENTIFIER



SECTION IDENTIFIER

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM — DATE 6/29/04
CHECKED BY TWS — DATE 10/06/04
REVISED BY — DATE
SCALE AS SHOWN

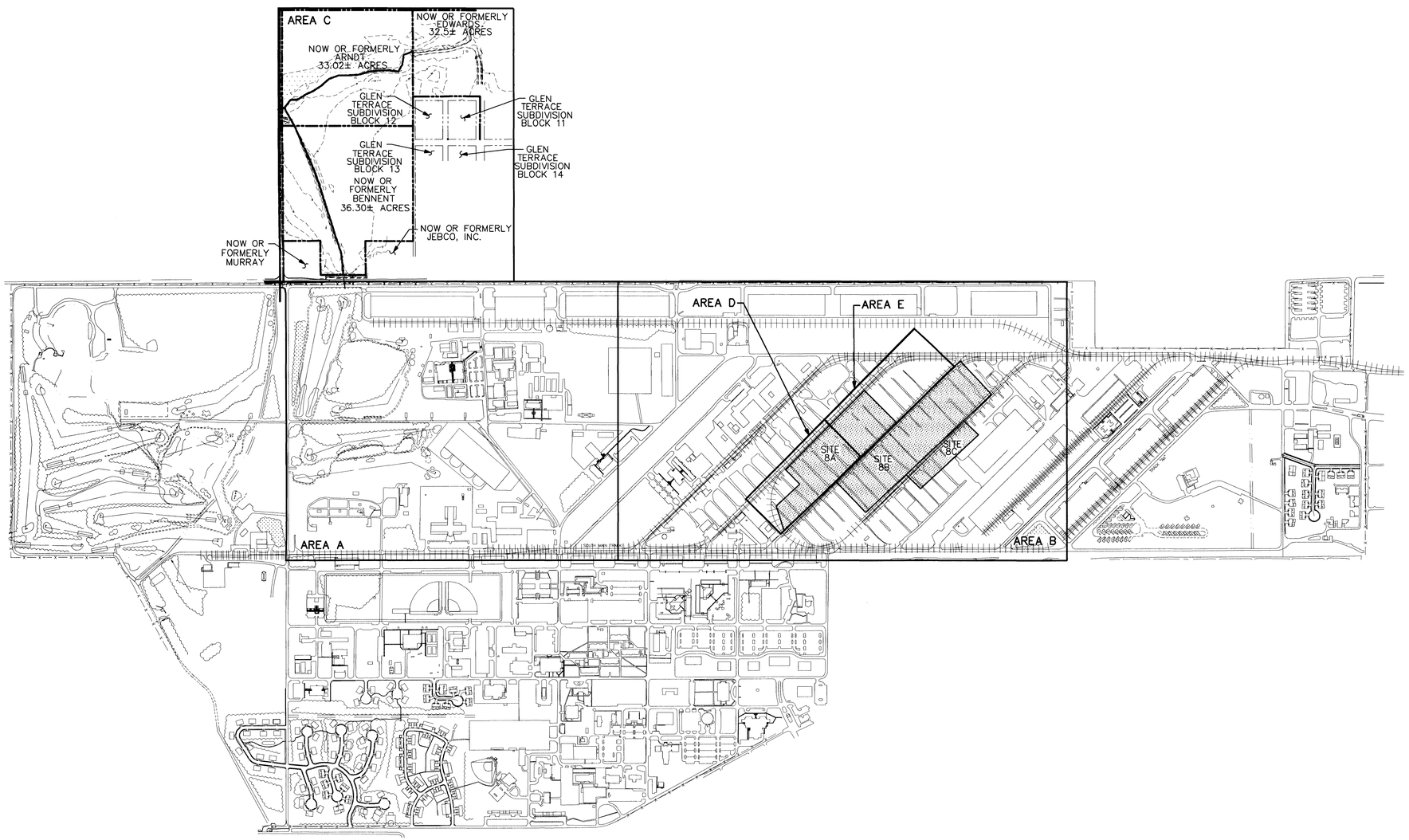
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

GENERAL NOTES AND LEGEND
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424662
APPROVED BY — DATE 10/6/04
DRAWING NO. T–2
REV. 0

ACAD: 7379CN06.dwg 9/28/04 MF PIT

DRAWING NO. T–2 REV. 0



	EXISTING CONDITIONS PLAN	EROSION, SEDIMENT AND STORMWATER CONTROL PLAN	EXCAVATION AND FILL PLAN	FINAL GRADING PLAN
AREA A	C-1	C-6	C-15	C-20
AREA B	C-2	C-7	C-16	C-21
AREA C	C-3	C-8	C-17	C-22
AREA D	C-4	C-9	C-18	C-23
AREA E	C-5	C-10	C-19	C-24

NOTE:

BOUNDARIES FOR SITES 8B AND 8C ARE APPROXIMATE.

0 600 1200
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM DATE 6/28/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS SHOWN

PLAN LOCATION MAP
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424663
APPROVED BY DATE 10/6/04
DRAWING NO. T-3
REV. 0

ACAD: 7379GP27.dwg 09/28/04 MF PIT

DRAWING NO. T-3 REV. 0

DRAWING NO. C-1 REV. 0

OUTFALL 1
MATCHLINE WITH C-3
OUTFALL 3
OUTFALL 4
GATE 7
SRT 1
SRT 3 SRT 13 (SEE NOTE 2)
SRT 4
SRT 7
SRT 14
225
223
224
226
227
47
57
48
53
54
58
405
68
50
51
52
70
69
67
360
56
55
388
389
374
900
344
345
347
343
346
336
378
379
380
381
384
372
376
375
310
253
401
357
K5
K6
K8
COMPOST FACILITY
260B
260A
428
426
203
241
242
K7
298
240
25
24
17
15
139
138
137
108
109
110
106
105
28
420
183
182
180
186
190
191
192
348
364
65
13
12
15
14
11
10
EIGHTH ST
COLBY AVE
BROWN AVE
BUSSELL AVE
BAINBRIDGE AVE
SEVENTH ST
SOUTH MAIN TRACK
SOUTH TRACK NO. 1
MATCHLINE WITH C-2
N 321500
N 321000
N 320500
N 320000
N 319500
N 319000
E 888500
E 889000
E 889500
E 890000
E 890500
E 891000
E 891500
E 892000
E 892500

DRAWING KEY

C-3 C-4 C-5 C-1 C-2

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) FLOW IN DRAINAGE CHANNEL HAS BEEN REROUTED TO OUTFALL 1. ONLY UNDER HEAVY STORM CONDITIONS DOES FLOW DISCHARGE THROUGH OUTFALL 3.

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

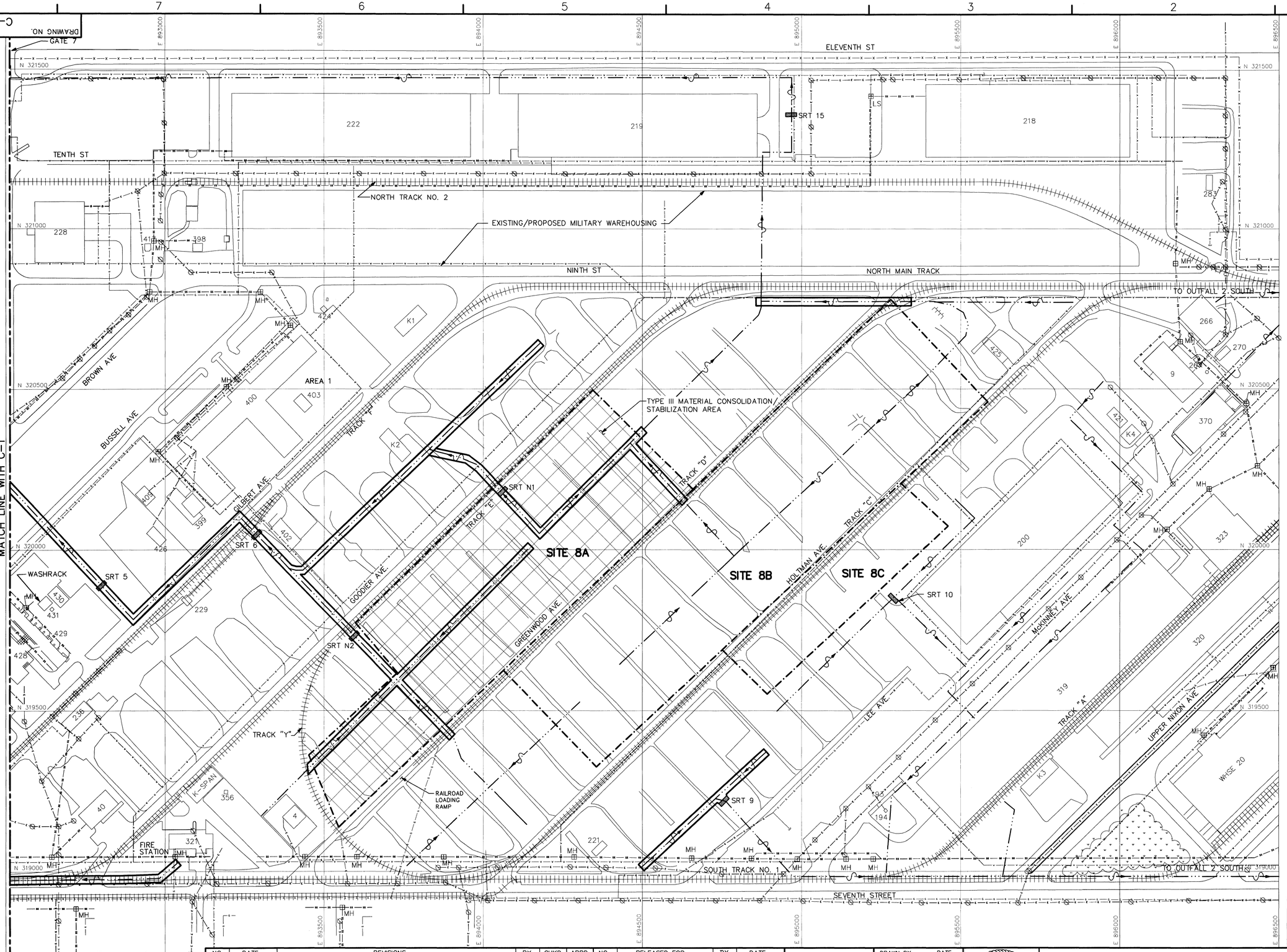
SEAL AREA

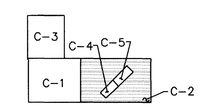
DRAWN BY DM	DATE 6/28/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS SHOWN	

EXISTING CONDITIONS PLAN (SHEET 1 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424664	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-1	REV. 0

ACAD: 73790M30.dwg 09/28/04 MF PIT





DRAWING KEY

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) BOUNDARIES FOR SITES 8B AND 8C SHOWN ARE APPROXIMATE.

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

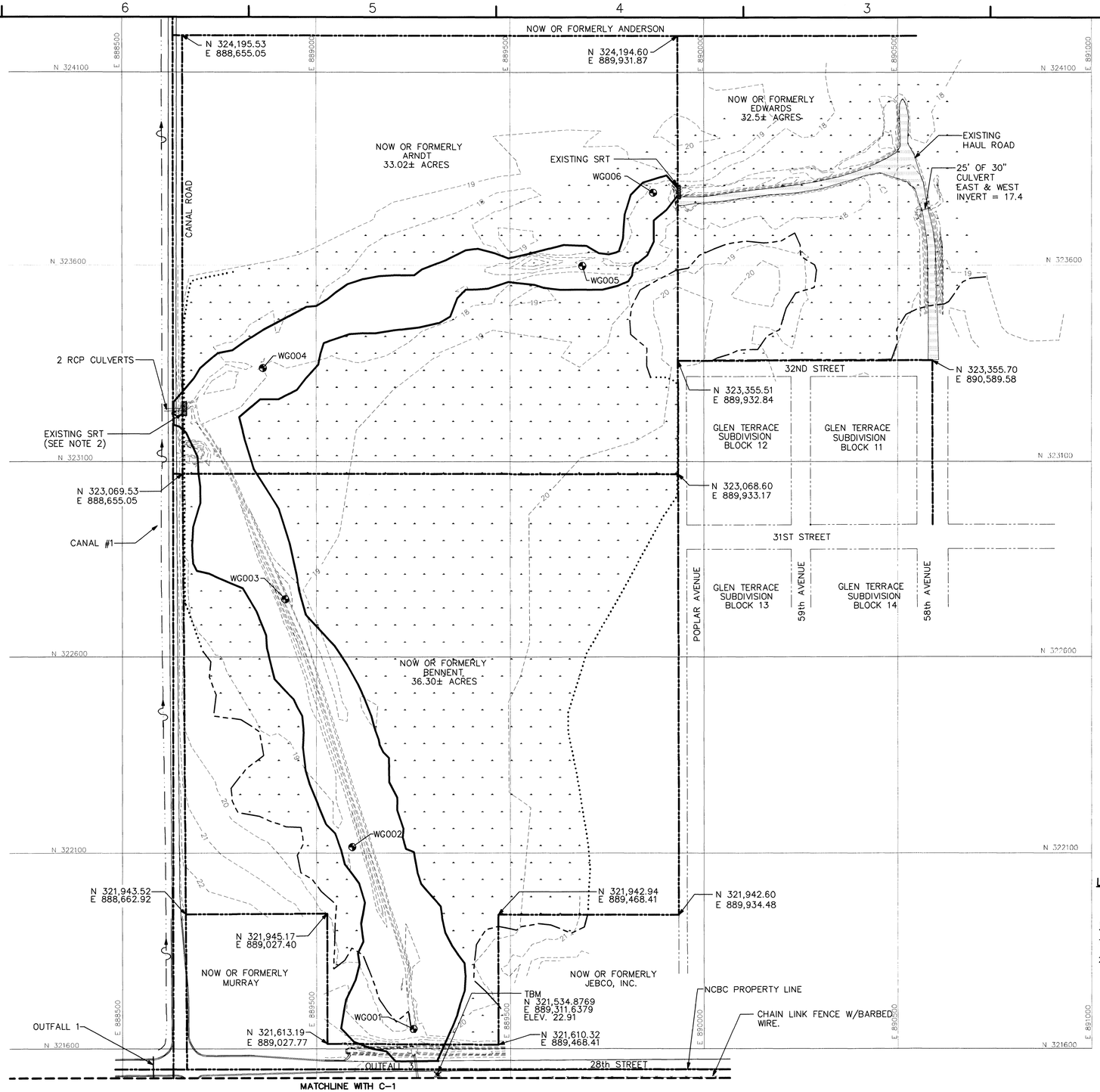
DRAWN BY DM	DATE 6/28/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS SHOWN	

EXISTING CONDITIONS PLAN
(SHEET 2 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424665	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-2	REV. 0

ACAD: 7379CM31.dwg 10/05/04 HJB PIT

DRAWING NO. C-2 REV. 0



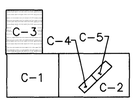
LEGEND:

SEE DRAWING NO. T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING NO. T-2 FOR GENERAL NOTES.

2.) IN APRIL 2002, TTNUS EXCAVATED APPROXIMATELY 30 CUBIC YARDS OF SEDIMENT ADJACENT TO CULVERTS UNDERLYING CANAL ROAD. THE SEDIMENT WAS TRANSPORTED TO SITE 8A AND STORED WITHIN THE MATERIALS HANDLING PAD USED DURING THE 2001 PILOT-SCALE TREATABILITY STUDY. AN SRT WAS CONSTRUCTED AT THE EASTERNMOST EXTENT OF THE EXCAVATION.



DRAWING KEY

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM — DATE 6/28/04
CHECKED BY TWS — DATE 10/06/04
REVISED BY — DATE
SCALE AS NOTED

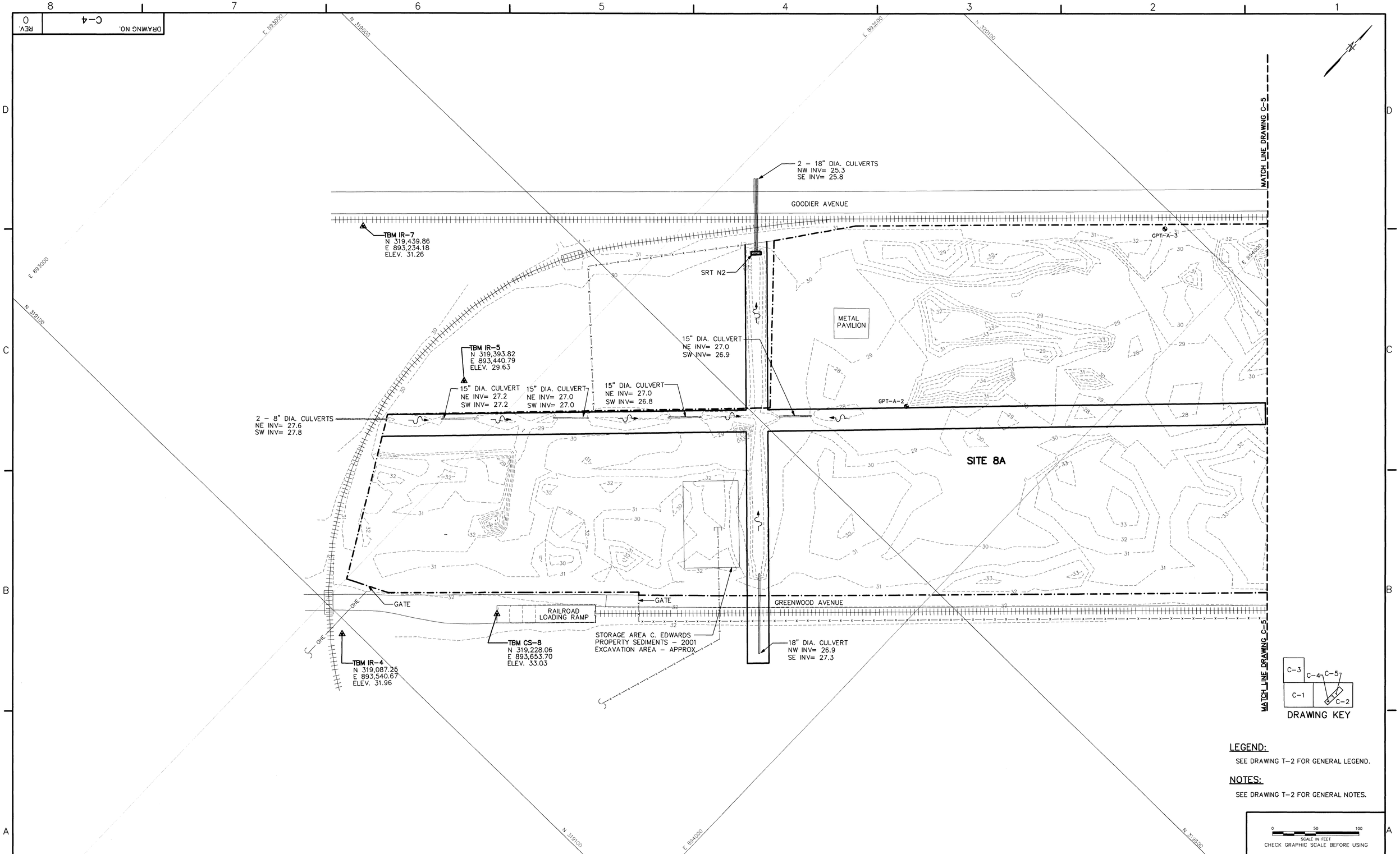
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

EXISTING CONDITIONS PLAN
(SHEET 3 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424666
APPROVED BY — DATE 10/6/04
DRAWING NO. C-3 — REV. 0

DRAWING NO. C-3 REV. 0

ACAD: 7379CM32.dwg 10/05/04 HJB PIT



LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

SEE DRAWING T-2 FOR GENERAL NOTES.

0 50 100
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM	DATE 6/28/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS NOTED	

DEPARTMENT OF THE NAVY · SOUTHERN DIV. FACILITIES ENGINEERING COMD.

EXISTING CONDITIONS PLAN
(SHEET 4 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424667	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-4	REV. 0

ACAD: 7379CM33.dwg 10/05/04 HJB PIT

DRAWING NO. C-4 REV. 0

DRAWING NO. C-5 REV. 0

MATCH LINE DRAWING C-4

TBM IR-1
N 320,206.37
E 894,001.67
ELEV. 31.37

24" DIA. CULVERT
NW INV= 25.5
SE INV= 25.9

GOODIER AVENUE

GPT-A-4

SRT N1

STORAGE AREA (SITE 8B AND 8C DRAINAGE AREA SEDIMENTS, APPROX.)

15" DIA. CULVERT
NE INV= 27.0
SW INV= 27.1

15" DIA. CULVERT
NE INV= 26.9
SW INV= 27.0

15" DIA. CULVERT
NE INV= 26.8
SW INV= 26.9

1 - 15" DIA. CULVERT
NE INV= 28.4
SW INV= 27.0

1 - 15" DIA. CULVERT
NE INV= 26.8
SW INV= 26.9

SITE 8A

GRAVEL ROAD

GREENWOOD AVENUE

TBM IR-2
N 320,191.54
E 894,696.18
ELEV. 31.38

TBM IR-3
N 320,185.37
E 894,629.50
ELEV. 31.98

18" CULVERT
NW INV= NOT SURVEYED
SE INV= 26.7

TBM IR-6
N 320,864.87
E 894,666.74
ELEV. 32.70

8" WATERLINE

9TH STREET

24" DIA. CULVERT
S INV= 26.3
N INV= 26.8

12" DIA. CULVERT
NE INV= 27.2
SW INV= 27.2

2 - 15" DIA. CULVERTS
N INV= 26.8
S INV= 26.6

GPT-A-1

EXISTING/PROPOSED MILITARY WAREHOUSING

18" DIA. CULVERT
E INV= 26.9
W INV= 26.8

18" DIA. CULVERT
E INV= NOT SURVEYED
W INV= 27.3

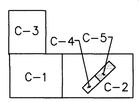
MATCH LINE DRAWING C-4

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

SEE DRAWING T-2 FOR GENERAL NOTES.



DRAWING KEY

0 50 100
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM DATE 6/28/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS NOTED

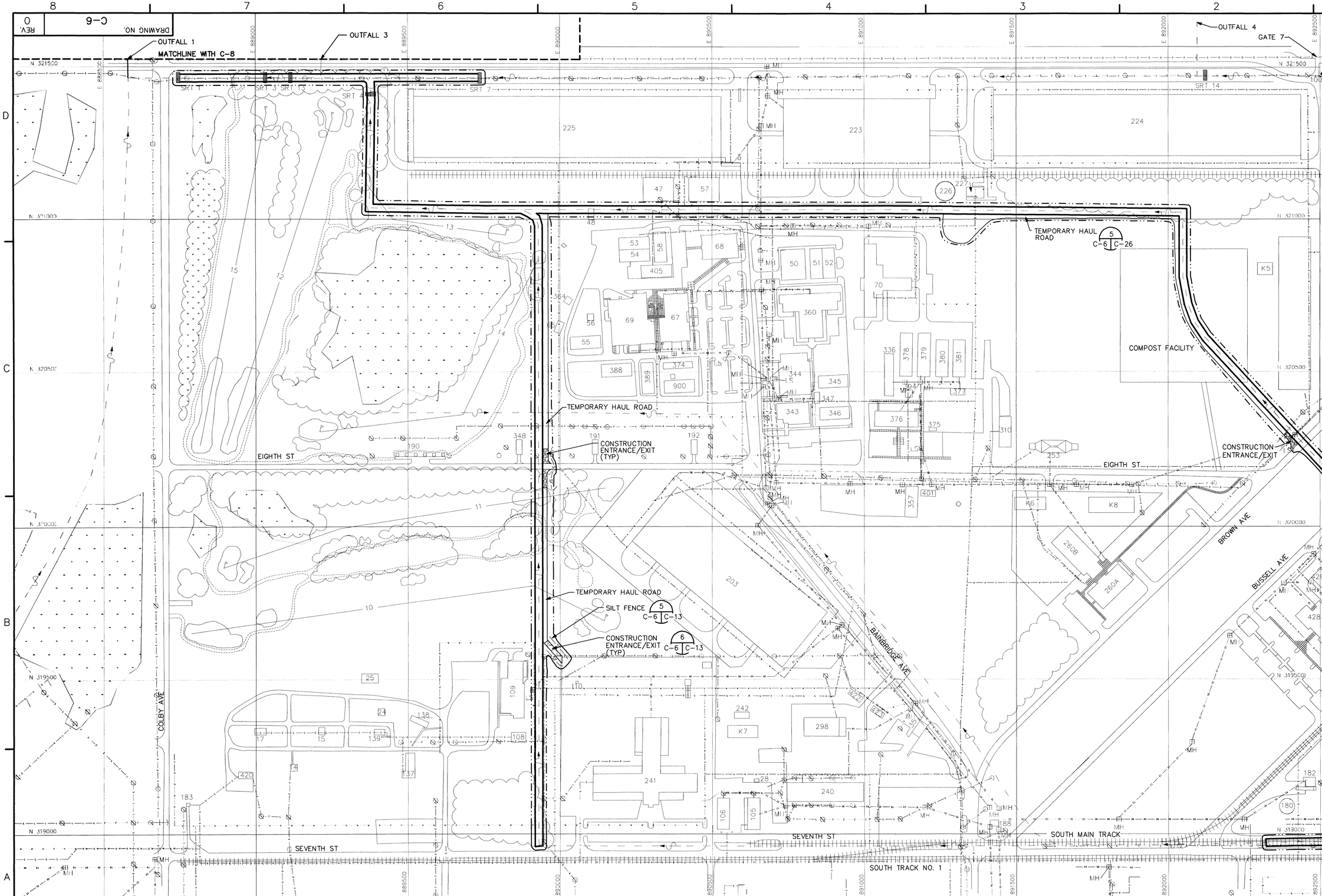
DEPARTMENT OF THE NAVY — SOUTHERN DIV. FACILITIES ENGINEERING COMMAND

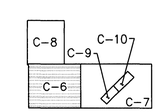
EXISTING CONDITIONS PLAN
(SHEET 5 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424668
APPROVED BY DATE 10/6/04
DRAWING NO. C-5 REV. 0

ACAD: 7379CN3A.dwg 09/28/04 MF PIT

DRAWING NO. C-6 REV. 0





DRAWING KEY

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) REFER TO DRAWINGS C-11 AND C-12 FOR EROSION, SEDIMENT AND STORMWATER CONTROL NOTES AND REVEGETATION NOTES RESPECTIVELY.

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

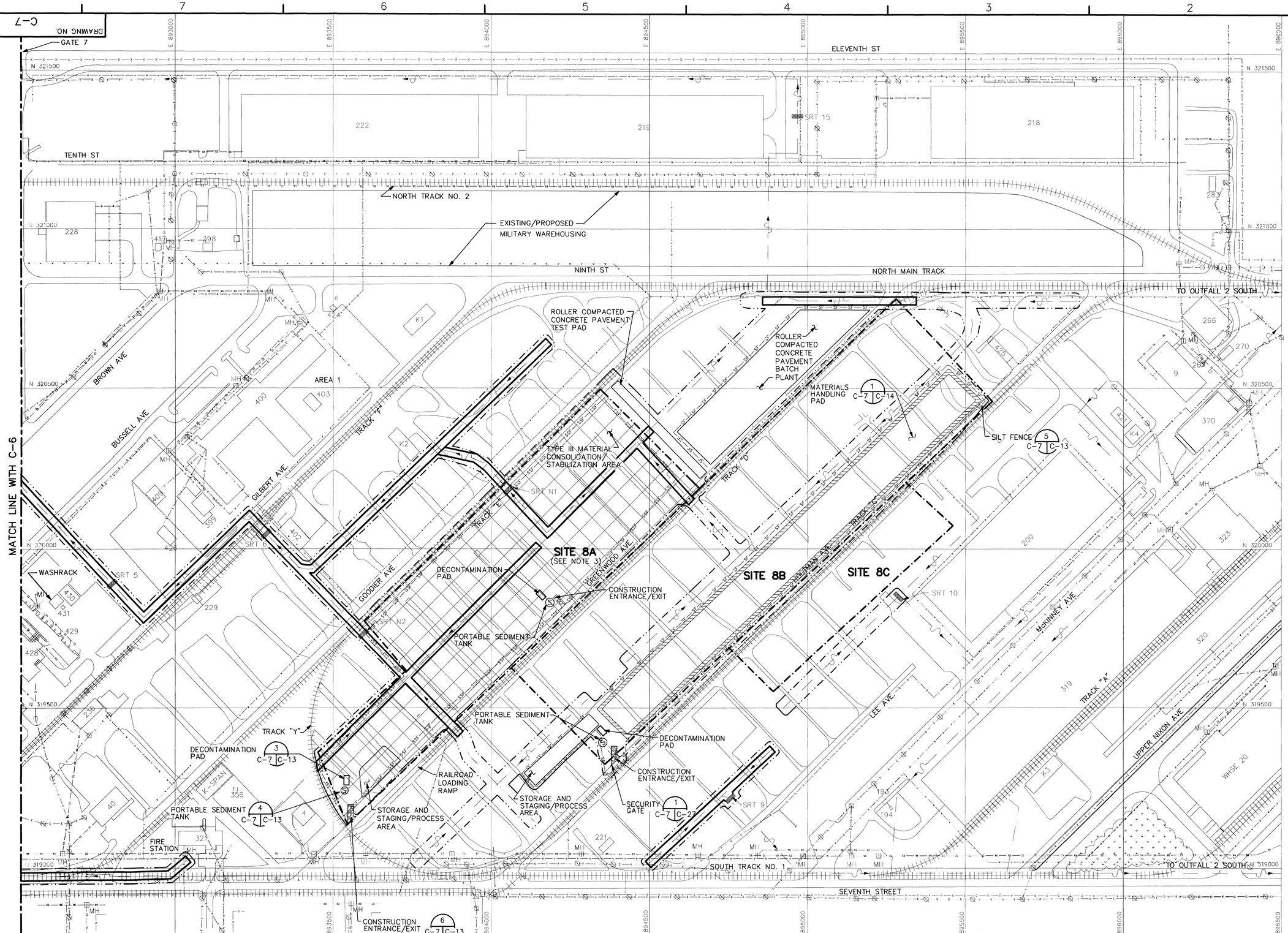
DRAWN BY DM DATE 6/28/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS SHOWN

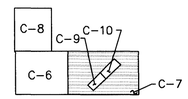
EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN
(SHEET 1 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424669
APPROVED BY DATE 10/6/04
DRAWING NO. C-6 REV. 0

ACAD: 7379C*28.dwg 10/05/04 H.B PIT

DRAWING NO. C-7 REV. 0





DRAWING KEY

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) BOUNDARIES FOR SITES 8B AND 8C SHOWN ARE APPROXIMATE.

3.) REFER TO DRAWINGS C-9 & C-10 FOR ADDITIONAL EROSION, SEDIMENT AND STORMWATER CONTROLS AND FINAL CONTOURS WITHIN THE LIMITS OF SITE 8A.

4.) REFER TO DRAWINGS C-11 AND C-12 FOR EROSION, SEDIMENT AND STORMWATER CONTROL NOTES AND REVEGETATION NOTES RESPECTIVELY.

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

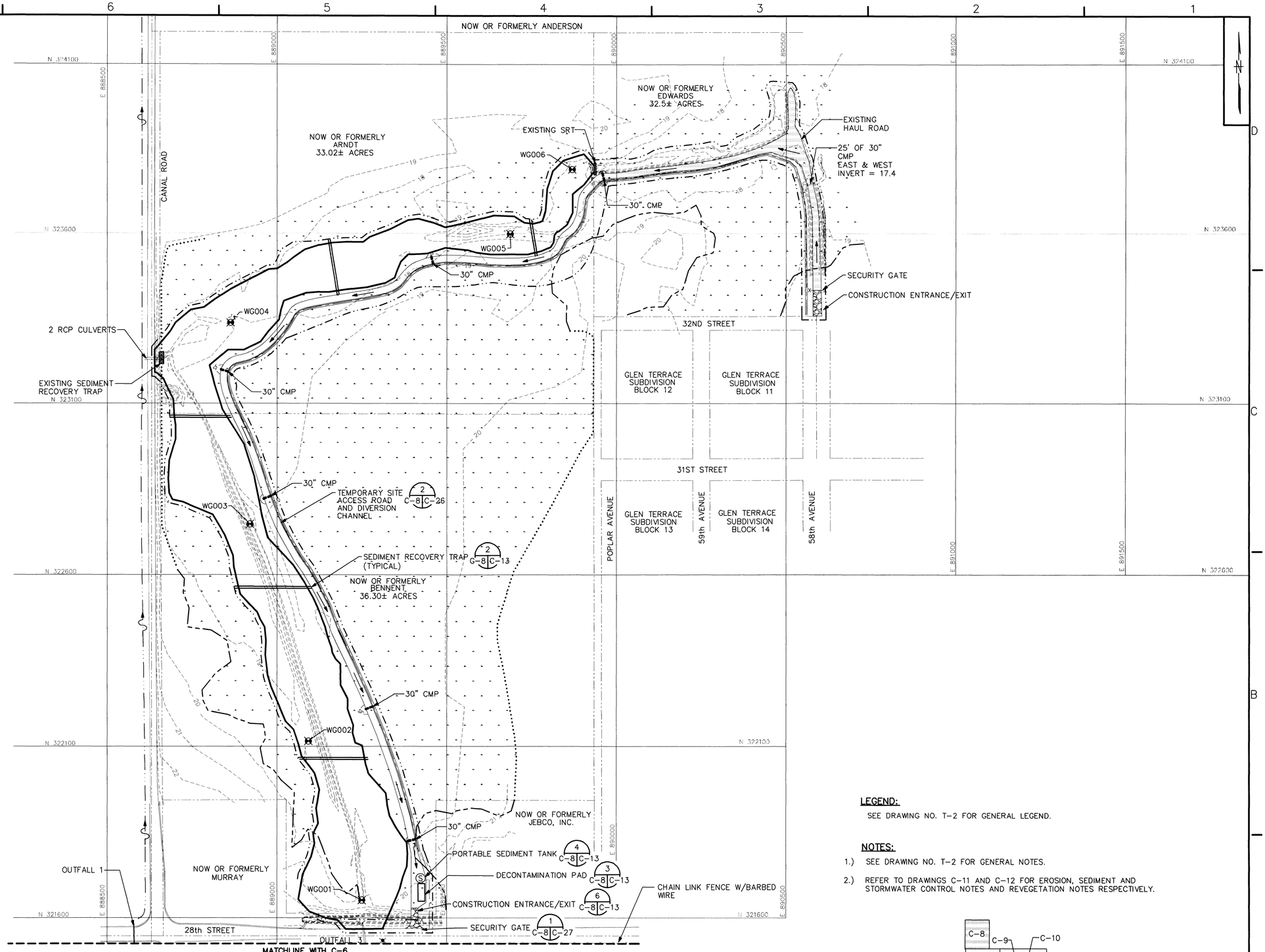
DRAWN BY DM	DATE 6/28/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS SHOWN	

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN
(SHEET 2 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO.	7379
NAVFAC NO.	5424670
APPROVED BY	DATE 10/6/04
DRAWING NO. C-7	REV. 0

ACAD: 73790P29.dwg 10/05/04 HJB PIT



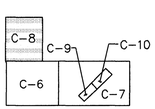
LEGEND:

SEE DRAWING NO. T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING NO. T-2 FOR GENERAL NOTES.

2.) REFER TO DRAWINGS C-11 AND C-12 FOR EROSION, SEDIMENT AND STORMWATER CONTROL NOTES AND REVEGETATION NOTES RESPECTIVELY.



DRAWING KEY

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0 150 300
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

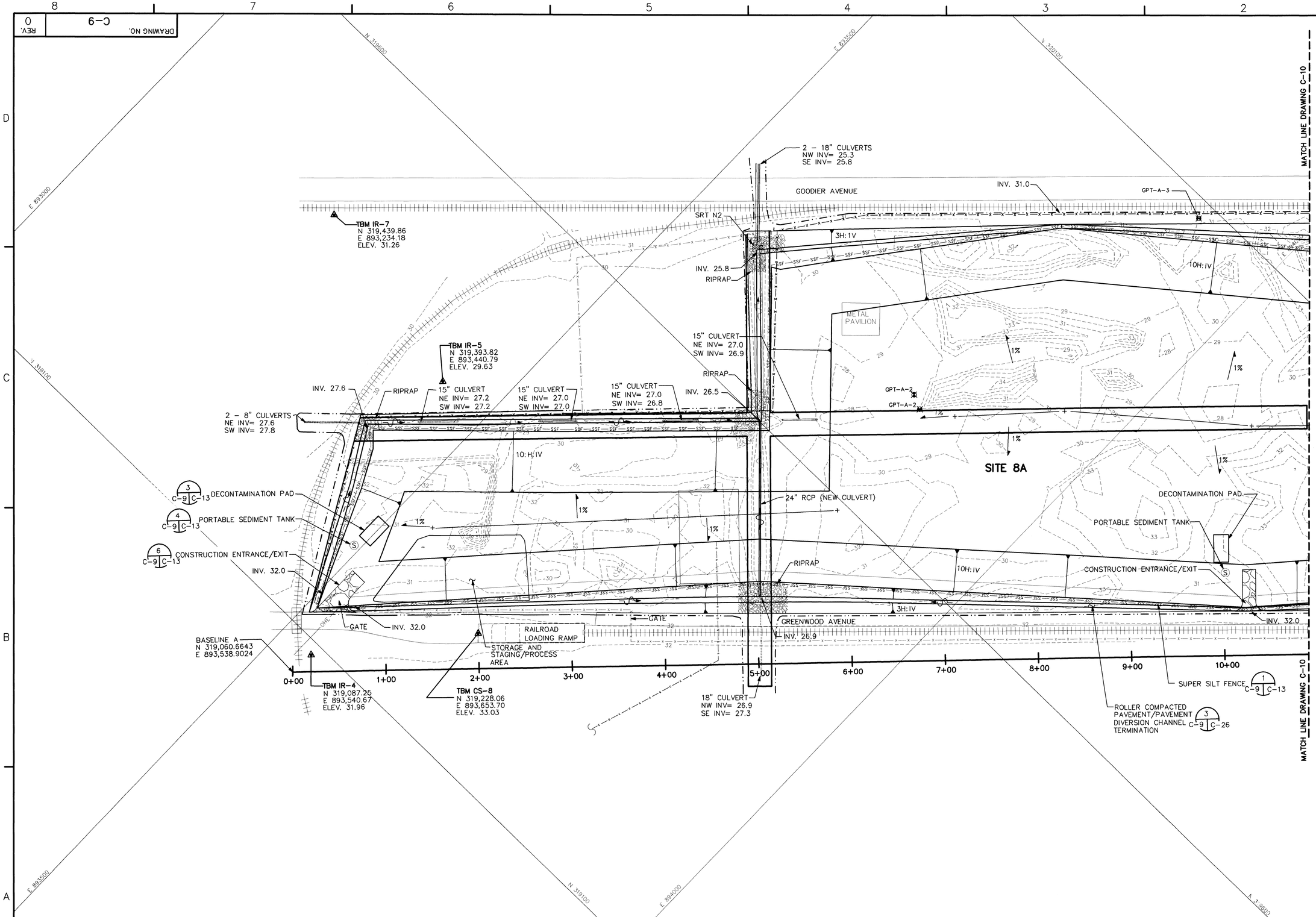
DRAWN BY DM	DATE 6/29/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS NOTED	

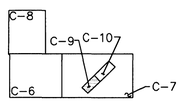
EROSION, SEDIMENT AND STORMWATER CONTROL PLAN
(SHEET 3 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424671	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-8	REV. 0

DRAWING NO. C-8 REV. 0

ACAD: 7379GP30.dwg 09/29/04 MF PIT





DRAWING KEY

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1. SEE DRAWING T-2 FOR GENERAL NOTES.
2. REFER TO DRAWINGS C-11 AND C-12 FOR EROSION, SEDIMENT AND STORMWATER CONTROL NOTES AND REVEGETATION NOTES RESPECTIVELY.

0 50 100
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

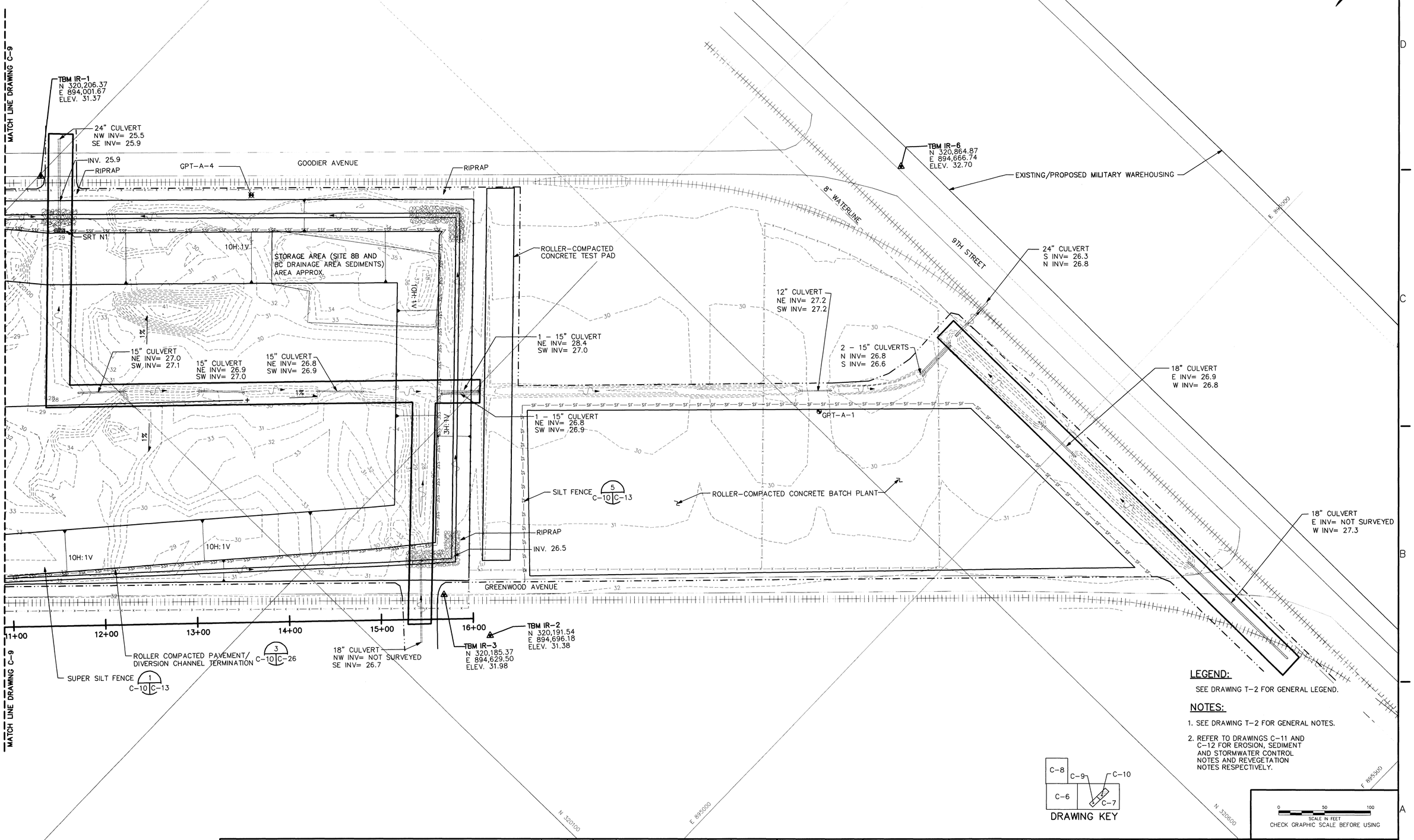
SEAL AREA

DRAWN BY DM DATE 6/29/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS NOTED

EROSION, SEDIMENT AND STORMWATER CONTROL PLAN
(SHEET 4 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424672
APPROVED BY DATE 10/6/04
DRAWING NO. C-9
REV. 0

ACAD:7379CP31.dwg 10/06/04 HJB PIT



LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1. SEE DRAWING T-2 FOR GENERAL NOTES.
2. REFER TO DRAWINGS C-11 AND C-12 FOR EROSION, SEDIMENT AND STORMWATER CONTROL NOTES AND REVEGETATION NOTES RESPECTIVELY.

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM	DATE 6/29/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS NOTED	

EROSION, SEDIMENT AND STORMWATER CONTROL PLAN
(SHEET 5 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424673	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-10	REV. 0

DRAWING NO. C-10 REV. 0

ACAD: 7379GP32.dwg 10/05/04 HJB PIT

EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN NOTES

EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN NOTES

1. UNLESS OTHERWISE INDICATED, ALL VEGETATION AND STRUCTURAL EROSION, SEDIMENT, AND STORMWATER CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE MISSISSIPPI PLANNING AND DESIGN MANUAL FOR THE CONTROL OF EROSION, SEDIMENT, AND STORMWATER.

2. THE CONTRACTOR SHALL OBTAIN A STORMWATER PERMIT [MISSISSIPPI STATE PERMIT 10 (MSP10)] PRIOR TO CONDUCTING ANY WORK. THE CONTRACTOR SHALL ALSO NOTIFY THE MISSISSIPPI OFFICE OF POLLUTION CONTROL IN WRITING AND BY TELEPHONE 7 DAYS PRIOR TO THE REQUIRED PRE-CONSTRUCTION MEETING.

3. THE CONTRACTOR SHALL NOTIFY THE ROICC IN WRITING AND BY TELEPHONE: (228) 871-2943

   A. 7 DAYS PRIOR TO THE REQUIRED PRE-CONSTRUCTION MEETING.

   B. FOLLOWING INSTALLATION OF EROSION, SEDIMENT, AND STORMWATER CONTROL DEVICES AND PRIOR TO COMMENCEMENT OF LAND DISTURBING ACTIVITIES.

   C. 7 DAYS PRIOR TO FINAL INSPECTION.

4. CONSTRUCT ALL EROSION, SEDIMENT, AND STORMWATER CONTROL MEASURES PER THE APPROVED PLAN AND SEQUENCE OF CONSTRUCTION CONTAINED IN THE EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN AND HAVE THEM INSPECTED AND APPROVED BY, THE ROICC PRIOR TO BEGINNING ANY OTHER LAND DISTURBANCES. MINOR SEDIMENT CONTROL DEVICE LOCATION, SIZE, AND NUMBER ADJUSTMENTS MAY BE MADE IN THE FIELD WITH THE APPROVAL OF THE ROICC. ENSURE THAT ALL RUNOFF FROM DISTURBED AREAS IS DIRECTED TO THE SEDIMENT CONTROL DEVICES AND DO NOT REMOVE ANY EROSION, SEDIMENT, OR STORMWATER CONTROL MEASURES WITHOUT PRIOR APPROVAL FROM THE ROICC. THE CONTRACTOR MUST OBTAIN PRIOR APPROVAL FROM THE ROICC FOR CHANGES TO THE EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN AND/OR THE SEQUENCE OF CONSTRUCTION.

5. THE CONTRACTOR MUST INSPECT AND MAINTAIN EROSION, SEDIMENT AND STORMWATER CONTROLS SO THAT THE CONTROLS REMAIN IN CONTINUOUS AND EFFECTIVE OPERATION UNTIL SUCH TIME AS THEY ARE REMOVED WITH PRIOR APPROVAL FROM THE ROICC. THE CONTRACTOR MUST RECORD THE INSTALLATION DATE OF THE SILT FENCE, AND RECORD ALL DAMAGES TO, DEFICIENCIES OF, AND CORRECTIVE MEASURES MADE TO, ANY AND ALL OF THE EROSION, SEDIMENT, AND STORMWATER CONTROL DEVICES. AT A MINIMUM THE CONTRACTOR SHALL INSPECT AND MAINTAIN EROSION, SEDIMENT, AND STORMWATER CONTROLS WEEKLY AND AFTER RAINFALL EVENTS THAT PRODUCE RAINFALL EQUAL TO OR GREATER THAN 0.5 INCHES. NON-FUNCTIONING EROSION, SEDIMENT, AND STORMWATER CONTROLS SHALL BE REPAIRED, REPLACED, OR SUPPLEMENTED WITH FUNCTIONAL CONTROLS WITHIN 24 HOURS OF DISCOVERING THE NON-FUNCTIONING CONTROL DEVICES.

6. ANY SEDIMENT REMOVED FROM THE EROSION, SEDIMENT, AND STORMWATER CONTROL DEVICES DURING MAINTENANCE ACTIVITIES, AND PRIOR TO VERIFICATION OF CONTAMINANT REMOVAL AND INSTALLATION OF THE FIRST LIFT OF ROLLER COMPACTED CONCRETE AT SITE 8A, WILL BE PLACED WITHIN THE CONSOLIDATION AREA AT SITE 8A. SEDIMENT REMOVED FROM EROSION, SEDIMENT, AND STORMWATER CONTROL DEVICES DURING MAINTENANCE ACTIVITIES FOLLOWING THE VERIFICATION OF CONTAMINANT REMOVAL FROM THE AREA DRAINING TO THE DEVICE AND INSTALLATION OF THE FIRST LIFT OF ROLLER COMPACTED CONCRETE PAVEMENT AT SITE 8A WILL BE STOCKPILED FOR USE ON SITE.

7. ALL INGRESS TO AND EGRESS FROM THE SITE SHALL BE AT LOCATIONS PROTECTED BY AN APPROVED CONSTRUCTION ENTRANCE/EXIT(S).

8. THE CONTRACTOR SHALL APPLY SEED AND ANCHORED STRAW MULCH, OR APPROVED STABILIZATION MEASURES TO ALL DISTURBED AREAS AND STOCKPILES WITHIN 14 CALENDAR DAYS (7 CALENDAR DAYS FOR SENSITIVE AREAS) AFTER STRIPPING AND GRUBBING ACTIVITIES HAVE CEASED IN THE AREA. MAINTENANCE SHALL BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION.

9. ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED EROSION, SEDIMENT, AND STORMWATER CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBANCE ACTIVITIES AND DURING SITE DEVELOPMENT UNTIL FINAL STABILIZATION IS ACHIEVED.

10. IN THE EVENT THAT A DETERMINATION IS MADE TO ALLOW SURFACE DISCHARGE OF OF WATER COLLECTED IN EXCAVATIONS, ALL WATER RESULTING FROM DEWATERING OPERATIONS SHALL PASS THROUGH AN APPROVED FILTRATION DEVICE AND THENCE TO A PROTECTED INLET OR SHALL BE BROADCAST UPON AN APPROVED VEGETATED AREA.

11. PRIOR TO REMOVAL OF EROSION, SEDIMENT, AND STORMWATER CONTROL MEASURES, THE CONTRACTOR SHALL STABILIZE AND HAVE ESTABLISHED PERMANENT STABILIZATION FOR ALL CONTRIBUTORY DISTURBED AREAS USING AN APPROVED PERMANENT SEED MIXTURE WITH REQUIRED SOIL AMENDMENTS AND AN APPROVED ANCHORED MULCH. AREAS BROUGHT TO FINISHED GRADE DURING THE SEEDING SEASON SHALL BE PERMANENTLY STABILIZED AS SOON AS POSSIBLE BUT NO LATER THAN 7 CALENDER DAYS AFTER ESTABLISHMENT. WHEN FINISHED GRADES ARE ESTABLISHED OUTSIDE OF THE SEEDING SEASON, TEMPORARY SEED AND ANCHORED STRAW MULCH SHALL BE APPLIED TO DISTURBED AREAS. PERMANENT SEEDING OF SUCH AREAS SHALL BE PERFORMED WITHIN 10 CALENDER DAYS OF THE BEGINNING OF THE NEXT SEEDING SEASON OR EARLIER IF GROUND AND WEATHER CONDITIONS ALLOW.

12. THE SITE'S APPROVAL LETTER, STORMWATER PERMIT, APPROVED EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN, APPROVED STORMWATER POLLUTION PREVENTION PLAN, STORMWATER POLLUTION PREVENTION LOG BOOKS, TEST REPORTS, AND LOG OF INSPECTIONS AND MAINTENANCE SHALL BE MAINTAINED BY THE CONTRACTOR AND MADE AVAILABLE AT THE SITE AT ALL TIMES FOR INSPECTION BY DULY AUTHORIZED OFFICIALS AND SHALL BE SUBMITTED TO NCBC FOLLOWING COMPLETION OF THE PROJECT.

13. SURFACE DRAINAGE OVER UNSTABILIZED CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER PREVENTING DRAINAGE FROM TRAVERSING THE SLOPES, ROUGHING THE SURFACE TO SLOW SURFACE DISCHARGE FLOW, OR BY INSTALLING PROTECTIVE DEVICES TO MINIMIZE DOWNSLOPE EROSION. PROTECTIVE METHODS, SUCH AS EROSION CONTROL MATTING AND RIPRAP MUST BE PROVIDED AT POINTS OF CONCENTRATED FLOW.

14. PERMANENT CHANNELS OR OTHER POINTS OF CONCENTRATED WATER FLOW SHALL BE STABILIZED WITH SEED, WITH AN APPROVED EROSION CONTROL MATTING, RIPRAP, OR BY OTHER MEASURES APPROVED BY THE ROICC.

15. TEMPORARY EROSION, SEDIMENT, AND STORMWATER CONTROL DEVICES SHALL BE REMOVED WITH THE APPROVAL OF THE ROICC, WITHIN 30 CALENDAR DAYS FOLLOWING FINAL STABILIZATION OF ALL DISTURBED AREAS AND FINAL STABILIZATION APPROVAL.

16. FOR FINISHED GRADING, THE CONTRACTOR SHALL PROVIDE ADEQUATE GRADIENTS TO PREVENT WATER FROM STANDING ON THE SURFACE FOR MORE THAN 24 HOURS AFTER THE END OF A RAINFALL EVENT, EXCEPT IN DESIGNATED DRAINAGE COURSES AND CHANNEL FLOW AREAS WHICH MAY DRAIN AS LONG AS 48 HOURS AFTER THE END OF A RAINFALL EVENT. AREAS DESIGNED TO HAVE STANDING WATER SHALL NOT BE REQUIRED TO MEET THIS REQUIREMENT.

17. THE ROICC HAS THE OPTION OF REQUIRING ADDITIONAL SAFETY OR SEDIMENT CONTROL MEASURES IF DEEMED NECESSARY.

18. VEGETATIVE STABILIZATION SHALL BE PERFORMED IN ACCORDANCE WITH THE MISSISSIPPI PLANNING AND DESIGN MANUAL FOR THE CONTROL OF EROSION, SEDIMENT, AND STORMWATER. REFER TO APPROPRIATE SPECIFICATIONS FOR TEMPORARY SEEDING, PERMANENT SEEDING, MULCHING, AND GROUND COVER.

19. OFF-SITE WASTE AND BORROW AREAS ON STATE OR FEDERAL PROPERTY MUST HAVE PRIOR APPROVAL FROM THE ROICC. ALL OFF-SITE WASTE AND BORROW AREAS MUST BE PROTECTED BY SEDIMENT CONTROL MEASURES AND STABILIZED.

20. PRIOR TO COMMENCING LAND DISTURBANCE ACTIVITIES IN AREAS OTHER THAN INDICATED ON THESE PLANS (INCLUDING, BUT NOT LIMITED TO, OFF-SITE BORROW AREAS), THE CONTRACTOR SHALL SUBMIT A SUPPLEMENTARY EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN TO THE ROICC FOR SUBMISSION TO THE STATE OF MISSISSIPPI FOR REVIEW AND APPROVAL. THE SUPPLEMENTARY PLAN SHALL NOT BE IMPLEMENTED UNTIL APPROVAL IS RECEIVED FROM THE STATE OF MISSISSIPPI AND THE ROICC.

21. ALL UNDISTURBED WETLANDS AREAS SHALL BE PROTECTED AT ALL TIMES DURING CONSTRUCTION ACTIVITIES AND UNTIL PERMANENT VEGETATION IN THE DISTURBED AREAS HAS BEEN ESTABLISHED.

22. EROSION, SEDIMENT, AND STORMWATER CONTROL PERSONNEL SHALL HAVE COMPLETED MISSISSIPPI'S EROSION, SEDIMENT, AND STORMWATER CONTROL COURSE FOR THE CONTRACTORS, OR EQUIVALENT, PRIOR TO CONSTRUCTION OR PLACEMENT OF EROSION, SEDIMENT, AND STORMWATER CONTROLS FOR THIS PROJECT.

23. AS WORK PROGRESSES AND VARIOUS SUBCONTRACTORS AND/OR NEW EMPLOYEES ARE BROUGHT INTO THE WORK SITE, EACH SHOULD BE FAMILIARIZED WITH THE EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN. AT THE BEGINNING OF EACH WORK WEEK, SCHEDULED ITEMS OF THE PLAN TO BE IMPLEMENTED DURING THAT WORK WEEK SHOULD BE BROUGHT TO THE ATTENTION OF THE IMPACTED WORK FORCE.

24. TRAINING WILL BE PROVIDED TO PERSONNEL RESPONSIBLE FOR CONTINUED OPERATION OF THE COMPLETED PROJECT. THIS SHOULD INCLUDE AN ANNUAL REVIEW OF SCHEDULE FOR MAINTENANCE ACTIVITIES.

25. SOIL STABILIZATION THROUGHOUT THE DESIGN IS ASSUMED TO BE ACHIEVED THROUGH THE USE OF TEMPORARY AND/OR PERMANENT SEEDING AS PRESENTED ON DRAWING C-12, AND THE MISSISSIPPI PLANNING AND DESIGN MANUAL FOR THE CONTROL OF EROSION, SEDIMENT, AND STORMWATER. ALTERNATIVE STABILIZATION METHODS SHALL MEET THE MISSISSIPPI PLANNING AND DESIGN MANUAL FOR THE CONTROL OF EROSION, SEDIMENT, AND STORMWATER REQUIREMENTS SUBJECT TO THE APPROVAL OF THE ROICC.

26. FOLLOWING THE REQUIRED EXCAVATION AND RESTORATION, REMOVE CONSTRUCTED HAUL ROADS (UNLESS INDICATED OTHERWISE) AND RESTORE AREA USING TOPSOIL AND SEED WITH PERMANENT SEED MIXTURE. IN ADDITION, ANY DAMAGE TO EXISTING ROADWAYS USED FOR HAUL ROUTES SHALL BE REPAIRED IN SUCH A MANNER THAT ROADWAY CONDITIONS ARE EQUIVALENT TO, OR BETTER THAN, PRE-CONSTRUCTION CONDITIONS.

27. SITE INFORMATION:

SITE 8A

TOTAL AREA OF SITE: 560,100 SQUARE FEET
AREA DISTURBED: 609,900 SQUARE FEET
CONSOLIDATION VOLUME: 70,970 CUBIC YARDS

ON-BASE DRAINAGE CHANNELS (EXCAVATION AND RESTORATION)
ESTIMATED LENGTH OF DISTURBANCE: 11,260 FEET
ESTIMATED AREA OF DISTURBANCE: 225,200 SQUARE FEET
EXCAVATION VOLUME: 16,420 CUBIC YARDS
OFF-SITE BORROW (TOPSOIL): 12,020 CUBIC YARDS

ON-BASE DRAINAGE CHANNELS (RESTORATION)
ESTIMATED LENGTH OF DISTURBANCE: 3,800 FEET
ESTIMATED AREA OF DISTURBANCE: 34,960 SQUARE FEET
OFF-SITE BORROW (TOPSOIL): 920 CUBIC YARDS

OFF-BASE AREA OF CONTAMINATION
TOTAL AREA OF CONTAMINATION: 499,050 SQUARE FEET
AREA DISTURBED: 883,750 SQUARE FEET
EXCAVATION VOLUME: 27,725 CUBIC YARDS
OFF-SITE BORROW (COMMON FILL): 18,483 CUBIC YARDS
OFF-SITE BORROW (TOPSOILL): 9,242 CUBIC YARDS

SEQUENCE OF CONSTRUCTION

1. HOLD PRE-CONSTRUCTION MEETING WITH THE ROICC.

2. INSPECT THE SITE PRIOR TO CONSTRUCTION TO VERIFY EXISTING SITE CONDITIONS AND UNDERGROUND UTILITY LOCATIONS.

3. ESTABLISH HORIZONTAL AND VERTICAL CONTROL FOR CONSTRUCTION. STAKE THE LOCATION OF ALL AREAS TO BE EXCAVATED OR DISTURBED PRIOR TO ACTUAL WORK.

4. INSTALL PERIMETER CONTROLS FOR THE CONSTRUCTION ENTRANCE(S)/EXIT(S). CONSTRUCT THE CONSTRUCTION ENTRANCE(S)/EXIT(S). INSTALL REMAINING PERIMETER CONTROLS AS INDICATED ON DRAWINGS C-6 THROUGH C-10 AND ADDITIONAL CONSTRUCTION ENTRANCE(S)/EXIT(S) IF APPROVED BY THE ROICC PRIOR TO ANY EARTH-DISTURBANCE ACTIVITIES. ALL PERIMETER CONTROLS WILL CONFORM TO MDEQ STANDARDS, UNLESS OTHERWISE SPECIFIED. THE PERIMETER CONTROLS TO BE INSTALLED INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

   * PLACEMENT OF SILT FENCING AROUND THE CONSTRUCTION ENTRANCE(S)/EXITS(S), MATERIAL HANDLING PAD, DECONTAMINATION PAD(S), AND CONSTRUCTION LAYDOWN, STORAGE AND STAGING/PROCESSING AREA(S).

   * PLACEMENT OF SRTS WITHIN THE OFF-BASE AOC.

   * TEMPORARY SECURITY FENCE AND/OR GATES SHALL BE INSTALLED ALONG THE SITE PERIMETER AS NECESSARY TO RESTRICT ACCESS.

   * ADDITIONAL CONTROLS AS MAY BE REQUIRED BY THE ROICC AND/OR WARRANTED BY SITE CONDITIONS AND BEST CONSTRUCTION PRACTICES.

5. INSTALL THE ACCESS ROAD AND TEMPORARY DIVERSION ALONG THE EXCAVATION AREA IN THE OFF-BASE AOC. INSTALL CULVERTS AND ADDITIONAL SRTS AS INDICATED ON DRAWING C-8 OR WHERE APPROPRIATE SUBJECT TO APPROVAL OF THE ROICC.

6. CLEAR AND GRUB AREAS FOR MATERIAL HANDLING PAD, DECONTAMINATION PAD(S), AND CONSTRUCTION LAYDOWN, STORAGE AND STAGING/PROCESSING AREA(S), UNLESS INDICATED OTHERWISE.

7. CONSTRUCT MATERIAL HANDLING PAD, DECONTAMINATION PAD(S), AND MATERIALS HANDLING PAD, STORAGE AND STAGING/PROCESSING AREA(S).

8. RESTORE CHANNELS EXCAVATED DURING 2002 ON SITES 8B AND 8C BY PLACING 6 INCHES OF TOPSOIL AND TEMPORARY EROSION CONTROL MATTING (ECM) AND SEEDING WITH THE PERMANENT SEED MIXTURE INDICATED ON DRAWING C-12.

9. REMOVE ITEMS IDENTIFIED ON DRAWINGS C-18 AND C-19 FROM SITE 8A AND ABANDON THE PERMANENT MONITORING WELLS ON SITE 8A AND THE TEMPORARY MONITORING WELLS WITHIN THE OFF-BASE AOC, AS INDICATED ON THE DRAWINGS AND IN THE SPECIFICATIONS.

10. CLEAR BUT DO NOT GRUB ALL AREAS WHERE EXCAVATION WILL OCCUR (I.E., OFF-BASE AOC, ON-BASE DRAINAGE CHANNELS, AND SITE 8A). ONLY CLEAR THE AREAS THAT ARE SCHEDULED FOR EXCAVATION DURING THE CURRENT CONSTRUCTION PERIOD.

11. EXCAVATE CONTAMINATED SEDIMENTS FROM THE OFF-BASE AOC AND TRANSPORT SEDIMENT TO THE MATERIAL HANDLING PAD LOCATED ON SITE 8B. THE NAVY WILL COLLECT SOIL AND GROUNDWATER VERIFICATION SAMPLES FROM THE OFF-BASE AOC IN ACCORDANCE WITH THE VERIFICATION SAMPLING AND ANALYSIS PLAN (VSAP) (TTNUS, 2003). VERIFICATION SAMPLING AND ANALYSIS WILL FOLLOW VISUAL CONFIRMATION THAT ALL CONTAMINATED MATERIAL HAS BEEN EXCAVATED. IF VERIFICATION RESULTS INDICATE CONTAMINANTS ARE EITHER COMPLETELY REMOVED OR AT LEVELS LESS THAN THE PRELIMINARY REMEDIATION GOAL (PRG) FOR DIOXIN, EXCAVATION OF CONTAMINATED SEDIMENT IS COMPLETE. IF THE INITIAL VERIFICATION RESULTS INDICATE THAT SEDIMENT REMAINS ON SITE WITH DIOXIN CONCENTRATIONS GREATER THAN THE PRG, CONTINUE EXCAVATION IN ACCORDANCE WITH THE VSAP AND THE NAVY WILL CONDUCT ADDITIONAL VERIFICATION SAMPLING AND ANALYSIS. CONTINUE THE EXCAVATION PROCESS UNTIL CONTAMINANTS ARE REMOVED AND THE PRG IS ACHIEVED.

12. UPON APPROVAL BY THE ROICC, RESTORE THE OFF-BASE AOC AREA OF DISTURBANCE BY PLACING COMMON FILL AS REQUIRED, PLACING 6 INCHES OF TOPSOIL, AND REVEGETATING USING THE WETLAND PLANT SCHEDULE AND WETLAND SEED MIXTURE PRESENTED ON DRAWING C-22. FOLLOWING STABILIZATION AND AFTER APPROVAL OF STABILIZATION FROM THE ROICC AND MDEQ, REMOVE SRTS (INSTALLED AND EXISTING) WITHIN THE OFF-BASE AOC. FOLLOWING THE RESTORATION OF THE OFF-BASE AOC REMOVE THE TEMPORARY ACCESS ROAD TO THE TIMBER USED FOR SUBGRADE.

13. INSTALL REQUIRED HAUL ROADS ALONG THE ON-BASE DRAINAGE CHANNEL EXCAVATION AREAS. SEQUENTIALLY EXCAVATE ON-BASE SEDIMENT FROM THE DRAINAGE CHANNELS USING CHANNEL SEGREGATION DEVICES AND PUMPS TO RESTRICT THE DISTURBED CHANNEL TO MANAGEABLE LENGTHS. EXCAVATE CONTAMINATED SEDIMENT FROM INDICATED DRAINAGE CHANNELS AND ASSOCIATED CULVERTS. TRANSPORT THE SEDIMENT TO THE MATERIAL HANDLING PAD LOCATED ON SITE 8B. THE NAVY WILL COLLECT VERIFICATION SAMPLES IN ACCORDANCE WITH THE VSAP, AND AS OUTLINED IN SEQUENCE ITEM 11. UPON APPROVAL BY THE ROICC, RESTORE DRAINAGE CHANNEL SEGMENTS BY PLACING 6 INCHES OF TOPSOIL AND ECM AND APPLYING THE PERMANENT SEED MIXTURE PROVIDED ON DRAWING C-12. RESTRICT THE NUMBER OF CONCURRENTLY DISTURBED DRAINAGE CHANNEL SEGMENTS TO THREE.

14. EXCAVATE SOIL ASH FROM PILES WITHIN SITE 8A AND TRANSPORT SOIL ASH TO THE MATERIAL HANDLING PAD LOCATED AT SITE 8B. ESTABLISH THE PERIMETER CHANNELS AND STABILIZE WITH THE PLACEMENT OF 6 INCHES OF TOPSOIL AND ECM AND BY SEEDING WITH THE PERMANENT SEED MIXTURE PROVIDED ON DRAWING C-12. MODIFY THE EXISTING SITE 8A CULVERTS AS REQUIRED AND INSTALL THE NEW CULVERT. DEWATER THE EXISTING CHANNELS AND COMPACT THE REMAINING SOIL AT SITE 8A, WHERE REQUIRED, TO ACHIEVE A SUITABLE SUBGRADE AS DESCRIBED IN SPECIFICATION SECTION 02160A [SOLIDIFICATION/STABILIZATION (S/S) OF CONTAMINATED MATERIAL] PARAGRAPH TITLED "SUBGRADE PREPARATION" FOR THE CONSOLIDATED/STABILIZED MATERIAL.

15. SEQUENTIALLY EXCAVATE SEDIMENT FROM THE DRAINAGE CHANNELS WITHIN THE BOUNDARIES OF SITE 8A USING CHANNEL SEGREGATION DEVICES AND PUMPS TO RESTRICT THE DISTURBED CHANNEL TO MANAGEABLE LENGTHS. EXCAVATE CONTAMINATED SEDIMENT FROM INDICATED DRAINAGE CHANNELS AND ASSOCIATED CULVERTS. TRANSPORT THE SEDIMENT TO THE MATERIAL HANDLING PAD LOCATED ON SITE 8B. THE NAVY WILL COLLECT VERIFICATION SAMPLES IN ACCORDANCE WITH THE VSAP, AND AS OUTLINED IN SEQUENCE ITEM 11. RESTRICT THE NUMBER OF CONCURRENTLY DISTURBED DRAINAGE CHANNEL SEGMENTS TO THREE.

16. CONSOLIDATE CONTAMINATED OFF-BASE SEDIMENT, CONTAMINATED ON-BASE SEDIMENT, AND SOIL ASH TO ACHIEVE THE DESIRED MATERIAL BLEND. TRANSPORT TO SITE 8A AND SPREAD THE MATERIAL BLEND, IN LIFTS WHERE REQUIRED, TO ACHIEVE THE INTERIM GRADE (12 INCHES BELOW FINAL GRADE). STABILIZE THE MATERIAL BLEND. COMPACT EACH LIFT OF CONSOLIDATED/STABILIZED MATERIAL IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS.

17. FOLLOWING THE PLACEMENT OF THE CONSOLIDATED/STABILIZED MATERIAL BLEND (INCLUDING SEDIMENT REMOVED FROM PERIMETER CONTROLS), INSTALL THE 12-INCH-THICK ROLLER-COMPACTED CONCRETE CAP IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS.

18. FOLLOWING THE PLACEMENT OF THE ROLLER-COMPACTED CONCRETE, REMOVE THE MATERIAL HANDLING PAD, DECONTAMINATION PAD(S), AND CONSTRUCTION LAYDOWN, STORAGE AND STAGING/PROCESSING AREA(S). TRANSPORT AND DISPOSE OFF SITE ALL REQUIRED MATERIALS FROM THESE TEMPORARY FEATURES. THE NAVY WILL COLLECT VERIFICATION SAMPLES FROM THE SOIL BELOW THE MATERIAL HANDLING PAD AND ALL DECONTAMINATION PADS IN ACCORDANCE WITH THE VSAP AND AS OUTLINED IN SEQUENCE ITEM 11. STABILIZE ALL REMAINING AREAS OF DISTURBANCE WITH THE PERMANENT SEED MIXTURE PROVIDED ON DRAWING C-12.

19. STABILIZE ALL REMAINING AREAS OF DISTURBANCE WITH THE PERMANENT SEED MIXTURE PROVIDED ON DRAWING C-12.

20. WHEN UPSTREAM AREAS AND ALL ON-BASE DRAINAGE CHANNELS HAVE BEEN STABILIZED AND APPROVAL OF STABILIZATION HAS BEEN RECEIVED FROM THE ROICC AND MDEQ. REMOVE ALL REMAINING TEMPORARY PERIMETER CONTROLS AND ALL REMAINING ON-BASE SRTS ON SITES 8A, 8B, AND 8C AND FROM ALL DOWNSTREAM DRAINAGE CHANNELS.

WARNING ! EROSION AND SEDIMENT CONTROL WILL BE STRICTLY ENFORCED ! ! !

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM DATE 6/28/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS SHOWN

EROSION, SEDIMENT, AND STORMWATER CONTROL PLAN NOTES
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424674
APPROVED BY DATE 10/6/04
DRAWING NO. C-11
REV. 0

ACAD: 7379CN04.dwg 09/29/04 MF PIT

DRAWING NO. C-11 REV. 0

REVEGETATION NOTES

SECTION I – VEGETATIVE STABILIZATION METHODS AND MATERIALS

A. SITE PREPARATION

I. INSTALL EROSION, SEDIMENT, AND STORMWATER CONTROL STRUCTURES (EITHER TEMPORARY OR PERMANENT), SUCH AS SILT FENCE, CONSTRUCTION ENTRANCE/EXIT(S), SEDIMENT RECOVERY TRAPS, AND EROSION CONTROL MATTING, PRIOR TO OTHER SITE DISTURBANCE.

II. PERFORM ALL GRADING OPERATIONS AT RIGHT ANGLES TO THE SLOPE. FINAL GRADING AND SHAPING IS NOT NECESSARY FOR TEMPORARY SEEDING.

III. SCHEDULE REQUIRED SOIL TESTS TO DETERMINE SOIL AMENDMENT COMPOSITION AND APPLICATION RATES. SUBMIT TEST RESULTS AND RECOMMENDATIONS FOR SEED MIXTURE AND FERTILIZER RATES FOR APPROVAL BY ROICC.

B. SOIL AMENDMENTS (FERTILIZER AND LIME SPECIFICATIONS)

I. SOIL TESTS MUST BE PERFORMED TO DETERMINE THE EXACT RATIOS AND APPLICATION RATES FOR BOTH LIME AND FERTILIZER. SOIL ANALYSIS IS PERFORMED BY THE MISSISSIPPI COOPERATIVE EXTENSION SERVICE SOIL TESTING LABORATORY (INFORMATION IS AVAILABLE THROUGH THE COUNTY EXTENSION SERVICE OFFICE) OR BY A RECOGNIZED COMMERCIAL LABORATORY. SOIL SAMPLES TAKEN FOR ENGINEERING PURPOSES MAY ALSO BE USED FOR CHEMICAL ANALYSIS.

II. FERTILIZERS SHALL BE UNIFORM IN COMPOSITION, FREE FLOWING, AND SUITABLE FOR ACCURATE APPLICATION BY APPROVED EQUIPMENT. MANURE MAY BE SUBSTITUTED FOR FERTILIZER WITH PRIOR APPROVAL FROM THE ROICC. FERTILIZERS SHALL BE DELIVERED TO THE SITE, FULLY LABELED ACCORDING TO APPLICABLE STATE FERTILIZER LAWS AND SHALL BEAR THE NAME, TRADE NAME OR TRADEMARK, AND WARRANTY OF THE PRODUCER.

III. LIME MATERIALS SHALL BE GROUND AGRICULTURAL LIMESTONE (HYDRATED OR BURNT LIME MAY BE SUBSTITUTED) WHICH CONTAINS AT LEAST 50% TOTAL OXIDES (CALCIUM OXIDE PLUS MAGNESIUM OXIDE). LIMESTONE SHALL BE GROUND TO SUCH FINENESS THAT AT LEAST 50% WILL PASS THROUGH A #100 MESH SIEVE, AND 98 TO 100% WILL PASS THROUGH A #20 MESH SIEVE.

IV. INCORPORATE LIME AND FERTILIZER EVENLY, AND INCORPORATE INTO THE TOP 4 TO 6 INCHES OF SOIL BY DISCING OR OTHER SUITABLE MEANS UNLESS INDICATED OTHERWISE THROUGH TESTING. APPLY GROUND AGRICULTURAL LIMESTONE AND FERTILIZER AT RATES IDENTIFIED IN THE SEED SUMMARY.

C. SEEDBED PREPARATION

I. TEMPORARY SEEDING

a. SEEDBED PREPARATION SHALL CONSIST OF LOOSENING SOIL TO A DEPTH OF 4 TO 6 INCHES BY MEANS OF SUITABLE AGRICULTURAL OR CONSTRUCTION EQUIPMENT, SUCH AS DISC HARROWS, CHISEL PLOWS, OR RIPPERS MOUNTED ON CONSTRUCTION EQUIPMENT. AFTER THE SOIL IS LOOSENED, IT SHOULD NOT BE ROLLED OR DRAGGED SMOOTH, BUT LEFT IN THE ROUGHENED CONDITION. SLOPED AREAS (GREATER THAN 3H:1V) SHOULD BE TRACKED BY A DOZER LEAVING THE SURFACE IN AN IRREGULAR CONDITION WITH RIDGES RUNNING PARALLEL TO THE CONTOUR OF THE SLOPE.

b. SOIL pH SHALL BE BETWEEN 6.0 AND 7.0.

c. APPLY FERTILIZER AND LIME AS PRESCRIBED ON THE SEEDING SUMMARY.

d. INCORPORATE LIME AND FERTILIZER INTO THE TOP 4 TO 6 INCHES OF SOIL BY DISCING OR OTHER SUITABLE MEANS.

II. PERMANENT SEEDING

a. IN ACCORDANCE WITH THE MISSISSIPPI PLANNING AND DESIGN MANUAL FOR THE CONTROL OF EROSION, SEDIMENT, AND STORMWATER (PDMCESS), PERMANENT SEEDING CHAPTER (CHAPTER 5), THE MINIMUM SOIL CONDITIONS REQUIRED FOR PERMANENT VEGETATION ESTABLISHMENT ARE AS FOLLOWS:

1. SOIL pH SHALL BE BETWEEN 6.0 AND 7.0, ORGANIC CONTENT AT LEAST 1% ORGANIC MATTER AND SOLUBLE SALTS SHALL BE LESS THAN 500 PARTS PER MILLION (PPM).

2. SUFFICIENT DEPTH OF SOIL TO PROVIDE AN ADEQUATE ROOT ZONE. THE MINIMUM DEPTH TO ROCK OR IMPERMEABLE LAYERS SHOULD BE 12 INCHES.

3. SOIL MUST CONTAIN SUFFICIENT PORE SPACE TO PERMIT ADEQUATE ROOT PENETRATION.

4. FREE FROM LARGE ROOTS, BRANCHES, STONES, LARGE CLODS OF EARTH, OR TRASH OF ANY KIND. CLODS AND STONES MAY BE LEFT ON SLOPES THAT EXCEED 3H:1V, IF SLOPES ARE TO BE HYDROSEEDED.

b. AREAS PREVIOUSLY GRADED IN CONFORMANCE WITH THE DRAWINGS SHALL BE MAINTAINED IN A TRUE AND EVEN GRADE, THEN SCARIFIED OR OTHERWISE LOOSENED TO A DEPTH OF 4 INCHES TO PERMIT BONDING OF THE SOIL TO THE SURFACE AND TO CREATE HORIZONTAL EROSION CHECK SLOTS TO PREVENT SOIL FROM SLIDING DOWN A SLOPE.

c. APPLY SOIL AMENDMENTS AS PER SOIL TEST.

d. MIX SOIL AMENDMENTS INTO THE TOP 4 TO 6 INCHES OF SOIL BY DISCING OR OTHER SUITABLE MEANS. LAWN AREAS SHOULD BE RAKED TO SMOOTH THE SURFACE; REMOVE LARGE OBJECTS LIKE STONES AND BRANCHES, AND READY THE AREA FOR SEED APPLICATION. WHERE SITE CONDITIONS WILL NOT PERMIT NORMAL SEEDBED PREPARATION. LOOSEN SURFACE SOIL BY DRAGGING WITH A HEAVY CHAIN OR OTHER EQUIPMENT TO ROUGHEN THE SURFACE. STEEP SLOPES (STEEPER THAN 3H:1V) SHOULD BE TRACKED BY A DOZER, LEAVING THE SOIL IN AN IRREGULAR CONDITION WITH RIDGES RUNNING PARALLEL TO THE CONTOUR OF THE SLOPE. THE TOP 1 TO 3 INCHES OF SOIL SHOULD BE LOOSE AND FRIABLE. SEEDBED LOOSENING MAY BE NECESSARY ON NEWLY DISTURBED AREAS.

D. SEED SPECIFICATIONS

I. ALL SEED MUST CONFORM TO MISSISSIPPI SEED LAW REGARDING NOXIOUS WEED SEED. EACH BAG OF SEED MUST BE LABELED WITH A BAG TAG SHOWING PERCENT PURE SEED, PERCENT GERMINATION (INCLUDING HARD SEED), AND PERCENT WEED SEED. ALL SEED SHALL BE SUBJECT TO RE-TESTING BY A RECOGNIZED SEED LABORATORY. THE INFORMATION ON THE BAG TAG SHALL BE FROM A SEED TEST MADE WITHIN 6 MONTHS IMMEDIATELY PRECEDING THE DATE OF PLANTING SUCH MATERIAL ON THIS JOB. SEED TAGS SHALL BE MADE AVAILABLE TO THE ROICC TO VERIFY TYPE AND RATE OF SEED USED.

E. METHODS OF SEEDING

I. FOR TEMPORARY AND PERMANENT SEEDING, EVENLY APPLY SEED USING A CYCLONE SEEDER (BROADCAST), DRILL, CULTIPACKER SEEDER, OR HYDROSEEDER. USE SEED RATES PROVIDED IN THE SEEDING SUMMARY. BROADCASTING OR HYDROSEEDING ARE APPROPRIATE FOR STEEP SLOPES WHERE EQUIPMENT CANNOT BE DRIVEN. HAND BROADCASTING IS NOT RECOMMENDED BECAUSE OF DIFFICULTY IN ACHIEVING A UNIFORM DISTRIBUTION.

II. HYDROSEEDING: WHEN HYDROSEEDING, SURFACE ROUGHENING IS PARTICULARLY IMPORTANT, AS A ROUGHENED SLOPE WILL PROVIDE SOME NATURAL COVERAGE OF LIME FERTILIZER AND SEED. THE SURFACE SHOULD NOT BE COMPACTED OR SMOOTH. FINE SEEDBED PREPARATION IS NOT NECESSARY FOR HYDROSEEDING OPERATIONS; LARGE CLODS, STONES, AND IRREGULARITIES PROVIDE CAVITIES IN WHICH SEEDS CAN LODGE.

a. APPLY LEGUME INOCULANTS AT FOUR TIMES THE RECOMMENDED RATE WHEN ADDING INOCULANTS TO A HYDROSEEDER SLURRY.

b. IF A MACHINERY BREAKDOWN OF 1/2 TO 2 HOURS OCCURS, ADD 50% MORE SEED TO THE TANK, BASED ON THE PROPORTION OF THE REMAINING SLURRY. BEYOND 2 HOURS, A FULL RATE OF NEW SEED MAY BE NECESSARY.

c. LIME – LIME IS NOT NORMALLY APPLIED WITH A HYDRAULIC SEEDER BECAUSE IT IS ABRASIVE. IF LIME IS APPLIED WITH A HYDRAULIC SEEDER, USE ONLY GROUND AGRICULTURAL LIMESTONE. NORMALLY NOT MORE THAN 2 TONS/ACRE ARE APPLIED BY HYDROSEEDING AT ANY ONE TIME. DO NOT USE BURNT OR HYDRATED LIME WHEN HYDROSEEDING.

d. SEED AND FERTILIZER SHALL BE MIXED ON SITE NO MORE THAN 30 MINUTES BEFORE APPLICATION.

e. IF SOIL AMENDMENTS ARE BEING APPLIED DURING HYDROSEEDING, APPLICATION BY DISCING AS DISCUSSED IN REVEGETATION NOTE (SECTION I, B, IV) NEED NOT BE PERFORMED.

III. DRY SEEDING: THIS INCLUDES USE OF CONVENTIONAL DROP OR BROADCAST SPREADERS.

a. SEED SPREAD SHALL BE INCORPORATED INTO THE SOIL AT THE RATES PRESCRIBED ON THE TEMPORARY OR PERMANENT SEEDING SUMMARIES. THE SEEDBED AREA SHALL THEN BE ROLLED WITH A WEIGHTED ROLLER TO PROVIDE GOOD SEED-TO-SOIL CONTACT.

b. WHERE PRACTICAL, SEED SHOULD BE APPLIED IN TWO DIRECTIONS PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION.

IV. DRILL OR CULTIPACKER SEEDING: MECHANIZED SEEDERS THAT APPLY SEED AT THE RATES IDENTIFIED ON THE PERMANENT AND TEMPORARY SEEDING SUMMARIES AND COVER SEED WITH SOIL.

a. CULTIPACKING SEEDERS ARE REQUIRED TO BURY THE SEED IN SUCH A FASHION AS TO PROVIDE NO MORE THAN 1/2 INCH OF SOIL COVERING FOR GRASSES AND LEGUMES AND NO MORE THAN 1 INCH FOR SMALL GRAINS. SEEDBED MUST BE FIRM AFTER PLANTING.

b. WHERE PRACTICAL, SEED SHOULD BE APPLIED IN TWO DIRECTIONS PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION.

F. MULCH SPECIFICATIONS

I. STERILE STRAW SHALL CONSIST OF THOROUGHLY THRESHED WHEAT OR OAT STRAW, REASONABLY BRIGHT IN COLOR, AND SHALL NOT BE MUSTY, MOLDY, CAKED, DECAYED, OR EXCESSIVELY DUSTY, AND SHALL BE FREE OF NOXIOUS WEED SEEDS.

II. WOOD CELLULOSE FIBER MULCH (WCFM)

a. WCFM SHALL CONSIST OF SPECIALLY PREPARED WOOD CELLULOSE PROCESSED INTO A UNIFORM FIBROUS PHYSICAL STATE.

b. WCFM SHALL BE DYED GREEN OR CONTAIN A GREEN DYE IN THE PACKAGE THAT WILL PROVIDE AN APPROPRIATE COLOR TO FACILITATE VISUAL INSPECTION OF THE UNIFORMLY SPREAD SLURRY.

c. WCFM, INCLUDING DYE, SHALL CONTAIN NO GERMINATION OR GROWTH INHIBITING AGENTS.

d. WCFM SHALL BE MANUFACTURED AND PROCESSED IN SUCH A MANNER THAT THE WOOD CELLULOSE FIBER MULCH WILL REMAIN IN UNIFORM SUSPENSION IN WATER UNDER AGITATION AND WILL BLEND WITH SEED, FERTILIZERS AND OTHER ADDITIVES TO FORM A HOMOGENOUS SLURRY. THE MULCH MATERIAL SHALL FORM A BLOTTER-LIKE GROUND COVER, ON APPLICATION, HAVING MOISTURE ABSORPTION AND PERCOLATION PROPERTIES AND SHALL COVER AND HOLD GRASS SEED IN CONTACT WITH THE SOIL WITHOUT INHIBITING THE GROWTH OF THE GRASS SEEDINGS.

e. WCFM SHALL CONTAIN NO ELEMENTS OR COMPOUNDS AT CONCENTRATION LEVELS THAT WILL BE PHYTO-TOXIC.

f. WHEN HYDROSEEDING, SLURRY SHOULD INCLUDE A WCFM.

NOTE: ONLY STERILE STRAW MULCH SHOULD BE USED IN AREAS WHERE A STAND OF ONE SPECIES OF GRASS IS DESIRED.

G. MULCHING SEEDED AREAS – MULCH SHALL BE APPLIED TO ALL SEEDED AREAS IMMEDIATELY AFTER SEEDING.

I. IF GRADING IS COMPLETED OUTSIDE OF THE SEEDING SEASON, MULCH SHALL BE APPLIED TO THE GRADED AREAS. IN THESE CASES, ORGANIC MULCH RATHER THAN WOOD FIBER MULCH SHOULD BE USED.

II. WHEN STERILE STRAW MULCH IS USED, IT SHALL BE SPREAD OVER ALL SEEDED AREAS AT THE RATE OF 1 TO 2 TONS/ACRE. MULCH SHALL BE APPLIED TO ACHIEVE A UNIFORM DISTRIBUTION AND DEPTH SO THAT THE SOIL SURFACE IS NOT EXPOSED, AND MUST BE ANCHORED.

III. WOOD FIBER, OR WOOD CELLULOSE FIBER, USED AS A MULCH SHALL BE APPLIED AT A NEW DRY WEIGHT OF 0.1 TO 1.0 TONS PER ACRE. THE WOOD CELLULOSE FIBER SHALL BE MIXED WITH WATER, AND THE MIXTURE SHALL CONTAIN A MAXIMUM OF 50 LBS OF WOOD CELLULOSE FIBER PER 100 GALLONS OF WATER. WOOD CELLULOSE FIBER DOES NOT REQUIRE TACKING, AND MAY BE USED THROUGH A HYDROSEEDER SLURRY TO TACK DOWN STRAW MULCH ON STEEP SLOPES.

H. SECURING STRAW MULCH (MULCH ANCHORING): MULCH ANCHORING SHALL BE PERFORMED IMMEDIATELY FOLLOWING MULCH APPLICATION TO MINIMIZE LOSS BY WIND OR WATER. THIS MAY BE DONE BY ONE OF THE FOLLOWING METHODS DEPENDING UPON THE AREA AND EROSION HAZARD.

I. A MULCH ANCHORING TOOL IS A TRACTOR DRAWN IMPLEMENT DESIGNED TO PUNCH MULCH INTO THE SOIL. THIS IS MOST EFFECTIVE ON LARGE AREAS, BUT IS LIMITED TO FLATTER SLOPES NO STEEPER THAN 3H:1V WHERE EQUIPMENT CAN OPERATE SAFELY ON THE CONTOUR.

II. WOOD CELLULOSE FIBER MAY BE USED FOR ANCHORING STRAW MULCH ON STEEP SLOPES.

III. APPLICATIONS OF LIQUID BINDERS SHOULD BE APPLIED HEAVIER AT EDGES WHERE WIND CATCHES MULCH, SUCH AS IN VALLEYS AND ON CRESTS OF BANKS. THE REMAINDER OF THE AREA SHOULD BE UNIFORM AFTER BINDER APPLICATION.

IV. LIGHTWEIGHT PLASTIC, COTTON, JUTE, WIRE, OR PAPER NETS MAY BE STAPLED OVER THE MULCH ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS. PLASTIC NETTING IS VERY EFFECTIVE IN HOLDING MULCH IN PLACE ON WATERWAYS AND SLOPES BEFORE GRASSES BECOME ESTABLISHED.

V. PEG AND TWINE: SECURE MULCH BY STRETCHING TWINE BETWEEN 8 TO 10 INCH LONG WOODEN PEGS DRIVEN TO WITHIN 3 INCHES OF THE SOIL SURFACE EVERY 4 FEET IN ALL DIRECTIONS. SECURE MULCH BY STRETCHING TWINE BETWEEN PEGS IN A CRISS-CROSS-WITHIN-A-SQUARE PATTERN.

I. REPAIRS AND MAINTENANCE

GENERALLY, A STAND OF VEGETATION CANNOT BE DETERMINED TO BE FULLY ESTABLISHED UNTIL SOIL COVER HAS BEEN MAINTAINED FOR ONE FULL YEAR FROM PLANTING. INSPECT ALL SEEDED AREAS FOR FAILURES AND MAKE NECESSARY REPAIRS AND RESEEDINGS WITHIN THE SAME PLANTING SEASON, IF POSSIBLE.

I. IF VEGETATION FAILS TO GROW, SOIL MUST BE TESTED TO DETERMINE IF ACIDITY OR NUTRIENT IMBALANCE IS RESPONSIBLE.

II. RESEEDING – IF A STAND HAS INADEQUATE COVER, AS DETERMINED BY THE ROICC, RE-EVALUATE CHOICE OF PLANT MATERIALS AND QUANTITIES OF LIME AND FERTILIZER. RE-ESTABLISH THE STAND AFTER SEEDBED PREPARATION OR OVERSEED THE STAND. CONSIDER SEEDING TEMPORARY ANNUAL SPECIES IF THE TIME OF YEAR IS NOT APPROPRIATE FOR PERMANENT SEEDING.

III. FERTILIZATION – ON THE TYPICAL DISTURBED AREA, FULL ESTABLISHMENT USUALLY REQUIRES REFERTILIZATION IN THE SECOND GROWING SEASON. FINE TURF REQUIRES ANNUAL MAINTENANCE FERTILIZATION. USE SOIL TESTS IF POSSIBLE OR APPLY 200 TO 300 POUNDS OF 13-13-13 FERTILIZER PER ACRE WHEN GROWTH BEGINS. APPLY ADDITIONAL NITROGEN, IF NEEDED, DURING THE GROWING SEASON.

IV. FOR TEMPORARY SEEDING, RESEED AND MULCH AREAS AS SOON AS POSSIBLE WHERE SEEDLING IMMERGENCE IS POOR, OR WHERE EROSION OCCURS. DO NOT MOW. PROTECT FROM TRAFFIC AS MUCH AS POSSIBLE.

SECTION II – TEMPORARY SEEDING

VEGETATION – ANNUAL GRASS USED TO PROVIDE COVER ON DISTURBED AREAS FOR UP TO 12 MONTHS. FOR LONGER DURATION OF VEGETATIVE COVER, PERMANENT SEEDING IS REQUIRED.

TEMPORARY SEEDING SUMMARY

SEED MIXTURE (SEE TABLE 5.4 OF THE MISSISSIPPI PDMCESS)				FERTILIZER RATE (13-13-13)	LIME RATE (TONS/ACRE)
SPECIES	APPLICATION RATE (LB/AC)	SEEDING DATES	SEEDING DEPTHS		
RYEGRASS	30	9/1 – 11/30	1/2 INCH	600 LB/AC (14 LBS/1000 SF)	1 TO 1/2 (COARSE TEXTURED SOIL) 2 TO 3 (FINE TEXTURED SOIL)

NOTES:
1. FERTILIZER AND LIME APPLICATION RATES MAY VARY DEPENDING UPON THE RESULTS OF THE SOIL TEST INDICATED IN REVEGETATION NOTE SECTION I,B,I.
2. ALL OTHER SEED SPECIES IDENTIFIED IN TABLE 5.4 OF THE MISSISSIPPI PDMCESS ARE APPROPRIATE FOR PLANTING IN ZONE 3. CHECK WITH THIS TEMPORARY SEEDING TABLE (TABLE 5.4 OF THE MISSISSIPPI PDMCESS) FOR APPLICATION RATE IF ANOTHER SPECIES OF SEED IS SELECTED.
3. SEEDING DEPTHS – VERY SMALL GRAINS SHOULD BE PLANTED NO MORE THAN 1 INCH DEEP AND GRASSES AND LEGUMES NO MORE THAN 1/2 INCHES DEEP.

SECTION III – PERMANENT SEEDING

SEEDING GRASS AND LEGUMES TO ESTABLISH GROUND COVER FOR A MINIMUM PERIOD OF ONE YEAR ON DISTURBED AREAS GENERALLY RECEIVING LOW MAINTENANCE.

PERMANENT SEEDING SUMMARY

SEED MIXTURE (SEE TABLE 5.2 OF THE MISSISSIPPI PDMCESS)				FERTILIZER RATE (13-13-13)	LIME RATE (TONS/ACRE)
SPECIES	APPLICATION RATE (LB/AC)	SEEDING DATES	SEEDING DEPTHS		
COMMON BERMUDA GRASS	15	3/1-7/15 9/1-11/30	1/4-1/2 INCHES	600 LB/AC (14 LBS/1000 SF)	2

NOTES:
1. FERTILIZER AND LIME APPLICATION RATES MAY VARY DEPENDING UPON THE RESULTS OF THE SOIL TEST INDICATED IN REVEGETATION NOTE SECTION I,B,I.
2. WHEN PLANTING BETWEEN 12/1 AND 2/28 USE COMMON BERMUDA GRASS (10 LBS/ACRE) AND ANNUAL RYEGRASS (30 LBS/ACRE).

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

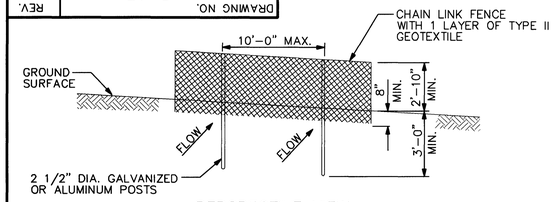
SEAL AREA

DRAWN BY DM DATE 6/29/04
CHECKED BY TWS DATE 10/06/04
REVISED BY ---- DATE ----
SCALE AS SHOWN

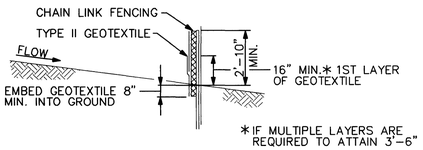
REVEGETATION NOTES
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424675
APPROVED BY DATE 10/6/04
DRAWING NO. C-12 REV. 0

ACAD: 7379CN05.dwg 09/29/04 MF PIT



PERSPECTIVE VIEW



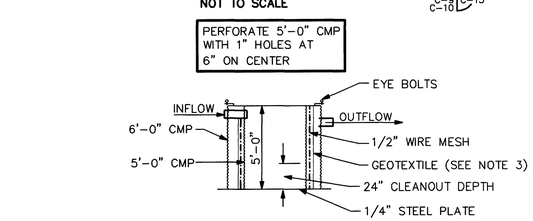
CROSS SECTION

NOTES:

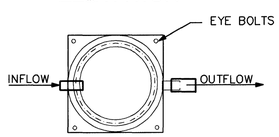
1. WHEN GEOTEXTILE SECTIONS ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED 6" AND FOLDED.
2. FENCING SHALL BE 42" (MIN.) IN HEIGHT AND CONSTRUCTED IN ACCORDANCE WITH THE LATEST MISSISSIPPI STATE HIGHWAY DETAILS FOR CHAIN LINK FENCING.
3. CHAIN LINK FENCE SHALL BE FASTENED SECURELY TO THE FENCE POSTS WITH WIRE TIES. THE LOWER TENSION WIRE, BRACE AND TRUSS RODS, DRIVE ANCHORS, AND POST CAPS ARE NOT REQUIRED EXCEPT ON THE ENDS OF THE FENCE.
4. GEOTEXTILE SHALL BE FASTENED SECURELY TO THE CHAIN LINK FENCE WITH TIES SPACED 24" AT THE TOP AND MID-SECTION AND SHALL MEET THE REQUIREMENTS OF TYPE II GEOTEXTILE.
5. CONTRACTOR IS TO EMBED SUPER SILT FENCE POSTS SUCH THAT A MAXIMUM HORIZONTAL DEFLECTION OF 1" RESULTS (MEASURED AT A HEIGHT OF 33" ABOVE GRADE) WHEN 5 POUNDS OF HORIZONTAL FORCE IS APPLIED AT THE POINT WHERE DEFLECTION IS MEASURED.
6. SEDIMENT SHALL BE REMOVED FROM THE CONTROL DEVICE WHEN THE SEDIMENT REACHES 1/3 TO 1/2 THE HEIGHT OF THE CONTROL DEVICE.

SUPER SILT FENCE DETAIL (1 / C-9 C-10 | C-13)

NOT TO SCALE



ELEVATION



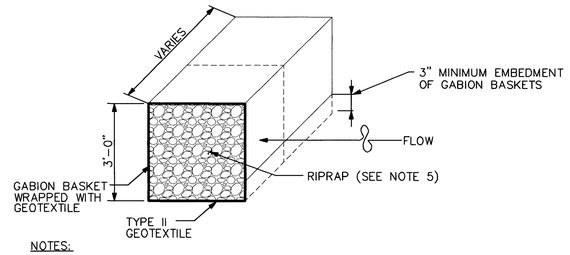
PLAN VIEW

NOTES:

1. AN EXAMPLE OF A TYPICAL SEDIMENT TANK IS SHOWN. OTHER CONTAINER DESIGNS CAN BE USED IF THE STORAGE VOLUME IS ADEQUATE AND APPROVAL IS OBTAINED FROM THE ROICC.
2. PORTABLE SEDIMENT TANKS SHALL BE PLACED IN SERIES IF ADDITIONAL RETENTION TIME OR CAPACITY IS REQUIRED. ONE CUBIC FOOT OF STORAGE SHALL BE PROVIDED FOR EACH GALLON PER MINUTE OF PUMP DISCHARGE CAPACITY.
3. GEOTEXTILE MESH SIZE MAY VARY FROM TANK TO TANK IF TANKS ARE INSTALLED IN SERIES. ALL GEOTEXTILES SHALL HAVE AOS LESS THAN 0.3 MM, PERMEABILITY GREATER THAN 0.01 CM/SEC, GRAB TENSILE GREATER THAN 90 LBS AND BURST STRENGTH GREATER THAN 145 PSI. THE DOWNSTREAM-MOST GEOTEXTILE SHALL HAVE BURST STRENGTH GREATER THAN 320 PSI.
4. DISCHARGE FROM PORTABLE SEDIMENT TANKS SHALL BE CONTROLLED TO PROTECT DOWNSLOPE AREAS FROM EROSION. EROSION CONTROLS (E.G. EROSION CONTROL MATTING, RIPRAP, ETC.) SHALL BE SUBJECT TO ROICC APPROVAL.

PORTABLE SEDIMENT TANK DETAIL (4 / C-7 C-8 C-9 | C-13)

NOT TO SCALE

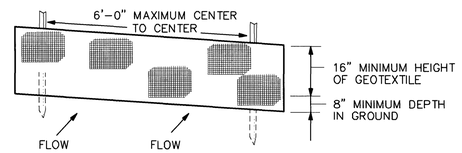


NOTES:

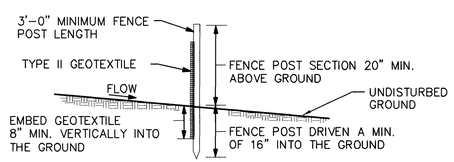
1. THE LENGTH OF EACH SRT WILL VARY DEPENDING ON THE LOCATION.
2. SRT SIZES CAN BE INCREASED BY STACKING GABION BASKETS.
3. GEOTEXTILES SHOULD BE OVERLAPPED A MINIMUM OF 6 INCHES.
4. OVERLAP FREE ENDS OF GEOTEXTILE A MINIMUM OF 1'. FASTEN TO GABION BASKET WITH TIES.
5. STONE USED FOR RIPRAP SHALL BE d50 @ SIZE OF 6" APPOXIMATELY EQUAL TO THE 200 POUND STONE IDENTIFIED IN SECTION 705 OF THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

SEDIMENT RECOVERY TRAP (SRT) DETAIL (2 / C-8 C-13)

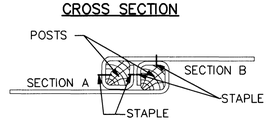
NOT TO SCALE



PERSPECTIVE VIEW



CROSS SECTION



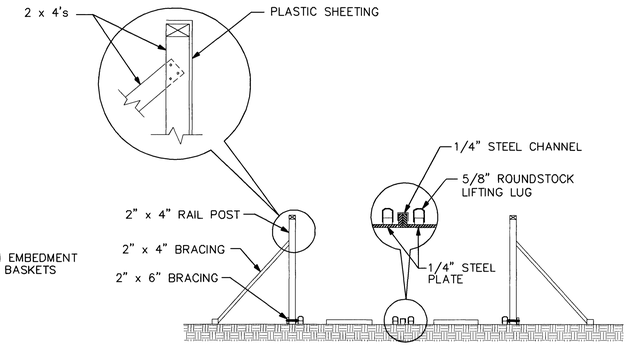
TOP VIEW – JOINING TWO ADJACENT SILT FENCE SECTIONS

NOTES:

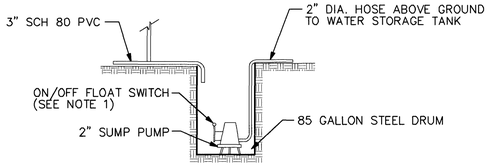
1. FENCE POSTS SHALL BE A MINIMUM OF 3'-0" LONG DRIVEN 16" MINIMUM INTO THE GROUND. WOOD POSTS SHALL BE 1.5" BY 1.5" SQUARE (MIN) CUT OR 1.75" DIA. (MIN) ROUND AND SHALL BE OF SOUND HARDWOOD. STEEL POSTS WILL BE STANDARD T OR U SECTION WEIGHING NOT LESS THAN 1 POUND PER LINEAR FOOT.
2. GEOTEXTILE SHALL BE FASTENED SECURELY TO EACH FENCE POST WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION AND SHALL MEET THE REQUIREMENTS OF TYPE II GEOTEXTILE.
3. SEDIMENT SHALL BE REMOVED FROM THE CONTROL DEVICE WHEN THE SEDIMENT REACHES 1/3 TO 1/2 THE HEIGHT OF THE CONTROL DEVICE.

SILT FENCE DETAIL (5 / C-6 C-7 C-10 | C-13)

NOT TO SCALE



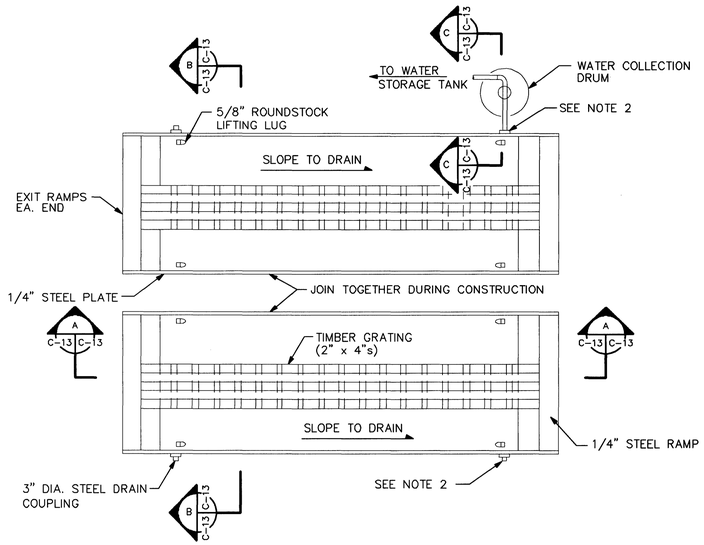
SECTION (B / C-13 C-13)



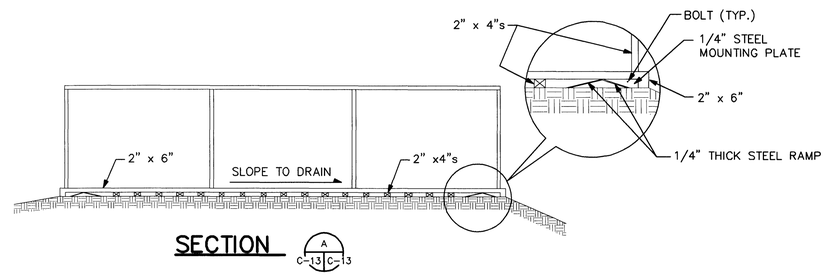
SECTION (C / C-13 C-13)

NOTES:

1. ON/OFF OPERATION OF PUMP IS CONTROLLED BY FLOAT SO THAT PUMP STARTS WHEN SUMP WATER LEVEL REACHES 4" BELOW SUMP INLET AND SHUTS OFF WHEN WATER LEVEL DROPS TO PUMP DISCHARGE LEVEL.
2. DRAIN COUPLING IS TO BE FITTED WITH QUICK DISCONNECT AND 3" DIA. SCH 80 PVC (INNER COUPLING) OR 3" DIA. RUBBER DISCHARGE HOSE (OUTER COUPLING) TO SUMP. THE OUTER DRAIN COUPLING IS TO BE USED ONLY AFTER VEHICLE HAS LEFT THE PAD. PLUG ALL DRAINS NOT BEING USED.



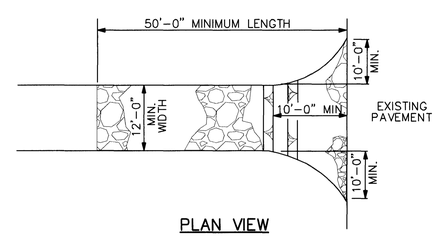
PLAN – DECONTAMINATION PAD



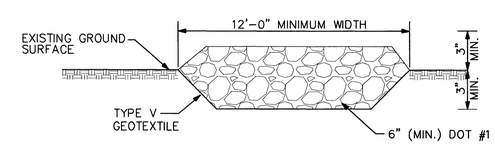
SECTION (A / C-13 C-13)

DECONTAMINATION PAD DETAIL (TYP.) (3 / C-7 C-8 C-9 | C-13)

NOT TO SCALE



PLAN VIEW



CROSS SECTION

CONSTRUCTION ENTRANCE/EXIT DETAIL (6 / C-6 C-7 C-8 C-9 | C-13)

NOT TO SCALE

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

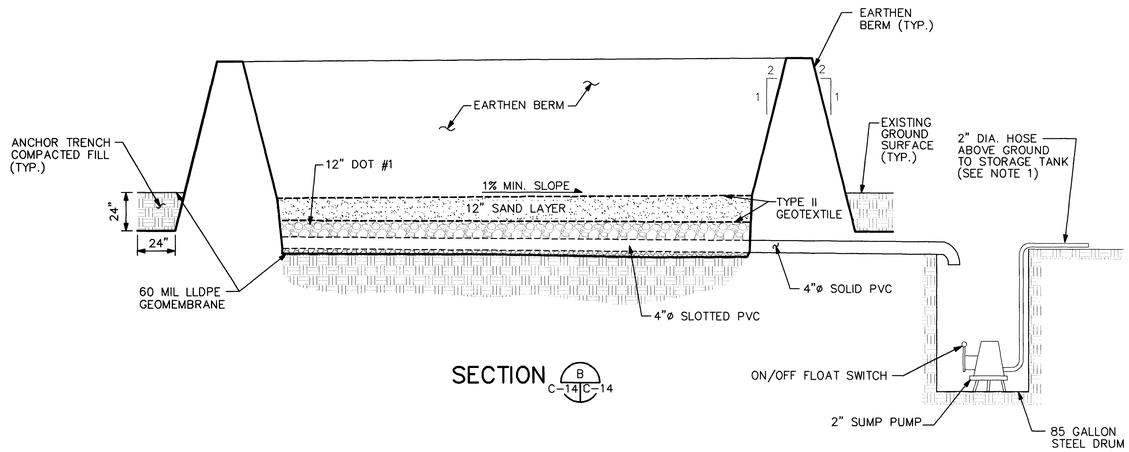
SEAL AREA

DRAWN BY DM DATE 6/29/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS SHOWN

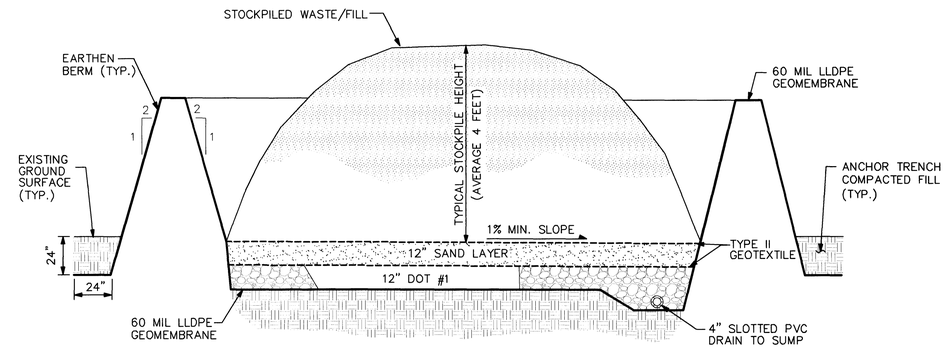
EROSION, SEDIMENT AND STORMWATER CONTROL DTLS. (SHEET 1 OF 2)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424676
APPROVED BY — DATE 10/6/04
DRAWING NO. C-13 REV. 0

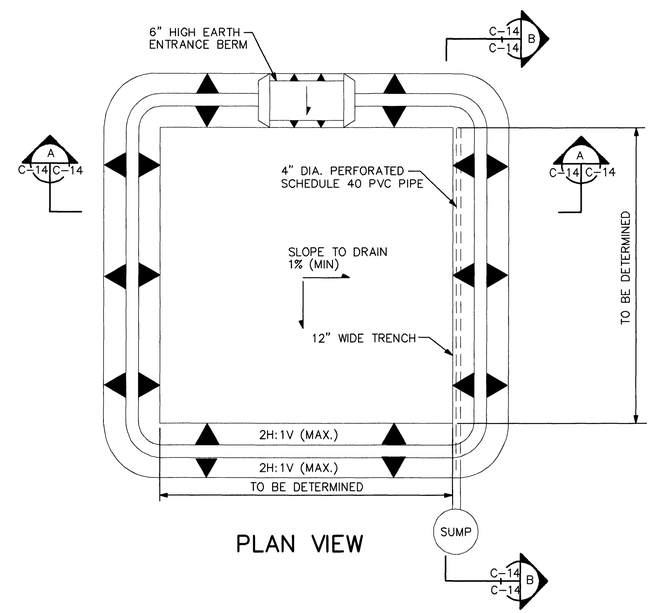
ACAD: 7379CD09.dwg 10/05/04 MF PIT



SECTION B C-14 C-14



SECTION A C-14 C-14



PLAN VIEW

MATERIAL HANDLING PAD

1 C-7 C-14

NOT TO SCALE

NOTES: PRIOR TO DISCHARGE OR OFFSITE TREATMENT/DISPOSAL OF COLLECTED WATER, REMOVE SEDIMENT. SEDIMENT REMOVED FROM COLLECTED WATER SHALL BE ADDED TO THE MATERIAL BLEND.

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM DATE 6/29/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS SHOWN

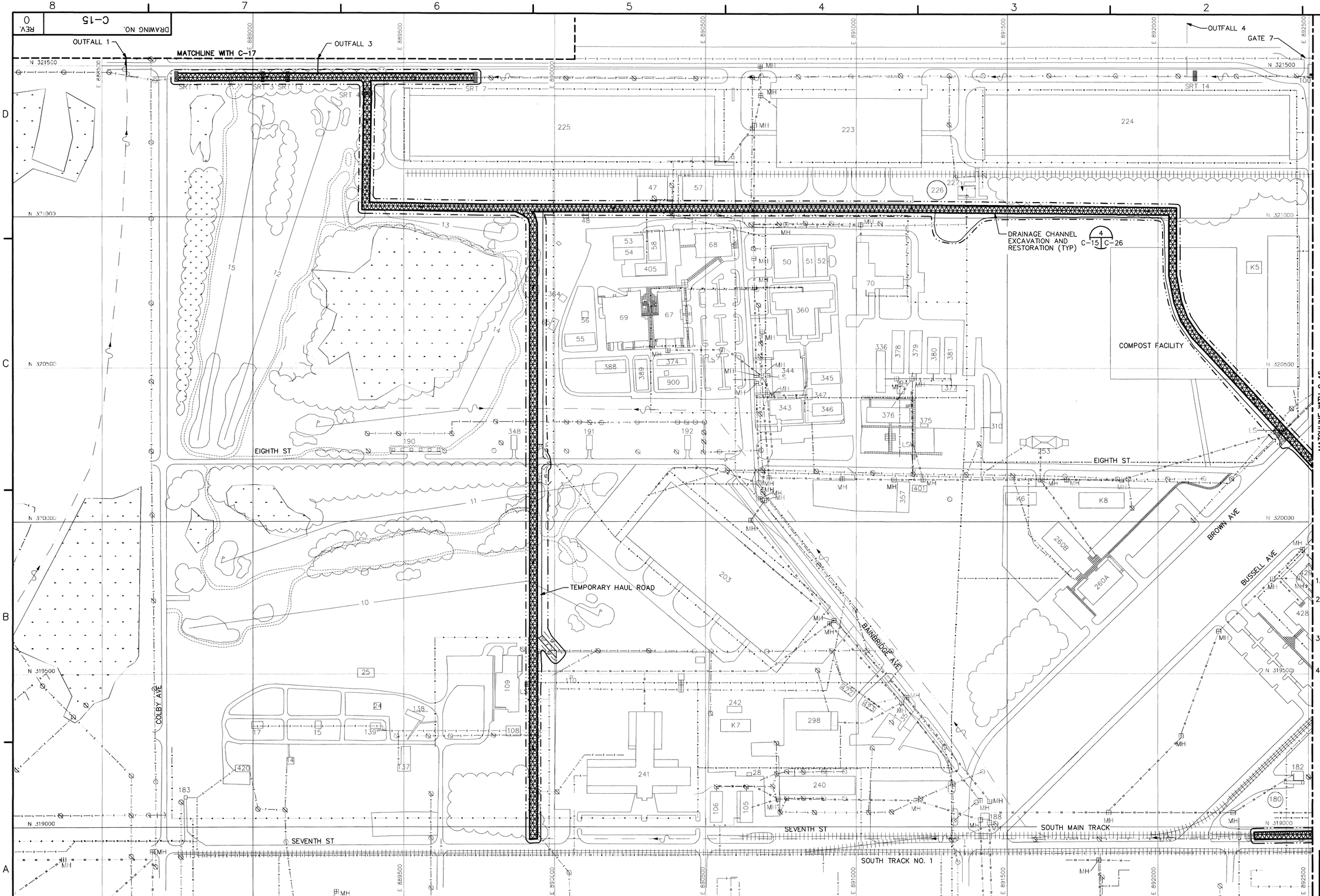
EROSION, SEDIMENT AND STORMWATER CONTROL DTLS.
(SHEET 2 OF 2)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424677
APPROVED BY DATE 10/6/04
DRAWING NO. C-14
REV. 0

ACAD:7379C005.dwg 09/29/04 MF PIT

DRAWING NO. C-14 REV. 0

DRAWING NO. C-15 REV. 0



LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

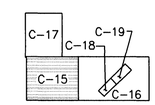
NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) REFER TO DRAWINGS C-11 AND C-12 FOR EROSION, SEDIMENT AND STORMWATER CONTROL NOTES AND REVEGETATION NOTES RESPECTIVELY.

3.) CLEAR BUT DO NOT GRUB WITHIN THE LIMITS OF CONTAMINATED SOIL AND SEDIMENT.

4.) LIMITS OF CONTAMINATED SEDIMENT ARE APPROXIMATE. THE VERTICAL AND HORIZONTAL EXTENT OF CONTAMINATED SEDIMENT WITHIN THESE LIMITS VARIES. WHERE CULVERTS ARE FOUND WITHIN LIMITS OF CONTAMINATED SEDIMENT THE CONTRACTOR SHALL REMOVE SEDIMENT FROM THE CULVERT (IN PLACE) AND STOCKPILE THE REMOVED SEDIMENT AT SITE 8A.



DRAWING KEY

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM	DATE 6/30/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS SHOWN	

DEPARTMENT OF THE NAVY — SOUTHERN DIV. FACILITIES ENGINEERING COMMAND

EXCAVATION AND FILL PLAN
(SHEET 1 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424678	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-15	REV. 0

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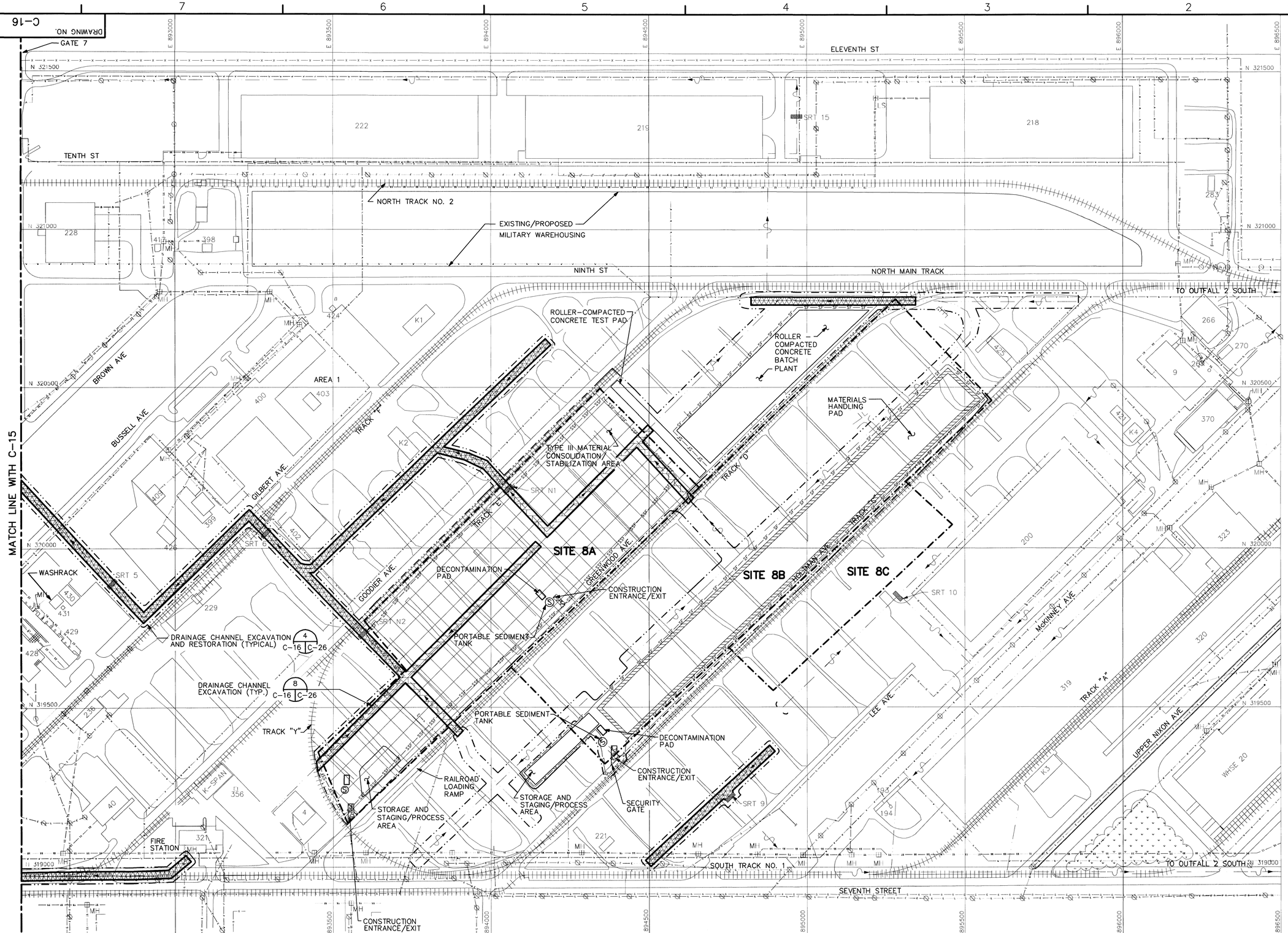


LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

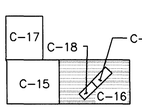
2.) BOUNDARIES FOR SITES 8B AND 8C SHOWN ARE APPROXIMATE.

3.) REMOVE SRTs FOLLOWING EXCAVATION AND/OR RESTORATION OF ALL CHANNELS AND PLACEMENT OF ROLLER-COMPACTED CONCRETE AT SITE 8A.

4.) REMOVE SEDIMENT FROM CULVERTS LOCATED WITHIN THE LIMITS OF CHANNEL EXCAVATION.

5.) CLEAR BUT DO NOT GRUB WITHIN LIMITS OF CONTAMINATED SEDIMENT.

6.) LIMITS OF CONTAMINATED SEDIMENT ARE APPROXIMATE. THE VERTICAL AND HORIZONTAL EXTENT OF CONTAMINATED SEDIMENT WITHIN THESE LIMITS VARIES. WHERE CULVERTS ARE FOUND WITHIN LIMITS OF CONTAMINATED SEDIMENT THE CONTRACTOR SHALL REMOVE SEDIMENT FROM THE CULVERT (IN PLACE) AND STOCKPILE THE REMOVED SEDIMENT AT SITE 8A.



DRAWING KEY

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM DATE 6/30/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS SHOWN

DEPARTMENT OF THE NAVY · NAVAL FACILITIES ENGINEERING COMMAND

EXCAVATION AND FILL PLAN
(SHEET 2 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424679
APPROVED BY DATE 10/6/04
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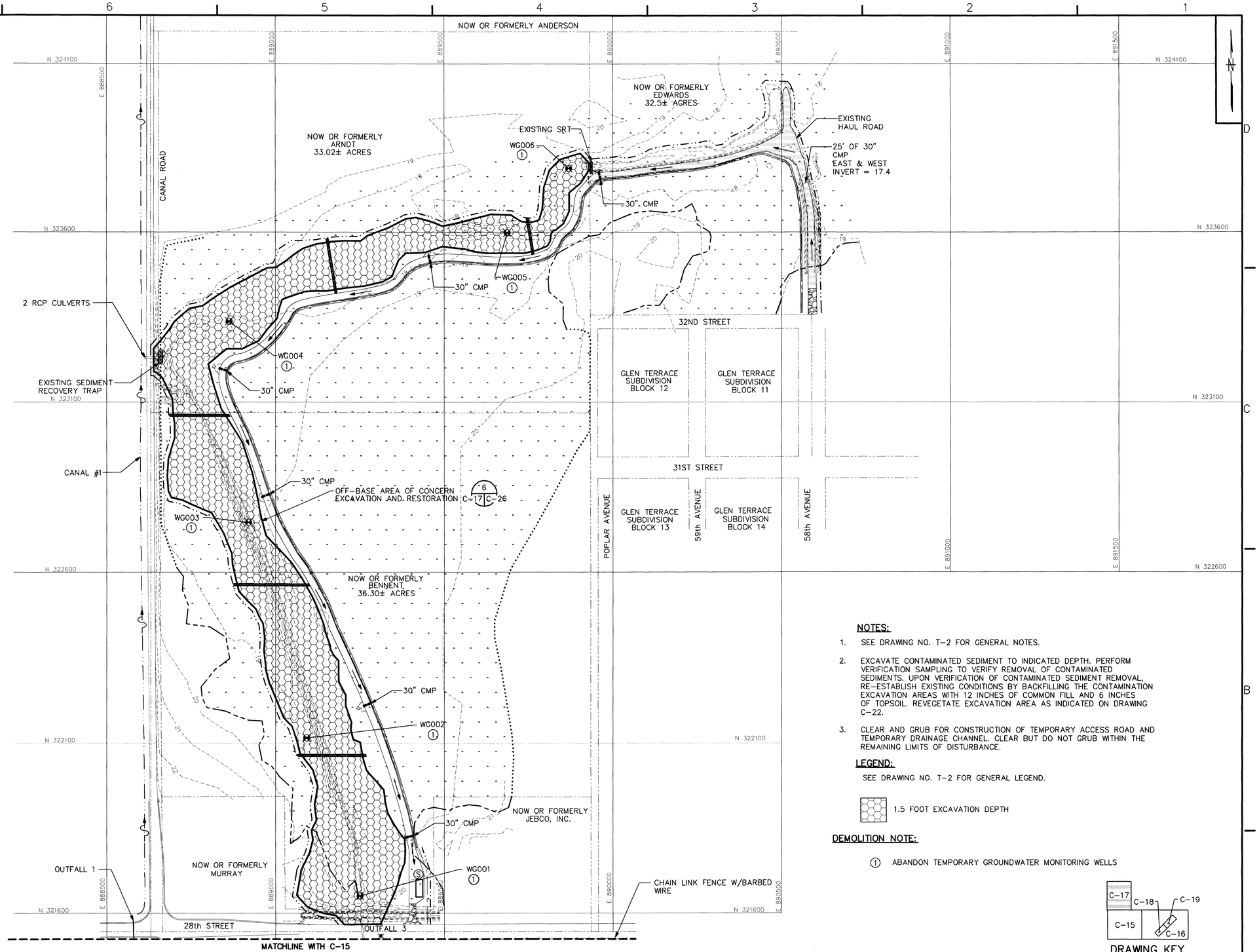
REV. 0

ACAD: 7379DP34.dwg 10/05/04 DM PIT

DRAWING NO. C-16
REV. 0



NOTES:

1. SEE DRAWING NO. T-2 FOR GENERAL NOTES.
2. EXCAVATE CONTAMINATED SEDIMENT TO INDICATED DEPTH. PERFORM VERIFICATION SAMPLING TO VERIFY REMOVAL OF CONTAMINATED SEDIMENTS. UPON VERIFICATION OF CONTAMINATED SEDIMENT REMOVAL, RE-ESTABLISH EXISTING CONDITIONS BY BACKFILLING THE CONTAMINATION EXCAVATION AREAS WITH 12 INCHES OF COMMON FILL AND 6 INCHES OF TOPSOIL. REVEGETATE EXCAVATION AREA AS INDICATED ON DRAWING C-22.
3. CLEAR AND GRUB FOR CONSTRUCTION OF TEMPORARY ACCESS ROAD AND TEMPORARY DRAINAGE CHANNEL. CLEAR BUT DO NOT GRUB WITHIN THE REMAINING LIMITS OF DISTURBANCE.

LEGEND:

SEE DRAWING NO. T-2 FOR GENERAL LEGEND.

1.5 FOOT EXCAVATION DEPTH

DEMOLITION NOTE:

(1) ABANDON TEMPORARY GROUNDWATER MONITORING WELLS

DRAWING KEY

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

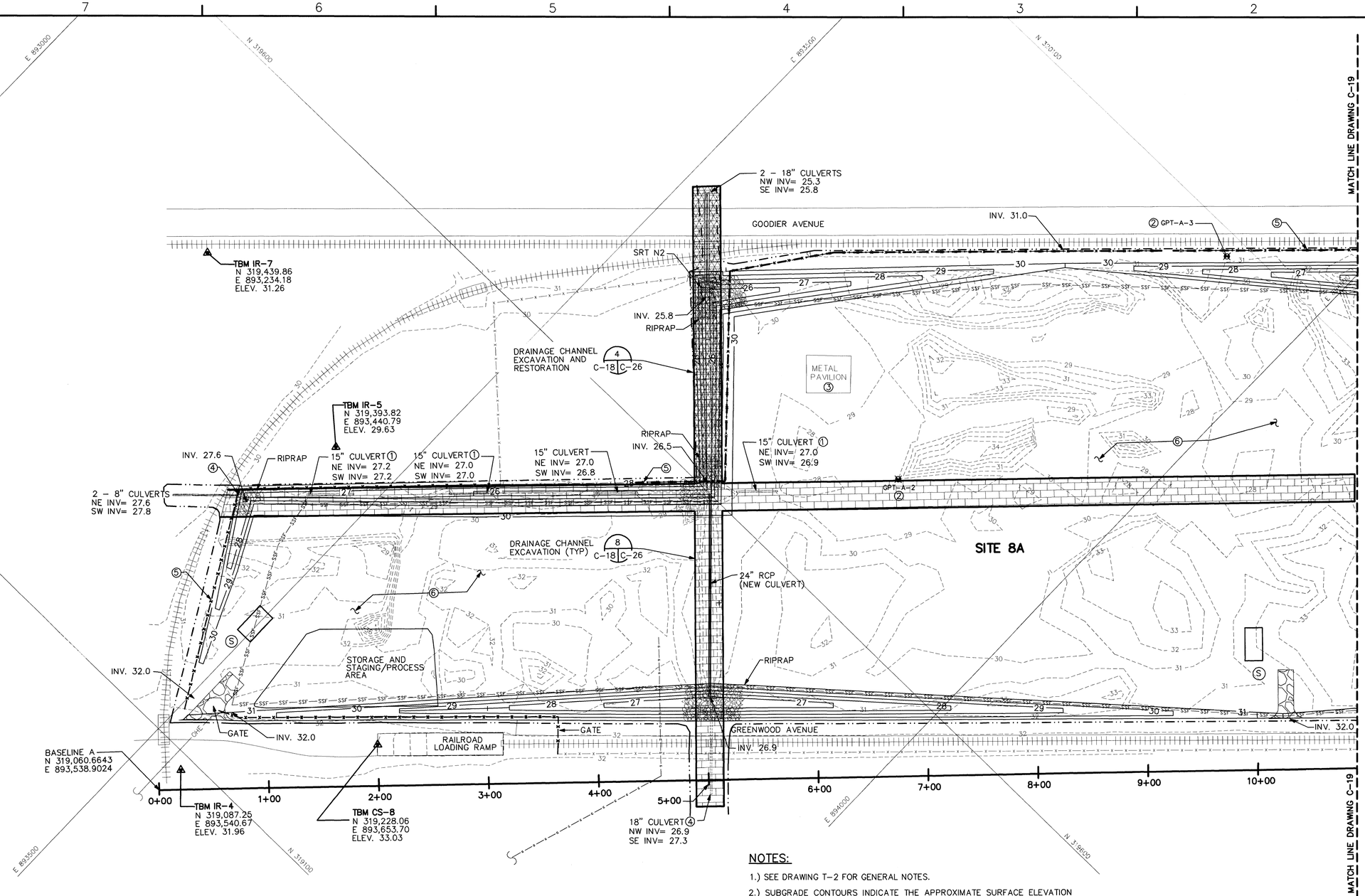
SEAL AREA

DRAWN BY DM	DATE 6/30/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS NOTED	

EXCAVATION AND FILL PLAN
(SHEET 3 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424680	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-17	REV. 0

ACAD: 7379GP35.dwg 10/05/04 DM PIT



NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) SUBGRADE CONTOURS INDICATE THE APPROXIMATE SURFACE ELEVATION FOLLOWING THE REMOVAL OF SOIL ASH PILES. SOIL ASH PILE REMOVAL IS CONSIDERED FINAL WHEN PORTLAND CEMENT STABILIZED SOIL OR NATIVE SOIL IS ENCOUNTERED. STOCKPILE SOIL ASH MATERIAL AT SITE 8B ON THE MATERIALS HANDLING PAD.

3.) INSPECT AREA WHERE EXISTING ELEVATIONS ARE BELOW PROPOSED PRE-CONSOLIDATION ELEVATIONS. DEWATER, REMOVE OBJECTIONABLE MATERIAL, AND SOFT SPOTS WHERE REQUIRED OR AS DIRECTED BY THE ROICC AND STABILIZE OR PLACE STRUCTURAL FILL, TO PROVIDE AN UNYIELDING SUBGRADE FOR THE STABILIZED MATERIAL BLEND.

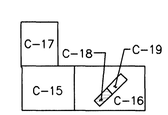
4.) LIMITS OF CONTAMINATED SEDIMENT ARE APPROXIMATE. THE VERTICAL AND HORIZONTAL EXTENT OF THE CONTAMINATED SEDIMENT WITHIN THESE LIMITS VARIES. WHERE CULVERTS ARE FOUND WITHIN LIMITS OF CONTAMINATED SEDIMENT THE CONTRACTOR SHALL REMOVE SEDIMENT FROM THE CULVERT (IN PLACE) AND STOCKPILE THE REMOVED SEDIMENT AT SITE 8A.

5.) REMOVE SRTs FOLLOWING EXCAVATION AND RESTORATION OF CHANNELS AND PLACEMENT OF ROLLER-COMPACTED CONCRETE PAVEMENT AT SITE 8A.

6.) CLEAR BUT DO NOT GRUB WITHIN THE LIMITS OF SITE 8A.

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.



DRAWING KEY

DEMOLITION/REMOVAL PLAN

1. REMOVE AND DISPOSE CULVERTS
2. ABANDON EXISTING MONITORING WELLS
3. REMOVE AND DISPOSE METAL PAVILION
4. CUT BACK EXISTING CULVERTS TO NEW CHANNELS
5. REMOVE 8 FT. CHAIN LINK FENCE WHERE INDICATED
6. REMOVE SOIL ASH PILES

SCALE IN FEET 0 50 100
CHECK GRAPHIC SCALE BEFORE USING

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

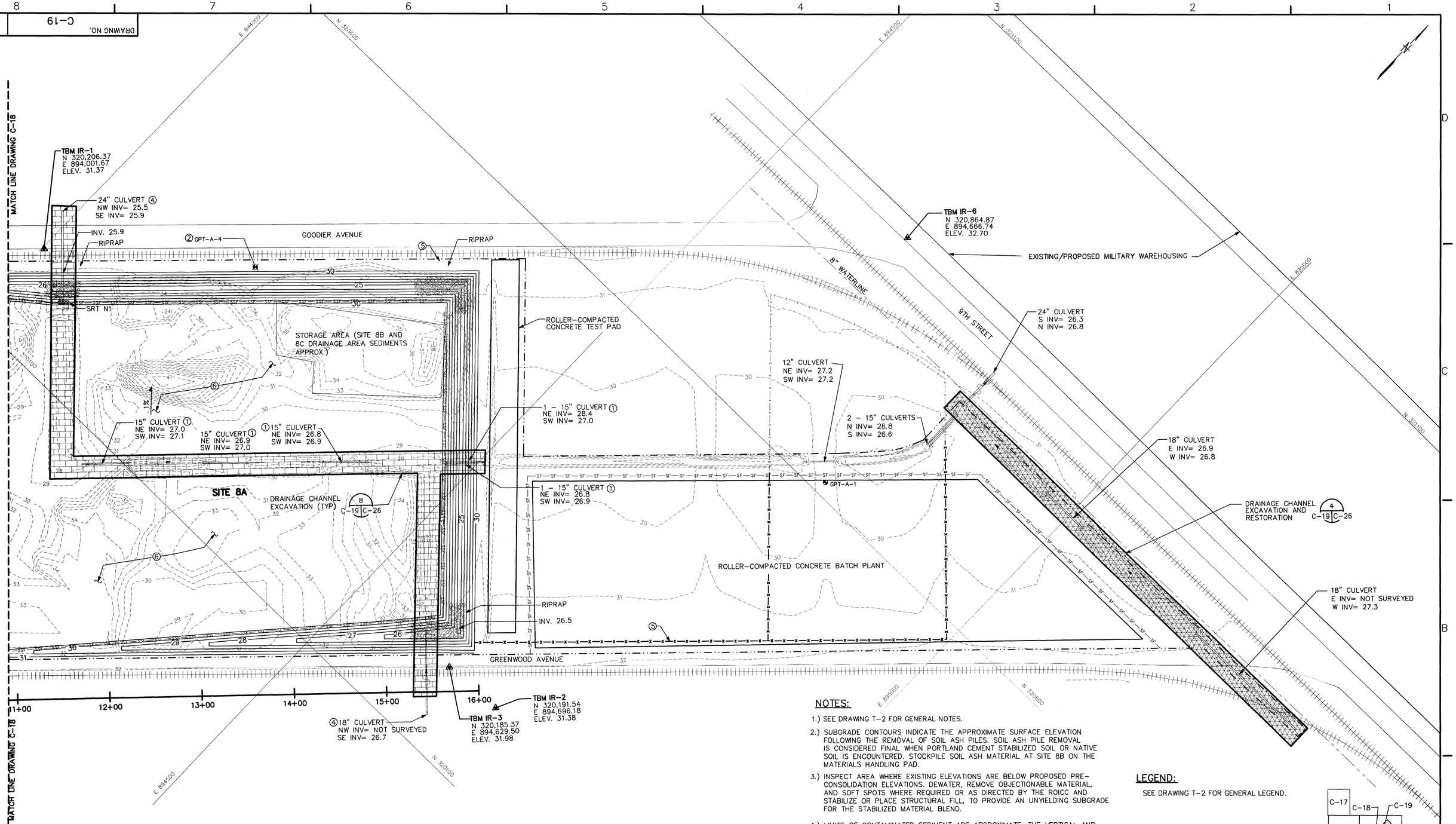
SEAL AREA

DRAWN BY DM DATE 6/29/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS NOTED

EXCAVATION AND FILL PLAN
(SHEET 4 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424681
APPROVED BY DATE 10/6/04
DRAWING NO. C-18 REV. 0

ACAD:7379GP36.dwg 10/05/04 DM PIT



NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) SUBGRADE CONTOURS INDICATE THE APPROXIMATE SURFACE ELEVATION FOLLOWING THE REMOVAL OF SOIL ASH PILES. SOIL ASH PILE REMOVAL IS CONSIDERED FINAL WHEN PORTLAND CEMENT STABILIZED SOIL OR NATIVE SOIL IS ENCOUNTERED. STOCKPILE SOIL ASH MATERIAL AT SITE 8B ON THE MATERIALS HANDLING PAD.

3.) INSPECT AREA WHERE EXISTING ELEVATIONS ARE BELOW PROPOSED PRE-CONSOLIDATION ELEVATIONS. DEWATER, REMOVE OBJECTIONABLE MATERIAL, AND SOFT SPOTS WHERE REQUIRED OR AS DIRECTED BY THE ROICC AND STABILIZE OR PLACE STRUCTURAL FILL, TO PROVIDE AN UNYIELDING SUBGRADE FOR THE STABILIZED MATERIAL BLEND.

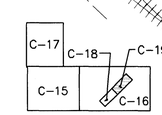
4.) LIMITS OF CONTAMINATED SEDIMENT ARE APPROXIMATE. THE VERTICAL AND HORIZONTAL EXTENT OF THE CONTAMINATED SEDIMENT WITHIN THESE LIMITS VARIES. WHERE CULVERTS ARE FOUND WITHIN LIMITS OF CONTAMINATED SEDIMENT. THE CONTRACTOR SHALL REMOVE SEDIMENT FROM THE CULVERT (IN PLACE) AND STOCKPILE THE REMOVED SEDIMENT AT SITE 8A.

5.) REMOVE SRTs FOLLOWING EXCAVATION AND RESTORATION OF CHANNELS AND PLACEMENT OF ROLLER COMPACTED CONCRETE AT SITE 8A.

6.) CLEAR BUT DO NOT GRUB WITHIN THE LIMITS OF SITE 8A.

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.



DRAWING KEY

0 50 100
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

DEMOLITION/REMOVAL PLAN

① REMOVE AND DISPOSE INDICATED CULVERTS

② ABANDON EXISTING MONITORING WELL

④ CUT BACK EXISTING CULVERTS TO NEW CHANNEL

⑤ REMOVE 8 FOOT CHAIN LINK FENCE WHERE INDICATED

⑥ REMOVE SOIL ASH PILES

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM DATE 6/29/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS NOTED

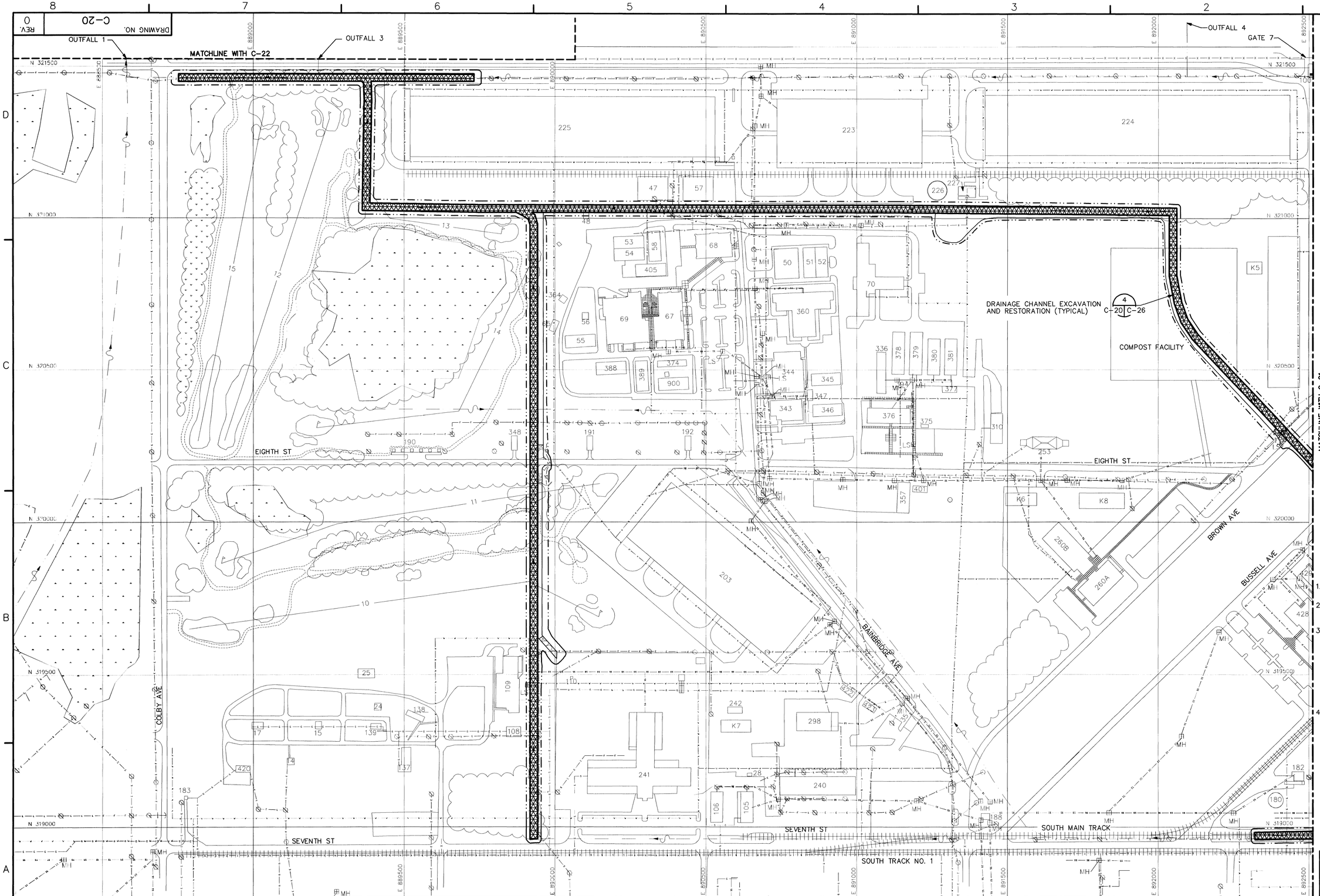
DEPARTMENT OF THE NAVY · NAVAL FACILITIES ENGINEERING COMMAND · SOUTHERN DIVISION

EXCAVATION AND FILL PLAN
(SHEET 5 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424682
APPROVED BY DATE 10/6/04
DRAWING NO. C-19
REV. 0

DRAWING NO. C-19
REV. 0

ACAD: 7379GP37.dwg 10/05/04 MF PIT



LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

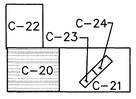
NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) SEE DRAWING C-12 FOR REVEGETATION NOTES AND PERMANENT SEED MIXTURE.

3.) FOLLOWING RESTORATION OF DRAINAGE CHANNELS, REMOVE TEMPORARY HAUL ROADS AND AND CONSTRUCTION ENTRANCES/ EXITS, BACKFILL WITH TOPSOIL AND RESTORE AREA WITH PERMANENT SEED MIXTURE. TOPSOIL AND SEEDING IS NOT REQUIRED IN CULVERTS OR WHERE RIPRAP IS SPECIFIED.

4.) WITH APPROVAL OF THE ROICC, REMOVE ALL SRTs FOLLOWING STABILIZATION OF ALL DISTURBED DRAINAGE CHANNELS AND INSTALLATION OF ROLLER COMPACTED CONCRETE CAP.



DRAWING KEY

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY DM — DATE 6/30/04
CHECKED BY TWS — DATE 10/06/04
REVISED BY — DATE
SCALE AS SHOWN

DEPARTMENT OF THE NAVY · CEC · SOUTHERN DIV FACILITIES ENGINEERING

FINAL GRADING PLAN
(SHEET 1 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424683
APPROVED BY — DATE 10/6/04
DRAWING NO. C-20
REV. 0

ACAD:7379GP38.dwg 10/05/04 MF PIT

DRAWING NO. C-21 REV. 0

MATCH LINE WITH C-20

GATE 7

ELEVENTH ST

TENTH ST

NORTH TRACK NO. 2

EXISTING/PROPOSED MILITARY WAREHOUSING

NINTH ST

NORTH MAIN TRACK

TO OUTFALL 2 SOUTH

BROWN AVE

BUSSELL AVE

GILBERT AVE.

GOODIER AVE.

GREENWOOD AVE.

HOLMAN AVE.

MCKINNEY AVE.

LEE AVE.

UPPER NIXON AVE

TRACK "P"

TRACK "Q"

TRACK "R"

TRACK "Y"

TRACK "A"

AREA 1

ROLLER-COMPACTED CONCRETE BATCH PLANT

SITE 8A

SEE DRAWINGS C-23 AND C-24 FOR FINAL GRADING AND RESTORATION FOR THIS AREA

SITE 8B

SITE 8C

WASHRACK

DRAINAGE CHANNEL EXCAVATION AND RESTORATION (TYP) C-21 4 C-26

DRAINAGE CHANNEL RESTORATION (TYP) C-21 1 C-26

RAILROAD LOADING RAMP

FIRE STATION

SOUTH TRACK NO. 1

SEVENTH STREET

TO OUTFALL 2 SOUTH

K-SPAN

WHSE 20

LEGEND:

SEE DRAWING T-2 FOR GENERAL LEGEND.

NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) BONDARIES SHOWN FOR SITES 8B AND 8C ARE APPROXIMATE.

3.) SEE DRAWING C-12 FOR REVEGETATION NOTES AND PERMANENT SEED MIXTURE.

4.) FOLLOWING RESTORATION OF DRAINAGE CHANNELS, REMOVE TEMPORARY HAUL ROADS AND AND CONSTRUCTION ENTRANCES/ EXITS, BACKFILL WITH TOPSOIL AND RESTORE AREA WITH PERMANENT SEED MIXTURE. TOPSOIL AND SEEDING IS NOT REQUIRED IN CULVERTS OR WHERE RIPRAP IS SPECIFIED.

5.) WITH APPROVAL OF THE ROICC, REMOVE ALL SRTs FOLLOWING STABILIZATION OF ALL DISTURBED DRAINAGE CHANNELS AND INSTALLATION OF ROLLER-COMPACTED CONCRETE CAP.

C-22 C-23 C-24 C-20 C-21

DRAWING KEY

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

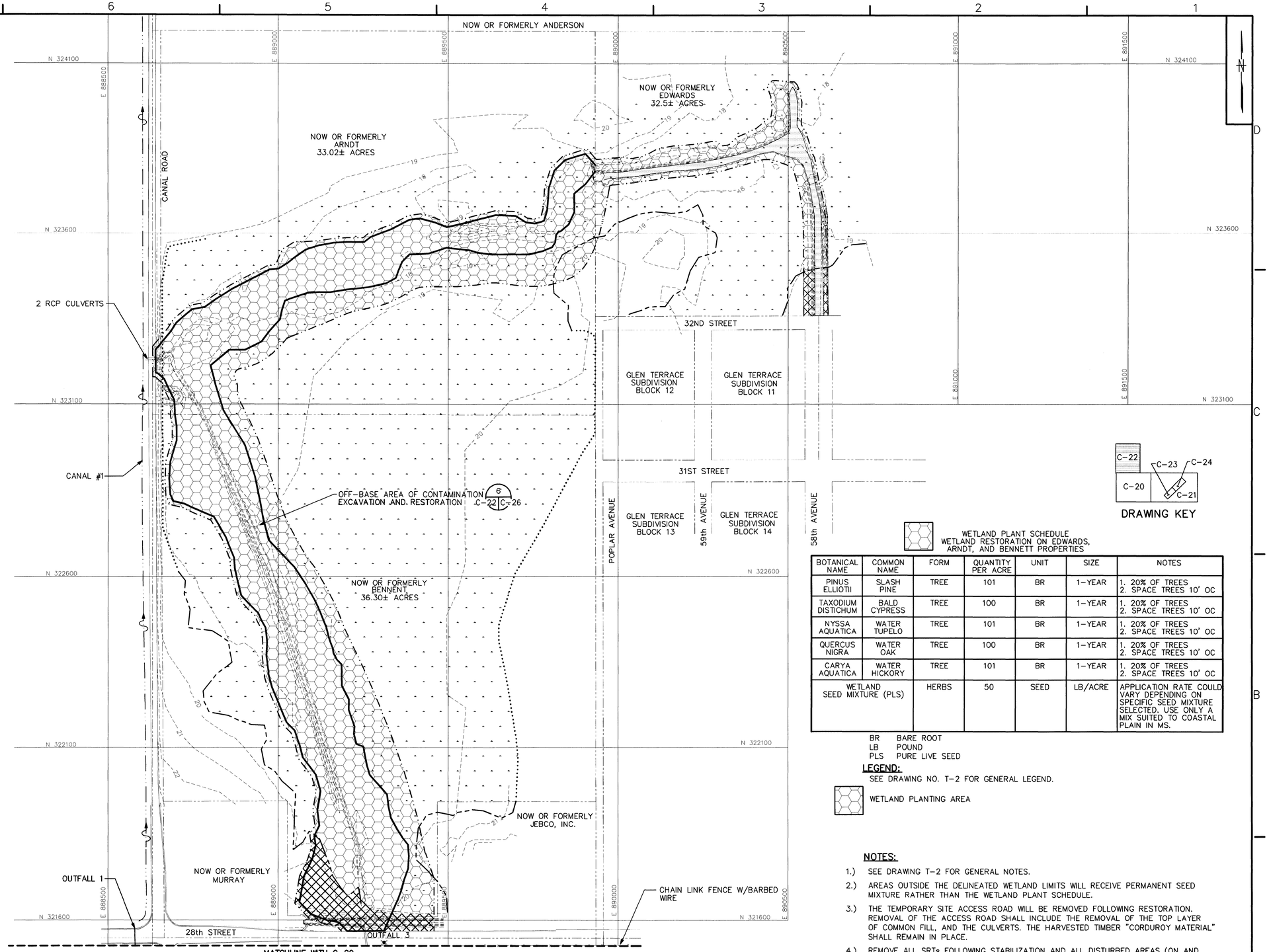
SEAL AREA

DRAWN BY MF	DATE 11/15/02
CHECKED BY TWS	DATE 5/12/03
REVISED BY	DATE
SCALE AS SHOWN	

FINAL GRADING PLAN
(SHEET 2 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424684	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-21	REV. 0

ACAD: 7379GP39.dwg 10/05/04 HJB PIT



WETLAND PLANT SCHEDULE
WETLAND RESTORATION ON EDWARDS, ARNDT, AND BENNETT PROPERTIES

BOTANICAL NAME	COMMON NAME	FORM	QUANTITY PER ACRE	UNIT	SIZE	NOTES
PINUS ELLIOTII	SLASH PINE	TREE	101	BR	1-YEAR	1. 20% OF TREES 2. SPACE TREES 10' OC
TAXODIUM DISTICHUM	BALD CYPRESS	TREE	100	BR	1-YEAR	1. 20% OF TREES 2. SPACE TREES 10' OC
NYSSA AQUATICA	WATER TUPELO	TREE	101	BR	1-YEAR	1. 20% OF TREES 2. SPACE TREES 10' OC
QUERCUS NIGRA	WATER OAK	TREE	100	BR	1-YEAR	1. 20% OF TREES 2. SPACE TREES 10' OC
CARYA AQUATICA	WATER HICKORY	TREE	101	BR	1-YEAR	1. 20% OF TREES 2. SPACE TREES 10' OC
WETLAND SEED MIXTURE (PLS)		HERBS	50	SEED	LB/ACRE	APPLICATION RATE COULD VARY DEPENDING ON SPECIFIC SEED MIXTURE SELECTED. USE ONLY A MIX SUITED TO COASTAL PLAIN IN MS.

BR BARE ROOT
LB POUND
PLS PURE LIVE SEED

LEGEND:

SEE DRAWING NO. T-2 FOR GENERAL LEGEND.

WETLAND PLANTING AREA

NOTES:

1.) SEE DRAWING T-2 FOR GENERAL NOTES.

2.) AREAS OUTSIDE THE DELINEATED WETLAND LIMITS WILL RECEIVE PERMANENT SEED MIXTURE RATHER THAN THE WETLAND PLANT SCHEDULE.

3.) THE TEMPORARY SITE ACCESS ROAD WILL BE REMOVED FOLLOWING RESTORATION. REMOVAL OF THE ACCESS ROAD SHALL INCLUDE THE REMOVAL OF THE TOP LAYER OF COMMON FILL, AND THE CULVERTS. THE HARVESTED TIMBER "CORDUROY MATERIAL" SHALL REMAIN IN PLACE.

4.) REMOVE ALL SRTs FOLLOWING STABILIZATION AND ALL DISTURBED AREAS (ON AND OFF-BASE) AND PLACEMENT OF ROLLER-COMPACTED CONCRETE CAP.

0 150 300
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

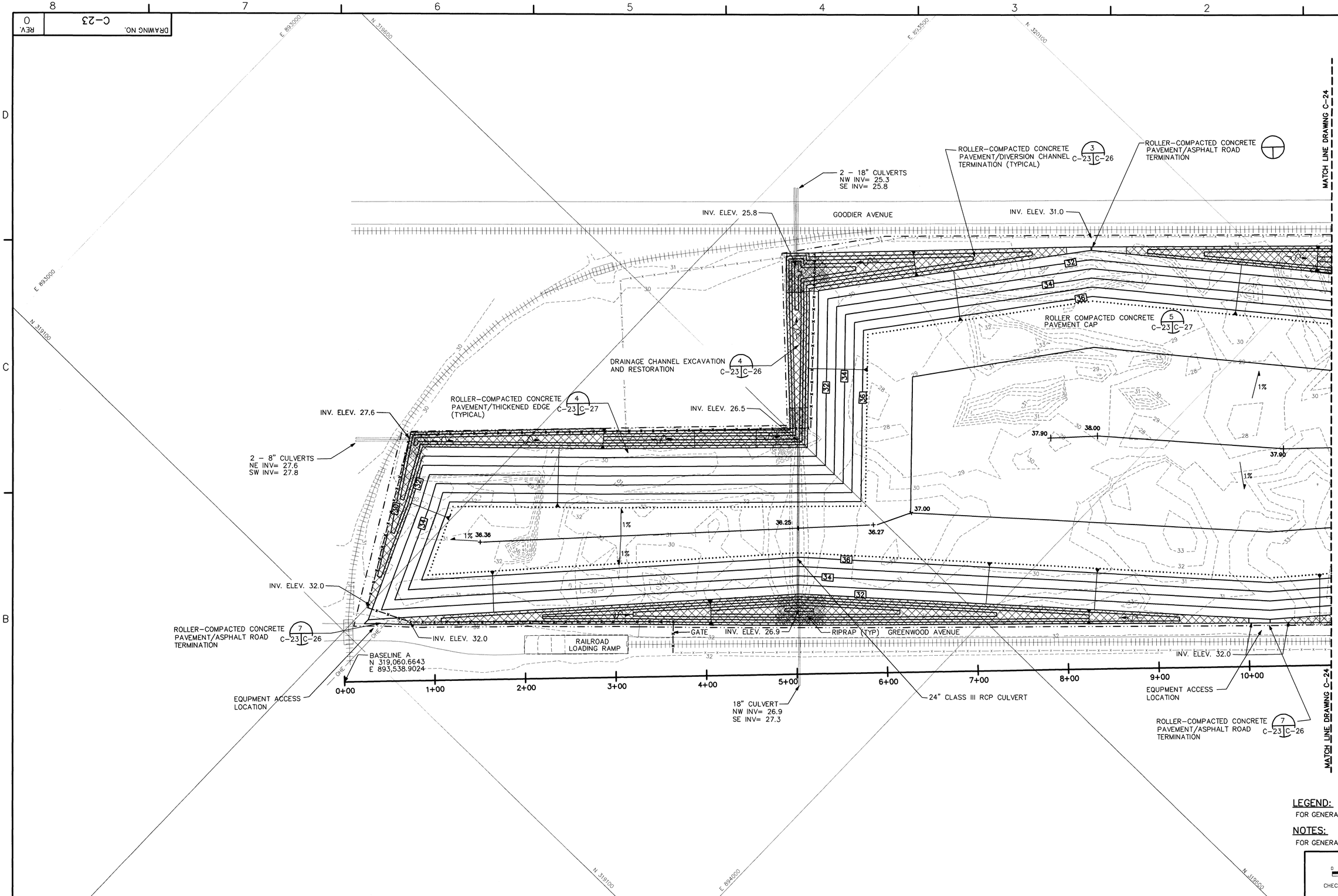
DRAWN BY DM DATE 6/30/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS NOTED

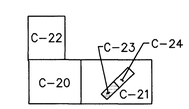
FINAL GRADING PLAN
(SHEET 3 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424685
APPROVED BY
DATE 10/6/04
DRAWING NO. C-22
REV. 0

DRAWING NO. C-22 REV. 0

ACAD: 7379GP40.dwg 10/05/04 MF PLT





DRAWING KEY

LEGEND:

FOR GENERAL LEGEND SEE DRAWING T-2.

NOTES:

FOR GENERAL NOTES SEE DRAWING T-2.

0 50 100
SCALE IN FEET
CHECK GRAPHIC SCALE BEFORE USING

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

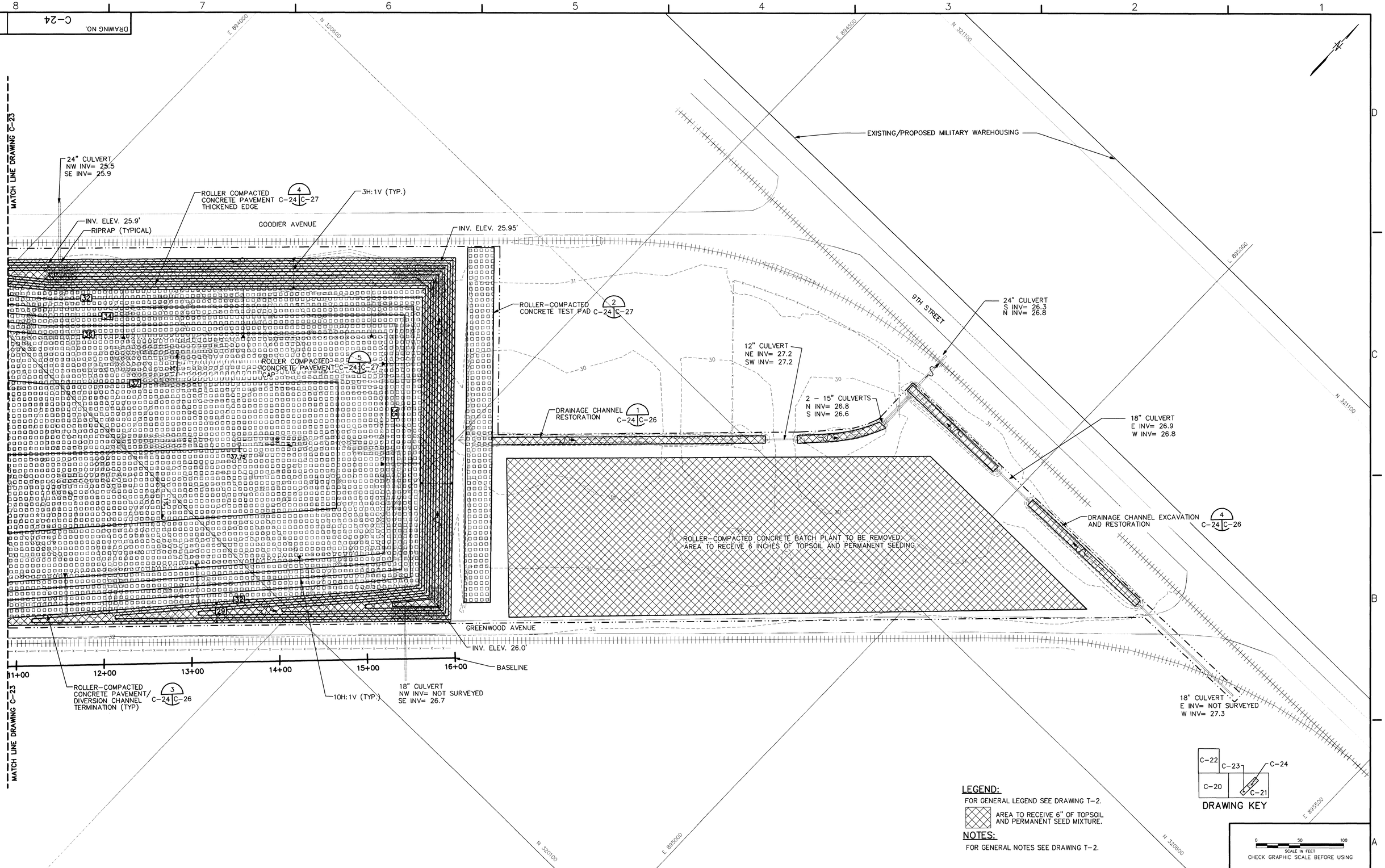
SEAL AREA

DRAWN BY DM	DATE 7/2/04
CHECKED BY TWS	DATE 10/06/04
REVISED BY	DATE
SCALE AS NOTED	

FINAL GRADING PLAN
(SHEET 4 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424686	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-23	REV. 0

ACAD: 7379GP25.DWG 10/05/04 DM PIT



LEGEND:

FOR GENERAL LEGEND SEE DRAWING T-2.

AREA TO RECEIVE 6" OF TOPSOIL AND PERMANENT SEED MIXTURE.

NOTES:

FOR GENERAL NOTES SEE DRAWING T-2.

BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

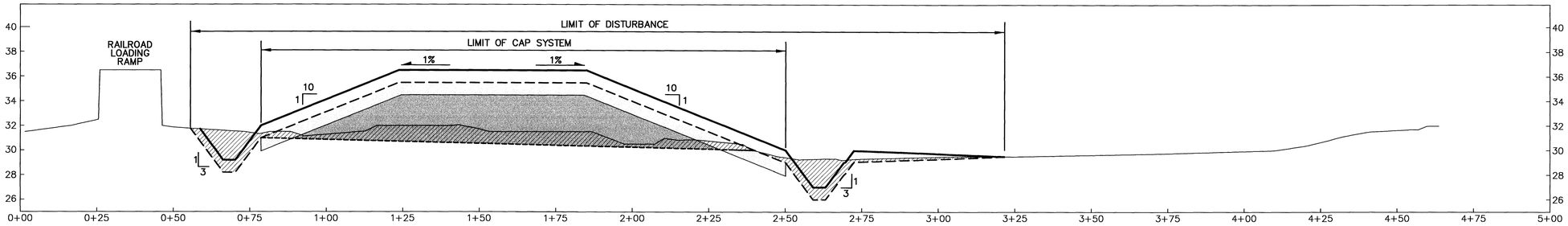
DRAWN BY MF	DATE 3/06/03
CHECKED BY TWS	DATE 5/12/03
REVISED BY	DATE
SCALE AS NOTED	

FINAL GRADING PLAN
(SHEET 5 OF 5)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

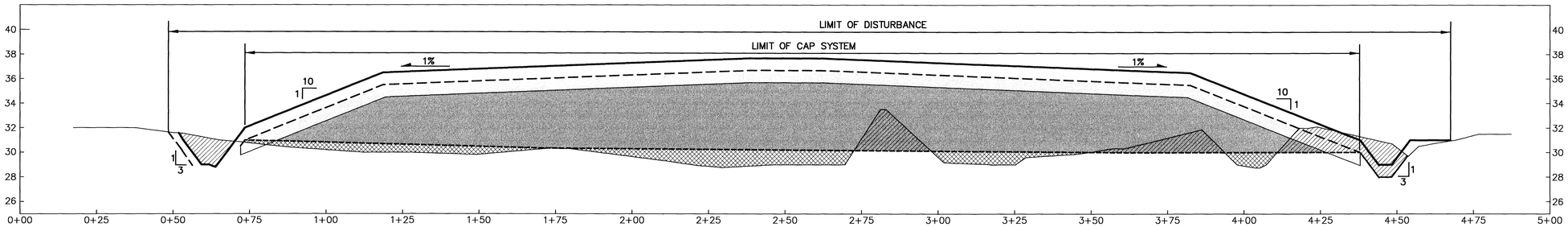
CONTRACT NO. 7379	
NAVFAC NO. 5424687	
APPROVED BY	DATE 10/10/04
DRAWING NO. C-24	REV. 0

DRAWING NO. C-24 REV. 0

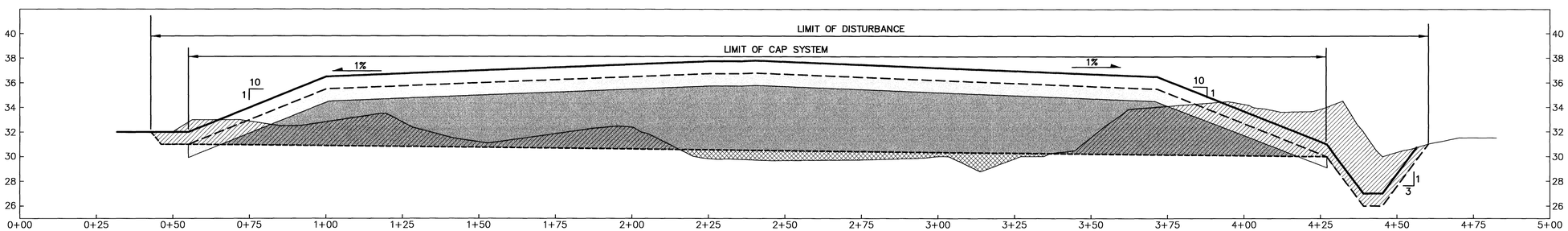
ACAD: 73790P26.DWG 10/05/04 DM PIT



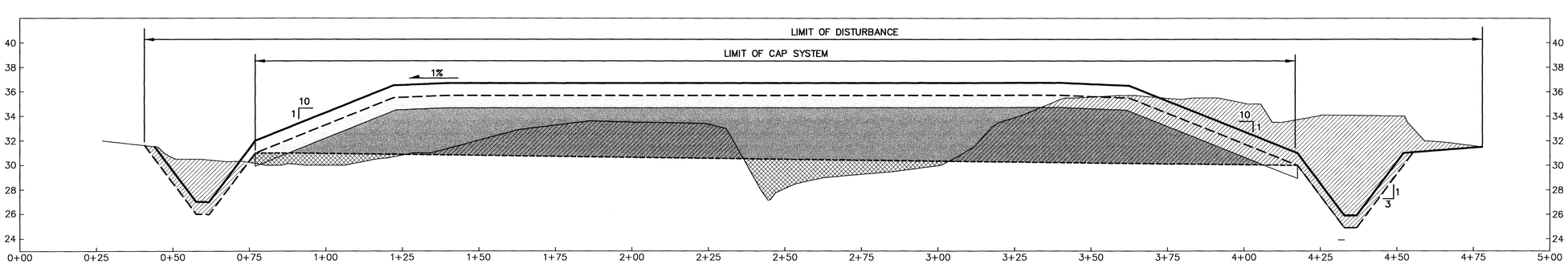
BASELINE A STA. 3+00



BASELINE A STA. 7+00



BASELINE A STA. 11+00



BASELINE A STA. 15+00

LEGEND:

- EXCAVATED ASH/REGRADED NATIVE SOIL
- PLACED/COMPACTED NATIVE SOIL
- PLACED/COMPACTED STABILIZED SOIL (THICKNESS VARIES)
- PLACED/COMPACTED BASE COURSE AND SUBBASE (12" THICK)
- FINAL GRADE
- INTERIM GRADE
- EXISTING GRADE
- SUBGRADE

0 20 40 HORIZONTAL SCALE IN FEET

0 5 10 VERTICAL SCALE IN FEET

CHECK GRAPHIC SCALE BEFORE USING

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

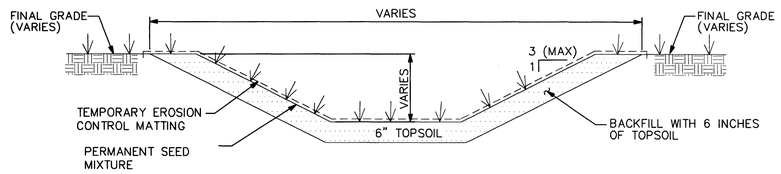
SEAL AREA

DRAWN BY DM DATE 6/30/04
CHECKED BY TWS DATE 10/06/04
REVISED BY DATE
SCALE AS SHOWN

CROSS SECTIONS
100% REMEDIAL DESIGN SUBMISSION
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424688
APPROVED BY DATE 10/6/04
DRAWING NO. C-25 REV. 0

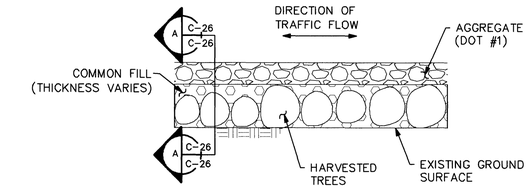
ACAD:7379GX02.dwg 10/05/04 MF PIT

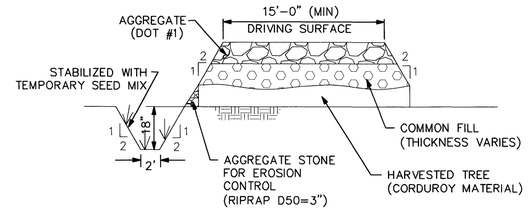


DRAINAGE CHANNEL RESTORATION DETAIL

NOT TO SCALE

1 C-21 C-24 C-26





SECTION

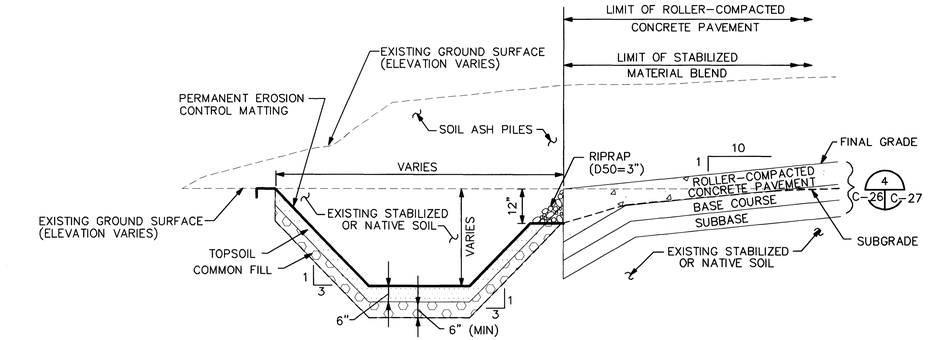
A C-26 C-26

NOTE: 1. FOLLOWING RESTORATION, REMOVE ROAD MATERIAL, LEAVE HARVESTED TREES IN PLACE.

TEMPORARY SITE ACCESS ROAD AND DIVERSION CHANNEL

NOT TO SCALE

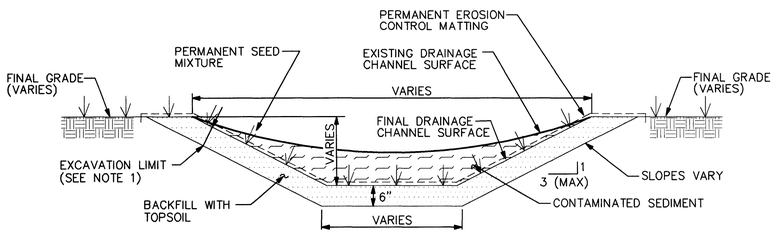
2 C-8 C-26



ROLLER COMPACTED CONCRETE PAVEMENT/DIVERSION CHANNEL TERMINATION DETAIL

NOT TO SCALE

3 C-9 C-10 C-23 C-24 C-26

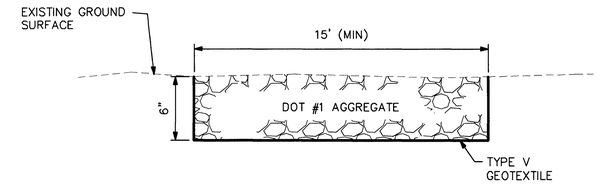


NOTES: 1. EXCAVATE CONTAMINATED SEDIMENT AND 6 INCHES OF UNDERLYING SOIL.

DRAINAGE CHANNEL DITCH EXCAVATION AND RESTORATION DETAIL

NOT TO SCALE

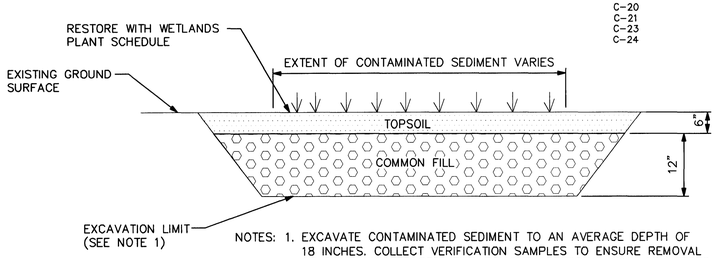
4 C-15 C-16 C-18 C-19 C-20 C-21 C-23 C-24 C-26



TEMPORARY HAUL ROAD (TYPICAL)

NOT TO SCALE

5 C-6 C-26

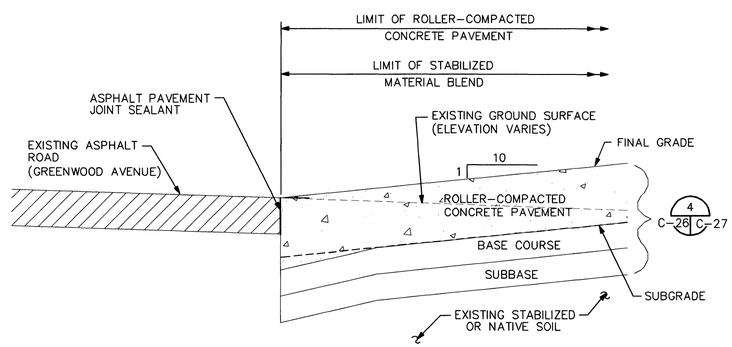


NOTES: 1. EXCAVATE CONTAMINATED SEDIMENT TO AN AVERAGE DEPTH OF 18 INCHES. COLLECT VERIFICATION SAMPLES TO ENSURE REMOVAL OF CONTAMINATED SEDIMENT. REMOVE ADDITIONAL SOIL AS NEEDED TO MEET PRGs.

OFF-BASE AREA OF CONTAMINATION EXCAVATION AND RESTORATION DETAIL

NOT TO SCALE

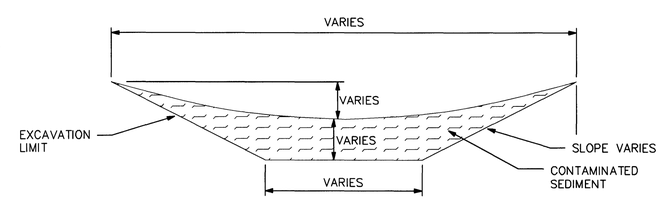
6 C-22 C-26



ROLLER COMPACTED PAVEMENT/ASPHALT ROAD TERMINATION DETAIL

NOT TO SCALE

7 C-23 C-26



NOTES: 1. WITHIN THE LIMITS OF THE ROLLER COMPACTED PAVEMENT CAP BACKFILL CHANNELS WITH STRUCTURAL FILL TO ACHIEVE SUBGRADE: OUTSIDE THESE LIMITS BACKFILL IN ACCORDANCE WITH THE ROLLER COMPACTED PAVEMENT/DIVERSION CHANNEL TERMINATION DETAIL

DRAINAGE CHANNEL EXCAVATION DETAIL

NOT TO SCALE

8 C-18 C-26 C-18 C-19

NOTES:

1. TEMPORARY STRUCTURES/FACILITIES SHALL ACCOMMODATE CONTRACTOR'S OPERATIONS SUBJECT TO ROICC APPROVAL. SIZES OF TEMPORARY STRUCTURES/ FACILITIES SHALL BE PROVIDED IN THE CONTRACTOR'S WORK PLAN.

NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

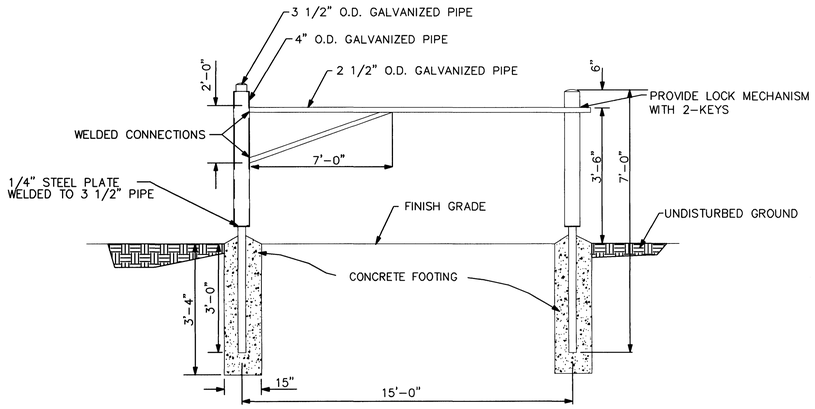
SEAL AREA

DRAWN BY HJB DATE 2/10/03
CHECKED BY TWS DATE 5/12/03
REVISED BY ---- DATE ----
SCALE AS SHOWN

MISCELLANEOUS DETAILS (SHEET 1 OF 2)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379
NAVFAC NO. 5424689
APPROVED BY DATE 10/6/04
DRAWING NO. C-26 REV. 0

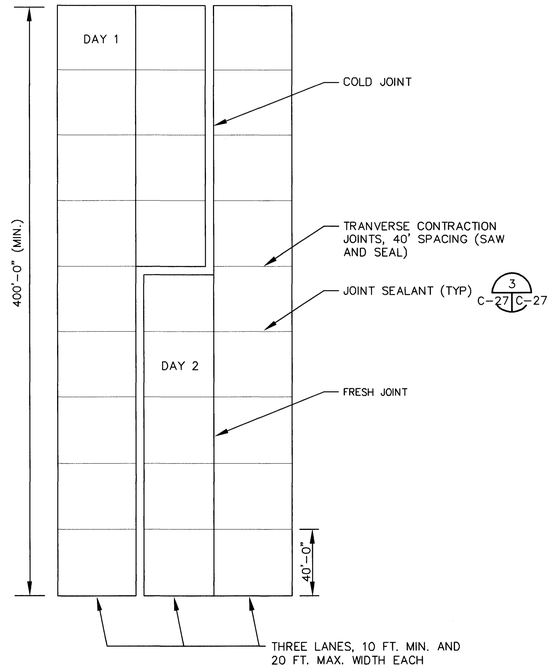
ACAD: 7379C006.dwg 10/01/04 MF PIT



SECURITY GATE DETAIL

NOT TO SCALE

1 C-7 C-8 C-27

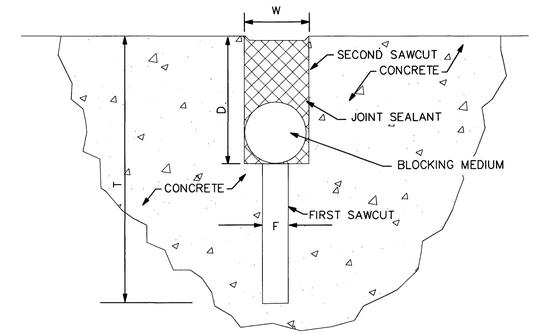


3 C-27 C-27

ROLLER COMPACTED CONCRETE PAVEMENT TEST SECTION

NOT TO SCALE

2 C-24 C-27



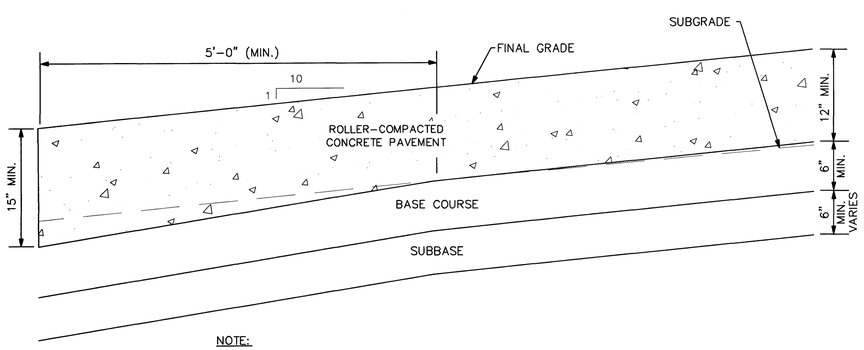
NOTES:

1. F = WIDTH OF FIRST SAWCUT = 1/8"
   W = WIDTH OF SEALANT = 1/2"
   T = DEPTH OF FIRST SAWCUT = 1/3 OF THE SLAB THICKNESS
   D = DEPTH OF SEALANT = 1-1/8"
2. SEPARATING TAPE OR BLOCKING MEDIUM REQUIRED TO PREVENT JOINT SEALANT FROM FLOWING INTO FIRST SAWCUT, TO SEPARATE NONCOMPATIBLE MATERIALS, AND TO PREVENT SEALANT FROM BONDING TO BOTTOM OF RESERVOIR.
3. TOP OF SEALANT WILL BE 1/8" TO 1/4" BELOW TOP OF PAVEMENT.

JOINT SEALANT DETAIL

NOT TO SCALE

3 C-27 C-27



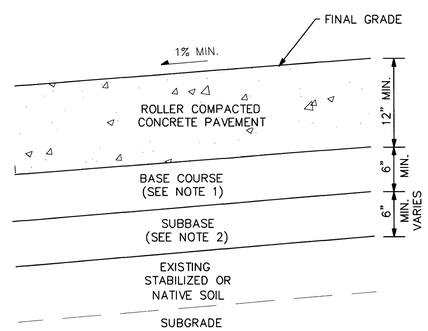
NOTE:

EXCAVATION INTO SUBGRADE WILL BE REQUIRED ALONG EDGES OF ROLLER-COMPACTED CONCRETE PAVEMENT TO ALLOW CONSTRUCTION OF THICKENED EDGE AND TO PROVIDE ROOM FOR BASE COURSE AND SUBBASE LAYERS.

ROLLER COMPACTED CONCRETE PAVEMENT THICKENED EDGE

NOT TO SCALE

4 C-23 C-24 C-27



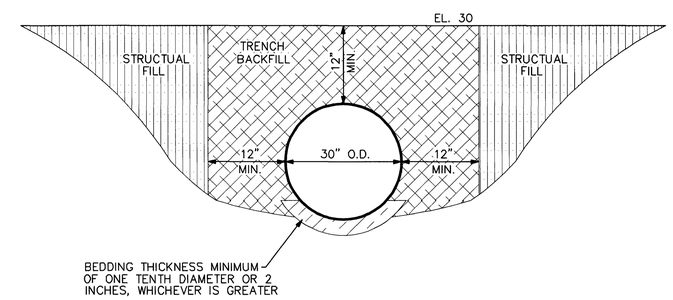
NOTES:

1. THE BASE COURSE CONSISTING OF STABILIZED MATERIAL BLEND SHALL BE PIGMENTED AND HAVE A MINIMUM UNCONFINED COMPRESSIVE STRENGTH OF 500 PSI AT 90 DAYS.
2. THE SUBBASE SHALL CONSIST OF A MINIMUM OF 6 INCHES OF STABILIZED MATERIAL BLEND HAVING A MINIMUM UNCONFINED COMPRESSIVE STRENGTH OF 50 PSI AT 90 DAYS OR A MINIMUM OF 6 INCHES OF EXISTING PORTLAND CEMENT STABILIZED SOIL.

ROLLER COMPACTED CONCRETE PAVEMENT CAP

NOT TO SCALE

5 C-23 C-24 C-27



NOTES:

1. PLACE STRUCTUAL FILL TO ELEVATION 30 AND COMPACT TO 95% OF ASTM D698 MAXIMUM DENSITY ±2% OPTIMUM MOISTURE CONTENT
2. TRENCH INTO STRUCTURAL FILL AND EXISTING GRADE TO REQUIRED DEPTH. EXISTING GRADE SHOULD BE OVEREXCAVATED IF NECESSARY SO A UNIFORM FOUNDATION FREE OF PROTRUDING ROCKS MAY BE PROVIDED.
3. THE BEDDING MATERIAL SHALL BE COARSE SAND ALL OF WHICH PASSES A 3/8" SIEVE AND NOT MORE THAN 10% OF WHICH PASSES A #200 SIEVE. THE LAYER OF BEDDING MATERIAL SHALL BE SHAPED TO FIT THE CONDUIT AND SHALL HAVE RECESSES SHAPED TO RECEIVE THE BELL IF BELL AND SPIGOT TYPE PIPE IS USED.
4. BACKFILL SHALL BE ASTM D 2487 SW OR SP, COMPACTED IN 6" LIFTS TO 12" ABOVE THE PIPE.

CULVERT DETAIL

NOT TO SCALE

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NO.	DATE	REVISIONS	BY	CHKD	APPD	NO.	RELEASED FOR	BY	DATE

SEAL AREA

DRAWN BY HJB	DATE 2/10/03
CHECKED BY TWS	DATE 5/12/03
REVISED BY	DATE
SCALE AS SHOWN	

MISCELLANEOUS DETAILS (SHEET 2 OF 2)
100% REMEDIAL DESIGN
SITE 8 – HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 7379	
NAVFAC NO. 5424690	
APPROVED BY	DATE 10/6/04
DRAWING NO. C-27	REV. 0

ACAD: 7379C008.dwg 10/05/04 MF PIT