APPROVED
DIVISION OF WASTE MANAGEMENT
SOLID WASTE SECTION
DATE 4-28-2011 BY Chad Lilly
DIN 13715

Fac/Permit/Co ID #	Date	Doc ID#
26-08	05/28/10	DIN 13222

US Army Corps of Engineers
Fort Bragg, NC

Construction and Demolition Landfill
Phase II Construction
Phase I Closure

Construction Permit Application

May 2010
Revised March 2011

Prepared for:

DPW Engineering Division
Attn: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000

Prepared by:

HDR

HDR Engineering inc. of the Carolinas
3733 National Drive Suite 207
Raleigh, NC 27612-4845
HDR Project 11236-120265-018

May 28, 2010

APPROVED
DIVISION OF WASTE MANAGEMENT
SOLID WASTE SECTION
DATE 05-28-2010 BY Geoff Little
DIN 13715

Fac/Perm/Co ID #	Date	Doc ID#
26-08	05/28/10	DIN 13222

Mr. Geoffrey Little
Solid Waste Section
Division of Waste Management
North Carolina Department of Environment and Natural Resources
1646 Mail Service Center
Raleigh, NC 27699-1646

Re: Construction Permit Application
Phase II Expansion and Phase I Closure
Construction and Demolition Landfill
Fort Bragg, North Carolina

Dear Mr. Little:

On behalf of the Ft. Bragg Directorate of Public Works, HDR Engineering, Inc. of the Carolinas is pleased to submit the Construction Permit Application for the Phase II expansion and Phase I closure of the construction and demolition landfill in Ft. Bragg, North Carolina. Enclosed are three copies for your review along with a check for the permit application fee of $18,500. When your review is completed, we will forward additional copies, if necessary, of the application for section approval and processing.

Please do not hesitate to call me at (919) 232-6618 if you should have any questions during your review.

Sincerely,

HDR Engineering, Inc. of the Carolinas
N.C. Engineering Board No. F0116

Thomas M. Yanoschak, PE
Project Engineer

Enclosures

cc: Paul Humphrey, Ft. Bragg
Sid Williamson, Ft. Bragg
Dan Messier, Ft. Bragg
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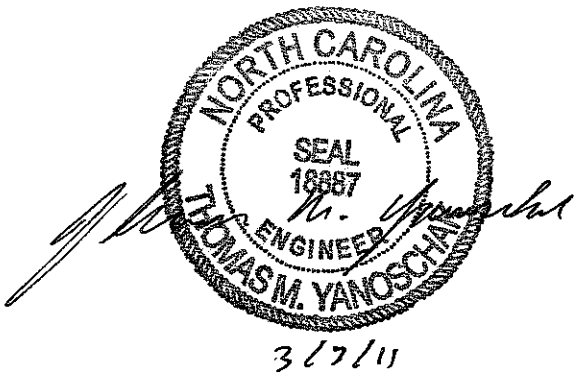

3/7/11

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

PHASE II CONSTRUCTION AND PHASE I CLOSURE PERMIT APPLICATION

MAY 2010
Revised MARCH 2011

Prepared for:

DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

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TABLE OF CONTENTS

SECTION 1.0 INTRODUCTION 1-1

SECTION 2.0 FACILITY PLAN 2-1

2.1 Facility Drawings 2-1
2.2 Waste Stream 2-1
2.2.1 Wastes Accepted for Disposal 2-1
2.2.2 Anticipated Disposal Rates 2-2
2.2.3 Service Area 2-2
2.2.4 Procedures for Segregated Waste Management 2-2
2.2.5 Equipment Requirements 2-3
2.3 Landfill Capacity 2-3
2.4 Special Engineering Features 2-5
2.4.1 Leachate Management Systems 2-5
2.4.2 Containment and Environmental Control Systems 2-5
2.4.3 Base Liner Systems 2-6
2.4.4 Other Devices, Components, and Structures 2-6

SECTION 3.0 ENGINEERING PLAN 3-1

3.1 Summary of Facility Design 3-1
3.1.1 Analytical Methods 3-1
3.1.2 Critical Conditions and Assumptions 3-1
3.1.3 Technical References 3-1
3.1.4 Location Restrictions 3-2
3.1.5 Construction Requirements 3-2
3.2 Construction Materials and Practices 3-4
3.3 Design Hydrogeologic Report 3-4

SECTION 4.0 CONSTRUCTION QUALITY ASSURANCE PLAN 4-1

SECTION 5.0 OPERATIONS PLAN 5-1

SECTION 6.0 CLOSURE AND POST-CLOSURE PLAN 6-1

SECTION 7.0 MONITORING PLAN 7-1

TABLE OF CONTENTS

APPENDICES

A – Calculations
- Airspace Calculations
- Drainage Calculations

B – Technical Specifications
C – CQA Plan – New Construction
D – CQA Plan - Closure
E – Operation Plan
F – Closure Plan
G – Post-Closure Plan
H – Monitoring Plan
I – Subsurface Investigation
J – Landfill Gas Monitoring Plan

LIST OF DRAWINGS

Sheet 1 of 14 – Cover Sheet
Sheet 2 of 14 – Vicinity Map
Sheet 3 of 14 – Overall Site Plan
Sheet 4 of 14 – Phase I Final Grade Plan
Sheet 5 of 14 – Phase II Excavation Plan
Sheet 6 of 14 – Phase II Final Grade Plan
Sheet 7 of 14 – Phase III and IV Excavation Plan
Sheet 8 of 14 – Phase III Final Grade Plan
Sheet 9 of 14 – Phase IV Final Grade Plan
Sheet 10 of 14 – Details
Sheet 11 of 14 – Details
Sheet 12 of 14 – Details
Sheet 13 of 14 – Cross Section
Sheet 14 of 14 – Monitoring Plan

SECTION 1.0
INTRODUCTION

Fort Bragg currently owns and operates the Lamont Road Construction and Demolition Debris (C&D) Landfill, which is located on the eastern side of Lamont Road and within the Fort Bragg Military Reservation in Cumberland County, North Carolina. The landfill operates under Permit No. 26-08 which was issued on July 13, 2007 and expires on July 13, 2012.

The most recent construction permit application for the facility was submitted to the North Carolina Department of Environment and Natural Resources (NCDENR) in April 2004 and was subsequently approved with the issuance of a Permit to Construct Phase I on September 21, 2004. A Permit to Operate Phase I was issued by NCDENR on July 13, 2007. The landfill development plans included with this previous permit application provided for the construction of the landfill in three phases (Phases I, II, and III). Phases I and II had projected operational lives of five years each while Phase III had a projected operational life of four years. The number of phases has been revised within this application.

Current tonnages have decreased and are anticipated to remain lower than the projected tonnages from the Phase I Construction Permit Application. As a result of the reduced tonnages, the number of phases has increased to four, each with a design life of approximately five years. The final landfill acreage, height, and layout remain the same as stated in the Phase I Construction Permit Application.

The information contained in this submittal is intended to fulfill the requirements of North Carolina Solid Waste Management Rule 15A NCAC 13B .0547(3) which applies to C&D landfill units in operation prior to January 1, 2007. This construction permit application includes the development of the next phase of the landfill, Phase II, and the closure of Phase I once it has reached final grades.

The intent of this construction permit application is to incorporate the landfill design elements that were included with the April 2004 submittal. The subgrades, final grades, waste limits, and total waste capacities presented within this permit application are therefore consistent with those previously submitted to NCDENR and no further site geologic or hydrogeologic investigations are required.

SECTION 2.0
FACILITY PLAN

This Facility Plan meets the requirements of Rule 15A NCAC 13B .0537, Facility Plan for C&DLFS and is consistent with the facility design previously submitted to NCDENR with the Phase I construction permit application submitted in April 2004.

2.1 Facility Drawings

The drawings submitted with this construction permit application meet the requirements of Rule 15A NCA 13B .0537(d) by providing the following information relating to the Fort Bragg C&D Landfill.

- Existing site conditions
- Areal limits of landfill units incorporating buffer requirements
- Locations of waste management facilities, infrastructure, and landfill units
- Areal limits of grading, including borrow and stockpile areas
- Defined phases of development which are approximately five years of operating capacity each
- Proposed final contours and facility features for closure
- Other physical features, as applicable

The drawings also include the required operational information including proposed transitional contours for each remaining phase of development including operational grades for Phase I and construction grading for Phases II, III and IV. Stormwater segregation features for Phase I after closure are also provided.

The C&D landfill lies well within the limits of the Fort Bragg Military Reservation; therefore, a survey locating property boundaries for the landfill is not required.

2.2 Waste Stream

The following information pertaining to the waste stream at the Fort Bragg C&D Landfill reflects currently permitted conditions. There are no changes requested as a result of this construction permit application.

2.2.1 Wastes Accepted for Disposal

The Fort Bragg C&D Landfill is currently permitted to receive only the following types of waste.

- Construction and demolition debris as defined in G.S. 130A-290 (4) which includes solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures.
- Inert debris as defined in G.S. 130A-290 (14) which includes solid waste that consists solely of material that is virtually inert, such as brick, concrete, rock, and clean soil.
- Land clearing debris as defined in G.S. 130A-290 (15) which includes solid waste that is generated solely from land-clearing activities such as stumps and tree trunks.

- Asphalt in accordance with G.S. 130-294(m).

2.2.2 Anticipated Disposal Rates

The projected disposal rate at the Fort Bragg C&D Landfill is 110,000 tons per year, which is equivalent to a representative daily disposal rate of 430 tons per day based on the landfill operating a total of 256 days per year. This waste disposal rate is based on recent historical acceptance rates for the facility and Fort Bragg's knowledge of factors affecting their waste stream. The yearly disposal quantities at the facility for the last six years are as shown on Table 2-1.

Table 2-1 Fort Bragg C&D Landfill Yearly Disposal Quantities

Period	Disposal Quantity (tons)
July 1, 2008 – June 30, 2009	100,423
July 1, 2007 – June 30, 2008	93,460
July 1, 2006 – June 30, 2007	105,986
July 1, 2005 – June 30, 2006	218,565
July 1, 2004 – June 30, 2005	247,701
July 1, 2003 – June 30, 2004	222,335

Table 2-1 indicates that there has been a substantial drop in the yearly disposal quantities over the last six years. This drop is primarily due to increased recycling at the facility and a reduction in the number of demolition projects at the base.

2.2.3 Service Area

The permitted service area for the Fort Bragg C&D Landfill is Fort Bragg only. Waste generated outside of the limits of Fort Bragg will not be accepted.

2.2.4 Procedures for Segregated Waste Management

The Fort Bragg C&D Landfill site includes a municipal solid waste (MSW) transfer station and a recycling facility in addition to the C&D landfill.

The MSW transfer station is located south of the C&D landfill as shown on Sheet 3 of 14, Overall Site Plan. The transfer station is only used for the collection of MSW generated within Fort Bragg and subsequent transfer to the Sampson County Landfill for disposal. The transfer station is not used for the collection of C&D waste destined for disposal within the Fort Bragg C&D Landfill. The transfer station operations are therefore adequately segregated from the landfill operations to prevent the accidental disposal of MSW within the landfill.

The recycling facility is currently located northwest of Phase I of the C&D landfill in an area occupied by a closed land clearing and inert debris (LCID) landfill as shown on Sheet 3 of 14, Overall Site Plan. Materials currently processed at the recycling facility include concrete, asphalt, and yard waste. Portions of the current recycling facility will eventually be occupied by Phases III

and IV of the expanded C&D landfill as shown on Sheet 8 of 14, Phase III Final Grade Plan, and Sheet 9 of 14, Phase IV Final Grade Plan. The recycling facility will be located outside active and closed portions of the C&D landfill in order to avoid interfering with landfill operations and to avoid damage to the final cover system. Ultimately, the recycling facility will be limited to a triangular area located west of the C&D landfill at full build-out as shown on Sheet 9 of 14, Phase IV Final Grade Plan. Recycled material recovered at the facility will be used for various construction and maintenance projects located within the limits of the landfill and Fort Bragg with unsuitable material being disposed within the C&D landfill.

2.2.5 Equipment Requirements

The following equipment is typically kept on-site for operation of the Fort Bragg C&D Landfill.

- 1 compactor
- 2 bulldozers
- 1 excavator
- 1 water truck
- 1 hydroseeder
- 2 dump trucks
- 2 loaders

Additional equipment can be obtained from elsewhere within Fort Bragg or from equipment rental companies if required due to heavy waste volumes or equipment breakdowns.

2.3 Landfill Capacity

The estimated remaining gross capacity of the Fort Bragg C&D Landfill is 1,881,800 cubic yards (cy) of which approximately 278,100 cy is located within Phase I; 530,100 cy is within Phase II; 492,100 cy is within Phase III; and 581,500 cy is within Phase IV as of the latest topographic survey of the landfill dated October 8, 2009.

Earthwork and landfill life calculations for the remaining Phase I capacity as well as Phases II, III and IV are provided in Appendix A and summarized in Table 2-2, Landfill Capacity and Soil Requirements. These calculations are based on a waste to cover ratio of 10:1; an in-place waste density of 2,339 lb/cy; and a disposal rate of 110,000 tons per year.

Table 2-2 Landfill Capacity and Soil Requirements

Phase	Area (acres)	Excavated Volume (cy)	Gross Volume (cy)	Final Cover Volume (cy)	Daily & Intermediate Cover Volume (cy)	Net Operating Volume (cy)	Lifespan (yrs)
I*	15.70	N/A	278,100	33,880	21,980	222,240	2.6
II	6.03	11,422	530,100	27,588	45,226	457,286	5.3
III	6.11	21,813	492,100	35,332	41,109	415,659	4.9
IV	13.71	N/A	581,500	88,572	44,364	448,564	5.2
Total	41.55	33,235	1,881,800	185,372	152,679	1,543,749	18.0

*Phase I remaining volume based on site topography dated October 8, 2009.
Assumptions: In-place waste density = 2,339lb/cy
Refuse intake = 110,000 TPY
Daily and intermediate cover = 9% of airspace capacity

The calculations indicate that as of October 8, 2009, Phase I is expected to have a remaining operational life of approximately 2.6 years. The estimated remaining waste volume of the phase is approximately 222,240 cy. The estimated soil required for operational cover for the remainder of Phase I is approximately 21,980 cy.

Phase II development of the site is expected to have an operational life of approximately five years. The estimated waste volume of the phase is approximately 457,286 cy. The estimated soil required for operational cover is approximately 45,226 cy.

Phase III development of the site is expected to have an operational life of approximately five years. The estimated waste volume of the phase is approximately 415,659 cy. The estimated soil required for operational cover is approximately 41,109 cy.

Phase IV development of the site is expected to have an operational life of approximately five years. The estimated waste volume of the phase is approximately 448,564 cy. The estimated soil required for operational cover is approximately 44,364 cy.

In addition to the operational cover requirements noted above, approximately 185,372 cy of soil will be required for the construction of final cover over the entire C&D landfill. Half of this amount will be required for the construction of 18 inches of low permeability barrier layer with a maximum hydraulic conductivity of $1x10^{-5}$ cm/sec. The remainder of the final cover soil will consist of 18 inches of erosion layer placed over the barrier layer.

Approximately 33,235 cy of operational soil is anticipated to be available from the excavation of Phases II, III, and IV resulting in a projected net soil deficit for the facility of approximately 304,800 cy. It is anticipated that the additional soil required for operational cover and final cover will be obtained from the Fort Bragg Borrow Source located across from the existing landfill on Lamont Road and soil brought to the facility from various construction projects on base. Currently, approximately 100,000 cy of clayey soils have been stockpiled at the borrow source for use as final cover barrier layer.

2.4 Special Engineering Features

The following subsections address the Special Engineering Features requirements of the Facility Report as contained in 15A NCAC 13B .0537(e)(3).

2.4.1 Leachate Management Systems

The Fort Bragg C&D Landfill design does not include a leachate collection and management system.

2.4.2 Containment and Environmental Control Systems

Containment and environmental control systems used at the Fort Bragg C&D Landfill consist of horizontal buffers, vertical separation of waste from groundwater and bedrock, a landfill cap system, stormwater control, and sedimentation and erosion control.

The horizontal buffers employed at the landfill meet the requirements of 15A NCAC 13B .0540(1) and include a minimum 200-foot buffer between the C&D landfill unit and all property lines; a minimum 500-foot buffer between the C&D landfill unit and existing residential structures and wells; and, a minimum 50-foot buffer between the C&D landfill unit and any stream, river, lake, pond, or other waters of the state as defined in G.S. 143-212. These buffers allow the natural attenuation of potential contaminants that may enter the groundwater of the site prior to off-site impacts and allow space for remediation projects, if needed.

The vertical separation provided at the landfill satisfies 15A NCAC 13B .0540(2) which includes a minimum post-settlement separation between the waste and seasonal high groundwater table and bedrock with the top two feet of separation being provided by in-situ soils classified as SC, SM, ML, CL, MH, or CH soils per the Unified Soil Classification System (USCS). A subsurface investigation report dated March 26, 2004 demonstrated that the natural soils located beneath the landfill expansion areas meet these classification requirements. A copy of this report is included in Appendix I. These vertical separation requirements allow for the natural attenuation of potential contaminants prior to entering the groundwater and prevent the direct access of water seeping through the waste to the groundwater. The NCDENR approved design potentiometric surface, as presented in the April 2004 Design Hydrogeologic Report for the facility, is shown on Sheet 13 of 14, Cross Section, along with the proposed landfill subgrades. The cross section shows that the minimum separation requirement from groundwater is maintained. The Design Hydrogeologic Report also states that the soils at the site extend at least 125 feet below ground surface, therefore maintaining the required separation from bedrock.

The landfill cap that will be constructed over the landfill during closure will satisfy the requirements of 15A NCAC 13B .0543 and will consist of 18 inches of low permeability barrier layer with a maximum hydraulic conductivity of $1x10^{-5}$ cm/sec overlain by an 18-inch erosion layer. The landfill cap, as well as the required operational cover, will limit the quantity of rainfall infiltration into the waste and therefore limit the quantity of potentially impacted seepage into the groundwater at the site.

Stormwater control measures employed at the site include the use of sideslope swales, diversion berms, downpipes, and perimeter channels to safely remove stormwater from the landfill while keeping the final cover system intact and limiting the potential for the exposure of waste and washouts. All stormwater controls will be designed for a minimum 24-hour, 25-year storm event in accordance with 15A NCAC 13B .0540(7). The locations of the proposed stormwater control measures that will be installed during the phases of landfill development are shown on Sheets 4 through 9 of 14.

Sedimentation and erosion controls will consist of seeding and mulching, erosion control matting, riprap aprons, and an existing retention pond designed to limit the amount of erosion occurring on-site and prevent sediment from leaving the site. The locations of the proposed sedimentation and erosion control measures that will be installed during the phases of landfill development are shown on Sheets 4 through 9 of 14. Sediment and erosion controls will be installed in accordance with the Erosion and Sedimentation Control Plan for the facility approved May 25, 1999 and in accordance with the Sedimentation control Act codified in 15 NCAC 4.

2.4.3 Base Liner Systems

The Fort Bragg C&D Landfill design does not include a base liner system beyond the vertical separation soil layer required by 15A NCAC 13B .0540(2).

2.4.4 Other Devices, Components, and Structures

The Fort Bragg C&D Landfill design includes provisions for a gas venting system beneath the low permeability barrier layer of the final cover to minimize pressures on the barrier layer in accordance with 15A NCAC 13B .0543 (a)(2)(B). The gas venting system consists of horizontal gas wells installed within the waste that are passively vented through the landfill cap. The horizontal wells will be installed at a general frequency of one well per closure acre. Details for the horizontal wells are provided on Sheet 12 of 14.

SECTION 3.0
ENGINEERING PLAN

The purpose of this section is to meet the requirements of 15A NCAC 13B .0539 regarding the preparation of an Engineering Plan for the Fort Bragg C&D Landfill.

3.1 Summary of Facility Design

3.1.1 Analytical Methods

Engineering calculations related to the Fort Bragg C&D Landfill design are provided in Appendix A. These calculations include downpipe sizing, perimeter channel design, riprap apron design, and volume calculations. The calculations describe the analytical methods used for each calculation.

All volume calculations were performed using AutoCAD Civil 3D, Version 08 software by comparing digital three dimensional topographic surfaces.

3.1.2 Critical Conditions and Assumptions

All stormwater calculations provided in Appendix A are based on the rainfall intensity from a 25-year storm event with a duration of 5 minutes. This is a more severe condition than using the 24-hour duration described in 15ANCAC 13B .0540(7). Other critical conditions and assumptions related to the stormwater calculations can be found in Appendix A.

All volume calculations are based on the Phase I, Phase II, Phase III, and Phase IV proposed intermediate and final contours that were adjusted based on the April 2004 construction permit application. These contours were then compared to the October 8, 2009 topographic map of the site to determine available airspace.

3.1.3 Technical References

The following is a list of technical references used in the analysis and design of the Fort Bragg C&D Landfill.

- Autodesk, Inc., AutoCAD Civil 3D, Version 08.
- North Carolina Sedimentation Control Commission, et al., "Erosion and Sediment Control Planning and Design Manual", rev. 2006.
- Naval Facilities Engineering Command (NAVFAC), "Foundations and Earth Structures, Design Manual 7.2", 1982.
- Annapolis Engineering Software, STEDWIN, Version 2.7.
- U.S. Dept. of Transportation, "PC-STABLSM, User's Guide", 1989.
- U.S. Geologic Survey, "National Seismic Hazard Maps", 2008.
- HDR Engineering, Inc. of the Carolinas, "LCID/C&D Landfill, Fort Bragg, North Carolina, Design Hydrogeologic Report", April 2004.

- J. E. Bowles, "Physical and Geotechnical Properties of Soils", 1984.

3.1.4 Location Restrictions

Location restriction demonstrations for the Fort Bragg C&D Landfill meeting the requirements of 15A NCAC 13B .0536 were provided in the Site Application for the facility prepared by KCI Technologies, Inc. dated January 1999, and approved by NCDENR in April 1999.

3.1.5 Construction Requirements

The following subsections demonstrate that the materials and construction practices used at the Fort Bragg C&D Landfill conform to the requirements of 15A NCAC 13B .0540.

3.1.5.1 Horizontal Separation Requirements

The horizontal buffers employed at the landfill meet the requirements of 15A NCAC 13B .0540(1) and include a minimum 200-foot buffer between the C&D landfill unit and all property lines; a minimum 500-foot buffer between the C&D landfill unit and existing residential structures and wells; and, a minimum 50-foot buffer between the C&D landfill unit and any stream, river, lake, pond, or other waters of the state as defined in G.S. 143-212.

The requirement of 15A NCAC 13B .0540(1)(d) that a monitoring zone be established between a new C&D landfill unit and any existing landfill units does not apply to the Fort Bragg facility. NCDENR's approval of the April 2004 construction permit application for the site allows for the C&D landfill to be constructed over the closed LCID landfill at the site without requiring a monitoring zone.

3.1.5.2 Vertical Separation Requirements

The vertical separation requirements satisfy 15A NCAC 13B .0540(2) which includes a minimum post-settlement separation between the waste and seasonal high groundwater table and bedrock with the top two feet of separation being provided by in-situ soils classified as SC, SM, ML, CL, MH, or CH soils per the Unified Soil Classification System (USCS). A subsurface investigation report dated March 26, 2004 demonstrated that the natural soils located beneath the landfill expansion areas meet these classification requirements. A copy of this report is included in Appendix I. The NCDENR approved design potentiometric surface, as presented in the April 2004 Design Hydrogeologic Report for the facility, is shown on Sheet 13 of 14, Cross Section, along with the proposed landfill subgrades. The cross sections show that the minimum separation requirement from groundwater is maintained. The Design Hydrogeologic Report also states that the soils at the site extend at least 125 feet below ground surface, therefore maintaining the required separation from bedrock.

3.1.5.3 Survey Control

Survey control has been established at the facility meeting the requirements of 15A NCAC 13B .0540(3). The location of a permanent benchmark of known elevation,

established by a Registered Land Surveyor, is shown on Sheet 3 of 14, Overall Site Plan. The latitude and longitude of the approximate center of the facility is also shown on the same sheet.

3.1.5.4 Location Coordinates

The drawings provided with this permit application are referenced to the North Carolina State Plane Coordinate System (NCSP), Zone 3200, NAD 83, in accordance with 15A NCAC 13B .0540(4).

3.1.5.5 Landfill Subgrade

The C&D landfill subgrades are generally based on the April 2004 construction permit application and subsequently approved by NCDENR and are shown on the phasing drawings (Sheets 4 through 9 of 14). The top two feet of subgrade soil will consist of in-situ soils classified as SC, SM, ML, CL, MH, or CH soils per the Unified Soil Classification System (USCS).

The subgrade will be inspected by a qualified geologist or engineer when excavation is completed in order to confirm that suitable in-situ soils are included within the upper two feet.

The NCDENR Division of Waste Management's hydrogeologist will be notified at least 24 hours before subgrade inspection.

Subgrade construction and inspection will be performed in accordance with the requirements of the Construction Quality Assurance (CQA) Plan – New Construction, provided in Appendix C.

3.1.5.6 Special Engineering Structures

The only special engineering structure that will be incorporated as part of this construction permit application is a landfill cap that will be constructed over the Phase I area. The landfill cap will satisfy the requirements of 15A NCAC 13B .0543 and will consist of 18 inches of low permeability barrier layer with a maximum hydraulic conductivity of $1x10^{-5}$ cm/sec overlain by 18 inches of erosion layer.

The proposed extent of the Phase I cap system as well as the anticipated locations of sideslope swales, diversion berms, downpipes, perimeter channels and other features are shown on Sheet 4 of 14, Phase I Final Grade Plan. Closure details are shown on Sheets 10 through 12 of 14. The CQA Plan for the Phase I closure meeting the requirements of 15A NCAC 13B .0541 is provided in Appendix D.

The Fort Bragg C&D Landfill design includes provisions for a gas venting system beneath the low permeability barrier layer of the final cover to minimize pressures on the barrier layer in accordance with 15A NCAC 13B .0543 (a)(2)(B). The gas venting system consists of horizontal gas wells installed within the waste that are passively vented through the landfill cap. The horizontal wells will be installed at a general frequency of one well per closure acre. Details for the horizontal wells are provided on Sheet 12 of 14.

3.1.5.7 Sedimentation and Erosion Control

Sedimentation and erosion controls will consist of seeding and mulching, erosion control matting, diversion berms, riprap aprons, and an existing retention pond designed to limit the amount of erosion occurring on-site and prevent sediment from leaving the site. The locations of the proposed sedimentation and erosion control measures that will be installed during the phases of landfill development are shown on Sheets 4 through 9 of 14. Details of the controls are provided on Sheets 10 and 11 of 14. The calculations for the controls, which are provided in Appendix A, show that they are designed to manage the runoff generated by the 24-hour, 25-year storm or more conservative design criteria. Sediment and erosion controls will be installed in accordance with the Erosion and Sedimentation Control Plan for the facility approved by the NCDENR Division of Land Resources on August 19, 2004 and in accordance with the Sedimentation Control Act codified in 15 NCAC 4.

3.1.5.8 Construction Quality Assurance Report

CQA reports will be prepared for expansion of the landfill and final cap construction in accordance with 15A NCAC 13B .0541 and the approved CQA plans. The CQA plans for new cell construction and closure construction are provided in Appendices C and D, respectively.

3.2 Construction Materials and Practices

A description of the construction materials and practices proposed for Phase II cell construction and Phase I cap construction is provided in Section 3.1.5, Construction Requirements. Additional information can be found on the drawings and within the technical specifications located in Appendix B.

3.3 Design Hydrogeologic Report

A Design Hydrogeologic Report for the Fort Bragg C&D Landfill was submitted with the April 2004 construction permit application which was subsequently approved by NDENR in September 2004. The subgrades, final grades, waste limits, and total waste capacities presented within this current permit application are generally consistent with those previously approved by NCDENR and therefore no further site geologic or hydrogeologic investigations are required.

SECTION 4.0
CONSTRUCTION QUALITY ASSURANCE PLAN

CQA plans for new cell construction and closure construction, prepared in accordance with15A NCAC 13B .0541, are provided in Appendices C and D, respectively.

SECTION 5.0
OPERATIONS PLAN

An Operations Plan for the Fort Bragg C&D Landfill, meeting the requirements of 15A NCAC 13B .0542, is provided in Appendix E.

SECTION 6.0
CLOSURE AND POST-CLOSURE PLAN

Closure and Post-Closure Plans for the Fort Bragg C&D Landfill, meeting the requirements of 15A NCAC 13B .0543, are provided in Appendices F and G, respectively.

SECTION 7.0
MONITORING PLAN

A Monitoring Plan for the Fort Bragg C&D Landfill, meeting the requirements of 15A NCAC 13B .0544, is provided in Appendix H. The monitoring plan is generally consistent with the NCDENR approved monitoring plan provided within the April 2004 construction permit application but has been updated to comply with current site conditions and regulatory requirements. Monitoring locations are shown on Sheet 14 of 14, Monitoring Plan.

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

APPENDIX A
CALCULATIONS

MAY 2010

Prepared for:
DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

Prepared by:
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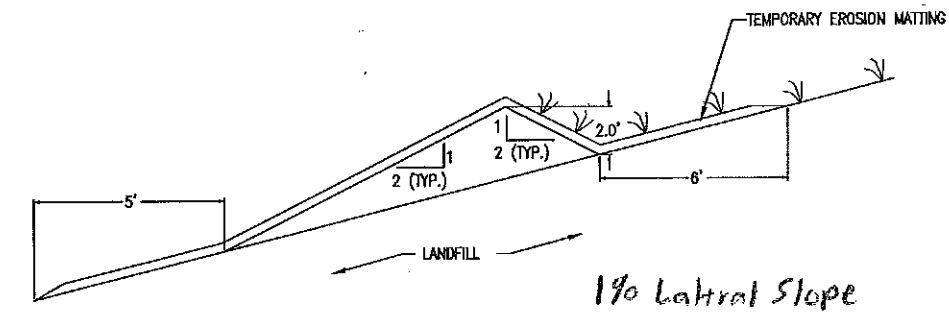
Project: Ft. Bragg CoD Landfill	Computed: JMY	Date: 3/9/10	
Subject: Stormwater Calcs.	Checked: DTD	Date: 3/15/10	
Task: Sideslope Swale Calcs.	Page: 1	of: 3	
Job #: 120265	No:		

OBJECTIVE:

Verify proposed sideslope swale design is adequate for 25-yr design storm.

ASSUMPTIONS:

① Design for 25-yr storm,
② Use procedures in June 2006 Erosion and Sediment Control Planning and Design Manual (ESCPDM),
③ Proposed sideslope swale design is as follows:



SIDESLOPE SWALE 2-10

NOTE:
1) EROSION MATTING SHALL HAVE A MINIMUM PERMISSIBLE UNIT SHEAR STRESS OF ~~1.50~~ 1.45 lb/sqft.

PROCEDURE:

① Determine maximum flow in any sideslope swale.

Use Rational method: $Q = CIA$ (see downpipe calcs. for definitions).

From A77.A, Max. area draining to any swale = 1.19 AC = A

Use C for Pasture, Heavy Soil

For 5% slopes use C = 0.30 (1/3 of area)

For 3:1 slopes use C = 0.45 (2/3 of area)

Composite C = 0.33 (0.30) + 0.66 (0.45) = 0.40 = C

Use I_{25} = 8.94 in/hr (Fayetteville, NC)

∴ Q_{25} = 0.40 (8.94) (1.19) = 4.26 CFS

② Determine flow capacity of sideslope swale.

Use Manning's Eqn. for triangular channel:

$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$ (see perimeter channel calcs. for definitio

Use n = 0.05 (From perimeter channel calcs.)

S = 1% = 0.01 by design

Calculate flow capacity assuming channel full using FlowMaster V. 3.16:

From Att. B Q = 28.24 CFS > 4.26 CFS ok

Critical Depth = 1.51 ft

Velocity = 2.82 ft/s

③ Evaluate Channel Lining.

From Att. C, max. allowable velocity for grassed channel in easily erodible soils is 5.0 ft/s > 2.82 ft/s ok

∴ Do not need protective lining once grass is established.

Check stability of channel prior to grass establishment:

From Att. D, max. allowable velocity for fine sand
= 2.5 ft/s > 2.82 ft/s Ok

However, since design velocity is close to max. allowable velocity, provide temporary erosion matting to allow grass to be established.

Calculate shear stress on channel liner flowing full.

$T = \gamma d s$ (see perimeter channel calcs. for definitions).
$\gamma = 62.4$ lb/ft³, $d = 2.0$ ft, $s = 0.01$

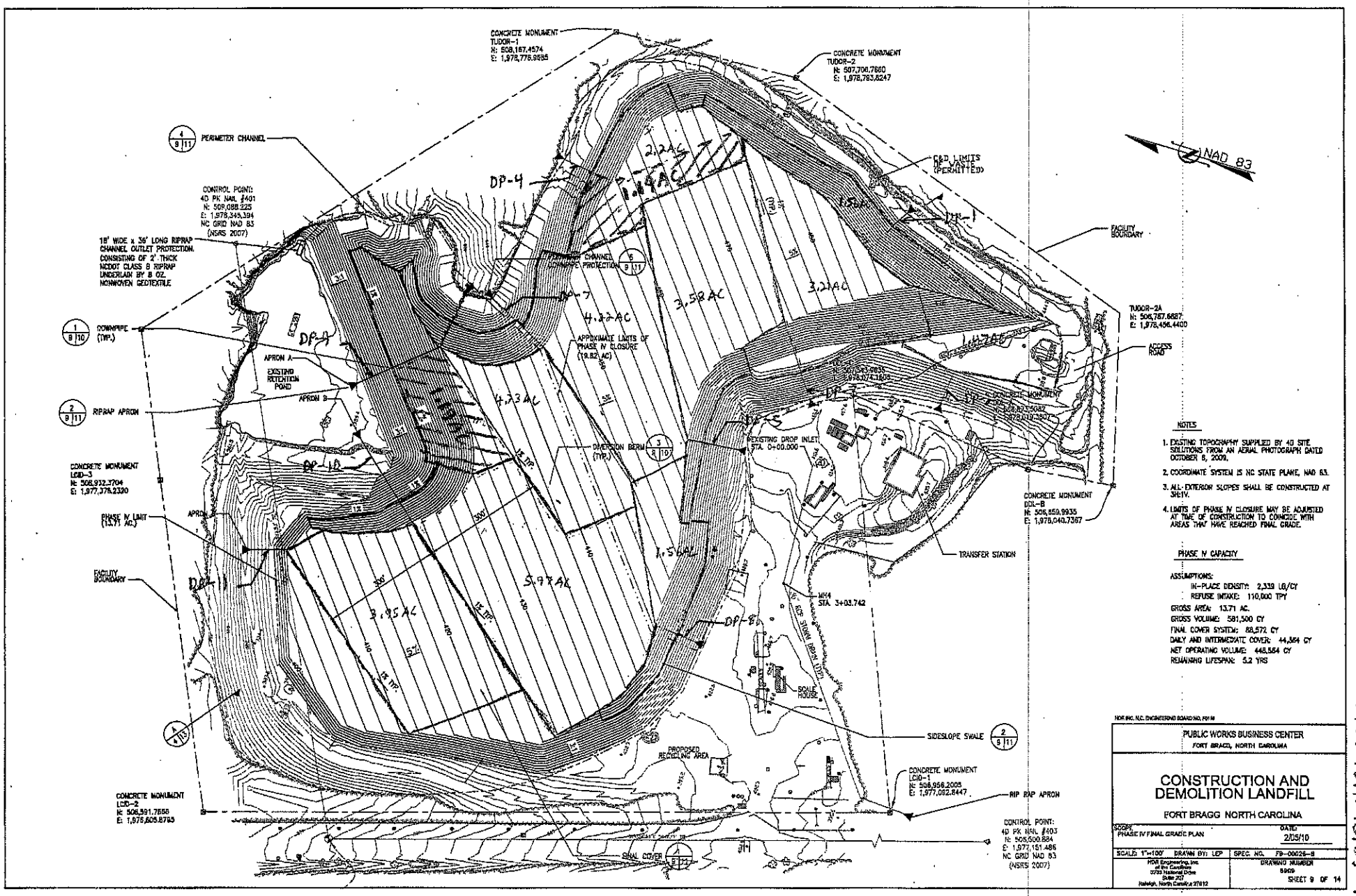
$\therefore T = 62.4(2.0)(0.01) = \underline{1.25}$ lb/ft²

From Att. E, max. allowable shear stress with straw net blanket = 1.45 lb/ft² > 1.25 lb/ft² Ok

∴ line swales with straw net blanket.

CONCLUSIONS:

Proposed sideslope swale design is adequate to handle 25-yr storm flow. No permanent lining is needed once grass is established. A temporary straw net blanket should be used to allow vegetation to get established.



NOTES

1. EXISTING TOPOGRAPHY SUPPLIED BY 4D SITE SOLUTIONS FROM AN AERIAL PHOTOGRAPH DATED OCTOBER 8, 2009.
2. COORDINATE SYSTEM IS NC STATE PLANE, NAD 83.
3. ALL EXTERIOR SLOPES SHALL BE CONSTRUCTED AT 3H:1V.
4. LIMITS OF PHASE IV CLOSURE MAY BE ADJUSTED AT TIME OF CONSTRUCTION TO COINCIDE WITH AREAS THAT HAVE REACHED FINAL GRADE.

PHASE IV CAPACITY

ASSUMPTIONS:
- IN-PLACE DENSITY: 2,339 LB/CY
- REFUSE INTAKE: 110,000 TPY

GROSS AREA: 13.71 AC.
GROSS VOLUME: 581,500 CY
FINAL COVER SYSTEM: 88,572 CY
DAILY AND INTERMEDIATE COVER: 44,364 CY
NET OPERATING VOLUME: 448,564 CY
REMAINING LIFESPAN: 5.2 YRS

HDR INC. N.C. ENGINEERING BOARD NO. F0118

PUBLIC WORKS BUSINESS CENTER
FORT BRAGG, NORTH CAROLINA

CONSTRUCTION AND DEMOLITION LANDFILL

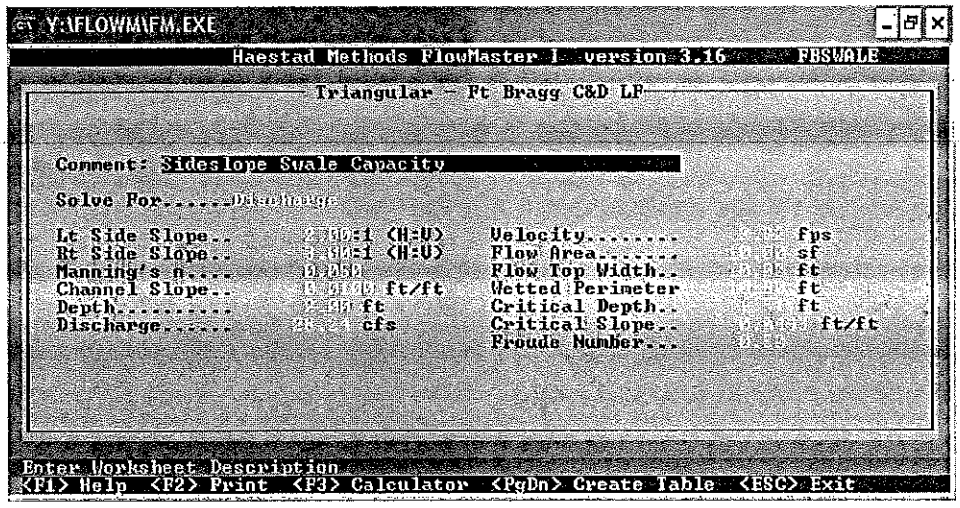
FORT BRAGG NORTH CAROLINA

SCOPE: PHASE IV FINAL GRADE PLAN
DATE: 2/05/10
SCALE: 1"=100' DRAWN BY: LEP
SPEC. NO. FB-00026-B
DRAWING NUMBER: 8909
SHEET 9 OF 14

HDR Engineering, Inc. of the Carolinas
2733 National Drive
Suite 202
Raleigh, North Carolina 27612

ATTACHMENT A

ATTACHMENT B



ATTACHMENT C

Table 8.05a
Maximum Allowable Design Velocities[1]
for Vegetated Channels

Typical Channel Slope Application	Soil Characteristics[2]	Grass Lining	Permissible Velocity[3] for Established Grass Lining (ft/sec)
0-5%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	5.0
		Tall fescue	4.5
		Bahiagrass	4.5
		Kentucky bluegrass	4.5
		Grass-legume mixture	3.5
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	6.0
		Tall fescue	5.5
		Bahiagrass	5.5
		Kentucky bluegrass	5.5
		Grass-legume mixture	4.5
5-10%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	4.5
		Tall fescue	4.0
		Bahiagrass	4.0
		Kentucky bluegrass	4.0
		Grass-legume mixture	3.0
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	5.5
		Tall fescue	5.0
		Bahiagrass	5.0
		Kentucky bluegrass	5.0
		Grass-legume mixture	3.5
>10%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	3.5
		Tall fescue	2.5
		Bahiagrass	2.5
		Kentucky bluegrass	2.5
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	4.5
		Tall fescue	3.5
		Bahiagrass	3.5
		Kentucky bluegrass	3.5

Source: USDA-SCS Modified

NOTE: [1]Permissible Velocity based on 10-year storm peak runoff
[2]Soil erodibility based on resistance to soil movement from concentrated flowing water.
[3]Before grass is established, permissible velocity is determined by the type of temporary liner used.

Selecting Channel Cross-Section Geometry

To calculate the required size of an open channel, assume the design flow is uniform and does not vary with time. Since actual flow conditions change throughout the length of a channel, subdivide the channel into design reaches, and design each reach to carry the appropriate capacity.

The three most commonly used channel cross-sections are "V"-shaped, parabolic, and trapezoidal. Figure 8.05b gives mathematical formulas for the area, hydraulic radius and top width of each of these shapes.

Source: ESCPDM

ATTACHMENT D

Table 8.05d
Maximum Permissible Velocities for Unprotected Soils in Existing Channels.

Materials	Maximum Permissible Velocities (fps)
Fine Sand (noncolloidal)	2.5
Sand Loam (noncolloidal)	2.5
Silt Loam (noncolloidal)	3.0
Ordinary Firm Loam	3.5
Fine Gravel	5.0
Stiff Clay (very colloidal)	5.0
Graded, Loam to Cobbles (noncolloidal)	5.0
Graded, Silt to Cobbles (colloidal)	5.5
Alluvial Silts (noncolloidal)	3.5
Alluvial Silts (colloidal)	5.0
Coarse Gravel (noncolloidal)	6.0
Cobbles and Shingles	5.5

Sample Problem 8.05a
Design of a Grass-lined Channel.

Given:

Design Q_{10} = 16.6 cfs

Proposed channel grade = 2%
Proposed vegetation: Tall fescue
Soil: Creedmoor (easily erodible)
Permissible velocity, V_p = 4.5 ft/s (Table 8.05a)
Retardance class: "B" uncut, "D" cut (Table 8.05c).
Trapezoidal channel dimensions:
designing for low retardance condition (retardance class D)
design to meet V_p.

Find:

Channel dimensions

Solution:

Make an initial estimate of channel size

$A = Q/V$, 16.6 cfs/4.5 ft/sec = 3.69 ft²
Try bottom width = 3.0 ft w/side slopes of 3:1

$Z = 3$
$A = bd + Zd^2$
$P = b + 2d\sqrt{Z^2 + 1}$
$R = A/P$

An iterative solution using Figure 8.05a to relate flow depth to Manning's *n* proceeds as follows: Manning's equation is used to check velocities.
*From Fig. 8.05c, pg. 8.05.7, Retardance Class d (VR=4.5x0.54=2.43)

d (ft)	A (ft²)	R (ft)	*n	Vt (fps)	Q (cfs)	Comments
0.8	4.32	0.54	0.043	3.25	14.0	$V<V_p$ OK, $Q<Q_{10}$
						(too small, try deeper channel)
0.9	5.13	0.59	0.042	3.53	18.10	$V<V_p$, OK, $Q>Q_{10}$, OK

Now design for high retardance (class B):

For the ease of construction and maintenance assume and try d = 1.5 ft and trial velocity V_t = 3.0 ft/sec

d (ft)	A (ft²)	R (ft)	V_t (fps)	n	V (fps)	Q (cfs)	Comments
1.5	11.25	0.90	3.0	0.08	2.5	28	reduce V_t
			2.0	0.11	1.8	20	reduce V_t
			1.6	0.12	1.6	18	
			**1.5	0.13	1.5	17	$Q>Q_{10}$ OK

** These assumptions = actual V (fps.) (chart continued on next page)

Source: ESCPDM

ATTACHMENT E

Table 8.05g
Permissible Shear Stresses for Riprap and Temporary Liners

Lining Category	Lining Type	Permissible Unit Shear Stress, T_d (lb/ft²)
Temporary	Woven Paper Net	0.15
	Jute Net	0.45
	Fiberglass Roving:	
	Single	0.60
	Double	0.85
	Straw with Net	1.45
	Curled Wood mat	1.55
	Synthetic Mat	2.00
	d_{50} Stone Size (inches)	
Gravel Riprap	1	0.33
	2	0.67
Rock Riprap	6	2.00
	9	3.00
	12	4.00
	15	5.00
	18	6.00
	21	7.80
	24	8.00

Adapted From: FHWA, HEC-15, April 1983, pgs. 17 & 37.

Design Procedure-Temporary Liners

The following is a step-by-step procedure for designing a temporary liner for a channel. Because temporary liners have a short period of service, the design Q may be reduced. For liners that are needed for six months or less, the 2-year frequency storm is recommended.

Step 1. Select a liner material suitable for site conditions and application. Determine roughness coefficient from manufacturer's specifications or Table 8.05e, page 8.05.10.

Step 2. Calculate the normal flow depth using Manning's equation (Figure 8.05d). Check to see that depth is consistent with that assumed for selection of Manning's *n* in Figure 8.05d, page 8.05.11. For smaller runoffs Figure 8.05d is not as clearly defined. Recommended solutions can be determined by using the Manning equation.

Step 3. Calculate shear stress at normal depth.

Step 4. Compare computed shear stress with the permissible shear stress for the liner.

Step 5. If computed shear is greater than permissible shear, adjust channel dimensions to reduce shear, or select a more resistant lining and repeat steps 1 through 4.

Design of a channel with temporary lining is illustrated in Sample Problem 8.05b, page 8.05.14.

SOURCE: ESCPDM

OBJECTIVE:

Design riprap outlet protection at downpipe locations DP-9 (Apron A), DP-10 (Apron B), and DP-11 (Apron C). All other downpipe outlets will drain to perimeter channel which will be lined with riprap in vicinity of outlet. (See Att. A)

ASSUMPTIONS:

① Design for 25-yr storm.
② Use procedures in June 2006 Erosion and Sediment Control Planning and Design Manual (ESCPDM).
③ Assume minimum tailwater condition ($T_w < 0.5$ pipe diameter)

PROCEDURE:

APRON A:

Determine Q_{25}: (see downpipe calcs. for references)

3:1 slope area = 1.56Ac, 5% slope area = 2.67Ac

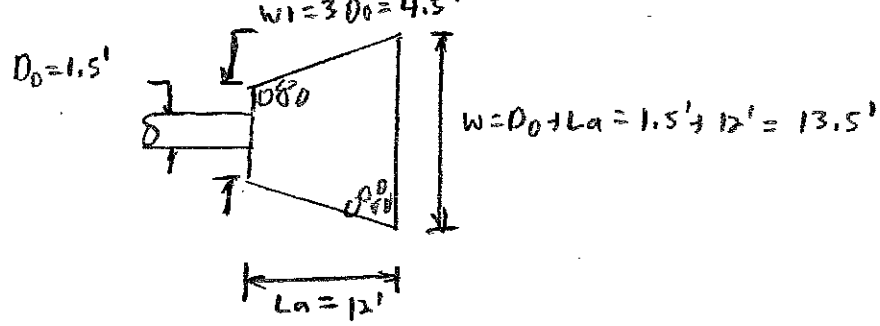
Composite $C = \frac{0.95(1.56) + 0.30(2.67)}{4.23Ac} = 0.36$

$I_{25} = 8.94$ in/hr

$A = 4.23$ Ac

$\therefore Q_{25} = 0.36(8.94)(4.23) = \underline{13.61 \text{ cfs}}$

Design Apron using Att. B:



From Att. B, d_{50} of stone must be at least $0.4' = 4.8"$
d_{50} of NCDOT Class B riprap = $8" > 4.8"$ OK

Thickness of riprap must be at least 1.5 max. stone dia.
Max. stone dia. for NCDOT Class B riprap = 12"
Reqd. apron thickness = 1.5 (12") = 18".

Apron B:

Determine Q_{25}:

From downpipe calcs, $Q_{25} = 16.55$ CFS

Design apron using Att. B:

$W_1 = 3D_0 = 3(1.5) = 4.5'$
$L_a = 16'$
$W = D_0 + L_a = 1.5 + 16 = 17.5'$
$d_{50} \geq 0.5'$ ∴ use NCDOT Class B riprap, $d_{50} = 8"$, $d_{max} = 12"$
Riprap thickness = 1.5 (12") = 18"

Apron C:

Determine Q_{25}:

$Q_{25} = 0.30(8.94)(3.95) = 10.59$ CFS

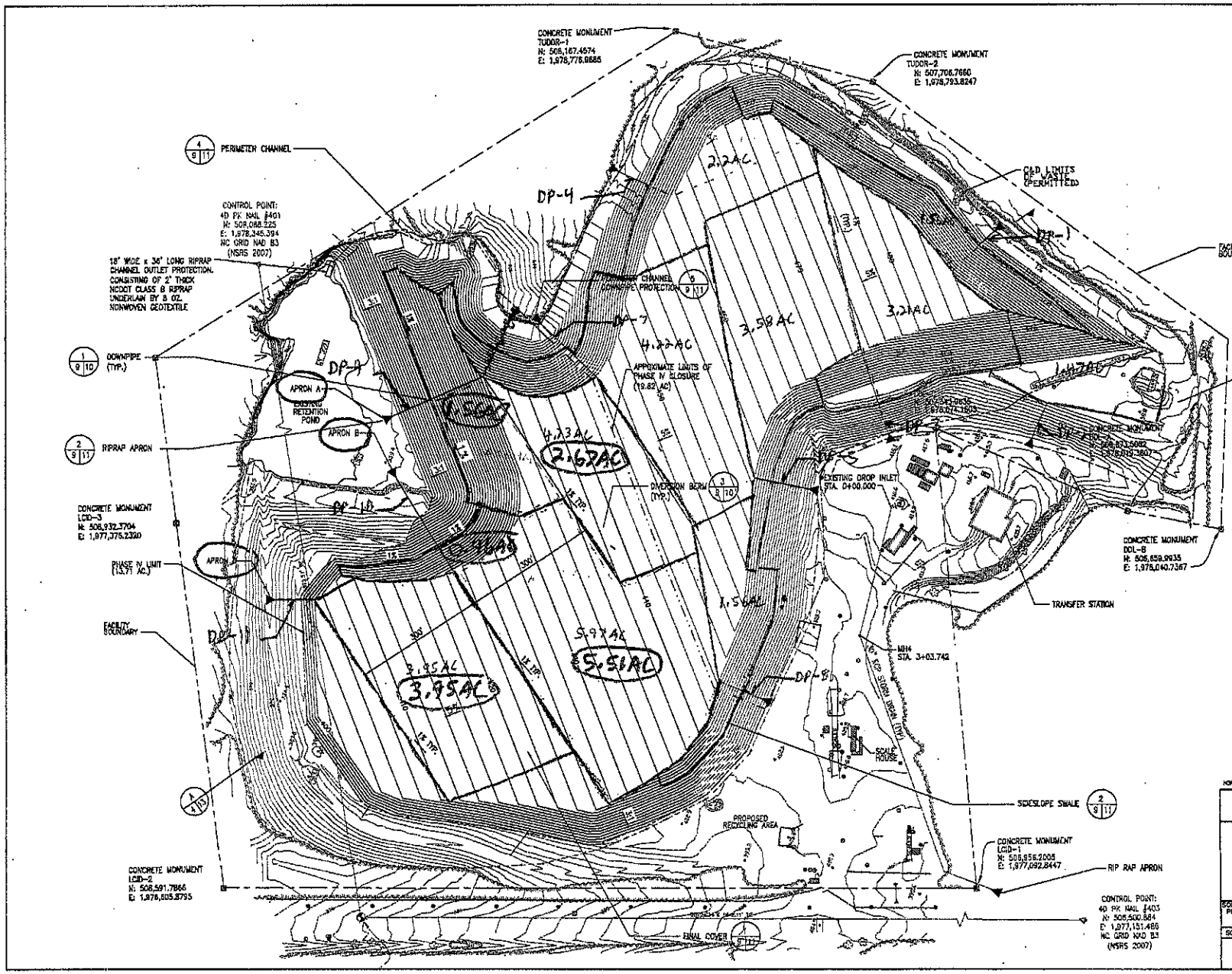
Design apron using Att. B:

$W_1 = 3D_0 = 3(1.5) = 4.5'$
$L_a = 10'$
$W = D_0 + L_a = 1.5 + 10' = 11.5'$
$d_{50} \geq 0.3'$ ∴ use NCDOT Class B riprap, $d_{50} = 8"$, $d_{max} = 12"$
Riprap thickness = 1.5 (12") = 18".

Install filter fabric beneath riprap.

CONCLUSION:

Proposed riprap apron designs will adequately dissipate flows due to 25yr storm and reduce erosion at downpipe outlets.



NOTES

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PHASE IV CAPACITY

ASSUMPTIONS:
IN-PLACE DENSITY: 2,339 LB/CY
REFUSE INTAKE: 110,000 TPY
GROSS AREA: 13.71 AC.
GROSS VOLUME: 581,500 CY
FINAL COVER SYSTEM: 86,572 CY
DAILY AND INTERMEDIATE COVER: 44,384 CY
NET OPERATING VOLUME: 448,564 CY
REMAINING LIFESPAN: 5.2 YRS

DRAINAGE MAP

HDR INC, N.C. ENGINEERING BOARD NO. F0119

PUBLIC WORKS BUSINESS CENTER
FORT BRAGG, NORTH CAROLINA

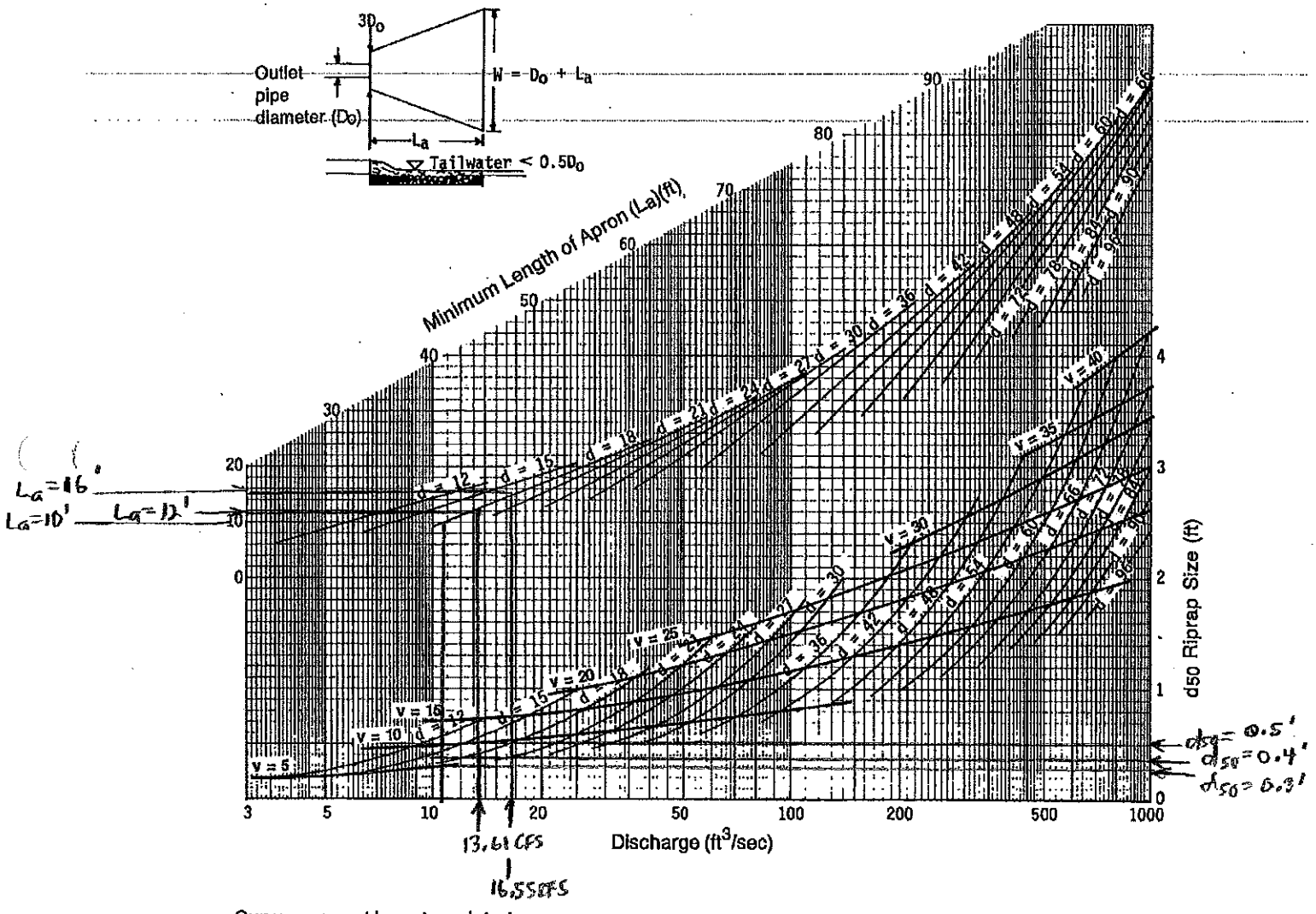
CONSTRUCTION AND DEMOLITION LANDFILL

FORT BRAGG NORTH CAROLINA

SCOPE: PHASE IV FINAL GRADE PLAN
DATE: 2/05/10
SCALE: 1"=100' DRAWN BY: LEP
SPEC. NO. F9-00026-8
HDR Engineering, Inc. of Pat Carolina 8723 National Drive Suite 207 Raleigh, North Carolina 27612
DRAWING NUMBER 8909
SHEET 9 OF 14

ATTACHMENT A

ATTACHMENT B



Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

Source: ESCPDM

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HDR | ONE COMPANY *Many Solutions™*

Project: Ft. Bragg CaD Landfill	Computed: JMY	Date: 3/2/10	
Subject: Stormwater Calcs.	Checked: DAD	Date: 3/26/10	
Task: Perimeter Channel Calcs.	Page: 1	of: 4	
Job #: 120265	No:		

OBJECTIVE:

Design perimeter channel for Ft. Bragg CaD landfill.

ASSUMPTIONS:

① Design for 25-yr storm.
② Use procedures in June, 2006 Erosion and Sediment Control Planning and Design Manual. (ESCPDM).

PROCEDURE:

① Determine design flow in channel:

Use Rational Method; $Q = CIA$ where:
Q = peak runoff (cfs)
C = runoff coeff.
I = rainfall intensity (in/hr)
A = drainage area in acres.

From Att. A area contributing flow to south perimeter channel ≈ 29.2 AC.

Determine composite C as follows: (See Att. B)

30% – 5% slopes, pasture	C = 0.30
30% – 3:1 slopes, pasture	C = 0.45
10% – asphalt pavement	C = 0.95
10% – woodlands	C = 0.25
20% – Bare Packed Soil	C = 0.60
100%	

∴ Composite $C = 0.3(0.30) + 0.3(0.45) + 0.1(0.95) + 0.1(0.25) + 0.2(0.6$

$= 0.47$

From Att. C, conservatively assume time of conc. = 5 min.
∴ Q_{25} for Fayetteville = 8.94 in/hr

A = 29.2 AC.

∴ $Q_{25} = 0.47(8.94)(29.2) = 122.7$ CFS

② Determine flow capacity of perimeter channel.

Use Manning's Eqn. for trapezoidal channel:

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$ where:

Q = flow (CFS)
n = Manning's roughness coeff.
R = Hydraulic radius = flow area / wetted perimeter
S = slope of channel
A = flow area of channel.

Determine n using procedure in Section 8.04 of ESCPDM

From table 8.04a of ESCPDM, basic value for n for channels in earth = 0.02. (Att. D)

From Table 8.04b, use modifying value for moderate surface irregularity of 0.010 (Att. E)

From Table 8.04c, use modifying value for variations in channel cross section of 0.000 (Assume constant C/S) (Att. E)

From Table 8.04d, use modifying value for obstructions in channel of 0.010 (minor obstructions) (Att. F)

From Table 8.04e, use modifying value for vegetation of 0.010 (low to medium effect) (Att. G)

Determine n_s for reach: $n_s = 0.02 + 0.01 + 0 + 0.01 + 0.01 = \underline{0.05}$

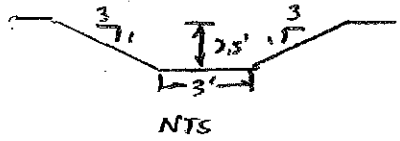
Determine S based on average slope along channel:

El. at beginning of channel = 424 ft
El. at end of channel = 360 ft
Length of channel = 3,437 ft

$\therefore$ Avg. slope = $\frac{424 - 360}{3,437} = 0.019 = \underline{1.9\%}$

Calculate flow capacity assuming channel full using FlowMaster V. 3.16:

From Att. H Q = 134.28 CFS > 122.7 CFS Ok
Critical Depth = 2.18 ft
Velocity = 5.12 ft/s



NTS

③ Evaluate Channel Lining.

From Att. I, max. allowable velocity for grassed channel in easily erodible soils is 5.0 ft/sec < 5.12 ft/s
$\therefore$ Need turf reinforcement matting.

Calculate shear stress on channel liner flowing full:

$T = \gamma d s$ where: T = shear stress (lb/ft^2)
γ = unit wt. of water = 62.4 lb/ft^3
d = flow depth = 2.5 ft
s = channel gradient (ft/ft) = 0.019 ft/ft

How determined?

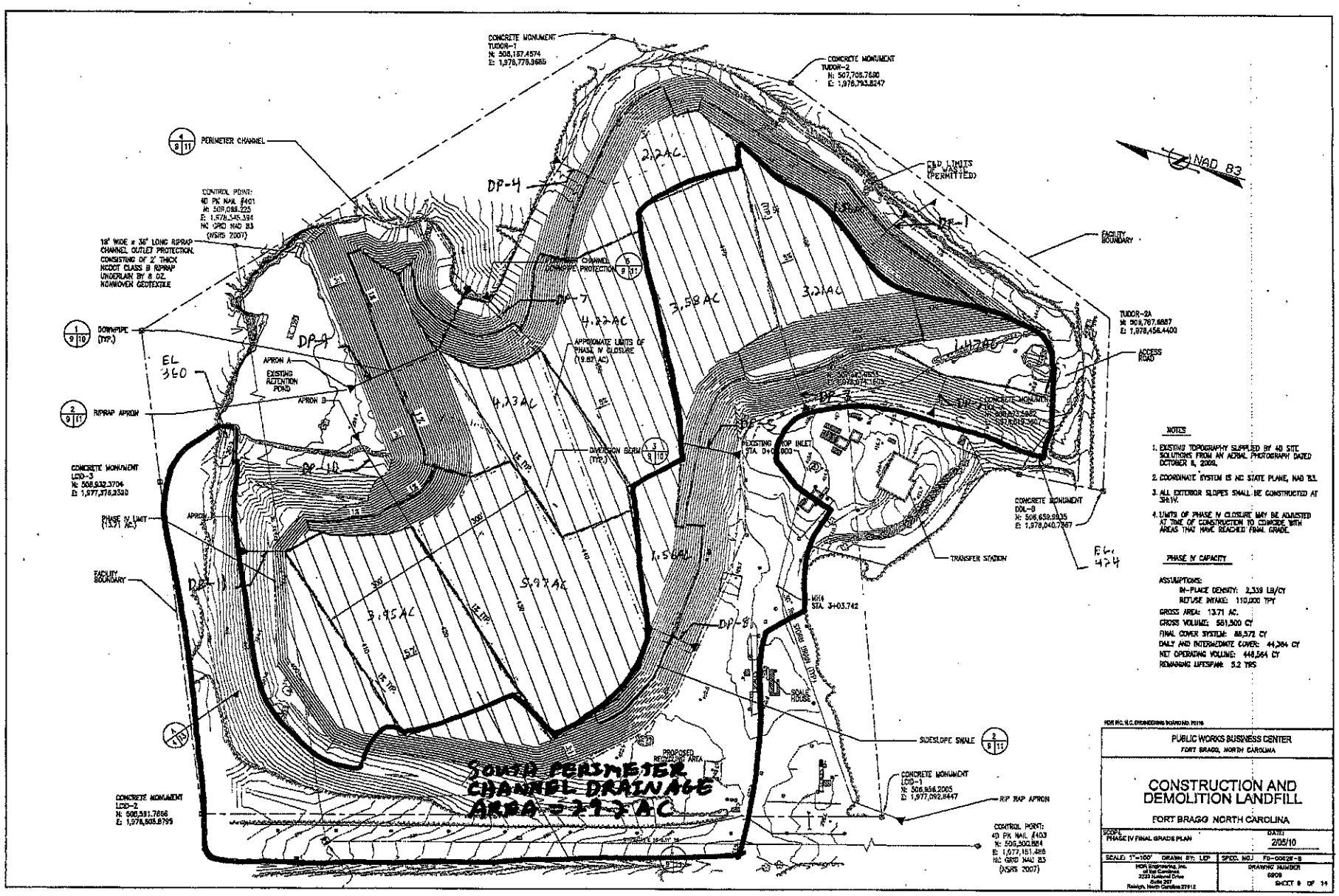
$\therefore T = 62.4 (2.5)(0.019) = \underline{2.96}$ lb/ft^2

* Provide turf reinforcement matting (TRM) with capability to withstand T = (5.2) lb/ft² and V = (16) ft/s in order to account for variations in channel slope.

CONCLUSIONS:

Proposed perimeter channel design is adequate to handle 25-yr storm flow. Channel must be lined with permanent turf reinforcement matting (TRM). Use TRM capable of withstanding a velocity (V) of 16 ft/s and a shear stress (T) of 5.7 lb/ft2.

North perimeter channel has much less contributing flow area than south channel (≈8Ac vs. 29.2Ac). South channel design will also be adequate for North channel. Line final 100' of North channel with 18" Thick NCDOT Class B riprap underlain with NCDOT Type 2 filter fabric to protect channel on steep slope prior to entering retention pond.



ATTACHMENT A

ATTACHMENT B

8

Table 8.03b
Value of Runoff Coefficient (C) for Rational Formula

Land Use	C
Business:	
Downtown areas	0.70-0.95
Neighborhood areas	0.50-0.70
Residential:	
Single-family areas	0.30-0.50
Multi units, detached	0.40-0.60
Multi units, Attached	0.60-0.75
Suburban	0.25-0.40
Industrial:	
Light areas	0.50-0.80
Heavy areas	0.60-0.90
Parks, cemeteries	0.10-0.25
Playgrounds	0.20-0.35
Railroad yard areas	0.20-0.40
Unimproved areas	0.10-0.30
Streets:	
Asphalt	0.70-0.95
Concrete	0.80-0.95
Brick	0.70-0.85
Drives and walks	0.75-0.85
Roofs	0.75-0.85

Land Use	C
Lawns:	
Sandy soil, flat, 2%	0.05-0.10
Sandy soil, ave., 2-7%	0.10-0.15
Sandy soil, steep, 7%	0.15-0.20
Heavy soil, flat, 2%	0.13-0.17
Heavy soil, ave., 2-7%	0.18-0.22
Heavy soil, steep, 7%	0.25-0.35
	0.30-0.60
	0.20-0.50
Agricultural land:	
Bare packed soil	0.30-0.60
Smooth	0.20-0.50
Rough	0.20-0.40
Cultivated rows	0.10-0.25
Heavy soil no crop	
Heavy soil with crop	0.15-0.45
Sandy soil no crop	0.05-0.25
Sandy soil with crop	0.05-0.25
Pasture	0.10-0.25
Heavy soil	0.15-0.45
Sandy soil	0.05-0.25
Woodlands	0.05-0.25

NOTE: The designer must use judgement to select the appropriate C value within the range for the appropriate land use. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have lowest C values. Smaller areas with slowly permeable soils, steep slopes, and sparse vegetation should be assigned highest C values.

Source: American Society of Civil Engineers

Source: ESCPDm

ATTACHMENT C

Raleigh, North Carolina 35.8706N, 78.7864W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	5.58	4.46	3.74	2.58	1.62	0.94	0.66	0.40	0.24	0.14
10	7.08	5.66	4.78	3.46	2.25	1.33	0.95	0.58	0.34	0.021
25	7.78	6.19	5.24	3.88	2.58	1.54	1.11	0.68	0.41	0.24
100	8.64	6.86	5.78	4.43	3.05	1.85	1.36	0.84	0.51	0.30

Fayetteville, North Carolina 35.0583N, 78.8583W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.11	4.88	4.09	2.83	1.77	1.04	0.74	0.44	0.26	0.15
10	7.96	6.36	5.36	3.88	2.53	1.54	1.10	0.66	0.39	0.23
25	8.94	7.13	6.02	4.46	2.97	1.83	1.32	0.80	0.47	0.28
100	10.44	8.29	6.99	5.35	3.69	2.29	1.69	1.03	0.62	0.36

Wilmington, North Carolina 34.2683N, 77.9061W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	7.39	5.92	4.96	3.42	2.15	1.28	0.91	0.56	0.33	0.19
10	9.70	7.75	6.54	4.74	3.08	1.94	1.39	0.87	0.51	0.30
25	10.98	8.75	7.40	5.48	3.65	2.38	1.73	1.08	0.64	0.38
100	12.92	10.27	8.65	6.83	4.56	3.18	2.37	1.49	0.89	0.53

Washington, North Carolina 35.5333N, 77.0167W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.41	5.12	4.29	2.96	1.86	1.10	0.78	0.47	0.27	0.16
10	8.38	6.70	5.65	4.09	2.66	1.64	1.19	0.72	0.42	0.25
25	9.48	7.55	6.38	4.73	3.15	1.99	1.46	0.88	0.52	0.31
100	11.16	8.87	7.47	5.72	3.94	2.58	1.93	1.18	0.70	0.42

Manteo Airport, North Carolina 35.9167N, 75.7000W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.46	5.16	4.32	2.99	1.87	1.08	0.79	0.48	0.29	0.17
10	8.47	6.77	5.71	4.14	2.69	1.62	1.20	0.74	0.44	0.27
25	9.58	7.62	6.44	4.77	3.17	1.96	1.47	0.91	0.54	0.33
100	11.26	8.95	7.54	5.77	3.98	2.54	1.95	1.21	0.73	0.44

Cape Hatteras, North Carolina, 35.2322N, 75.6225W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	7.20	5.75	4.82	3.33	2.09	1.29	0.94	0.58	0.34	0.20
10	9.41	7.52	6.35	4.60	2.99	1.93	1.43	0.89	0.53	0.31
25	10.66	8.49	7.18	5.31	3.54	2.33	1.75	1.09	0.65	0.38
100	12.53	9.95	8.39	6.42	4.42	3.03	2.32	1.45	0.88	0.51

Source: ESCPDM

ATTACHMENT D

8.04

ESTIMATING ROUGHNESS COEFFICIENTS

This section describes a method for estimating the roughness coefficient *n* for use in hydraulic computations associated with natural streams, floodways, and excavated channels. The procedure applies to the estimation of *n* in Manning's formula (*Appendix 8.05*).

The coefficient of roughness *n* quantifies retardation of flow due to roughness of channel sides, bottom, and irregularities.

Estimation of *n* requires the application of subjective judgement to evaluate five primary factors:

- irregularity of the surfaces of the channel sides and bottom;
- variations in the shape and size of the channel cross sections;
- obstructions in the channel;
- vegetation in the channel; and
- meandering of the channel.

Procedure For Estimating *n*

The procedure for estimating *n* involves selecting a basic value for a straight, uniform, smooth channel in the existing soil materials, then modifying that value with each of the five primary factors listed above.

In selecting modifying values, it is important that each factor be examined and considered independently.

Step 1. Selection of basic value of *n*. Select a basic *n* value for a straight, uniform, smooth channel in the natural materials involved. The conditions of straight alignment, uniform cross section, and smooth side and bottom surfaces without vegetation should be kept in mind. Thus, basic *n* varies only with the material than forms the sides and bottom of the channel. Select the basic *n* for natural or excavated channels from Table 8.04a. If the bottom and sides of a channel consist of different materials, select an intermediate value.

Table 8.04a
Basic Value of Roughness Coefficient for Channel Materials

Soil Material	Basic *n*
Channels in earth	0.02
Channels in fine gravel	0.024
Channels cut into rock	0.025
Channels in coarse gravel	0.028

Step 2. Selection of modifying value for surface irregularity. This factor is based on the degree of roughness or irregularity of the surfaces of channel sides and bottom. Consider the actual surface irregularity, first in relation to the degree of surface smoothness obtainable with the natural materials involved, and second in relation to the depths of flow expected. If the surface irregularity is comparable to the best surface possible for the channel materials, assign a modifying value of zero. Irregularity induces turbulence that calls for increased modifying values. Table 8.04b may be used as a guide to selection of these modifying values.

SOURCE: ESCPDM

ATTACHMENT E

Table 8.04b Modifying Value for Roughness Coefficient Due to Surface Irregularity of Channels

Degree of Irregularity	Surface Comparable	Modifying Value
Smooth	The best obtainable for the materials	0.000
Minor	Well-dredged channels; slightly eroded or scoured side slope of canals or drainage channels	0.005
Moderate	Fair to poorly dredged channels; moderately sloughed or eroded side slopes of canals or drainage channels	0.010
Severe	Badly sloughed banks of natural channels; badly eroded or sloughed sides of canals or drainage channels; unshaped, jagged and irregular surfaces of channels excavated in rock	0.020

Source for Tables b - f: Estimating Hydraulic Roughness Coefficients

Step 3. Selection of modifying value for variations in the shape and size of cross sections. In considering this factor, judge the approximate magnitude of increase and decrease in successive cross sections as compared to the average. Gradual and uniform changes do not cause significant turbulence. Turbulence increases with the frequency and abruptness of alternation from large to small channel sections.

Shape changes causing the greatest turbulence are those for which flow shifts from side to side in the channel. Select modifying values based on Table 8.04c.

Step 4. Selection of modifying value for obstructions. This factor is based on the presence and characteristics of obstructions such as debris deposits, stumps, exposed roots, boulders, and fallen and lodged logs. Take care that conditions considered in other steps not be double-counted in this step.

In judging the relative effect of obstructions, consider the degree to which the obstructions reduce the average cross-sectional area at various depths and the characteristics of the obstructions. Sharp-edged or angular objects induce more turbulence than curved, smooth-surfaced objects. Also consider the

Table 8.04c Modifying Value for Roughness Coefficient Due to Variations of Channel Cross Section

Character of Variation	Modifying Value
Changes in size or shape occurring gradually	0.000
Large and small sections alternating occasionally, or shape changes causing occasional shift of main flow from side to side	0.005
Large and small sections alternating frequently, or shape changes causing frequent shift of main flow from side to side	0.010 - 0.015

SOURCE: ESCPDM

ATTACHMENT F

transverse and longitudinal position and spacing of obstructions in the reach. Select modifying values based on Table 8.04d.

Step 5. Selection of modifying value for vegetation. The retarding effect of vegetation is due primarily to turbulence induced as the water flows around and between limbs, stems, and foliage and secondarily to reduction in cross section. As depth and velocity increase, the force of flowing water tends to bend the vegetation. Therefore, the ability of vegetation to cause turbulence is related to its resistance to bending. Note that the amount and characteristics of foliage vary seasonally. In judging the retarding effect of vegetation, consider the following: height of vegetation in relation to depth of flow, its resistance to bending, the degree to which the cross section is occupied or blocked, and the transverse and longitudinal distribution of densities and heights of vegetation in the reach. Use Table 8.04e as a guide.

Step 6. Computation of n_s for the reach. The first estimate of roughness for the reach, n_s, is obtained by neglecting meandering and adding the basic n value obtained in step 1 and modifying values from steps 2 through 5.

$$n_s = n + \Sigma \text{ modifying values}$$

Step 7. Meander. The modifying value for meandering is not independent of the other modifying values. It is estimated from the n_s obtained in step 6, and the ratio of the meandering length to the straight length. The modifying value for meandering may be selected from Table 8.04f.

Step 8. Computation of n for a channel reach with meandering. Add the modifying value obtained in step 7, to n_s obtained in step 6.

The procedure for estimating roughness for an existing channel is illustrated in Sample Problem 8.04a.

Out-of-Bank Condition Channel And Flood Plain Flow

Work with natural floodways and streams often requires consideration of a wide range of discharges. At higher stages, both channel and overbank or flood plain flow may occur. Usually, the retardance of the flood plain differs significantly from that of the channel, and the hydraulic computations can be improved by subdividing the cross section and assigning different n values for flow in the channel and the flood plain. If conditions warrant, the flood plain may be subdivided further. **Do not average channel n with flood plain n.** The n value for in-bank and out-of-bank flow in the channel may be averaged.

Table 8.04d Modifying Value for Roughness Coefficient Due to Obstructions in the Channel

Relative Effect of Obstructions	Modifying Value
Negligible	0.000
Minor	0.010 to 0.015
Appreciable	0.020 to 0.0.30
Severe	0.040 to 0.060

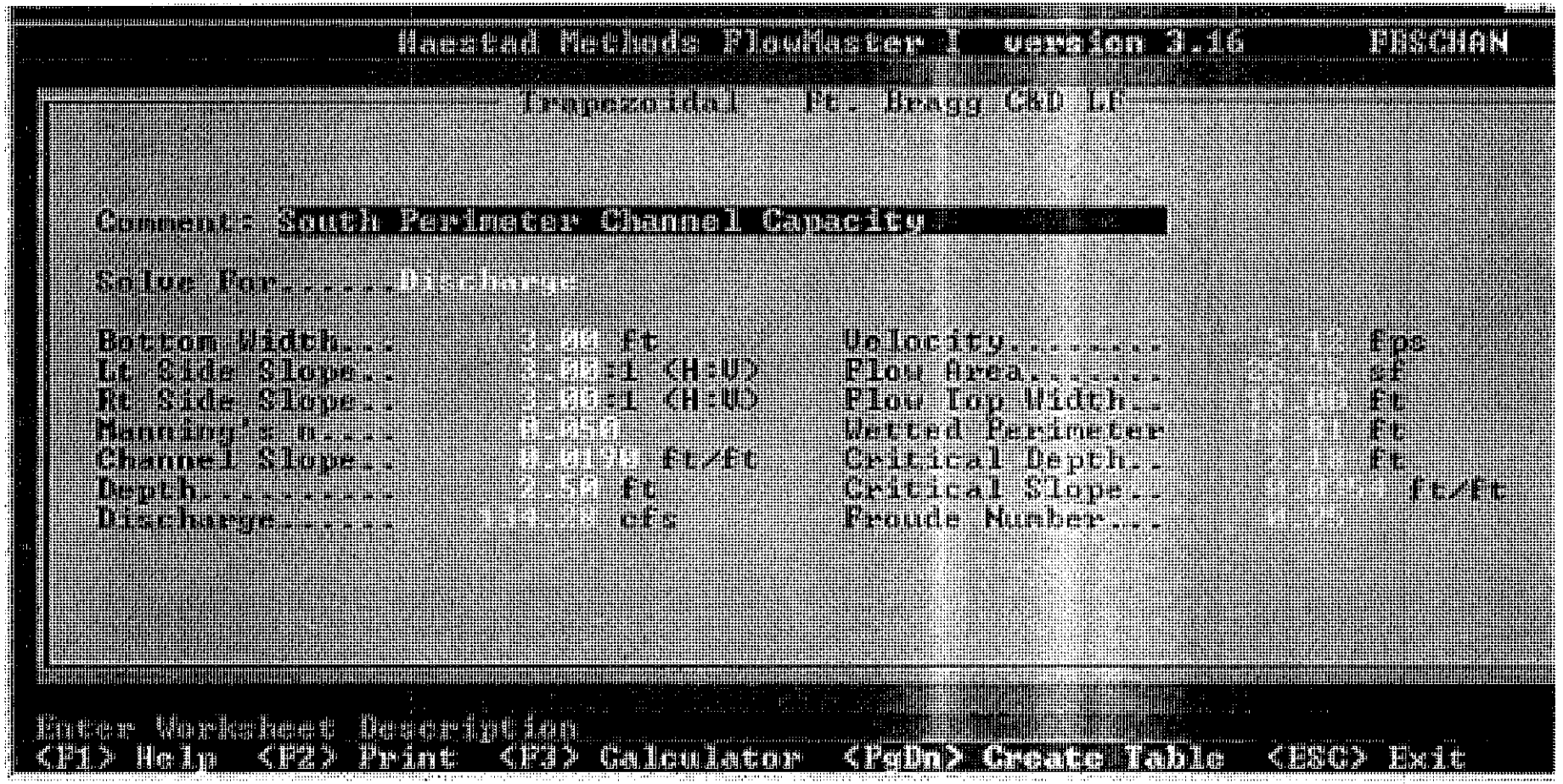
SOURCE: ESCPDM

ATTACHMENT G

Table 8.04e Modifying Value for Roughness Coefficient Due to Vegetation in the Channel

Vegetation and Flow Conditions Comparable to:	Range in Modifying Value
Low Effect Dense growths of flexible turf grass or weeds, such as Bermudagrass and Kentucky bluegrass. Average depth of flow is 2 to 3 times the height of the vegetation	0.005 to 0.010
Medium Effect Turf grasses where the average depth of flow is 1 to 2 times the height of vegetation Stemmy grasses, weeds or tree seedlings with moderate cover where the average depth of flow is 2 to 3 times the height of vegetation Brushy growths, moderately dense, similar to willows 1 to 2 years old, dormant season, along side slopes of channel with no significant vegetation along the channel bottom, where the hydraulic radius is greater than 2 feet	0.010 to 0.025
High Effect Grasses where the average depth of flow is about equal to the height of vegetation Dormant season, willow or cottonwood trees 8 - 10 years old, intergrown with some weeds and brush; hydraulic radius 2 to 4 feet 1-year old, intergrown with some weeds in full foliage along side slopes; no significant vegetation along channel bottom; hydraulic radius 2 to 4 feet Grasses where average depth of flow is less than one-half the height of vegetation	0.025 to 0.050
Very High Effect Growing season, bushy willows about 1-year old, intergrown with weeds in full foliage along side slopes; dense growth of cattails or similar rooted vegetation along channel bottom; hydraulic radius greater than 4 feet Growing season, trees intergrown with weeds and brush, all in full foliage; hydraulic radius greater than 4 feet	0.050 to 0.100

SOURCE: ESCPDM



ATTACHMENT H

ATTACHMENT I

Table 8.05a
Maximum Allowable Design Velocities[1]
for Vegetated Channels

Typical Channel Slope Application	Soil Characteristics[2]	Grass Lining	Permissible Velocity[3] for Established Grass Lining (ft/sec)
0-5%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	5.0
		Tall fescue	4.5
		Bahiagrass	4.5
		Kentucky bluegrass	4.5
		Grass-legume mixture	3.5
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	6.0
		Tall fescue	5.5
		Bahiagrass	5.5
		Kentucky bluegrass	5.5
		Grass-legume mixture	4.5
5-10%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	4.5
		Tall fescue	4.0
		Bahiagrass	4.0
		Kentucky bluegrass	4.0
		Grass-legume mixture	3.0
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	5.5
		Tall fescue	5.0
		Bahiagrass	5.0
		Kentucky bluegrass	5.0
		Grass-legume mixture	3.5
>10%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	3.5
		Tall fescue	2.5
		Bahiagrass	2.5
		Kentucky bluegrass	2.5
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	4.5
		Tall fescue	3.5
		Bahiagrass	3.5
		Kentucky bluegrass	3.5

Source: USDA-SCS Modified

NOTE: [1]Permissible Velocity based on 10-year storm peak runoff
[2]Soil erodibility based on resistance to soil movement from concentrated flowing water.
[3]Before grass is established, permissible velocity is determined by the type of temporary liner used.

Selecting Channel Cross-Section Geometry

To calculate the required size of an open channel, assume the design flow is uniform and does not vary with time. Since actual flow conditions change throughout the length of a channel, subdivide the channel into design reaches, and design each reach to carry the appropriate capacity.

The three most commonly used channel cross-sections are "V"-shaped, parabolic, and trapezoidal. Figure 8.05b gives mathematical formulas for the area, hydraulic radius and top width of each of these shapes.

SOURCE: ESCPDM

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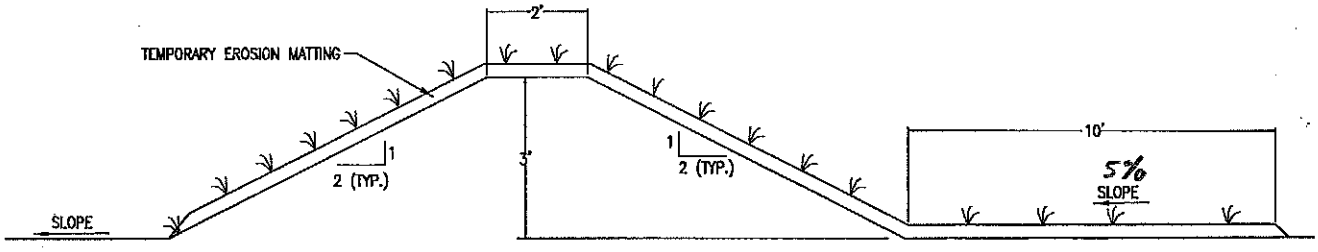
Project:	Ft. Bragg CoD Landfill	Computed:	JMH	Date:	3/9/10
Subject:	Stormwater Calcs.	Checked:	DTD	Date:	3/15/10
Task:	Diversion Berm Calcs.	Page:	1	of:	3
Job #:	120265	No:			

OBJECTIVE:

Verify proposed diversion berm design is adequate for 25-yr design storm.

ASSUMPTIONS:

① Design for 25-yr storm.
② Use procedures in June 2006 Erosion and Sediment Control Planning and Design Manual (ESCPDM).
③ Proposed diversion berm design is as follows:



1% Lateral Slope

DIVERSION BERM – GRASS LINED

NTS

3
10

NOTE:
1) EROSION MATTING SHALL HAVE A MINIMUM PERMISSIBLE UNIT SHEAR STRESS FO 1.55 lb/sqft.

PROCEDURE:

① Determine maximum flow in any sideslope swale.

Use Rational Method: $Q = CIA$ (see downpipe calcs. for definitions),

From Att. A, max. area draining to any berm = 5.51 AC. = A

Use C = 0.36 (Pasture, Heavy Soil)

I_{25} = 8.94 in/hr (Fayetteville, NC)

$\therefore Q_{25} = 0.30(8.94)(5.51) = \underline{14.78 \text{ CFS}}$

② Determine maximum flow depth on uphill side of berm:

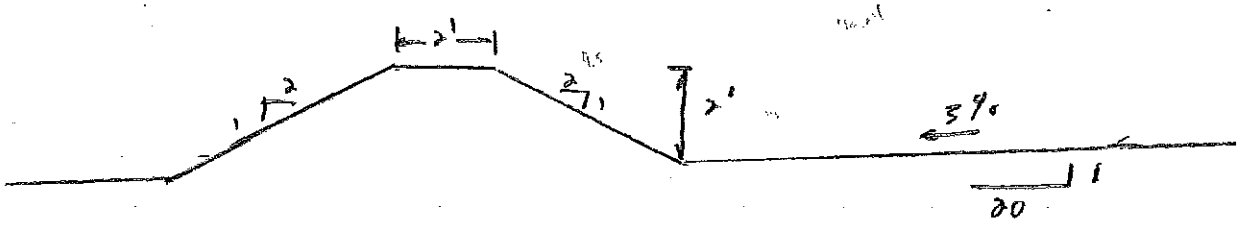
Use Manning's Eqn. for triangular channel:

$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A = \underline{14.78 \text{ CFS}}$ I GET 130 CFS FOR FLOWING FULL (130) — THIS VALUE IS FROM FLOWMASTER WHICH IS NOT FLOWING FULL.

Use $n = \underline{0.05}$ (From perimeter channel calcs.)

$S = 1\% = \underline{0.01}$ by design

Calculate flow depth and velocity behind berm using FlowMaster V. 3.16:



From A12.B Depth = $\underline{0.89 \text{ ft}} < 2'$ Flow width = 19.48'
Critical Depth = 0.65 ft
Velocity = 1.71 ft/s

③ Evaluate channel Lining:

From sideslope swale calcs., max. allowable velocity for grassed channel in easily erodible soils is 5.0 ft/s > 1.71 ft/s OK

∴ Do not need protective lining once grass is established.

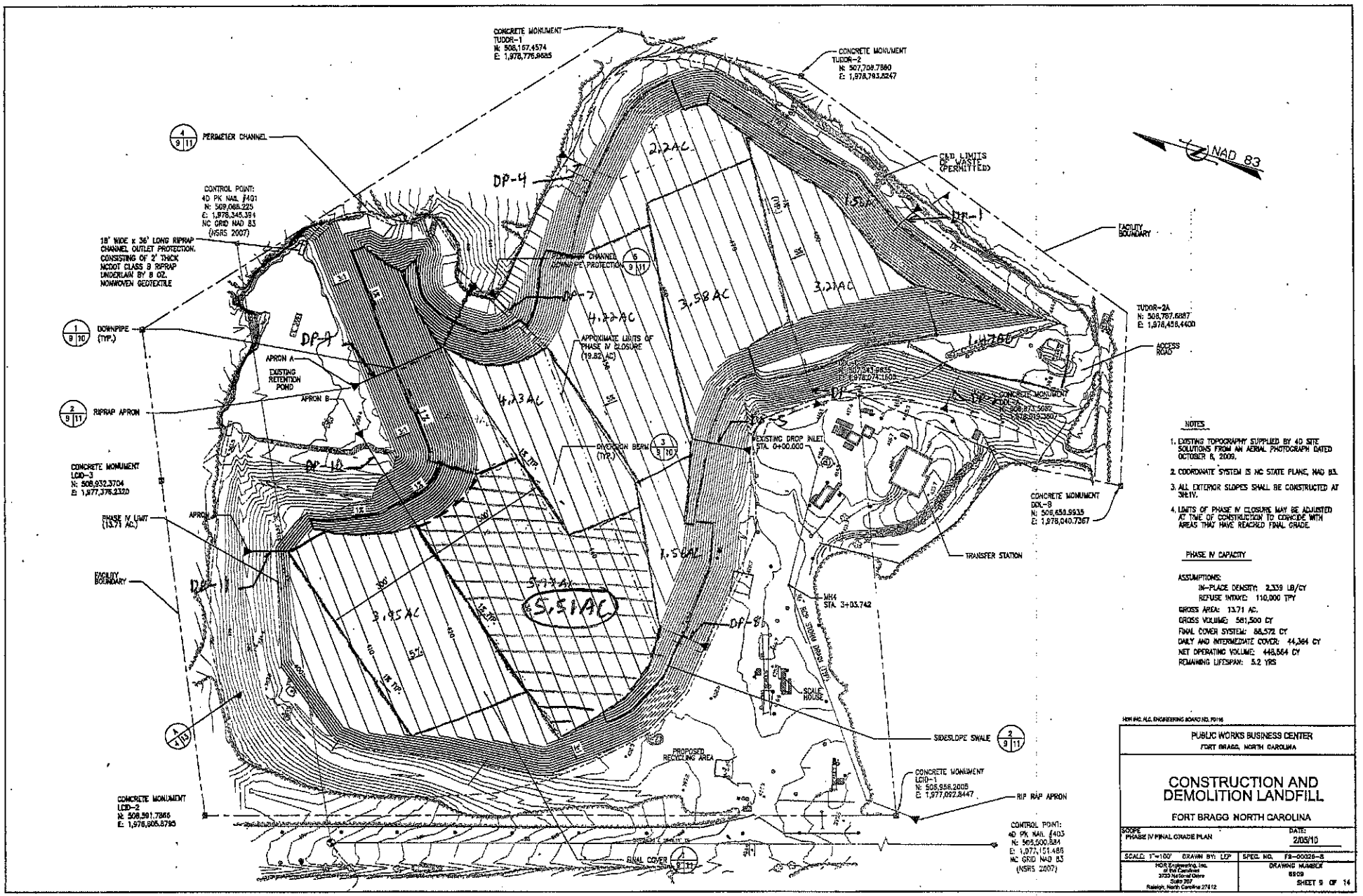
Check stability of channel prior to grass establishment:

From sideslope swale calcs., max. allowable velocity for fine sand = 2.5 ft/s > 1.71 ft/s ok

However, provide straw net blanket on berm and 10' upslope of berm to assist in grass establishment.

CONCLUSIONS:

Proposed diversion berm design is adequate to handle 25-yr storm flow. No permanent lining is needed. Temporary lining is not required based on calcs. but is recommended immediately adjacent to berm to assist in establishment of vegetation.



NOTES

1. EXISTING TOPOGRAPHY SUPPLIED BY 4D SITE SOLUTIONS FROM AN AERIAL PHOTOGRAPH DATED OCTOBER 6, 2009.
2. COORDINATE SYSTEM IS NC STATE PLANE, NAD 83.
3. ALL EXTERIOR SLOPES SHALL BE CONSTRUCTED AT 3H:1V.
4. LIMITS OF PHASE IV CLOSURE MAY BE ADJUSTED AT TIME OF CONSTRUCTION TO COINCIDE WITH AREAS THAT HAVE REACHED FINAL GRADE.

PHASE IV CAPACITY

ASSUMPTIONS:
IN-PLACE DENSITY: 2,339 LB/CY
REFUSE INTAKE: 110,000 TPY

GROSS AREA: 13.71 AC.
GROSS VOLUME: 581,500 CY
FINAL COVER SYSTEM: 88,572 CY
DAILY AND INTERMEDIATE COVER: 44,364 CY
NET OPERATING VOLUME: 448,564 CY
REMAINING LIFESPAN: 5.2 YRS

HDR INC. N.C. ENGINEERING BOARD NO. P0116

PUBLIC WORKS BUSINESS CENTER
FORT BRAGG, NORTH CAROLINA

CONSTRUCTION AND DEMOLITION LANDFILL

FORT BRAGG NORTH CAROLINA

SCOPE: PHASE IV FINAL GRADE PLAN
DATE: 2/05/10
SCALE: 1"=100' DRAWN BY: LEP
SPEC. NO. F8-00028-S
DRAWING NUMBER: 6909
SHEET 9 OF 14

HDR Engineering, Inc.
of the Carolinas
3733 National Drive
Suite 207
Raleigh, North Carolina 27612

ATTACHMENT A

ATTACHMENT B

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Project: Ft. Bragg C&D Landfill	Computed: TMY	Date: 3/1/10	
Subject: Stormwater Calcs.	Checked: DTD	Date: 3/15/10	
Task: Downpipe Calcs.	Page: 1	of: 3	
Job #: 120265	No:		

OBJECTIVE:

Verify proposed downpipe design is adequate for anticipated stormwater flows.

ASSUMPTIONS:

① Design for 25-yr storm.
② Use procedures in June, 2006 Erosion and Sediment Control Planning and Design Manual. (ESCPDM)

PROCEDURE:

① Determine max. flow into downpipe:

From drainage map (Att. A), max. drainage area into single downpipe is 5.97 AC at DP-10. Of this area, 5.51 AC is on 5% top slope and 0.46 AC on 3:1 slope

Use Rational Method: $Q = CIA$ where:
Q = peak runoff (CFS)
C = runoff coefficient
I = rainfall intensity (in/hr)
A = drainage area in acres.

From Att. B, use C range for Pasture, Heavy Soil
for 5% slopes use C = 0.30
for 3:1 slopes use C = 0.45
Composite $C = \frac{0.30(5.51\text{AC}) + 0.45(0.46\text{AC})}{5.97\text{AC}} = \underline{0.31}$

From Att. C, conservatively assume time of conc. = 5 min
∴ Q_{25} for Fayetteville = 8.94 in/hr

$\therefore Q_{25} = 0.31\,(8.94\ in/hr)(5.97\ AC) = \underline{16.55\ CFS}$

② Calculate capacity of 18" CPP w/ smooth interior wall:

Use Manning's Eqn. assuming pipe flowing full:

$Q = [\,0.463\, D^{8/3} S^{1/2}\,]/n$ where:

- Q = flow rate (CFS)
- D = pipe diameter = 18" = 1.5 ft
- S = pipe slope = 0.333 ft/ft
- n = Manning's roughness coeff. = 0.012 { From ADS-N-12 / Literature

$\therefore \underline{Q = 65.64\ CFS > 16.55\ CFS}$ OK

Flow velocity of pipe = 37.16 FPS.

③ Verify inlets of downpipes have adequate capacity.

Assume inlet control.

Max. flow through inlet at top of slope:

$Q_{25} = 0.30\,(8.94)(5.51) = 14.78\ CFS$

From Att. D, for D = 18" and Q = 14.78 CFS

$HW/D = 2.2 \Rightarrow HW = 2.2\,(18) = 39.6"$

where HW = Headwater depth at inlet.

HW available from proposed diversion berm detail = 36" < 39.

Inlets will have flared end sections, however, that will significantly improve inlet flow. Actual inlet capacity is expected to be significantly greater than shown in Att. D OK

Max. flow through sideslope inlet:

Max. area flowing to sideslope inlet = 1.19Ac at DP-9 (See Att. A)

$Q = 0.45(8.94)(1.19) = 4.79$ CFS

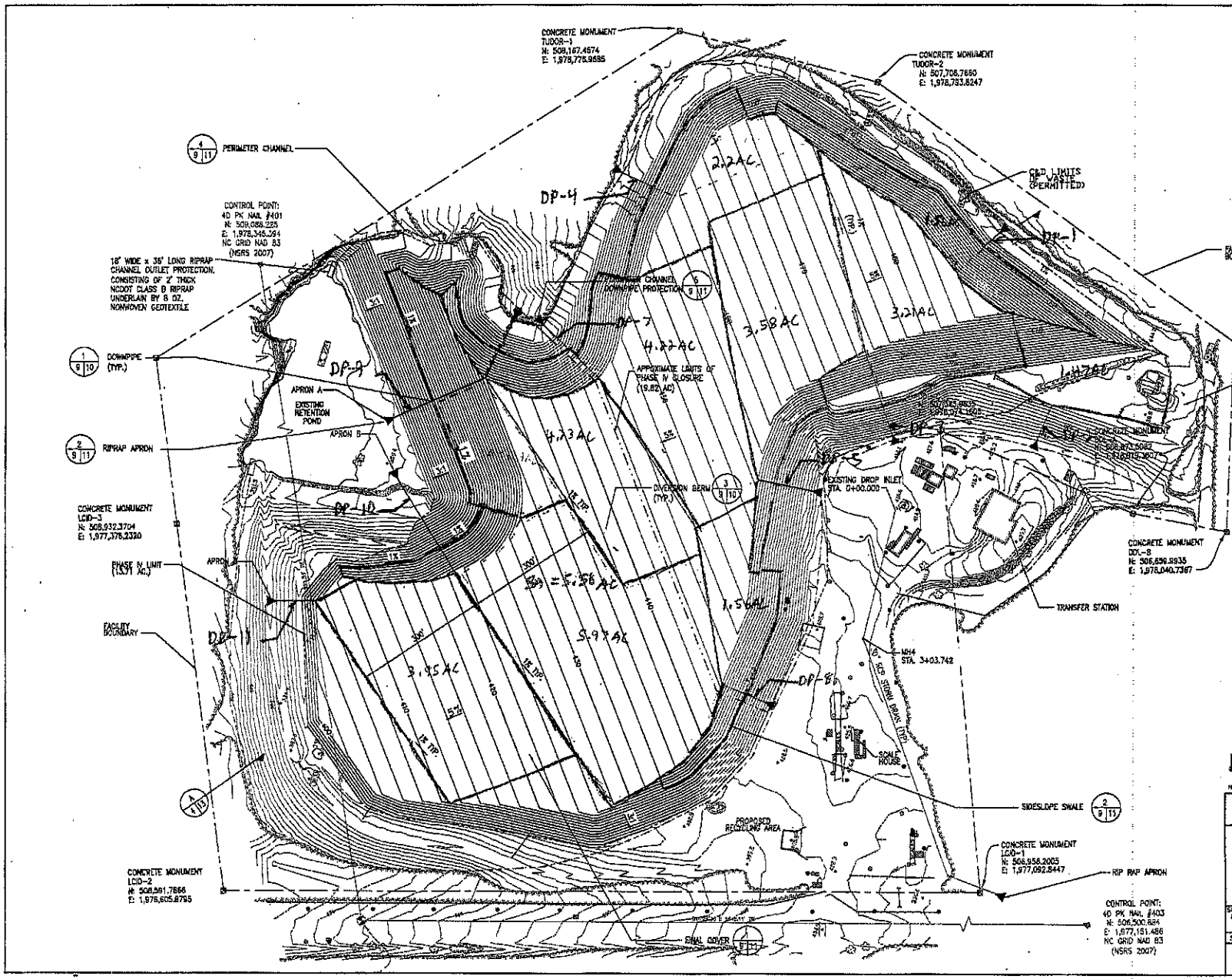
From Att. D, for D = 18" and Q = 4.79 CFS

$HW/D = 0.81 \Rightarrow HW = 0.81(18) = 14.6"$

HW available from sideslope swale detail = 2.0' > 14.6" OK

CONCLUSIONS:

Proposed downpipe design is adequate to pass 25-year storm flow.



NOTES

1. EXISTING TOPOGRAPHY SUPPLIED BY 4D SITE SOLUTIONS FROM AN AERIAL PHOTOGRAPH DATED OCTOBER 8, 2009.
2. COORDINATE SYSTEM IS NC STATE PLANE, NAD 83.
3. ALL EXTERIOR SLOPES SHALL BE CONSTRUCTED AT 3H:1V.
4. LIMITS OF PHASE IV CLOSURE MAY BE ADJUSTED AT TIME OF CONSTRUCTION TO COINCIDE WITH AREAS THAT HAVE REACHED FINAL GRADE.

PHASE IV CAPACITY

ASSUMPTIONS:
IN-PLACE DENSITY: 2,339 LB/CY
REFUSE INTAKE: 110,000 TPY
GROSS AREA: 13.71 AC.
GROSS VOLUME: 581,500 CY
FINAL COVER SYSTEM: 88,572 CY
DAILY AND INTERMEDIATE COVER: 44,364 CY
NET OPERATING VOLUME: 448,564 CY
REMAINING LIFESPAN: 5.2 YRS

DRAINAGE MAP

HDR INC. N.C. ENGINEERING BOARD NO. F0115

PUBLIC WORKS BUSINESS CENTER
FORT BRAGG, NORTH CAROLINA

CONSTRUCTION AND DEMOLITION LANDFILL

FORT BRAGG NORTH CAROLINA

SCOPE: PHASE IV FINAL GRADE PLAN	DATE: 2/05/10
SCALE: 1"=100' DRAWN BY: LEP	SPEC. NO. F9-00026-8
HDR Engineering, Inc. of the Carolinas 3733 National Drive Suite 207 Raleigh, North Carolina 27612	DRAWING NUMBER 6909 SHEET 9 OF 14

ATTACHMENT A

ATTACHMENT B

8

Table 8.03b
Value of Runoff Coefficient (C) for Rational Formula

Land Use	C
Business:	
Downtown areas	0.70-0.95
Neighborhood areas	0.50-0.70
Residential:	
Single-family areas	0.30-0.50
Multi units, detached	0.40-0.60
Multi units, Attached	0.60-0.75
Suburban	0.25-0.40
Industrial:	
Light areas	0.50-0.80
Heavy areas	0.60-0.90
Parks, cemeteries	0.10-0.25
Playgrounds	0.20-0.35
Railroad yard areas	0.20-0.40
Unimproved areas	0.10-0.30
Streets:	
Asphalt	0.70-0.95
Concrete	0.80-0.95
Brick	0.70-0.85
Drives and walks	0.75-0.85
Roofs	0.75-0.85

Land Use	C
Lawns:	
Sandy soil, flat, 2%	0.05-0.10
Sandy soil, ave., 2-7%	0.10-0.15
Sandy soil, steep, 7%	0.15-0.20
Heavy soil, flat, 2%	0.13-0.17
Heavy soil, ave., 2-7%	0.18-0.22
Heavy soil, steep, 7%	0.25-0.35
	0.30-0.60
	0.20-0.50
Agricultural land:	
Bare packed soil	0.30-0.60
Smooth	0.20-0.50
Rough	0.20-0.40
Cultivated rows	0.10-0.25
Heavy soil no crop	
Heavy soil with crop	0.15-0.45
	0.05-0.25
Sandy soil no crop	0.05-0.25
Sandy soil with crop	0.10-0.25
Pasture	
Heavy soil	0.15-0.45
Sandy soil	0.05-0.25
Woodlands	0.05-0.25

NOTE: The designer must use judgement to select the appropriate C value within the range for the appropriate land use. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have lowest C values. Smaller areas with slowly permeable soils, steep slopes, and sparse vegetation should be assigned highest C values.

Source: American Society of Civil Engineers

Source: ESCPDM

ATTACHMENT C

Raleigh, North Carolina 35.8706N, 78.7864W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	5.58	4.46	3.74	2.58	1.62	0.94	0.66	0.40	0.24	0.14
10	7.08	5.66	4.78	3.46	2.25	1.33	0.95	0.58	0.34	0.021
25	7.78	6.19	5.24	3.88	2.58	1.54	1.11	0.68	0.41	0.24
100	8.64	6.86	5.78	4.43	3.05	1.85	1.36	0.84	0.51	0.30

Fayetteville, North Carolina 35.0583N, 78.8583W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.11	4.88	4.09	2.83	1.77	1.04	0.74	0.44	0.26	0.15
10	7.96	6.36	5.36	3.88	2.53	1.54	1.10	0.66	0.39	0.23
25	8.94	7.13	6.02	4.46	2.97	1.83	1.32	0.80	0.47	0.28
100	10.44	8.29	6.99	5.35	3.69	2.29	1.69	1.03	0.62	0.36

Wilmington, North Carolina 34.2683N, 77.9061W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	7.39	5.92	4.96	3.42	2.15	1.28	0.91	0.56	0.33	0.19
10	9.70	7.75	6.54	4.74	3.08	1.94	1.39	0.87	0.51	0.30
25	10.98	8.75	7.40	5.48	3.65	2.38	1.73	1.08	0.64	0.38
100	12.92	10.27	8.65	6.63	4.56	3.18	2.37	1.49	0.89	0.53

Washington, North Carolina 35.5333N, 77.0167W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.41	5.12	4.29	2.96	1.86	1.10	0.78	0.47	0.27	0.16
10	8.38	6.70	5.65	4.09	2.66	1.64	1.19	0.72	0.42	0.25
25	9.48	7.55	6.38	4.73	3.15	1.99	1.46	0.88	0.52	0.31
100	11.16	8.87	7.47	5.72	3.94	2.58	1.93	1.18	0.70	0.42

Manteo Airport, North Carolina 35.9167N, 75.7000W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.46	5.16	4.32	2.99	1.87	1.08	0.79	0.48	0.29	0.17
10	8.47	6.77	5.71	4.14	2.69	1.62	1.20	0.74	0.44	0.27
25	9.56	7.62	6.44	4.77	3.17	1.96	1.47	0.91	0.54	0.33
100	11.26	8.95	7.54	5.77	3.98	2.54	1.95	1.21	0.73	0.44

Cape Hatteras, North Carolina, 35.2322N, 75.6225W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	7.20	5.75	4.82	3.33	2.09	1.29	0.94	0.58	0.34	0.20
10	9.41	7.52	6.35	4.80	2.99	1.93	1.43	0.89	0.53	0.31
25	10.66	8.49	7.18	5.31	3.54	2.33	1.75	1.09	0.65	0.38
100	12.53	9.95	8.39	6.42	4.42	3.03	2.32	1.45	0.88	0.51

Source: ESCPDM

ATTACHMENT D

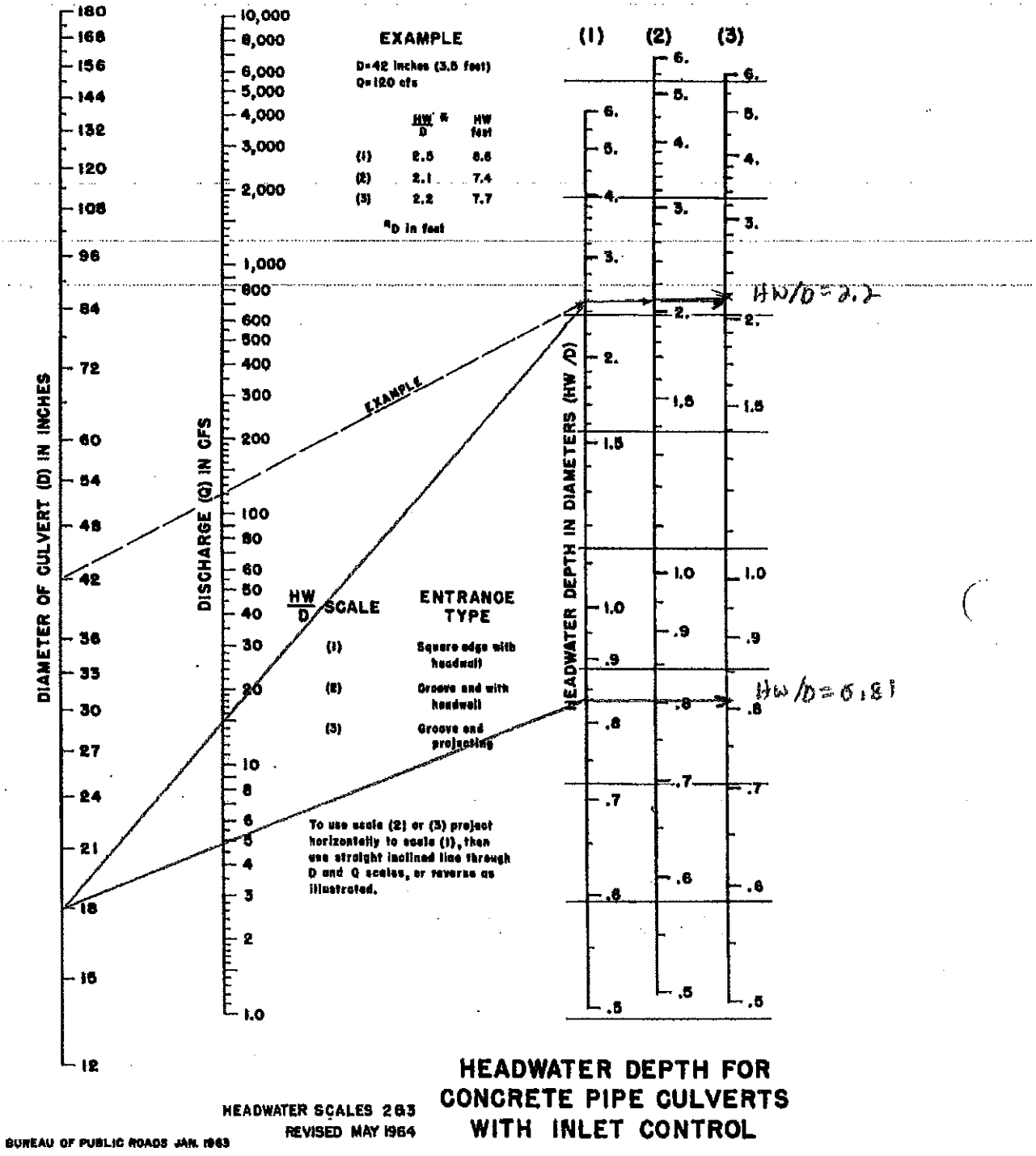


Figure 4.3-2(a) Headwater Depth for Concrete Pipe Culvert with Inlet Control

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Project: Ft. Bragg CAD Landfill	Computed:	Date:	3/10/10
Subject: Geotechnical Calcs	Checked: DPD	Date:	3/15/10
Task: Final Cover Stability	Page: 1	of:	2
Job #: 180265	No:		

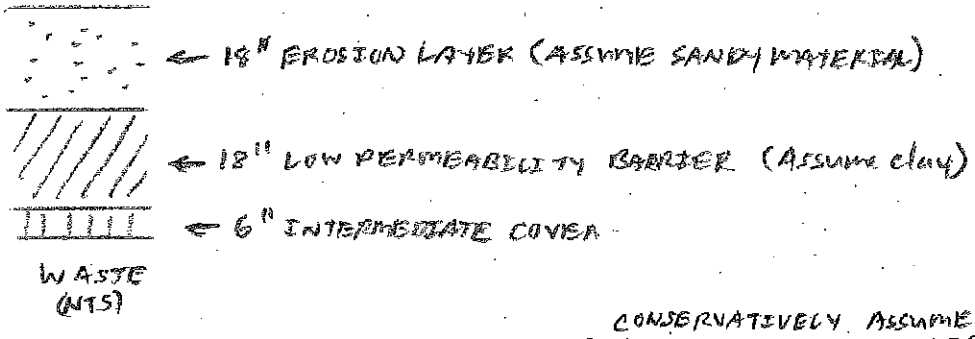
OBJECTIVE:

Evaluate stability of proposed final cover.

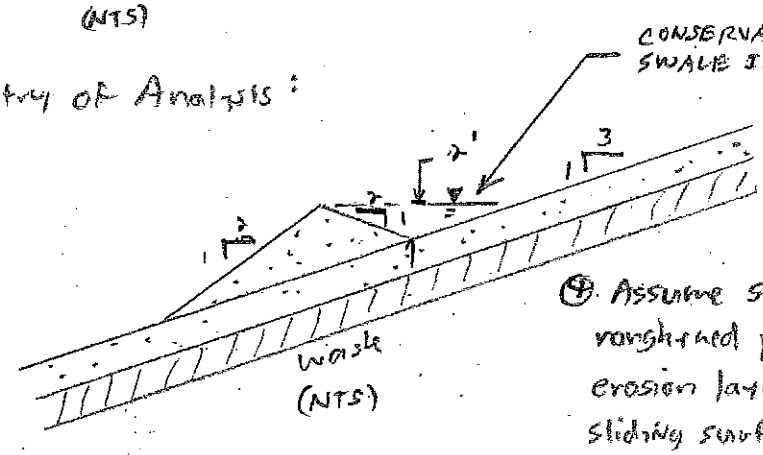
ASSUMPTIONS:

① Most critical part of final cover system is where sideslope swales are constructed over final cover.

② Final cover consists of the following:



③ Geometry of Analysis:



④ Assume surface of clay is roughened prior to placement of erosion layer to eliminate smooth sliding surface between soils.

PROCEDURE:

① Select Final Cover Soil Properties:

Erosion Layer:

Assume compacted sandy soil (SP): (See Att. A)
- Dry density (γ_d) ≈ 110 lb/ft³
- Opt. moisture content ≈ 17%
- Total unit wt. ≈ 110 + 0.17(110) = 129 lb/ft³ = γ_w
- C = 0, ϕ = 37°

Low Permeability Barrier:

Assume compacted high plasticity clay (CH): (See Att. A)
- γ_d ≈ 90 lb/ft³
- Opt. moisture content ≈ 28%
- γ_w ≈ 90 + 0.28(90) = 115 lb/ft³
- C = 230 lb/ft², ϕ = 19°

Waste; (See Global Stability Calcs).
- γ_w = 113 lb/ft³
- C = 0, ϕ = 33°

② Run stability analyses using PCSTABL5m and STEDwin 2.74 editor.

Evaluate circular arc failure surface using Modified Bishop method.
Evaluate sliding block failure surface using Modified Janbu Method.
Represent weight of water in swale as soil with unit wt. of 62.4 lb/ft³ and zero strength.

Results: Circular Arc – Min FS = 1.52
Sliding Block – Min FS = 1.95
} See Att. B.

CONCLUSION:

Proposed final cover for landfill is adequately stable.

TABLE 1
Typical Properties of Compacted Soils

Group Symbol	Soil Type	Range of Maximum Dry Unit Weight, pcf	Range of Optimum Moisture, Percent	Typical Value of Compression		Typical Strength Characteristics				Typical Coefficient of Permeability ft./min.	Range of CBR Values	Range of Subgrade Modulus k lbs/cu in. psi/in
				At 1.4 tsf (20 psi)	At 3.6 tsf (50 psi)	Cohesion (as compacted) psf	Cohesion (saturated) psf	ϕ (Effective Stress Envelope Degrees)	Tan ϕ			
				Percent of Original Height								
GW	Well graded clean gravels, gravel-sand mixtures.	125 - 135	11 - 8	0.3	0.6	0	0	>38	>0.79	5×10^{-2}	40 - 80	300 - 500
GP	Poorly graded clean gravels, gravel-sand mix	115 - 125	14 - 11	0.4	0.9	0	0	>37	>0.74	10^{-1}	30 - 60	250 - 400
GM	Silty gravels, poorly graded gravel-sand-silt.	120 - 135	12 - 8	0.5	1.1	.....	.....	>34	>0.67	$>10^{-6}$	20 - 60	100 - 400
GC	Clayey gravels, poorly graded gravel-sand-clay.	115 - 130	14 - 9	0.7	1.6	.....	.....	>31	>0.60	$>10^{-7}$	20 - 40	100 - 300
SW	Well graded clean sands, gravelly sands.	110 - 130	16 - 9	0.6	1.2	0	0	38	0.79	$>10^{-3}$	20 - 40	200 - 300
SP	Poorly graded clean sands, sand-gravel mix.	100 - 120	21 - 12	0.8	1.4	0	0	37	0.74	$>10^{-3}$	10 - 40	200 - 300
SM	Silty sands, poorly graded sand-silt mix.	110 - 125	16 - 11	0.8	1.6	1050	420	34	0.67	$5 \times >10^{-5}$	10 - 40	100 - 300
SM-SC	Sand-silt clay mix with slightly plastic fines.	110 - 130	15 - 11	0.8	1.4	1050	300	33	0.66	$2 \times >10^{-6}$	5 - 30	100 - 300
SC	Clayey sands, poorly graded sand-clay-mix.	105 - 125	19 - 11	1.1	2.2	1550	230	31	0.60	$5 \times >10^{-7}$	5 - 20	100 - 300
ML	Inorganic silts and clayey silts.	95 - 120	24 - 12	0.9	1.7	1400	190	32	0.62	$>10^{-5}$	15 or less	100 - 200
ML-CL	Mixture of inorganic silt and clay.	100 - 120	22 - 12	1.0	2.2	1350	460	32	0.62	$5 \times >10^{-7}$	.....	
CL	Inorganic clays of low to medium plasticity.	95 - 120	24 - 12	1.3	2.5	1800	270	28	0.54	$>10^{-7}$	15 or less	50 - 200
OL	Organic silts and silt-clays, low plasticity.	80 - 100	33 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	50 - 100
MH	Inorganic clayey silts, elastic silts.	70 - 95	40 - 24	2.0	3.8	1500	420	25	0.47	$5 \times >10^{-7}$	10 or less	50 - 100
CH	Inorganic clays of high plasticity	75 - 105	36 - 19	2.6	3.9	2150	230	19	0.35	$>10^{-7}$	15 or less	50 - 150
OH	Organic clays and silty clays	65 - 100	45 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	25 - 100

Notes:

1. All properties are for condition of "Standard Proctor" maximum density, except values of k and CBR which are for "modified Proctor" maximum density.
2. Typical stength characteristics are for effective strength envelopes and are obtained from USBR data.
3. Compression values are for vertical loading with complete lateral confinement.
4. (>) indicates that typical property is greater than the value shown.
   (..) indicates insufficient data available for an estimate.

Source: NAFAC DM 7.2

ATTACHMENT A

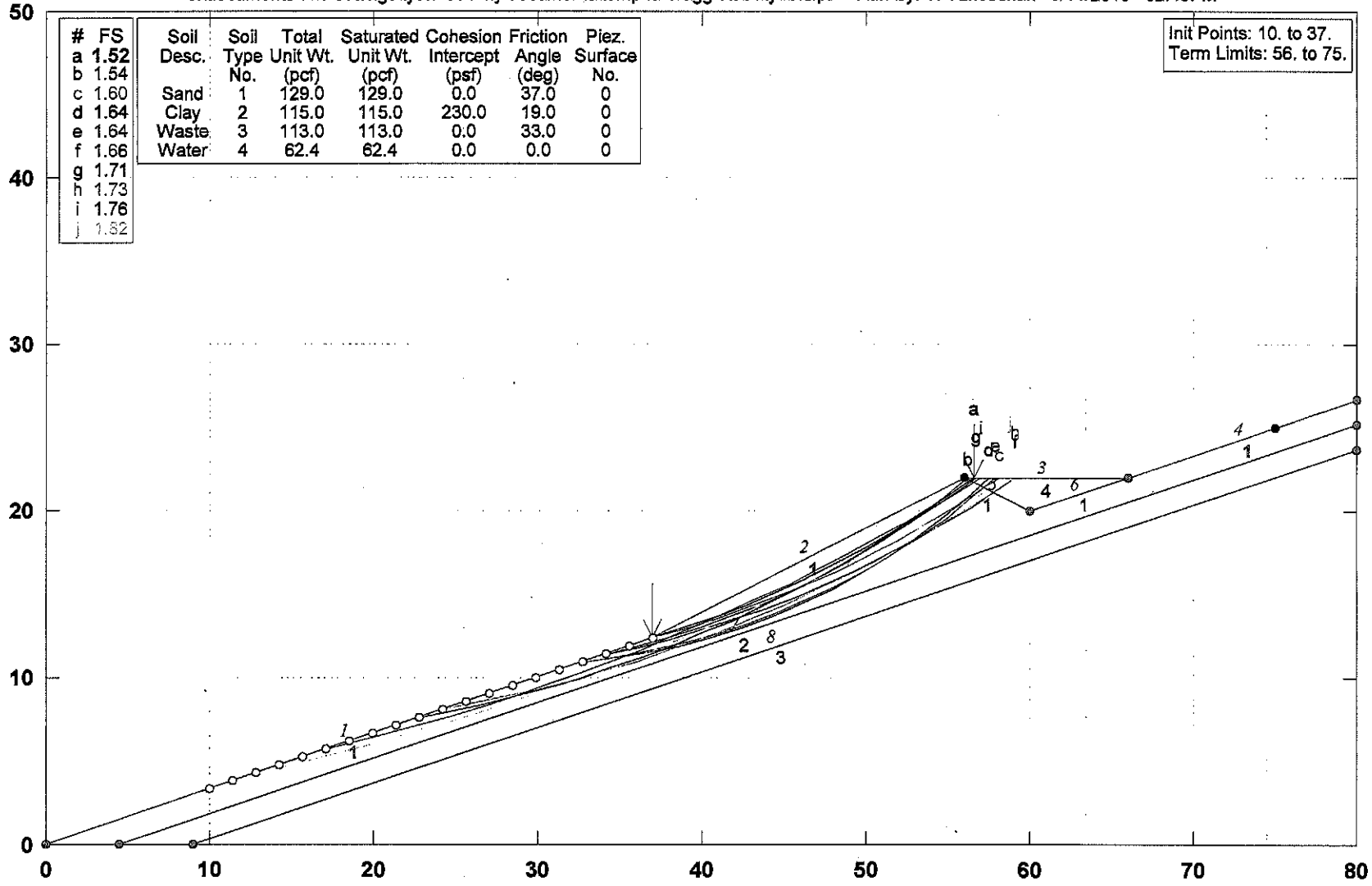
Fort Bragg C&D Landfill Final Cover Stability

c:\documents and settings\tyanosch\my documents\temp\ft. bragg stability\fbfc.pl2 Run By: T. Yanoschak 3/11/2010 02:48PM

#	FS
a	1.52
b	1.54
c	1.60
d	1.64
e	1.64
f	1.66
g	1.71
h	1.73
i	1.76
j	1.82

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Sand	1	129.0	129.0	0.0	37.0	0
Clay	2	115.0	115.0	230.0	19.0	0
Waste	3	113.0	113.0	0.0	33.0	0
Water	4	62.4	62.4	0.0	0.0	0

Init Points: 10. to 37.
Term Limits: 56. to 75.



PCSTABL5M/si FSmin=1.52

Safety Factors Are Calculated By The Modified Bishop Method

STED

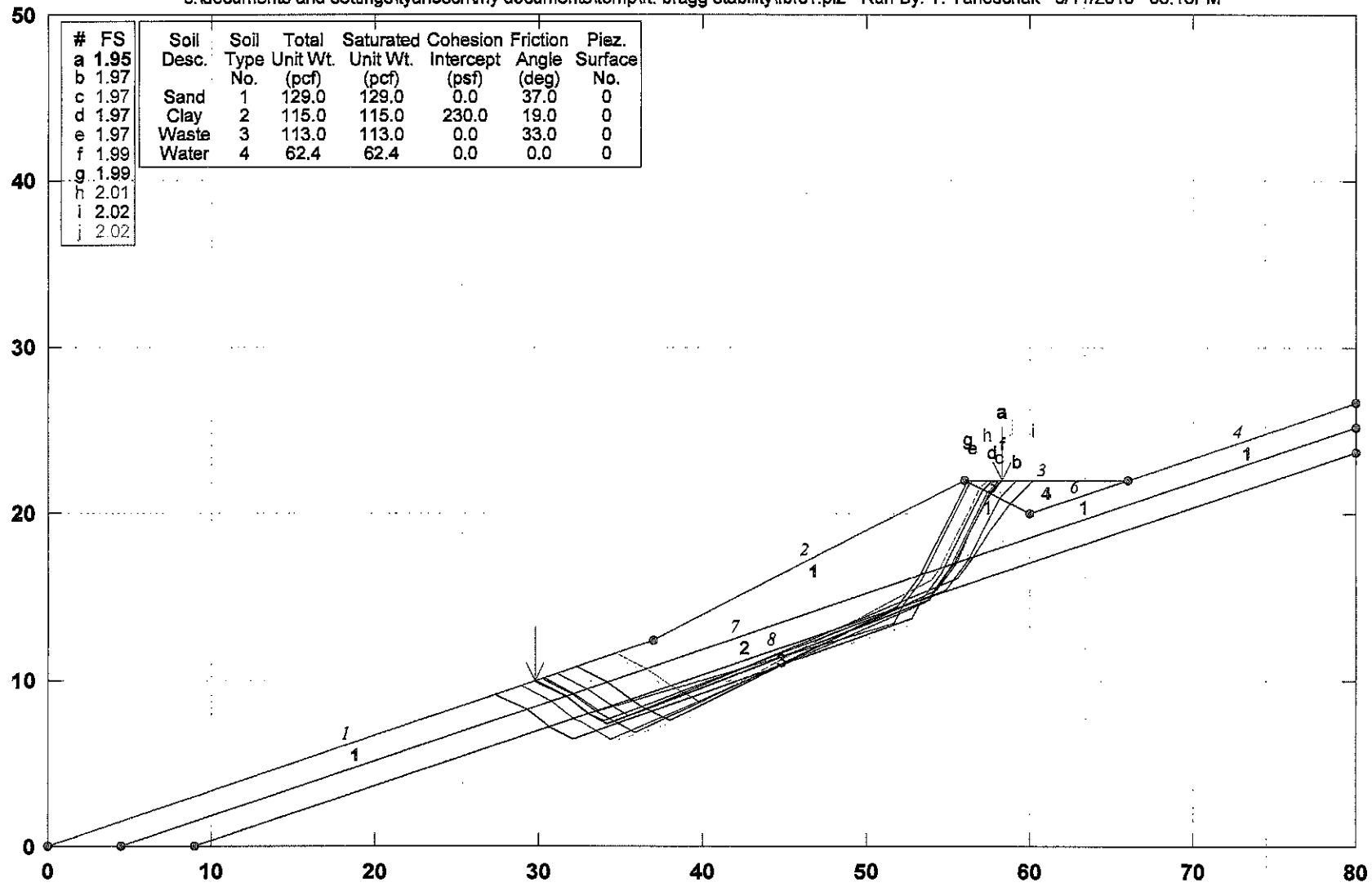
ATTACHMENT B

Fort Bragg C&D Landfill Final Cover Stability - Sliding Blocki

c:\documents and settings\tyanosch\my documents\temp\ft. bragg stability\fbfc1.pl2 Run By: T. Yanoschak 3/11/2010 03:13PM

#	FS
a	1.95
b	1.97
c	1.97
d	1.97
e	1.97
f	1.99
g	1.99
h	2.01
i	2.02
j	2.02

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Sand	1	129.0	129.0	0.0	37.0	0
Clay	2	115.0	115.0	230.0	19.0	0
Waste	3	113.0	113.0	0.0	33.0	0
Water	4	62.4	62.4	0.0	0.0	0



PCSTABL5M/si FSmin=1.95

STED

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

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Project:	Ft. Bragg C&D Landfill	Computed:	TMM	Date:	3/10/10
Subject:	Geotechnical Calcs.	Checked:	DTD	Date:	3/15/10
Task:	Global Stability	Page:	1	of:	3
Job #:	170265	No:			

OBJECTIVE:

Verify proposed C&D landfill design is adequately stable with respect to global stability.

ASSUMPTIONS:

① Minimum acceptable factors of safety = 1.5 (static) and 1.0 (seismic)

PROCEDURE:

① Determine if landfill is in seismic impact zone (2% prob. of exceedance in 50 yrs)

From Att. A, site is located in area where peak horizontal acceleration ≥ 0.11g > 0.10g. ∴ site is located in seismic impact zone.

② Select critical cross-sections:

Evaluate two different cross-sections that are expected to yield lowest factors of safety through development of landfill.

See Att. B — Phase II
See Att. C — Phase IV

These sections represent highest/steepest slopes.

③ Select C&D waste properties:

From permit application, in-place waste density = 2,339 lb/cy
= 86.63 lb/ft³
Conservatively assum 4:1 waste: cover ratio
The April 2004 Design Hydrogeologic report indicates

See Att. D

the subsurface soils at the site generally consist of medium dense to dense sand with various amounts of clay. Based on Shelby tube samples from site, wet density of soils (γ_w) ≈ 130 lb/ft³
Assuming similar soils will be used for cover:

$$\gamma_w \text{ (waste + soil)} = 86.63 + 0.20(130) = 112.63 \text{ lb/ft}^3$$
$$\therefore \text{ use } \gamma_{waste} = \underline{113 \text{ lb/ft}^3}$$

From Att. E, strength parameters for MSW can be approximated with $\phi = \underline{33^\circ}$, $\underline{c = 0}$. Conservatively assume C&D waste will have same properties.

④ Select Foundation Soil Properties:

From Att. D, assume $\gamma_w = \underline{130 \text{ lb/ft}^3}$

From Att. F, conservatively assume ϕ for medium dense to dense sandy soils = $\underline{32^\circ}$ and $\underline{c = 0}$

⑤ Select potentiometric surface:

Use potentiometric surface from April 2004 Design Hydrogeologic report shown on Sheet 14 of permit drawings.

⑥ Run stability analysis using PCSTABL5M and STEDwin 2.74 editor. For pseudo-static seismic analysis, use horizontal acceleration of 1/2 peak horizontal acceleration
= 1/2(0.11g) = 0.06g {source: RCRA subtitle D (258) seismic Design Guidance for Municipal Solid Waste Landfills, p. 110}
Use Bishop circular arc method.

RESULTS:

Phase II (static)	Min. FS = 1.96 > 1.5 OK	FB PH 2
Phase III (seismic)	" = 1.63 > 1.00 OK	FB PH 2S
Phase IV (static)	" = 1.97 > 1.5 OK	FB PH 4
Phase V (seismic)	" = 1.64 > 1.00 OK	FB PH 4S

(see Att. G for output plots)

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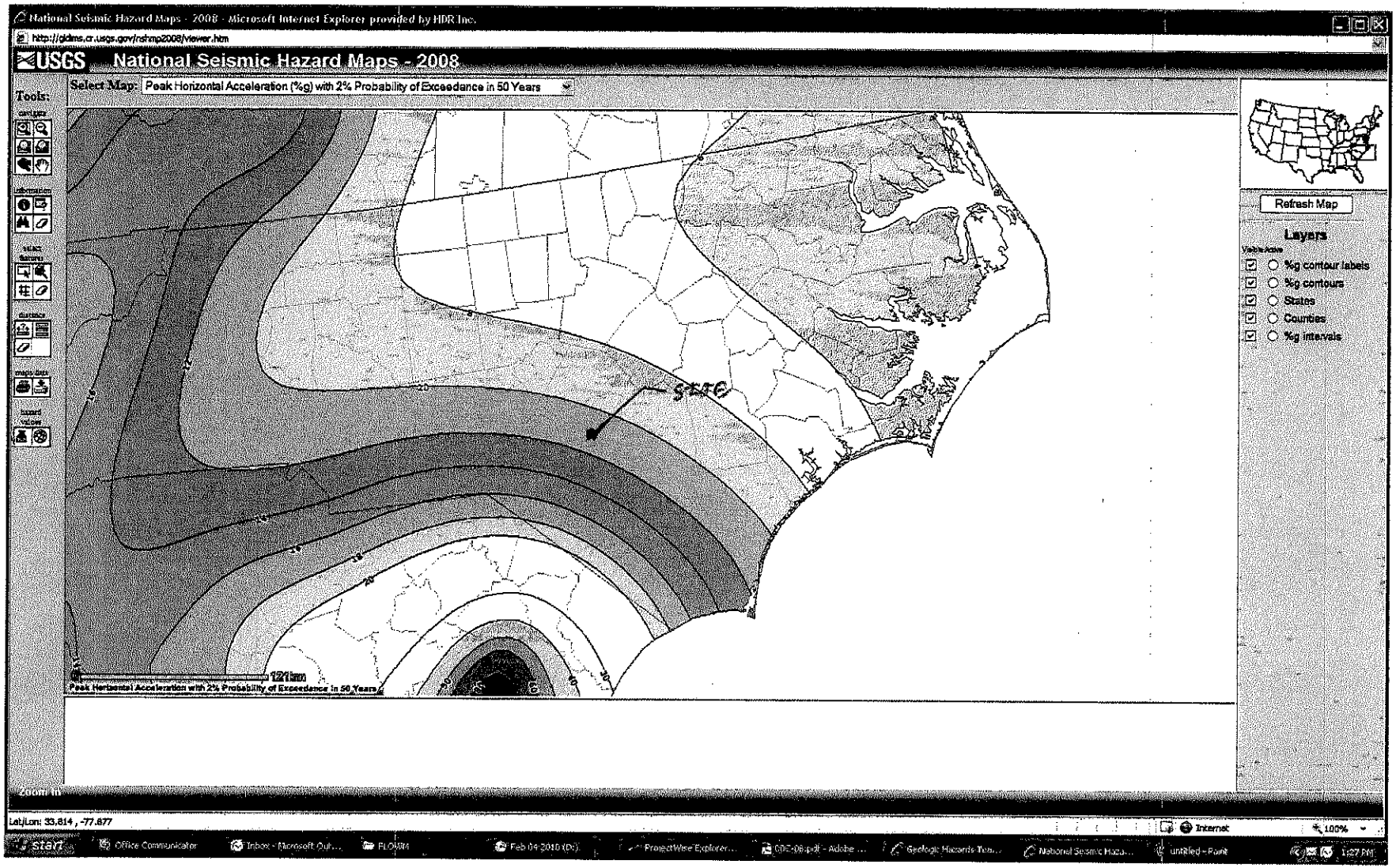
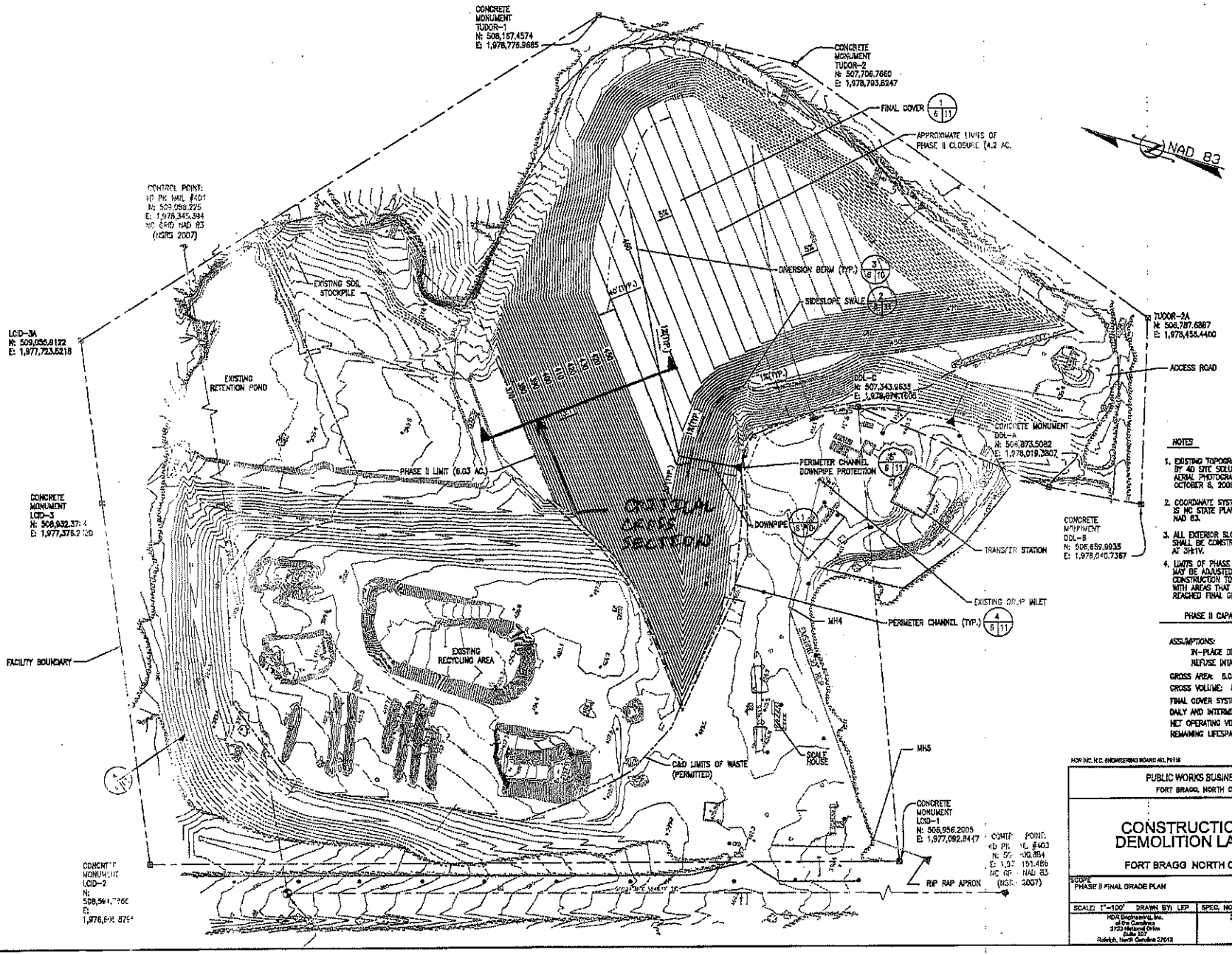
Project:	Computed:	Date:
Subject:	Checked:	Date:
Task:	Page:	of:
Job #:	No:	

CONCLUSIONS:

Proposed Ft. Bragg C&D Landfill expansion design is sufficiently stable under both static and seismic conditions.



ATTACHMENT A



NOTES

1. EXISTING TOPOGRAPHY SUPPLIED BY 40 SITE SOLUTIONS FROM AN AERIAL PHOTOGRAPH DATED OCTOBER 8, 2009.
2. COORDINATE SYSTEM IS NC STATE PLANE. NAD 83.
3. ALL EXTERIOR SLOPES SHALL BE CONSTRUCTED AT 3H:1V.
4. LIMITS OF PHASE II CLOSURE MAY BE ADJUSTED AT TIME OF CONSTRUCTION TO COINCIDE WITH AREAS THAT HAVE REACHED FINAL GRADE.

PHASE II CAPACITY

ASSUMPTIONS:
IN-PLACE DENSITY: 2,339 LB/CY
REFUSE INTAKE: 110,000 TPY

GROSS AREA: 6.03 AC.
GROSS VOLUME: 530,100 CY
FINAL COVER SYSTEM: 27,588 CY
DAILY AND INTERMEDIATE COVER: 45,226 CY
NET OPERATING VOLUME: 457,286 CY
REMAINING LIFESPAN: 5.3 YRS

HDR INC. N.C. ENGINEERING BOARD NO. F0118

PUBLIC WORKS BUSINESS CENTER
FORT BRAGG, NORTH CAROLINA

CONSTRUCTION AND DEMOLITION LANDFILL

FORT BRAGG NORTH CAROLINA

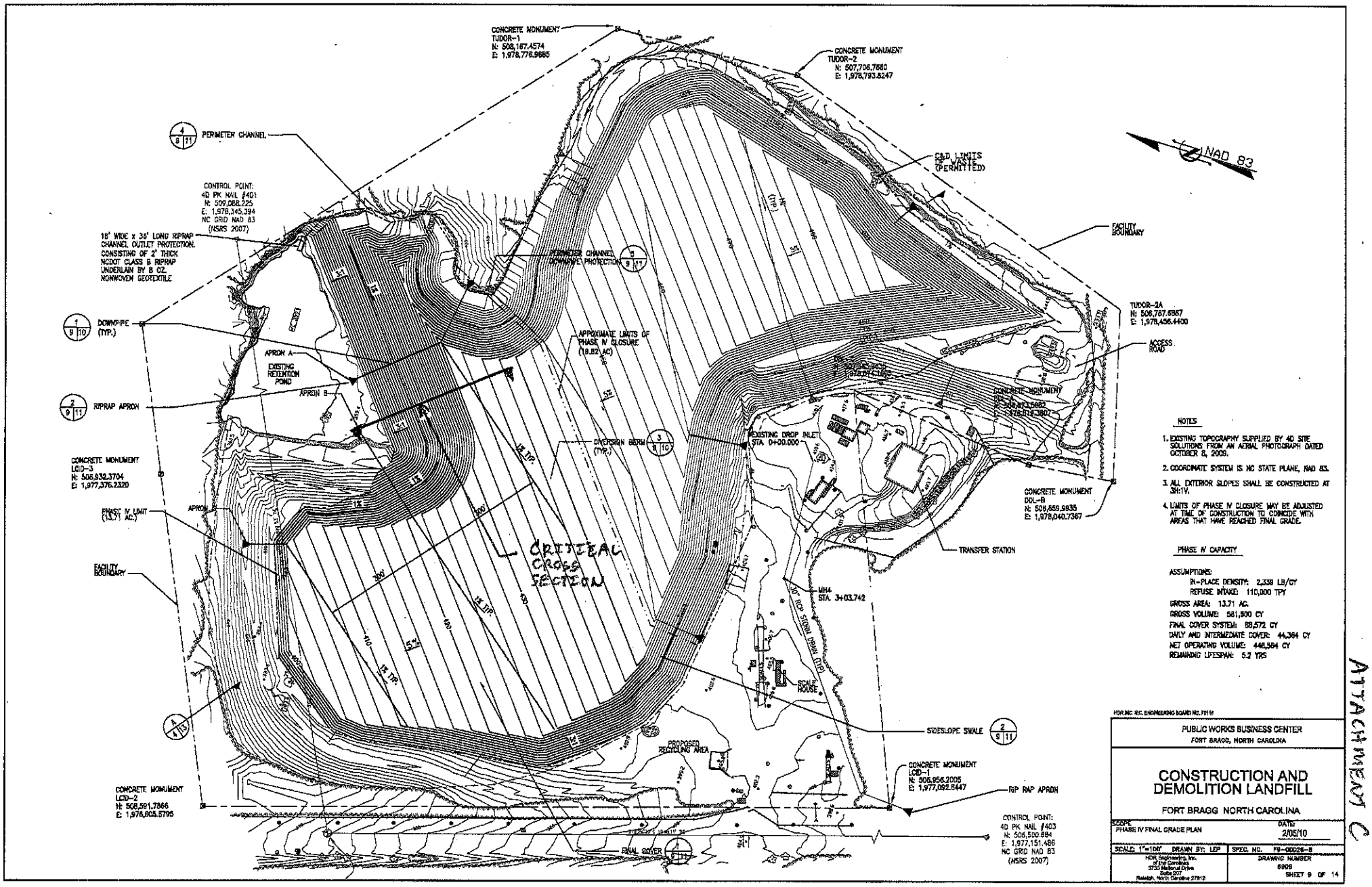
SCOPE: PHASE II FINAL GRADE PLAN
DATE: 2/05/10

SCALE: 1"=100' DRAWN BY: LEP
SPEC. NO. F9-00026-B

HDR Engineering, Inc. of the Carolinas
2723 National Drive
Suite 207
Raleigh, North Carolina 27612

DRAWING NUMBER 6909
SHEET 5 OF 14

ATTACHMENT B



NOTES

1. EXISTING TOPOGRAPHY SUPPLIED BY 4D SITE SOLUTIONS FROM AN AERIAL PHOTOGRAPH DATED OCTOBER 8, 2009.
2. COORDINATE SYSTEM IS NC STATE PLANE, NAD 83.
3. ALL EXTERIOR SLOPES SHALL BE CONSTRUCTED AT 3H:1V.
4. LIMITS OF PHASE IV CLOSURE MAY BE ADJUSTED AT TIME OF CONSTRUCTION TO COINCIDE WITH AREAS THAT HAVE REACHED FINAL GRADE.

PHASE IV CAPACITY

ASSUMPTIONS:
IN-PLACE DENSITY: 2,339 LB/CY
REFUSE INTAKE: 110,000 TPY

GROSS AREA: 13.71 AC.
GROSS VOLUME: 561,800 CY
FINAL COVER SYSTEM: 88,572 CY
DAILY AND INTERMEDIATE COVER: 44,364 CY
NET OPERATING VOLUME: 448,584 CY
REMAINING LIFESPAN: 5.2 YRS

FOR NC P.E. ENGINEERING BOARD NO. F0110

PUBLIC WORKS BUSINESS CENTER
FORT BRAGG, NORTH CAROLINA

CONSTRUCTION AND DEMOLITION LANDFILL

FORT BRAGG NORTH CAROLINA

SCOPE	DATE
PHASE IV FINAL GRADE PLAN	2/05/10

SCALE: 1"=100'	DRAWN BY: LEP	SPEC. NO. FB-00026-B
HDR Engineering, Inc. of the Carolinas, 3733 National Drive, Suite 207, Raleigh, North Carolina 27612		DRAWING NUMBER 6909, SHEET 9 OF 14

ATTACHMENT C

TABLE NO. 2: Soil Analytical Test Results

Location	Gradation Results- % Passing						Atterburg Limits, %			USCS	Wet Den., pcf	Moist. Content, %	Dry Den., pcf	Porosity, %	Coef. of Perm. cm/sec
	No. 8	No.16	No.30	No. 50	No. 100	No.200	LL	PL	PI						
MW-4 (top)	100	86	30	12	4.7	1.3	--	NP	NP	SP	125.9	23.0	102.4	37.0	$7.2X10^{-5}$
MW-4 (Bottom)	---	---	---	---	---	64.2	39	15	24	CL	135.6	19.6	113.4	31.4	$9.5X10^{-7}$
MW-5	100	89	47	13	3.6	0.8	--	NP	NP	SP	131.6	16.9	112.6	31.9	$1.4X10^{-4}$
MW-6 (Top)	100	75	26	13	5.9	4.7	--	NP	NP	SP	133.4	22.0	109.3	33.9	$8.3X10^{-5}$
MW-6 (Bottom)	---	---	---	---	---	73.5	27	16	11	CL	139.1	17.3	118.6	28.3	$2.9X10^{-7}$
MW-7	---	---	---	---	---	60.4	42	13	29	CL	131.1	19.3	109.9	33.5	$6.4X10^{-7}$
MW-8	100	98	82	33	5.6	2.8	--	NP	NP	SP	125.5	26.6	99.2	40.0	$4.9X10^{-5}$
MW-9	100	94	41	12	5.6	2.0	--	NP	NP	SP	130.4	17.8	110.7	33.1	$3.2X10^{-4}$

Typical ≈ 130 pcf

ATTACHMENT D

Source: April 2004 Design Hydrogeologic Report, HDR

ATTACHMENT E

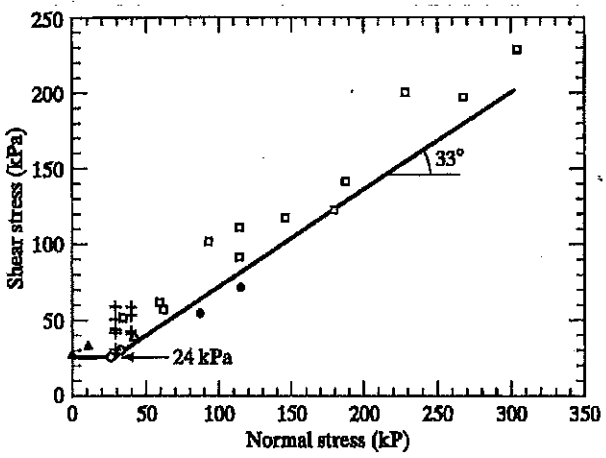


FIGURE 6.8 Shear Strength of Municipal Solid Waste from Different Locations (modified from Kavazanjian et al., 1995). Used with permission of ASCE.

The strength of municipal solid waste appears to increase with increasing norm stress (confining pressure), in much the same way as a soil. On the other hand, its hig organic and "fiber" content immediately after placement make it behave more like fibrous peat than a mineral soil (Landva and La Rochelle, 1983). The fiber content o municipal solid waste will remain relatively constant, but the putresible organic con tent will decrease with time. Therefore, some changes in geotechnical properties mu be expected. Also, municipal solid waste can be extremely heterogeneous, so tha sample taken at one location may not be indicative of the "average" properti (Howland and Landva, 1992).

The date of waste placement may also be a factor as well. Consider, for examp the increased use of plastics for packaging in the 1960's. Landva and Clark (1990) no that the friction angle between plastic bags is approximately 9 degrees (Figure 6.5 While plastics in the waste stream do not appear to reduce the average bulk strength of municipal solid waste to 9 degrees, Landva and Clark (1990) measured a friction angle of 24 degrees for a shredded refuse with a high plastic content (Figure 6.5).

Municipal solid waste placed in the 1990's again may behave differently than municipal solid waste of previous eras. Permitted landfill air space has become increasingly valuable and, therefore increased compactive effort is seen as a way to place more waste into the same space. Also, stricter enforcement of daily soil cover requirements will tend to increase the average density of the landfill mass. It is unknown whether the effect of increased density of the layered waste and daily cover on stability will be offset by a corresponding increase in strength. Increased recycling also will have an uncertain effect on waste composition and strength. Conversely, the use of alternative daily cover materials (ADCMs), in place of the customary 6 inches (150 mm) of soil, would greatly decrease the overall unit weight. Pohland and Gin (1993) present the following categories of ADCMs, all of which have the effect of decreasing the overall unit weight of MSW:

(i) Polymer foams,
(ii) Slurry sprays (paper or woodchip based),
(iii) Sludges and indig
(iv) Reusable geosynt

Perhaps the grea municipal solid waste Mohr-Coulomb theory under go large deform relevant? Failure is co strength or alternativel At what strain should f

Singh and Murph formed on Shelby tube continued to increase v tests conducted in Mo large deformations bu Based on this and otl Coulomb charac- -iza failure (through wa situation could differ d present case histories either within the was beneath the waste. Fail

In general, howe liner system or within mate the strength proj important (Fassett et materials properly, as v

COMPRESSIBILITY OF M

The compressibility of Early work focussed o sites. As the practice c scarce the focus shifted waste volume (Fassett summarized as follows:

(i) The majority of t
(ii) Increased compa
(iii) Settlement under (Fassett et al., 19

Two main fac ors density of the wa and pression); and the moi which affect physico-ch

ATTACHMENT F

Table 5-1 Typical values of e_{max}, e_{min}, unit weight and angle of internal friction (used in Chap. 13) for several soils

	Loose			Dense		
	Dry unit weight	e_{max}†	ϕ‡	Dry unit weight	e_{min}†	ϕ‡
Gravel	16.0–18.0	0.62–0.44	32–36°	18.0–20.0	0.44–0.30	35–50°
Coarse sand	15.0–17.5	0.73–0.50	32–38	17.5–19.6	0.50–0.33	35–48
Clayey sand	14.0–16.5	0.86–0.58	28–32	16.5–18.5	0.58–0.40	35–40
Silty sand	12.6–15.5	1.05–0.68	28–32	15.5–17.5	0.68–0.49	32–38
Fine sand	14.0–18.5	0.86–0.40	27–33	15.5–18.0	0.68–0.44	33–39
Sandy gravel	15.0–18.0	0.73–0.44	30–38	18.0–22.0	0.44–0.18	36–45
Gravelly sand	15.0–18.0	0.73–0.44	30–38	18.0–22.5	0.44–0.16	36–50
Silt	14.0–15.5	0.86–0.68	20–30	15.5–17.5	0.68–0.49	25–32

† Depends on G_s generally ranging from 2.65–2.72.
‡ Use higher values for angular particles.

where ϕ is termed the *angle of internal friction* of the soil. A lower limiting value for a dry sand, gravel, or sand-gravel mixture may be estimated as the angle formed from carefully pouring a quantity into a pile and measuring the angle of the resulting slope. The pile of soil is in about a minimum dense state e_{max} and for a sand will have an angle of repose (angle of internal friction) of about 30° (see Table 5-1).

In soil, either (or both) ϕ and c may be greater than zero, or zero—but not less than zero. If the soil state is such that both are zero, a very dangerous condition exists. These states will be considered in more detail in Chap. 13.

Since resistance to particle displacement, or shear strength, is also dependent on how well the particles are packed (density), particle interlocking (shape), degree of confinement, degree of saturation, and other factors, both cohesion and friction are statistical accumulations of these apparent effects for the instant soil state and under the conditions of measurement or test procedure. They are also subject to interpretation by the engineer. In any case they are widely used parameters which are state-dependent and not unique.

5-4 GRANULAR SOIL STRUCTURE

The arrangement of the individual soil particles in a granular soil may be termed *packing*. Packing of grains of soil, or any other particulate medium, is strongly influenced by both particle size distribution and particle shape.

Figure 5-2*a* illustrates ideal packing of spheres in a volume which is one sphere thick. In Fig. 5-2*b* the same number of spheres have been rearranged into a more dense configuration termed *rhombic packing*. According to theoretical

SOURCE: Physical and Geotechnical Properties of Soils; J.E. Bowles, 1984.

Ft. Bragg Global Stability Phase II Critical Cross Section

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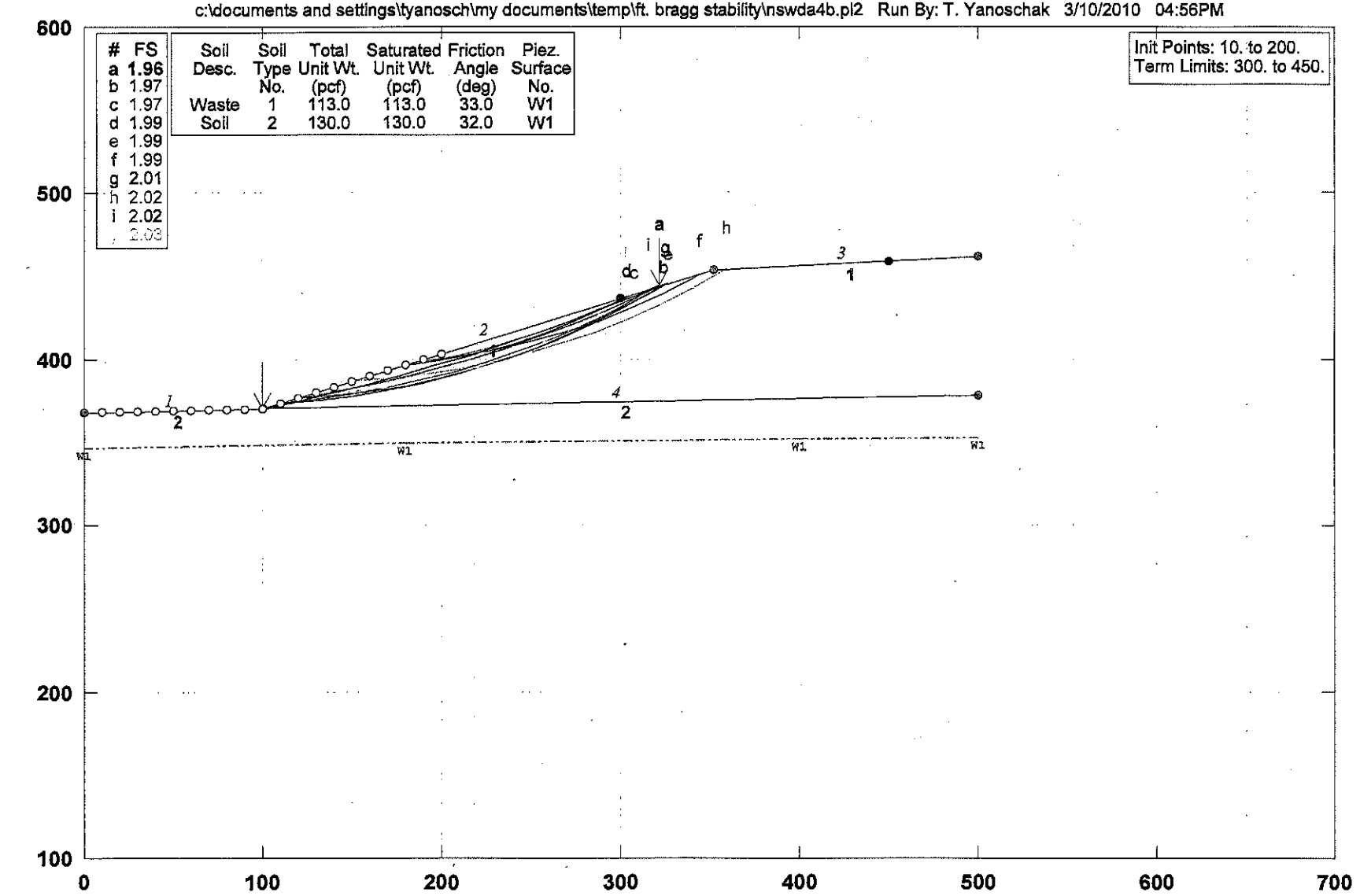

#	FS
a	1.96
b	1.97
c	1.97
d	1.99
e	1.99
f	1.99
g	2.01
h	2.02
i	2.02
j	2.03

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Waste	1	113.0	113.0	33.0	W1
Soil	2	130.0	130.0	32.0	W1

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Safety Factors Are Calculated By The Modified Bishop Method

STED

ATTACHMENT G

Ft. Bragg Global Stability - Seismic Phase II Critical Cross Section

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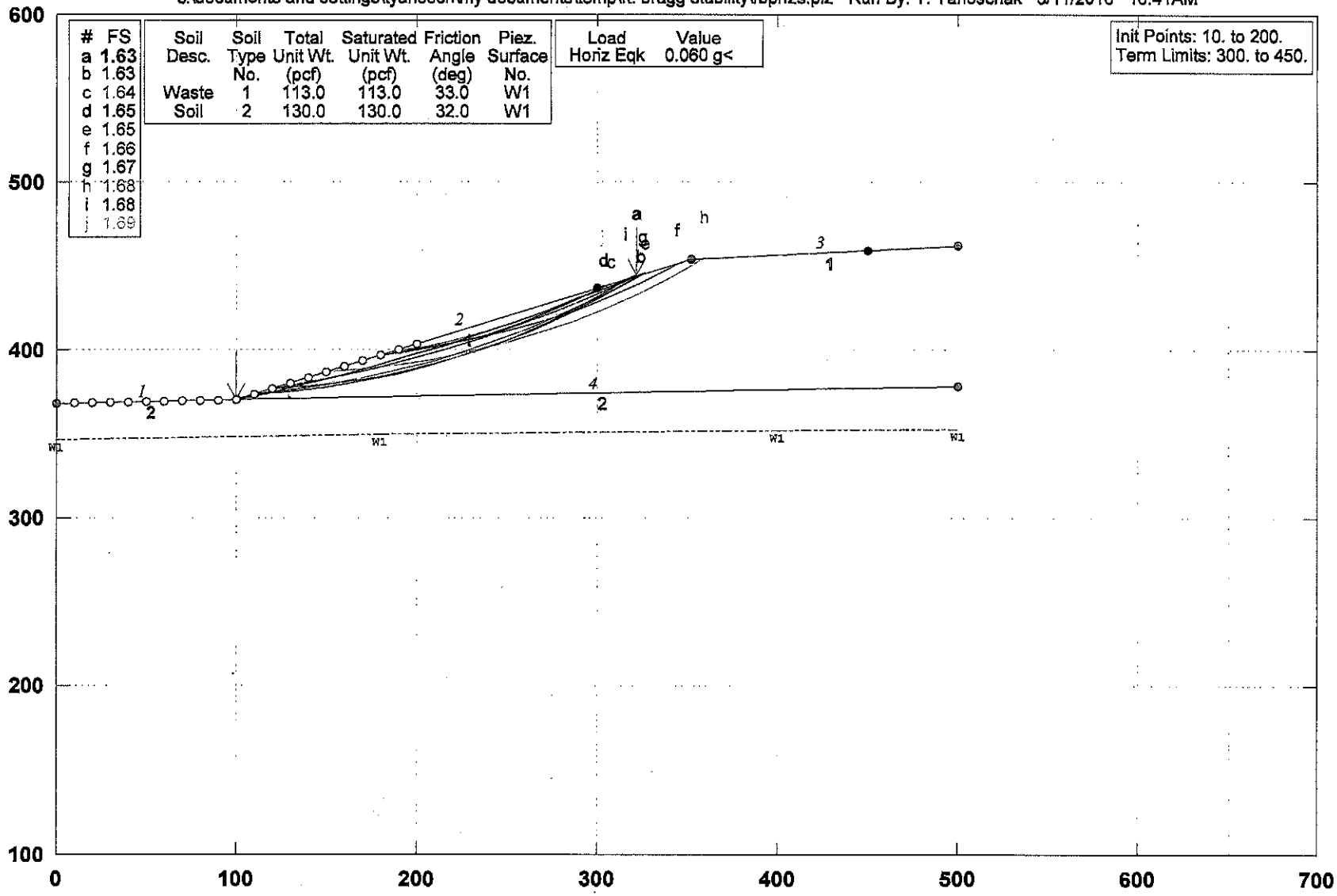

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Safety Factors Are Calculated By The Modified Bishop Method

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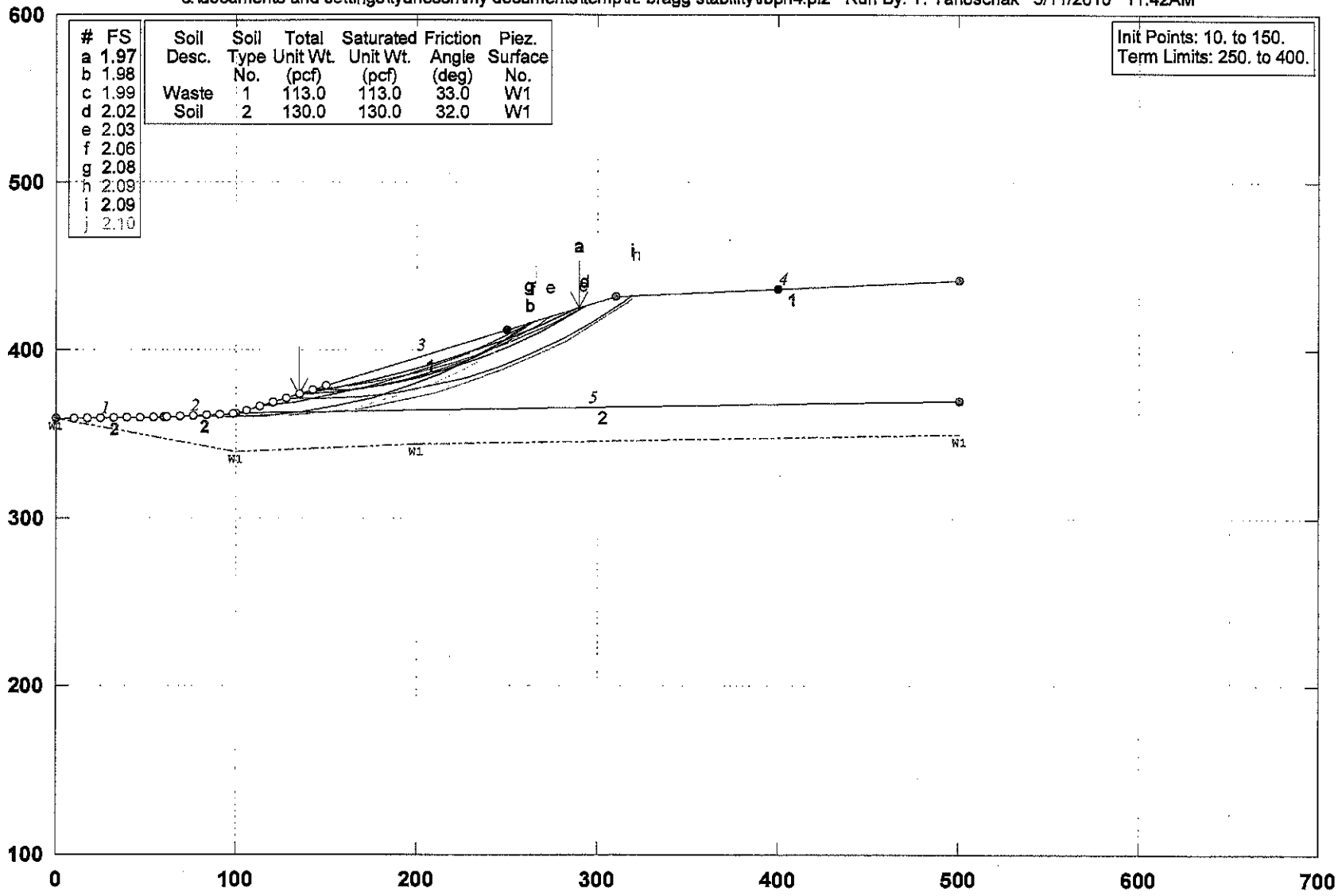

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Safety Factors Are Calculated By The Modified Bishop Method

STED

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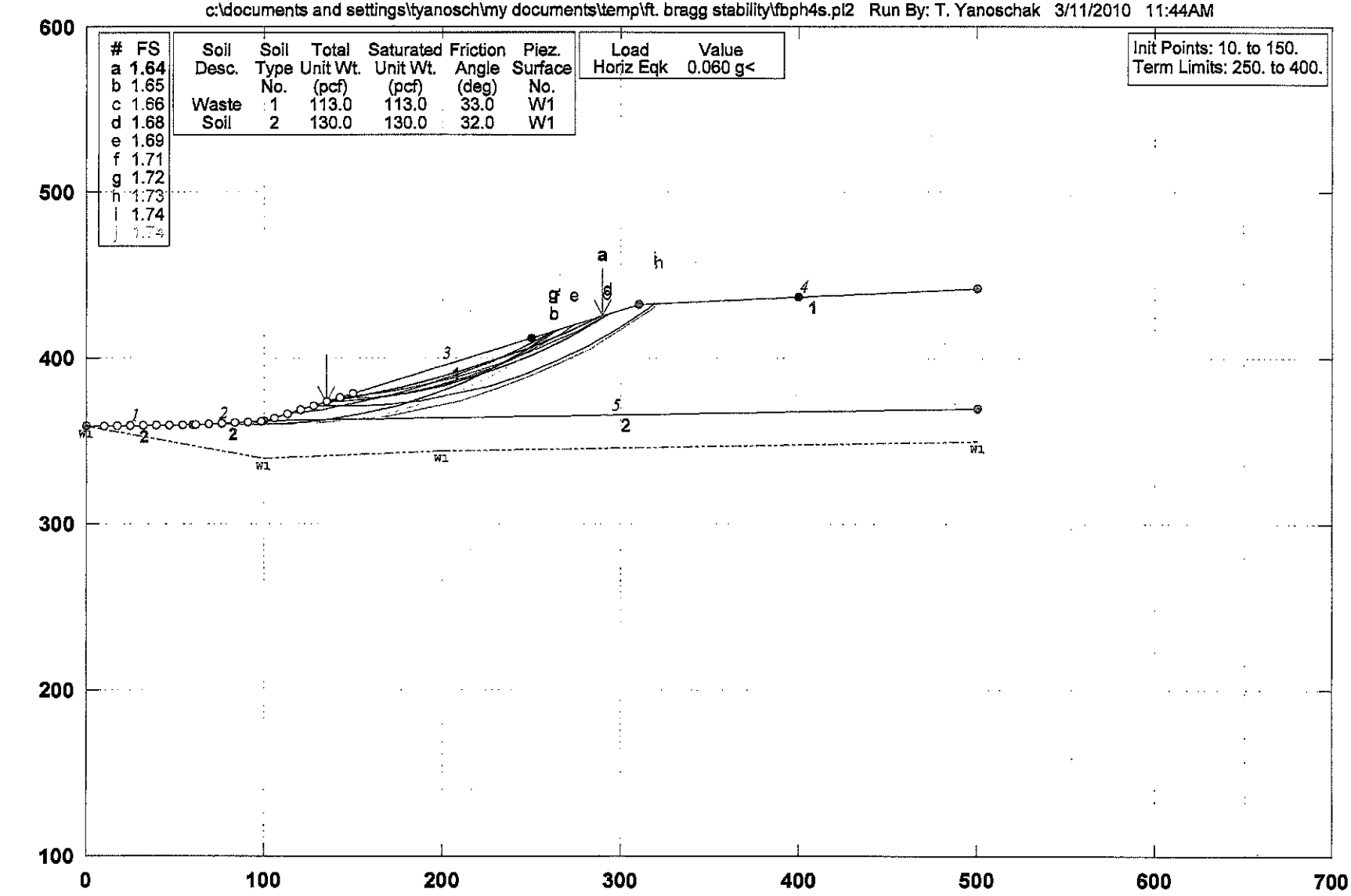

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Safety Factors Are Calculated By The Modified Bishop Method

STED

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

APPENDIX B
TECHNICAL
SPECIFICATIONS

MAY 2010

Prepared for:
DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

Prepared by:
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207
Raleigh, North Carolina 27612-4845

HDR

Draft
Technical Provisions

For: F9 00026-8
Develop Phase II of C&D Landfill, FORT BRAGG, NORTH CAROLINA

SECTION	DESCRIPTION	# of Pages

DIVISION 01 - GENERAL REQUIREMENTS

01 00 05	GENERAL AND SPECIAL PROVISIONS
01 33 00	SUBMITTAL PROCEDURES
01 42 00	SOURCES FOR REFERENCE PUBLICATIONS
01 45 01	USACE QUALITY CONTROL
01 50 00	TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
01 78 00	CLOSEOUT SUBMITTALS

DIVISION 02 - EXISTING CONDITIONS

02 01 03	ENVIRONMENTAL PROTECTION DURING CONSTRUCTION
02 56 14	CLAY (LOW PERMEABILITY) BARRIER LAYER
02 66 00	EROSION LAYER AND TOPSOIL FOR LANDFILL COVER
02 66 10	TEST FILL
02 92 01FB	EROSION CONTROL AND TURF SEEDING

DIVISION 31 - EARTHWORK

31 00 00	EARTHWORK
31 05 22	GEOTEXTILES USED AS FILTERS
31 11 00	CLEARING AND GRUBBING

DIVISION 33 - UTILITIES

33 40 00	STORM DRAINAGE UTILITIES

-- End of Project Table of Contents --

PREPARED BY:
HDR ENGINEERING, INC. OF THE CAROLINAS
3733 NATIONAL DRIVE, SUITE 207
RALEIGH, NC 27612
FOR
DIRECTORATE OF PUBLIC WORKS
FORT BRAGG, NORTH CAROLINA

SPECIFICATION No:
F9-00026-8
DRAWING NO.
DPW-6909

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SECTION 01 00 05

GENERAL AND SPECIAL PROVISIONS

1. SCOPE OF WORK

The work consists of furnishing all labor, equipment, transportation, and materials necessary to perform all work in strict accordance with these specifications, schedules, applicable DPW Drawings, and other contract documents. The scope of work of this contract includes, but is not limited to, the following specific items of work:

1.1 Civil Work

1.1.1 Construction of sediment and erosion control measures.

1.1.2 Excavation and grading of proposed subgrades.

1.1.3 Installation of landfill final capping system including landfill gas vents.

1.1.3 Installation of permanent stormwater controls.

1.2 Architectural Work (None)

1.3 Mechanical Work (None)

1.4 Electrical Work (None)

1.5 Landscaping and Grounds Restoration Work

1.5.1 Provide vegetative stabilization as shown on the plans.

2. PROJECT REQUIREMENTS

2.1 Installation Regulations

The employees of the Contractor will be required to abide by all installation regulations as published by the Commanding Officer. A copy of these regulations can be obtained from the Area/Resident Engineer at the installation. All costs in connection therewith shall be included in the contract price for the work.

2.2 Bulletin Board

Immediately upon beginning work, the Contractor shall provide a weatherproof, glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of the work the bulletin board shall be removed by and remain the property of the Contractor.

2.3 Time of Performance

All work shall be performed between 7:30 a.m. and 4 p.m. excluding official holidays, unless otherwise indicated or approved by the Contracting Officer. Requests to work during other than these normal hours shall be made in writing at least 36 hours in advance. For example, a request to work on a Saturday shall be submitted no later than Thursday at noon.

2.4 Certificates of Compliance and Material Submittals

The Contractor shall submit for approval all certificates of compliance and material submittals required in these technical provisions. Required submittals shall be submitted for approval not later than 30 days prior to the approval date needed to achieve compliance with the approved project schedule. Approval must be received from the Contracting Officer or his representative before incorporating the materials into the work. The Contractor shall provide a Submittal Register listing all required submittals in the contract to the COR at the time of the first submittal. Submittal forms (form 59-2-R) and a sample Submittal Register (Form 4288) will be provided at the Prework Conference.

2.5 Safety and Environmental Plans

The Contractor shall submit a proposed safety plan in accordance with the current Corps of Engineers Safety Manual, EM-385-1-1, and shall submit an environmental protection plan in accordance with specifications section 02013, Environmental Protection During Construction, if included in these technical provisions. A sample safety plan form will be provided at the Prework Conference.

2.6 Quality Control

The Contractor shall provide the job superintendent's name and telephone number to the DPW Contract Inspection Branch; building 3-1634, Butner Road; (910) 396-6033, prior to commencement of work. The Contractor shall furnish a daily Contractor Quality Control (CQC)/Superintendent's work report to the Contracting Officer's Representative (COR). A sample CQC report form will be provided at the Prework Conference.

2.7 Excavation (Digging) Permit

The Contractor shall have a completed and approved DPW Excavation Permit in his possession prior to any excavation, to include sign or fence-post holes. The Contractor shall schedule an appointment to locate utility lines at least 24 hours prior to any excavation with the DPW Facilities Maintenance Division, building 3-1634, Butner Road. Utilities are usually located within 5-10 workdays from the date of request but, due to weather conditions, construction workloads, etc., longer periods of time for these utility locates may be experienced. This will be accomplished by submitting a DPW Facilities Maintenance Division Service Order. Service Orders are obtained by calling (910) 396-0321, or making the request on-line at http://DPW.bragg.army.mil/DPW/soOnLine/2-3-1so_on-line.htm. Service Order status can also be checked on-line at the same web address. The permit will remain valid for a period of 60 days or as otherwise directed by the issuing authority. The Contractor shall be responsible for coordination with the Information Technology Business Center (ITBC), Outside Plant Branch; building 1-1434, Scott Street; (910) 396-8200, for locating government-owned communication lines prior to any excavation. Exterior electric utilities are non-government owned. For electrical utility

coordination, call 1-800-632-4949 (NC NO CUTS) 48 hours prior to DPW scheduled appointment. The Contractor shall also be responsible for coordination with any other known or suspected non-governmental utilities such as Sprint telecommunications or cable television. A copy of the DPW Excavation Permit form is at the end of this section.

2.8 Disposal and Borrow Permits

2.8.1 Disposal Permits

A permit is required to use the installation construction and demolition landfill. Landfill permit applications shall be processed with the Environmental Compliance Branch of the DPW Environmental Sustainment Division, (910) 396-3372. Permits are issued for up to one-year duration and for the specific contract only. Only materials produced on the project for which the permits are issued may be disposed-of in the construction and demolition landfill. The Contractor shall sort and deliver the waste to the landfill by like materials, such as separating construction and demolition materials from land clearing debris and yard waste. All metal products should be brought to the landfill separately and placed in the applicable container. The Contractor shall keep a copy of the completed permit with the vehicle throughout the contract disposal operation. The construction and demolition debris disposal site location is shown on the contract drawings. A copy of the DPW Landfill Permit Application form is at the end of this section.

The landfill will be open for customer service from 0730 to 1500 Monday through Friday except Federal holidays. When directed by the Contracting Officer the landfill may be available on an as-required basis for 2 to 6 hours approximately 12 weekends per year (Saturday, Sunday & Holiday).

2.8.2 Landfill Disposal Instructions

2.8.2.1 Fort Bragg has two Non-Hazardous Solid Waste Disposal Sites, which are permitted by the North Carolina Department of Environment and Natural Resources (NCDENR). They are located off Lamont Road, west of Fort Bragg's cantonment area, between Longstreet and McKellar Roads. One of the Solid Waste Sites is a permitted landfill which accepts waste from Fort Bragg and Pope Air Force Base. This landfill is for Construction and Demolition Debris (C&D) and Land Clearing and Inert Debris (LCID). The other permitted site is the Municipal Solid Waste (MSW) Transfer Station for the transferring the MSW off Fort Bragg to an approved and permitted landfill.

2.8.2.2 The C&D Landfill is permitted to receive construction and demolition debris, land clearing debris, inert debris (dirt, asphalt, bricks, concrete), and asbestos generated on Fort Bragg. This includes non-hazardous waste normally generated at a construction site such as painted and treated wood, incidental scrap metals, treated wood, packaging, insulation, shingles, empty metal cans, and wall board. Asbestos is disposed in a designated cell within the C&D landfill by the landfill operator. The asbestos waste shall be properly bagged or contained and with manifest documents before acceptance for the waste before placing into the C&D Landfill. Yard Waste is not allowed in the C&D Landfill.

2.8.2.3 The Waste Transfer Station (WTS) accepts MSW which includes garbage, paper, plastic and household waste from support activities, troop barracks and motor pools and Fort Bragg's family housing. The MSW is prepared for shipment and is transported to an approved and permitted landfill off Fort Bragg.

2.8.2.4 Concrete and Asphalt should not be mixed with debris and shall be stockpiled at the designated recycling site at the landfill.

2.8.2.5 Tires are prohibited from being disposed into the C&D Landfill and from the WTS.

2.8.2.6 Hazardous Waste and Liquid Waste are prohibited from being disposed into the C&D Landfill and the WTS.

2.8.2.7 Appliances/White Goods which include items such as; washers, dryers, refrigerators, and air conditioners are banned from the and C&D Landfill and the WTS and shall be disposed through the Prime Contractor with an off-post salvage company or through Defense Reutilization and Marketing Office (DRMO).

2.8.2.8 All landfill users must deliver loads pre-segregated for delivery to the C&D, MSW and recyclable areas. All landfill users will recycle to the maximum extent possible. Fort Bragg's landfill permit and the NC regulations require a minimum of 40% diversion annually.

2.8.2.9 A Landfill Disposal Permit is required to enter the landfill. Obtain a Landfill Permit through your Government Representative approval and issued by the Solid Waste Manage from the Public Works Business Center (DPW), Environmental Sustainment Division (ESD), phone number (910) 396-3372.

2.8.2.10 State Law and Post Regulations require covering of loads to prevent litter. 15A North Carolina Administrative Code 13B.0105(d) states: "vehicles transporting waste shall be loaded and moved in such a matter that the contents will not fall, leak, or spill and shall be covered when necessary to prevent blowing material. If a spill occurs, the transporter shall pick up the material immediately, returned to the vehicle and the area properly cleaned-up."

2.8.2.11 Prime Contractors are responsible for the waste generated on their sites and transported to the landfill and WTS and shall comply with all guidance within this document and other Fort Bragg regulations and policies. The loads coming into the C&D Landfill and WTS are subject to inspection and screening by the Landfill Operators and/or the Environmental Compliance Branch Personnel to ensure compliance is being maintained. Non-compliant loads will not be allowed to dump and the vehicles may be quarantined and subject to State notification.

2.8.3 Borrow Permits

A permit is required to use the Fort Bragg borrow material pits. Borrow pit permits shall be processed with the DPW Facilities Maintenance Division; Roads and Equipment Branch; Building O-3454, Lamont Road, 396-6873. Permits are issued for the life of the specific contract only. Borrow materials may only be used on the project for which the permits are issued. The Contractor shall keep a copy of the completed permit with the vehicle throughout the contract borrow operation. The borrow pit location is shown on the contract drawings. A copy of the DPW Borrow Permit form is at the end of this section.

2.9 Haul Routes

The Contractor is required to use the haul routes shown on the contract drawings for transportation of borrow materials, construction debris, or demolition materials unless otherwise permitted in writing by the COR.

When haul routes are not designated in the contract, the Contractor must obtain approval from the COR for the routes he intends to use. The axle load of earth-hauling equipment operating on paved streets shall not exceed 12,000 pounds. All construction debris/trash that leaves the project site will be covered from the time that it leaves the construction site. Any mud, soil or other material left along the haul route will be cleaned up by the Contractor immediately upon discovery or notification of such an occurrence

2.10 Utility Outages and Road Closures

Utility, road, and railroad closures require minimum 10 working days advance written notice and will be subject to COR approval. Utility outages will be held on normal workdays, after hours or on weekend/holidays as coordinated with the Contracting Officer, Fort Bragg DPW and the utility provider. The decision on when to have an outage (normal work hours, weekend, etc) will be based on the length of the outage and the normal business hours/hours of maximum usage for the facilities affected. Outages will be limited to 4 hours duration unless extenuating circumstances dictate otherwise. In the case of road closures, a sketch shall be provided showing the closure location and all necessary signs and barricades. Necessary signage, barricades, flag-persons, lights (including temporary traffic control lights), and markings for the safe movement of the public during construction shall be in accordance with the Manual on Uniform Traffic Control Devices, and shall be provided at no additional expense to the Government.

2.11 Availability and Use of Utility Services

2.11.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to and paid for by the Contractor at the prevailing rates. The rates listed below are current as of January 1, 2005 and are subject to change. The Contractor shall carefully conserve all utilities furnished.

2.11.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections, distribution lines, and meters required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer's Representative, in writing, no less than 10 working days before the temporary connection is made. The Contracting Officers Representative will then provide the contractor with the name and phone number of the non-government electrical utility provider. The contractor will be responsible for contacting the utility provider and making arrangements for connections and billing. For temporary electrical connections the Government or applicable utility provider will provide the meter (meter base provided by contractor) and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection. For temporary water and sewer connections the contractor will provide the meter and after inspection/approval by the Contracting Officer's Representative make the final connection at the contractor's expense.

2.11.3 Use of Permanent Building Utility Connections

Utilities consumed by the contractor from permanent building utility connections shall also be metered and paid for by the contractor. When the permanent system is activated the initial meter reading shall be recorded and reported as specified below. On building renovation projects the initial meter reading shall be recorded when the contractor is given possession of the building to perform the work. The contractor shall pay for utilities consumed through the permanent building connection until the work has been completed or the government has occupied the facility, which ever occurs first.

2.11.4 Initial Meter Readings

Upon installation of the meter, the initial reading shall be recorded (in the presence of the Contracting Officer's Representative) and forwarded to the point of contact for utility service with a copy to the Contracting Officer's Representative.

2.11.5 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer and the non-government electrical utility provider in writing 10 working days before termination is desired. The Government or the utility provider will take a final meter reading. The provider will disconnect the electric service. Water and sewer connections will be disconnected by the contractor, at his expenses and by a method approved by the Contracting Officer's Representative. The Contractor shall then remove all the temporary distribution lines, meters, meter bases, and associated equipment. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

2.11.6 Requirement for backflow prevention on temporary/permanent potable water connections.

The contractor shall install a backflow prevention device on all connections to the potable water system. The backflow prevention device shall be a reduced pressure or double check type, meeting all North Carolina State Plumbing code requirements for backflow prevention of potable water. If the Contractor requests the use of a fire hydrant and receives approval from the Contracting Officer's Representative, a backflow prevention device and meter shall be installed prior to each use.

2.11.7 Utilities Charge Rates

Water ---------- $1.9585 per 1,000 gallons
Electricity ------- $0.0752 per KW hour
Sewer ---------- $10.00/month for each connected trailer up to singlewide size.

The rate for larger trailers will be determined by the utility provider; however, this rate will not exceed $20.00/month per trailer.

2.12 As-Built Record Drawings

The Contractor shall be responsible for maintaining one set of master prints at the job-site on which he shall keep a careful and neat record of all deviations from the original contract drawings as the work progresses. The Contractor shall note all changes and corrections on these record

drawings promptly as the changes occur, but in no case less often than a weekly basis. In addition to incorporated modifications, these record drawings shall also include the actual location of all subsurface utility lines installed or encountered, and the type of materials used. The marked-up/annotated prints, or the annotated electronic drawings if applicable, shall be certified as to their correctness by an authorized representative of the Contractor and turned-over to the COR not later than 10 days after acceptance of the work by the Government. In the case of any subsurface utilities installed, the contractor shall provide an advance copy of the contract site plan to the COR showing the as-built location and type of all piping installed not later than 10 days after the utility work is accepted by the Government.

2.13 Contractor Storage Areas

Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including topsoil and seeding as necessary. The Contractor shall post the names and phone numbers of personnel who can be contacted by the Government after regular duty hours should an emergency arise. If the storage area is fenced, the emergency contact information shall be posted at the entrance gate. Otherwise, it shall be posted outside of the Contractor's office trailer or with the bulletin board containing the official wage and safety information required elsewhere in this contract.

2.14 Project Sign

The Contractor shall furnish and install a project sign at the location selected by the Contracting Officer. The project sign shall be painted on ½ inch thick exterior grade plywood. The sign layout and color shall be in accordance with the graphic format provided at the end of this section.

2.15 Color Boards (Omitted)

2.16 Protection

Contractor is responsible to provide such covering, shields and barricades as are required to protect building occupants, equipment, stores, supplies, etc., from dust, debris, weather intrusion, water, moisture or other cause of damage resulting from construction.

2.17 Replacement

The Contractor shall be held responsible for the replacement of any utility systems, facilities, or Government equipment damaged during the course of the contract.

2.18 Cleanup

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud, which is tracked onto paved or surfaced roadways, shall be cleaned away. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

2.19 Sanitation

Government toilet facilities will not be available to Contractor's personnel. The Contractor shall provide and maintain minimum field-type sanitary facilities approved by the Contracting Officer within the construction area.

3. SPECIAL PROVISIONS

3.1 Occupancy

The facility will be occupied and in normal usage during accomplishment of the work. Interference with and inconvenience to the occupants or routine use of the facility shall be held to an absolute minimum. The Contractor is responsible for providing such covering, shields, and barricades as are required to protect the facility occupants, furniture, equipment, supplies, etc., from dust, debris, weather intrusion, or other cause of damage resulting from construction.

3.2 Contractor Vehicle/Equipment Access to Fort Bragg

Fort Bragg is a closed installation, but vehicular access is controlled. Contractors are required to register each vehicle that will be traveling installation roads or streets under its own power. Each such vehicle shall have a registration decal. Registration may be accomplished at the Main Vehicle Registration Center, building 8-1078 on Randolph Street near Bragg Boulevard, 0800-1700 hours Monday through Friday. Unregistered vehicles should expect be stopped and delayed at all access control points. Contractors and all commercially registered vehicles shall use the Knox Street access control point off Bragg Boulevard for all access to Fort Bragg.

3.3 Special Access/Coordination Requirements

Representatives of the DPW Environmental Sustainment Division Soil Conservation Office, (910) 396-2301 ext 226, and the North Carolina Department of Environmental and Natural Resources - Land Resources Section, (910) 486-1541, for inspection of erosion control measures. Contractor will notify the Soil Conservation Office after construction limits have been staked and limits of tree removal has been flagged prior to commencing any land disturbing activities.

3.4 Special Work Constraints (Omitted)

Public Works Business Center

BORROW PIT PERMIT

Project Title/Description: _____

Contract Number: _____

Contractor Point Of Contact: _____

Phone Number: _____

Contracting Agency: _____

Government Inspector Name: _____

Phone Number: _____

Authorization for Use of Fort Bragg Borrow Pits

1. Your organization is authorized to remove up to the amount of material indicated from the Fort Bragg borrow pit listed below in support of the above project:

CUBIC YARDS	START DATE	END DATE

BORROW PIT	LOCATION	TRAINING AREA	GRID COORDINATES
Lamont	**Lamont Road**	**K**	**PJ 755 905**

2. This permit is subject to the following conditions:
   a. Limit borrow operations to the area listed above. Do not expand the boundary of the pit.
   b. Re-grade any areas worked so that water will not stand in the pit.
   c. Do not excavate trenches.
   d. Slopes cut at the edge of the areas worked will not exceed 3:1.
   e. Do not exceed amount of material authorized above. Requestor must apply for an amended permit to increase the amount.
   f. Maintain a copy of this permit at the work site. Be prepared to present it on demand to environmental compliance inspectors, Public Works employees, or law enforcement personnel.
   g. This permit does not guarantee exclusive right to work a specific borrow area within the pit. Coordination and cooperation with other contractors is required while at the borrow pit. It may be necessary to move excavation operations to different areas of the pit to accommodate other users.
   h. **Permits are valid only for 60-days from the issue date below.**
   i. **Contact the Engineering Equipment Section at 396-7156 prior to starting excavation operations.**

3. **Points of contact are Rick Akers at 910-396-7156 (DPW Engineering Equipment Section), or Dan Messier at 910-396-6873 (DPW Landfill and Borrow Pit)**

Permit Issued By: _____ Date Issued: _____
Dan Messier, Fort Bragg Borrow Pit Manager

Application for Landfill Permit

1. Contractors may dispose of on-post generated refuse at the Lamont Road Landfill provided the active contract allows the use of the Government Landfill and each vehicle carrying refuse displays a current landfill permit. The Government inspection representative will verify that the contract allows the use of the Government Landfill and will certify same by signing this request form.

2. Contractors will complete the information on this form and hand-carry it to the Environmental Compliance Branch (ECB), Public Works Business Center, located in Bldg. 3-1137, North of DPW Butner and Reilly Road personnel parking lot or FAX it to 910-396-4188. Contractors will insure that the Government inspection representative signs this form before submitting to ECB. Additional vehicles can be added on page 2 of this form.

Sid Williamson, Solid Waste/Recycling Manager
Environmental Compliance Branch
Phone # (910) 396-3372, Cell # (910) 977-2502

Prime Contractor _____ POC _____ Phone #_____

Sub Contractor _____ POC _____ Phone #_____

Project # _____ Project Name_____

Circle One: Fort Bragg Pope AFB Beginning Date _____ Duration _____

---

1) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

---

2) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

---

3) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

---

4) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

Approval of Government Representative

Print Name and Signature _____

Phone Number _____

SUBJECT: Application for Landfill Permit (continued)

5) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

6) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

7) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

8) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

9) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

10) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

11) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

12) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

13) Vehicle Year/Make _____/

License Plate # _____ State _____ Exp Date _____

Approval of Government Representative

Print Name and Signature _____

Phone Number _____

PUBLIC WORKS BUSINESS CENTER
EXCAVATION PERMIT

AR REG 420-49 DATE:

INSTRUCTIONS FOR USE OF EXCAVATION PERMIT

1. Excavation permit must be approved prior to any unearthing that penetrates the ground by more than six inches.
2. Permit will be approved at job site.
3. The PWBC staff shall approve all excavations on Fort Bragg and Camp Mackall. The ITBC shall also approve all excavations on Fort Bragg and Camp Mackall except those in family housing areas. SPRINT shall approve all excavations in family housing areas. ITBC may direct requestor to obtain SPRINT approval for excavations at other locations.
4. The requestor shall contact PWBC at 396-0321 for an appointment to field locate underground lines at least five full duty days in advance of desired work commencement. The requestor shall meet with these organizations at the job site with the project/contract drawings.
   a. PWBC, Plants and Utilities Branch
   b. ITBC, Outside Plant Branch
   c. SPRINT
   d. Time Warner Cable Company
   e. North Carolina Locate Service
5. Approval expires 60 days after date of approval signatures unless specified otherwise.
6. Each excavation site must have separate approval. A copy of the permit must remain at the job site while work is in progress.
7. Contractors shall NOT operate any utilities systems.
8. Any excavations on Pope Air Force Base requires a Work Clearance Permit issued by the Base Civil Engineer.

1. CLEARANCE IS REQUESTED TO PROCEED WITH WORK AT

ON SERVICE/WORK ORDER NO. CONTRACT NO.

2. METHOD OF EXCAVATION A. HAND B. POWER SHOVEL C. DITCHER D. OTHER (SPECIFY)

3. SCOPE OF WORK (DEPTH, WIDTH, LENGTH, LOCATION AND SKETCH AS APPLICABLE) IF CONTRACT, A COPY OF APPLICABLE DRAWINGS OR SKETCHES MUST BE ATTACHED

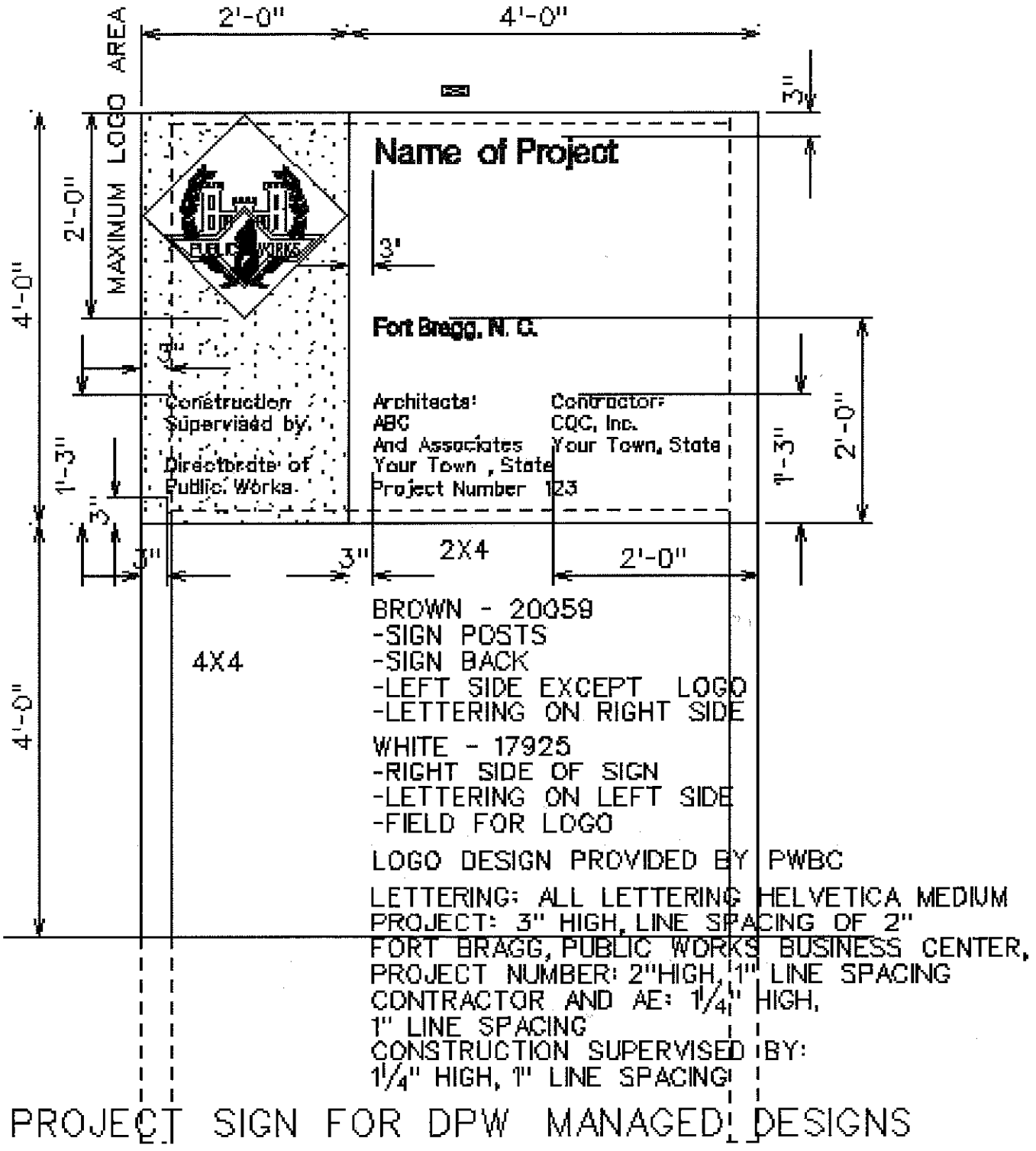
4. DATE CLEARANCE REQUIRED	5. TERMINATION DATE OF CLEARANCE (60 DAYS UNLESS SPECIFIED)	
6. REQUESTING ORGANIZATION OR COMPANY	7. PHONE NO	8. SIGNATURE (REQUESTING OFFICIAL)

9. EXCAVATION CLEARANCE APPROVAL

UTILITY	REMARKS (RESPONSIBILITY)	SIGNATURE OF APPROVING OFFICIAL	DATE
ELECTRICAL UNDERGROUND DISTRIBUTION	(PRIMARY - SANDHILLS UTILITY SERVICE SECONDARY - PWBC)		
STEAM OR HTW DISTRIBUTION	(HONEYWELL)		
CHILLER DISTRIBUTION	(HONEYWELL)		
SEWER LINES	(PWBC)		
WATER DISTRIBUTION	(PWBC)		
NATURAL GAS DISTRIBUTION	(PWBC or HONEYWELL or NORTH CAROLINA NATURAL GAS)		
TELEPHONE	(ITBC)		
TELEPHONE	(SPRINT)		
CABLE COMPANY	(TIME WARNER)		
OTHER			

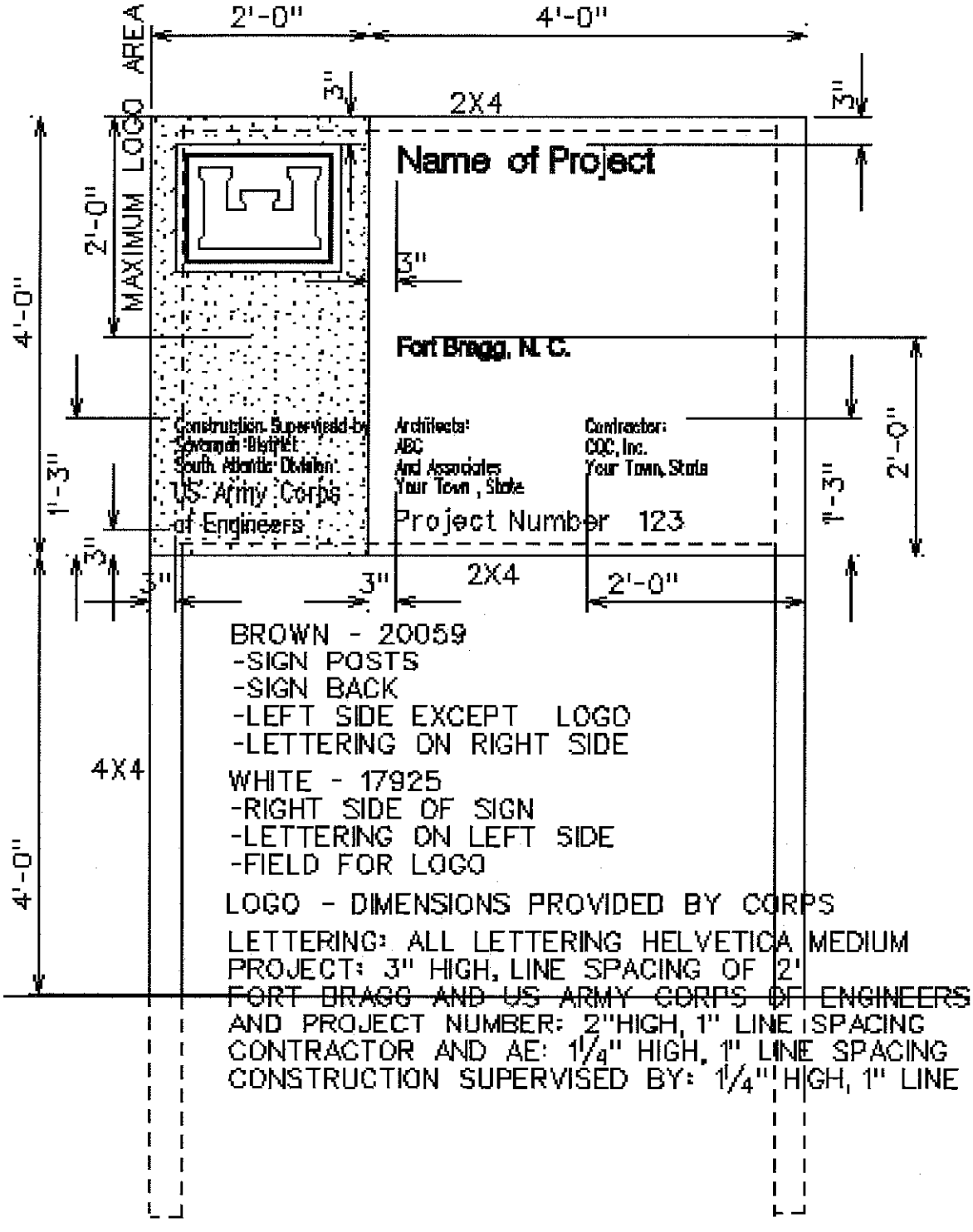
DIGGING WILL NOT BE PERMITTED UNLESS SIGNED

FB FORM 1605-E, SEP 03 (AFZA-PW) PREVIOUS EDITION IS OBSOLETE. V 2.3



PROJECT SIGN FOR DPW MANAGED DESIGNS

PROJECT SIGN FOR SAVANNAH MANAGED DESIGNS



SECTION 01 33 00

SUBMITTAL PROCEDURES
02/10

PART 1 GENERAL

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Contractor's Quality Control (CQC) System Manager and the Designer of Record, if applicable, to check and approve all items prior to submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval are to be scheduled and made prior to the acquisition of the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to issuance of notice to proceed commencing work on site or the start of the next major phase of the construction on a multi-phase contract. Includes schedules, tabular list of data, or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work, submitted prior to contract notice to proceed or next major phase of construction.

Certificates of insurance

Surety bonds

List of proposed subcontractors

List of proposed products

Construction Progress Schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of prices

Health and safety plan

Work plan

Quality control(QC) plan

Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

Design submittals, design substantiation submittals and extensions of design submittals.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material,

product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data (OMITTED)

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

Interim "DD Form 1354" with cost breakout for all assets 30 days prior to facility turnover.

1.1.2 Approving Authority

Office or designated person authorized to approve submittal.

1.1.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

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. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal Register; G

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Designer of Record Approved (DA)

Designer of Record (DOR) approval is required for extensions of design, critical materials, any deviations from the solicitation, the accepted proposal, or the completed design, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings." Contractor to provide the Government with the number of copies designated hereinafter of all DOR approved submittals. The Government may review any or all Designer of Record approved submittals for conformance to the Solicitation, Accepted Proposal and the completed design. The Government will review all submittals designated as deviating

from the Solicitation or Accepted Proposal, as described below. Generally, design submittals should be identified as SD-05 Design Data submittals.

1.3.2 Government Approved

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Government approval is required for any deviations from the Solicitation or Accepted Proposal and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.3.3 Government Conformance Review of Design (CR)

The Government will review all intermediate and final design submittals for conformance with the technical requirements of the solicitation. Review will be only for conformance with the applicable codes, standards and contract requirements. Generally, design submittals should be identified as SD-05 Design Data submittals.

1.3.4 Designer of Record Approved/Government Conformance Review (DA/CR)

1.3.4.1 Deviations to the Accepted Design

Designer of Record approval and the Government's concurrence are required for any proposed deviation from the accepted design which still complies with the contract before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings." If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative prior to officially submitting it to the Government. However, the Government reserves the right to review the submittal before providing an opinion, if deemed necessary. In any case, the Government will not formally agree to or provide a preliminary opinion on any deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with any deviation from the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

1.3.4.2 Substitutions

Unless prohibited or provided for otherwise elsewhere in the Contract, where the accepted contract proposal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, and the Contractor desires to substitute manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, identifying information and the DOR's approval, as meeting the contract requirements and that it is equal in function, performance, quality and salient features to that in the accepted contract proposal.

1.3.5 Designer of Record Approved/Government Approved (DA/GA)

In addition to the above stated requirements for proposed deviations to the accepted design, both Designer of Record and Government Approval and, where applicable, a contract modification are required before the Contractor is

authorized to proceed with material acquisition or installation for any proposed deviation to the contract (the solicitation and/or the accepted proposal), which constitutes a change to the contract terms. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings". The Government reserves the right to accept or reject any such proposed deviation at its discretion.

1.3.6 Information Only

Submittals not requiring Government approval will be for information only. For Design-build construction all submittals not requiring Designer of Record or Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.4.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of fabrication, forward to the Architect-Engineer: HDR Engineering, Inc. of the Carolinas, submittals required in the technical sections of this specification, including shop drawings, product data and samples. One copy of the transmittal form for all submittals shall be forwarded to the Resident Officer in Charge of Construction.

The Architect-Engineer for this project will review and approve for the Contracting Officer those submittals reserved for Contracting Officer approval to verify submittals comply with the contract requirements.

1.4.1.1 O&M Data

The Architect-Engineer for this project will review and approve for the Contracting Officer O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.5 PREPARATION

1.5.1 Transmittal Form

Use the attached sample transmittal form (ENG Form 4025) for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

1.5.2 Identifying Submittals

When submittals are provided by a Subcontractor, the Prime Contractor is to

prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location.

b. Construction contract number.

c. Date of the drawings and revisions.

d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other subcontractor associated with the submittal.

e. Section number of the specification section by which submittal is required.

f. Submittal description (SD) number of each component of submittal.

g. When a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission.

h. Product identification and location in project.

1.5.3 Format for SD-02 Shop Drawings

Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."

Number drawings in a logical sequence. Contractors may use their own number system. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than 2 inches on the right hand side of each sheet for the Government disposition stamp.

Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

1.5.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates.

Provide product data in metric dimensions. Where product data are included in preprinted catalogs with English units only, submit metric dimensions on separate sheet.

Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will be accepted for expedition of construction effort.

Submit manufacturer's instructions prior to installation.

1.5.5 Format of SD-04 Samples

Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2

by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.5.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.5.8 Format of SD-10 Operation and Maintenance Data (O&M)(OMITTED)

1.5.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

Provide all dimensions in administrative submittals in metric. Where data are included in preprinted material with English units only, submit metric dimensions on separate sheet.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies of SD-02 Shop Drawings

Submit six copies of submittals of shop drawings requiring review and approval only by QC organization and seven copies of shop drawings requiring review and approval by Contracting Officer.

1.6.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.3 Number of Samples SD-04 Samples

a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of non-solid materials.

1.6.4 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.6.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.6 Number of Copies of SD-10 Operation and Maintenance Data (OMITTED)

1.6.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit two sets of administrative submittals.

1.7 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work;

and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. For design-build construction the Government will retain 2 copies of information only submittals.

1.8 VARIATIONS / SUBSTITUTION REQUESTS

Variations from contract requirements require Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.8.1 Considering Variations

Discussion with Contracting Officer prior to submission, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.8.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

Check the column "variation" of ENG Form 4025 for submittals which include proposed deviations requested by the Contractor. Set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.8.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.8.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.9 SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Use electronic submittal register program furnished by the Government or any other format. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of

equipment and materials for which submittals are required by the specifications is provided as an attachment. This list may not be all inclusive and additional submittals may be required. The Government will provide the initial submittal register in electronic format with the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g. SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal.

1.9.1 Use of Submittal Register

Submit submittal register as an electronic database, using submittals management program furnished to Contractor. Submit with QC plan and project schedule. Verify that all submittals required for project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.9.2 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register program or equivalent fields in program utilized by Contractor with each submittal throughout contract.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.9.3 Approving Authority Use of Submittal Register

Update the following fields in the Government-furnished submittal register

program or equivalent fields in program utilized by Contractor.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (l) List date of submittal receipt.

Column (m) through (p)List Date related to review actions.

Column (q) List date returned to Contractor.

1.9.4 Contractor Action Code and Action Code

Entries for columns (j) and (o), are to be used are as follows (others may be prescribed by Transmittal Form):

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.9.5 Copies Delivered to the Government

Deliver one copy of submittal register updated by Contractor to Government with each invoice request.

1.10 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.

b. Submittals called for by the contract documents will be listed on the register. If a submittal is called for but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the register or marked "N/A".

c. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.

d. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

e. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days

for submittals for QC Manager approval and 20 working days for submittals for Contracting Officer approval. Period of review for submittals with Contracting Officer approval begins when Government receives submittal from QC organization.

f. For submittals requiring review by fire protection engineer, allow review period, beginning when Government receives submittal from QC organization, of 30 working days for return of submittal to the Contractor.

g. Period of review for each resubmittal is the same as for initial submittal.

At the Preconstruction conference, provide, for approval by the Contracting Officer, the following schedule of submittals:

a. A schedule of shop drawings and technical submittals required by the specifications and drawings. Indicate the specification or drawing reference requiring the submittal; the material, item, or process for which the submittal is required; the "SD" number and identifying title of the submittal; the Contractor's anticipated submission date and the approval need date.

b. A separate schedule of other submittals required under the contract but not listed in the specifications or drawings. Schedule will indicate the contract requirement reference; the type or title of the submittal; the Contractor's anticipated submission date and the approved need date (if approval is required).

1.10.1 Government Reviewed Design

The Government will review all design submittals for conformance with the technical requirements of the solicitation. Government review is required for deviation from the completed design. Review will be only for conformance with the contract requirements. Included are only those construction submittals for which the Designer of Record design documents do not include enough detail to ascertain contract compliance. The Government may, but is not required, to review extensions of design such as structural steel or reinforcement shop drawings.

1.11 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

a. Note date on which submittal was received from QC Manager.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph entitled "Review Notations" and with markings appropriate for action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date approved submittals. 6 copies of the approved submittal will be retained by the Contracting Officer and 2 copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the

submittals will be so identified and returned, as described above.

1.11.1 Review Notations

Contracting Officer review will be completed within 10 calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize the Contractor to proceed with the work covered.

b. Submittals marked "approved as noted" "or approved except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.

c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required , does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.12 DISAPPROVED SUBMITTALS

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes" is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED SUBMITTALS

The Contracting Officer's approval or acceptance of submittals is not be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactory. Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, the Contractor to assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for Materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to disapproved any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Contracting Officer does not relieve the Contractor of his responsibilities under the contract.

1.15 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.16 PROGRESS SCHEDULE

1.16.1 Bar Chart

a. Submit the progress chart, for approval by the Contracting Officer, at the Preconstruction Conference in one reproducible and 4 copies.

b. Prepare the progress chart in the form of a bar chart utilizing form "Construction Progress Chart" or comparable format acceptable to the Contracting Officer.

c. Include no less than the following information on the progress chart:

(1) Break out by major headings for primary work activity.

(2) A line item break out under each major heading sufficient to track the progress of the work.

(3) A line item showing contract finalization task which includes

punch list, clean-up and demolition, and final construction drawings.

(4) A materials bar and a separate labor bar for each line item. Both bars will show the scheduled percentage complete for any given date within the contract performance period. Labor bar will also show the number of men (man-load) expected to be working on any given date within the contract performance period.

(5) The estimated cost and percentage weight of total contract cost for each materials and labor bar on the chart.

(6) Separate line items for mobilization and drawing submittal and approval. (These items are to show no associated costs.)

d. Update the progress schedule in one reproduction and 4 copies every 30 calendar days throughout the contract performance period.

1.17 STATUS REPORT ON MATERIALS ORDERS

Within 30 calendar days after notice to proceed, submit, for approval by the Contracting Officer, an initial material status report on all materials orders. This report will be updated and re-submitted every 30 calendar days as the status on material orders changes.

Report to include list, in chronological order by need date, materials orders necessary for completion of the contract. The following information will be required for each material order listed:

a. Material name, supplier, and invoice number.

b. Bar chart line item or CPM activity number affected by the order.

c. Delivery date needed to allow directly and indirectly related work to be completed within the contract performance period.

d. Current delivery date agreed on by supplier.

e. When item d exceeds item c, the effect that delayed delivery date will have on contract completion date.

f. When item d exceeds item c, a summary of efforts made by the Contractor to expedite the delayed delivery date to bring it in line with the needed delivery date, including efforts made to place the order (or subcontract) with other suppliers.

1.18 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR (Firm Name)   _____ Approved _____ Approved with corrections as noted on submittal data and/or attached sheets(s)   SIGNATURE: _____ TITLE: _____ DATE: _____

For design-build construction, both the Contractor Quality Control System Manager and the Designer of Record are to stamp and sign to certify that the submittal meets contract requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS
05/09

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Ph: 800-926-7337
Fax: 303-347-0804
Internet: http://www.awwa.org

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9500
Fax: 610-832-9555
E-mail: service@astm.org
Internet: http://www.astm.org

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)
University of South California
Kaprielian Hall 200
Los Angeles, CA 90089-2531
Ph: 213-740-2032 or 800-545-6340

Fax: 213-740-8399
E-mail: fccchr@usc.edu
Internet: http://www.usc.edu/dept/fccchr

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 617-770-3000
Fax: 617-770-0700
E-mail: webmaster@nfpa.org
Internet: http://www.nfpa.org

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)
Order for sale documents from:
Superintendent of Documents
U.S. Government Printing Office (GPO)
732 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: http://www.gpoaccess.gov

Order free documents from:
Federal Aviation Administration
Department of Transportation
800 Independence Avenue, SW
Washington, DC 20591
Ph: 1-866-835-5322
Internet: http://www.faa.gov

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)
Office of Highway Safety (HHS-31)
400 Seventh Street, SW
Washington, DC 20590-0001
Ph: 202-366-0411
Fax: 202-366-2249
Internet: http://www.fhwa.dot.gov
Order from:

Superintendent of Documents
U. S. Government Printing Office (GPO)
732 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: http://www.gpoaccess.gov

-- End of Section --

SECTION 01 45 01

USACE QUALITY CONTROL
01/08

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 within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 3740	(2008) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2008) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all associated costs will be included in the applicable Bid Schedule unit or lump-sum prices.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system in compliance with the Contract Clause titled "Inspection of Construction." QC consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. Cover all construction operations, both onsite and offsite, and be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent must maintain a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 QUALITY CONTROL PLAN

Submit no later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the

requirements of the Contract Clause titled "Inspection of Construction." The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

3.2.1 Content of the CQC Plan

Include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager who reports to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Copies of these letters must be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer must be used.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by

different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.2 Additional Requirements for Design Quality Control (DQC) Plan (OMITTED)

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 30 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and the Contracting Officer and will become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager must receive direction and authority from the CQC System Manager and serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff must maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an

effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization who is responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager must be a construction person with a minimum of 10 years in related work. This CQC System Manager must be on the site at all times during construction and be employed by the prime Contractor. The CQC System Manager must be assigned as System Manager but may have duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: civil, environmental, materials technician, submittals clerk. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan. A single person may cover more than one area provided that they are qualified to perform QC activities in each designated and that workload allows.

Experience Matrix

	Area	Qualifications
a.	Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 yrs related experience
f.	Environmental	Graduate Environmental Engineer with 3 yrs experience
g.	Submittals	Submittal Clerk with 1 yr experience

3.4.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager must have completed the course entitled "Construction Quality Management For Contractors".

3.4.5 Organizational Changes

Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, must comply with the requirements in Section 01 33 00 SUBMITTAL PROCEDURES. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control must be conducted by the CQC System Manager for each definable feature of the construction work as follows:

3.6.1 Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.

b. Review of the contract drawings.

c. Check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. Review of the appropriate activity hazard analysis to assure

safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Discussion of the initial control phase.

k. The Government must be notified at least 24 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government must be notified at least 24 hours in advance of beginning the initial phase. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be

affected by the deficient work. Do not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. Procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel must meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $1,000 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government must be delivered to the Corps of Engineers Division Laboratory, f.o.b.

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Conduct an inspection of the work by the CQC Manager near the end of the work, or any increment of the work established by a time stated in the SPECIAL CONTRACT REQUIREMENTS Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications, as required by paragraph DOCUMENTATION. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph must be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative must be in attendance at the final acceptance

inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notify the Contracting Officer at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

Maintain current records providing factual evidence that required quality control activities and/or tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

g. Offsite surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. Furnish the original and one copy of these records in report form to the Government daily within 36 hours after

the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days must be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports must be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS (OMITTED)

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
08/09

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2007) Standard for Reduced-Pressure Principle Backflow Prevention Assembly

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies
FCCCHR Manual	(1988e9) Manual of Cross-Connection Control

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2009) Standard for Safeguarding Construction,Alteration, and Demolition Operations
NFPA 70	(2008; AMD 1 2008) National Electrical Code - 2008 Edition

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(Rev K) Obstruction Marking and Lighting

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2000) Manual of Uniform Traffic Control Devices

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. Submitted the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction site plan; G
Traffic control plan; G

SD-03 Product Data

Backflow preventers; G

SD-06 Test Reports

Backflow Preventer Tests; G

SD-07 Certificates

Backflow Tester Certification; G

Backflow Preventers Certificate of Full Approval

1.4 CONSTRUCTION SITE PLAN

Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.5 BACKFLOW PREVENTERS CERTIFICATE

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

1.5.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with any company participating in any other phase of this Contract.

1.5.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Immediately upon beginning of work, provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

2.1.2 Project and Safety Signs

The requirements for the signs, their content, and location are as specified in Section 01005 GENERAL AND SPECIAL PROVISIONS. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Haul Roads

At contractors expense construct access and haul roads necessary for proper prosecution of the work under this contract. Construct with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic are be avoided. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.2.3 Fencing

a. Provide fencing along the construction site at all open excavations and tunnels to control access by unauthorized people. Fencing must be installed to be able to restrain a force of at least 250 pounds against it.

2.2.4 Temporary Wiring

Provide temporary wiring in accordance with NFPA 241 and NFPA 70, Article 305-6(b), Assured Equipment Grounding Conductor Program. Include frequent inspection of all equipment and apparatus.

2.2.5 Backflow Preventers

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound mounted gate valve and strainer, stainless steel or bronze, internal parts. The particular make, model/design, and size of backflow preventers to be installed must be included in the latest edition of the List of Approved Backflow Prevention Assemblies issued by the FCCCHR List and be accompanied by a Certificate of Full Approval from FCCCHR List. After installation conduct Backflow Preventer Tests and provide test reports verifing that the installation meets the FCCCHR Manual Standards.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Contractor employees will park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking must not interfere with existing and established parking requirements of the government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Payment for Utility Services

a. The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed will be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. Carefully conserve any utilities furnished without charge.(See Section 01 00 05, GENERAL AND SPECIAL PROVISIONS)

b. Pay all costs incurred in connecting, converting, and transferring the utilities to the work. Make connections, including providing backflow-preventing devices on connections to domestic water lines; providing meters; and providing transformers; and make disconnections. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water.

3.2.3 Meters and Temporary Connections

At the Contractors expense and in a manner satisfactory to the Contracting Officer, provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. Notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary

wiring installation. The Contractor will not make the final electrical connection.

3.2.4 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

3.2.5 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. Then remove all the temporary distribution lines, meter bases, and associated paraphernalia. Pay all outstanding utility bills before final acceptance of the work by the Government.

3.2.6 Utilities at Special Locations (OMITTED)

3.2.7 Utility Services for Diego Garcia Projects (OMITTED)

3.2.8 Utility Services for Wake Island (OMITTED)

3.2.9 Telephones at Midway, Wake, and Diego Garcia (OMITTED)

3.2.10 Electricity (OMITTED)

3.2.11 Water

Make connections to existing facilities to provide water for construction purposes.

3.2.12 Sanitation

a. Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. Any penalties and / or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times without nuisance. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

b. Provide temporary sewer and sanitation facilities that are self-contained units with both urinals and stool capabilities. Ventilate the units to control odors and fumes and empty and clean them at least once a week or more often if required by the Contracting Officer. The doors shall be self-closing. The exterior of the unit

shall match the base standard color. Locate the facility behind the construction fence or out of the public view.

3.2.13 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.2.14 Obstruction Lighting of Cranes

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

3.2.15 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.3 TRAFFIC PROVISIONS

3.3.1 Maintenance of Traffic

a. Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

c. Provide, erect, and maintain, at contractors expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of any damage to roads caused by construction operations.

3.3.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations without notification to and approval by the Contracting Officer.

3.3.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Treat dust abatement on access roads with applications of calcium chloride, water sprinklers, or similar methods or treatment.

3.3.5 Commercial Vehicles In/Out of NAVSTA/NAS Norfolk, VA (OMITTED)

3.4 CONTRACTOR'S TEMPORARY FACILITIES

3.4.1 Safety

Protect the integrity of any installed safety systems or personnel safety devices. If entrance into systems serving safety devices is required, the Contractor must obtain prior approval from the Contracting Officer. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.4.2 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

3.4.3 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts, colored green, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store Trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on any given day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.4.4 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor is responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

3.4.5 Appearance of Trailers

a. Trailers utilized by the Contractor for administrative or material storage purposes must present a clean and neat exterior appearance and be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on installation property.

b. Paint using suitable paint and maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

3.4.6 Trailers or Storage Buildings

a. Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Contracting Officer. The trailers or buildings shall be in good condition, free from visible damage rust and deterioration, and meet all applicable safety requirements. Trailers shall be roadworthy and comply with all appropriate state and local vehicle requirements. Failure to maintain storage trailers or buildings to these standards shall result in the removal of non-complying units at the Contractor's expense. A sign not smaller than 24 by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state of local standards for anchoring mobile trailers.

3.4.7 Maintenance of Storage Area

a. Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles; gravel gradation will be at the Contractor's discretion. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers will be edged or trimmed neatly.

b. Cut grass (or annual weeds) within the construction and storage sites to a maximum 4 inch height at least once a week during the growing season unless the grass area is not visible to the public. Trim the grass around fences at time of grass cutting. Maintain grass or weeds on stockpiled earth as descried above.

3.4.8 New Building

In the event a new building is constructed for the temporary project field office, it will be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved

drinking water. Approved sanitary facilities must be furnished. Screen the windows and doors and provide the doors with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins will be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, furnish air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F. Any new building erected for a temporary field office must be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work become the property of the Contractor and removed from the site. All charges for telephone service for the temporary field office will be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

3.4.9 Security Provisions

Provide adequate outside security lighting at the Contractor's temporary facilities. The Contractor will be responsible for the security of its own equipment; in addition, the Contractor will notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

3.4.10 Storage Size and Location

The open site available for storage must be confined to the indicated operations area as indicated on the drawings.

3.4.11 Storage in Existing Buildings

The Contractor will be working around existing buildings; the storage of material will not be allowed in the buildings.

3.4.12 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.4.12.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.4.12.2 Hurricane Condition of Readiness

Unless directed otherwise, comply with:

a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping

practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards.

b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.

c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours): Curtail or cease routine activities until securing operation is complete. Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and Condition of Readiness (COR) updates and completion of required actions.

d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

3.5 GOVERNMENT FIELD OFFICE

3.5.1 Resident Engineer's Office (OMITTED)

3.5.2 Quality Control Manager Records and Field Office (OMITTED)

3.5.3 Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. Securely anchor the trailer to the ground at all four corners to guard against movement during high winds.

3.6 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor must install a satisfactory means of communication, such as telephone or other suitable devices and made available for use by Government personnel.

3.7 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. The safety fencing must be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved

location. Maintain the safety fencing during the life of the contract and, upon completion and acceptance of the work, will become the property of the Contractor and be removed from the work site.

3.8 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store within the fenced area described above or at the supplemental storage area any materials resulting from demolition activities which are salvageable. Neatly stacked stored materials not in trailers, whether new or salvaged.

3.9 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletinboard, signs, barricades, haulroads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore to the original or better condition, areas used by the Contractor for the storage of equipment or material, or other use. Gravel used to traverse grassed areas must be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

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SECTION 01 78 00

CLOSEOUT SUBMITTALS
05/09

PART 1 GENERAL

1.1 REFERENCES (OMITTED)

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

SD-11 Closeout Submittals

Record Drawings

Drawings showing final as-built conditions of the project. The final CADD record drawings must consist of one set of electronic CADD drawing files in the specified format, one set of mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working Record drawings.

1.3 PROJECT RECORD DOCUMENTS

1.3.1 Record Drawings

This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showning as-built conditions.

1.3.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file record drawings.

1.3.1.2 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans

which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Prepare final record (as-built) drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final record (as-built) drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final record drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the record drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. Show on the working and final record drawings, but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, show only the option selected for construction on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

j. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.

(1) Follow directions in the modification for posting descriptive changes.

(2) Place a Modification Circle at the location of each deletion.

(3) For new details or sections which are added to a drawing, place a Modification Circle by the detail or section title.

(4) For minor changes, place a Modification Circle by the area changed on the drawing (each location).

(5) For major changes to a drawing, place a Modification Circle by the title of the affected plan, section, or detail at each location.

(6) For changes to schedules or drawings, place a Modification Circle either by the schedule heading or by the change in the schedule.

(7) The Modification Circle size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.3.1.3 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. At the time of final inspection, 1 copy of the working record drawings shall be delivered to the Contractin Officer for review and approval. These working as-built marked prints must be neat, legible and accurate. These drawings are part of the permanent records of this project and must be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor must be satisfactorily replaced by the Contractor at no expense to the Government.

1.3.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only employ personnel proficient in the preparation of CADD drawings to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CADD files. The Contractor will use the most current version of Microstation software using Window NT operating system. The Contractor shall be responsible for providing all program files and hardware necessary to prepare final record drawings. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). Provide all program files and hardware necessary to prepare final record drawings. The Contracting Officer will review final record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

c. When final revisions have been completed, show the wording "RECORD DRAWINGS / AS-BUILT CONDITIONS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Mark all other contract drawings either "Record" drawing denoting no revisions on the sheet or "Revised Record" denoting one or more revisions. Date original contract drawings in the revision block.

d. Within 10 days for contracts less than $5 million, or 20 days for each specific phase of work for contracts $5 million and above after Government approval of all of the working record drawings for a phase of work, prepare the final CADD record drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 7 days for contracts less than $5 million 10 days for contracts $5 million and above revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 10 days for contracts less than $5 million 20 days for contracts $5 million and above of substantial completion of all phases of work, submit the final record drawing package for the entire project. Submit one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working record drawings. They must be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record drawing files and marked prints as specified will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made to the Contractor.

1.3.1.5 Manually Prepared Drawings (OMITTED)

1.3.1.6 Payment

No separate payment will be made for record drawings required under this contract, and all costs accrued in connection with such drawings are considered a subsidiary obligation of the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 02 01 03

ENVIRONMENTAL PROTECTION DURING CONSTRUCTION

Index

1. Scope
2. Quality Control
3. Environmental Protection Plan
4. Implementation
5. Subcontractors
6. Notification
7. Protection of Environmental Resources
8. Post-Construction Cleanup
9. Restoration of Landscape Damage
10. Maintenance of Pollution Control Facilities
11. Training in Pollution Control

1. SCOPE

This section covers prevention of environmental pollution and damage to the environment as the result of construction operations under this contract and for those measures set forth in other technical provisions of these specifications. For the purpose of this specification, environmental pollution and damage to the environment is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural, and/or historical purposes. The control of environmental pollution and damage requires consideration of the potential effects of an action upon air, water, and land resources, and includes management of visual aesthetics, natural and cultural resources, noise levels, solid waste, hazardous waste, toxic waste, radiant energy, and radioactive materials, as well as other pollutants.

2. QUALITY CONTROL

The Contractor shall establish and maintain quality control for environmental protection of all items set forth herein. The Contractor shall record on daily reports any problems in complying with laws, regulations, ordinances, and corrective action taken. The Contractor shall immediately inform the Contracting Officer's Representative of any environmental problem.

3. ENVIRONMENTAL PROTECTION PLAN

The Contractor shall submit an Environmental Protection Plan which must be approved by the PWBC Environmental/Natural Resources Division prior to construction. It shall include, but is not limited to, the following:

3.1 Legal Requirements

A list of Federal, State, and local laws, regulations, and permits concerning environmental protection and pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits shall be included. Whenever there is a conflict between Federal, State, or local laws, regulations, and permit requirements, the more restrictive provision shall apply.

3.2 Protection of Features

The Contractor shall prepare a listing of methods to protect resources needing preservation within authorized work areas. These include natural vegetation such as trees, shrubs, vines, grasses, and ground cover; landscape features; air and water quality; fish and wildlife habitat; endangered species; and soil conservation, as well as historical, archeological, and cultural resources.

3.3 Environmental Protection Procedures

Procedures to be implemented to provide the required environmental protection and to comply with the applicable laws and regulations shall be included. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures set out in accordance with the Environmental Protection Plan.

3.4 Design Drawings

Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, temporary fuel tanks, sanitary facilities, and stockpiles of excess or spoil materials shall be included.

3.5 Environmental Monitoring Management Plan

The Environmental Protection Plan shall include plans for monitoring environmental compliance for the jobsite, including land, water, air, noise, hazardous and toxic wastes, and materials and solid waste disposal.

3.6 Protection of Land Resources

Plan of protection for land resources as described in paragraph 7.1 of this specification shall be included.

3.7 Protection of Surface and Groundwater

Methods of protecting surface and groundwater during construction activities as described in paragraph 7.3 of this specification shall be included.

3.8 Protection of Air Resources

Methods for protecting air resources as described in paragraph 7.5 of this specification shall be included.

4. IMPLEMENTATION

The Contractor shall submit, in writing, the Environmental Protection Plan to the Contracting Officer's Representative within 10 days after receipt of Notice to Proceed. The Contracting Officer's Representative shall submit the plan to the PWBC Environmental/Natural Resources Division for approval. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures.

5. SUBCONTRACTORS

Assurance that subcontractors comply with the environmental protection requirements of this section will be the responsibility of the prime Contractor.

6. NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, State, or local laws or regulations, permits, and other elements of the Contractor's Environmental Protection Plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and implement such action as approved by the PWBC Environmental/Natural Resources Division. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspension.

7. PROTECTION OF ENVIRONMENTAL RESOURCES

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications. Environmental protection shall be as stated in the following subparagraphs:

7.1 Protection of Land Resources

Prior to the start of any construction, the Contractor shall identify all land resources to be preserved within the Contractor's work area. The Contractor shall not remove, cut, deface, injure, or destroy land resources, including trees, shrubs, vines, grasses, topsoil, and land forms, without special permission from the Contracting Officer. No ropes, cables, or guys shall be fastened or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times.

7.1.1 Forest Resources

Merchantable timber and pine straw shall neither be cut nor removed from the construction site until it has been assessed by the Savannah District Timber Harvest Office in conjunction with PWBC Natural Resources Branch. The Savannah District Timber Harvest Office will be given adequate time to arrange for the sale and removal of timber and pine straw. In the event that the Savannah District and Natural Resources Branch determine the amount or quality of timber or pine straw is not merchantable, they will inform the Contracting Officer. The Contracting Officer will authorize the Contractor to remove forest resources which are in the footprint of construction.

7.1.2 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that are not required to accomplish all work to be performed under this contract. Isolated areas within the general work area which are to be saved and

protected shall also be marked or fenced. Monuments, installed monitoring wells, and markers shall be protected before construction operations begin. Where construction operations are to be conducted during darkness, the markers shall still remain visible. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects. Damage to protected areas/objects shall be repaired immediately by the Contractor at no additional cost to the Government.

7.1.2.1 Installation or removal of Underground Storage Tanks, oil/water separators, and Aboveground Storage Tanks

Prior to any installation/removal of underground storage tanks (USTs), the Contractor will contact the PWBC Environmental Compliance Branch (ECB) UST Program Manager and provide all UST installation/removal information. The PWBC ECB UST Program Manager will apply for all UST installation/removal and operating permits. Removal or demolition of oil/water separators must be coordinated through the PWBC ECB Installation Restoration Program (IRP) Manager prior to start of demolition. Strict sampling requirements exist for removals of these structures. All of Fort Braggs oil/water separators are included as a Solid Waste Management Unit under the IRP Program.

7.1.3 Protection of Landscape

Trees, shrubs, vines, grasses, land forms, and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, wrapping, or any other approved techniques.

7.1.4 Reduction of Exposure of Unprotected Erodible Soils

Earthwork brought to final grade shall be vegetated as indicated and specified in the approved erosion control plan. Side slopes and back slopes shall be protected as soon as practicable, or within 15 working days of completion of final grading, or periods of no work activity. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in instances where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be cleared in total. Clearing of such areas shall progress in reasonably sized increments as needed to use the areas as approved by the Contracting Officer.

7.1.4.1 Erosion and Sedimentation Control Plan

When the total area of land disturbed is 1 acre or more in size, an Erosion and Sedimentation Control Plan shall be prepared by the Contractor. The plan will be prepared **using the local 25 year design storm and** in accordance with North Carolina Administrative Code, Title 15, Department of Natural and Economic Resources, Chapter 4, Sedimentation Control, January 1978. This plan is to be prepared, approved, and filed as part of the design prior to the start of any land-disturbing activity. When the area to be disturbed is less than 1 acre, a formal plan will not be required; however, erosion and sedimentation control measures will be incorporated as part of the design.

7.1.5 Temporary Protection of Disturbed Areas

Such methods as necessary shall be utilized to effectively prevent erosion and control sedimentation at all times including, but not limited to, the following:

7.1.5.1 Control of Runoff

Post construction runoff from the construction site shall **not be more than pre-development run-off and to** be controlled by construction of diversion ditches, benches, and silt basins; by checking dams and berms to reduce the velocity and divert runoff to protected drainage courses; and by any measures required by area wide plans approved under paragraph 208 of the Clean Water Act.

7.1.5.2 Sediment Basins

Sediment from construction areas shall be trapped in temporary or permanent sediment basins in accordance with basin plans shown on the drawings. The basins shall accommodate the runoff of a local **25**-year design storm. They shall be constructed as approved by the Contracting Officer to prevent sedimentation of downstream or down slope areas.

7.1.6 Disposal of Chemical Waste

The Contractor is responsible for the proper use, storage, and disposal of chemical material and waste in accordance with Fort Bragg Regulation 200-2. The PWBC Environmental/Natural Resources Division has established the following requirements in order for the post to remain in compliance with hazardous waste requirements as established by both State of North Carolina and Federal environmental laws:

7.1.6.1 Compatible Containers

Chemical waste shall be contained in and stored in aboveground compatible containers. Hazardous wastes shall not be stored underground. Any release or spill to the environment will be immediately reported to the Fort Bragg Fire Department at telephone (910) 396-7377/3015/1504 and to the PWBC Environmental/Natural Resources Division at telephone (910) 396-3341.

7.1.6.2 Recycling

The Contractor is encouraged to provide for recycling of waste through the Defense Reutilization and Marketing Office, Fort Bragg.

7.1.6.3 Chemical Analysis

The Contractor is responsible for obtaining chemical analyses of all chemical wastes. All chemical waste shall be disposed of in accordance with Fort Bragg's Waste Analysis Plan. Sampling of suspected hazardous waste is required to determine the hazardous waste characterization of the material. The Contractor is required to notify the contract inspector 1 day before the samples are taken. Samples shall be delivered by the contract inspector to the PWBC Environmental/Natural Resources Division for transmittal to an independent analytical laboratory. The laboratory shall be listed in the Environmental Protection Plan approved by the PWBC Environmental/Natural Resources Division.

7.1.6.4 Nonhazardous Waste

Waste that has been certified as nonhazardous waste may be removed off the project site by the Contractor. These wastes shall be disposed of in accordance with all applicable State of North Carolina requirements and U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM) guidance. The Contractor shall address the disposal method and location of

the disposal site for each chemical waste in the Environmental Protection Plan for the project.

7.1.6.5 Hazardous Waste

The Contractor may not normally remove hazardous waste from Fort Bragg. Removal shall be performed by a licensed hazardous waste firm. The hazardous waste contractor shall prepare the hazardous waste manifest form for signature by the Environmental/Natural Resources Division before each shipment of hazardous waste. Refer to Fort Bragg Regulation 200-2.

7.1.6.6 Labeling

Each container of hazardous waste shall be immediately labeled with a hazardous waste label and marked with the current date once any hazardous waste is put in the container. The Contractor shall keep the containers closed and inspect them weekly for signs of rust or deterioration. Inspection results shall be documented. Additionally, the U.S. Department of Transportation Shipping Name shall be marked on each container before it is removed from Fort Bragg. Refer to Fort Bragg Regulation 200-2.

7.1.6.7 Training

The Contractor shall ensure all of his employees who handle hazardous waste are trained in the management requirements for hazardous waste. Two hours of on-the-job training by the Environmental/Natural Resources Division will be scheduled for the first Wednesday of each month. All Contractor employees physically handling or managing waste media shall receive this training. Refer to Fort Bragg Regulation 200-2.

7.1.7 Disposal of Discarded Materials

Discarded materials, other than those which can be included in the solid waste category, will be handled as directed by the Contracting Officer. Construction and demolition debris shall be disposed of at the Fort Bragg Demolition Landfill on Lamont Road, and materials contaminated by asbestos or lead paint shall be contained and disposed of in the Asbestos Section of the Demolition Landfill. A permit from the PWBC Environmental/Natural Resources Division (building 3-1333) is required to dispose of materials in the landfills on post.

7.2 Preservation and Recovery of Historical, Archeological, and Cultural Resources

Existing historical, archeological, and cultural resources within the Contractor's work area will be designated by the Contracting Officer and precautions taken to preserve all significant resources as they existed at the time they were pointed out to the Contractor. The Contracting Officer's guidance shall be taken from the recommendations of the Cultural Resources Survey produced for the project area by the Savannah District, U.S. Army Corps of Engineers. The Contractor shall install all protection for resources designated on the drawings and shall be responsible for their preservation during this contract.

7.2.1 Artifacts Discovered During Construction

Any unforeseen historical or archeological finds encountered during Contractor operations shall be justification to cease all activity in the affected area. The PWBC Environmental/Natural Resources Division shall be promptly notified. They will determine the significance of the findings,

if necessary, after consultation with the North Carolina State Historic Preservation Officer, prior to authorizing the Contractor to resume operations in that area.

7.2.2 Cultural Resources Protected by Law

Cultural resources on Federal property are protected and managed by the Archeological Resources Protection Act of 1979, and other applicable laws. Artifacts may be collected on Fort Bragg only after approval by the Savannah District and the PWBC Environmental/Natural Resources Office as part of a controlled research design for scientific and cultural purposes. Collection for personal use is not authorized. Conviction subjects the violator to civil and criminal penalties.

7.3 Protection of Water Resources

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Special management techniques shall be implemented to control water pollution by any construction activities which are included in performing this contract.

7.3.1 Monitoring of Environmental Damage

Monitoring of water courses and wetland affected by construction activities shall be the responsibility of the Contractor. Wetland is intolerant to disturbance and will require special design and management to prevent encroachment. During construction, action will be required to maintain buffer areas and soil erosion control measures near water areas which could be adversely affected by construction activities.

7.4 Protection of Wildlife and Wildlife Habitat

The Contractor shall keep construction activities under surveillance, management, and control to minimize interference with, disturbance to, and damage of wildlife. Information concerning any species that require specific attention, along with measures for their protection, will be given by the PWBC Environmental/Natural Resources Division to the Contractor prior to start of construction operations.

7.4.1 Endangered Species Act

The Federal Endangered Species Act of 1973, as amended in 1982, requires that Federal lands be assessed for impacts upon endangered species and that such species be managed and protected. Although there are a number of rare, threatened, or endangered plant and animal species on Fort Bragg which are listed by either the Federal or State government, the species most often of concern are an endangered bird, the red-cockaded woodpecker (RCW) (Picoides borealis) and two endangered plants, the rough-leaf loosestrife (RLLS) (Lysimachia asperulaefolia) and Michaux's Sumac (MS) (Rhus michauxii).

7.4.2 Red-Cockaded Woodpecker

The RCW is dependent upon large numbers of mature pine trees for its survival. Their habitat is managed by the PWBC Natural Resources Division, Endangered Species Branch. The habitat of the RCW is marked in the following manner: (1) Cavity trees which are used by the birds for roosting and nesting are marked with two broad bands of white paint; and (2) Each cluster is protected by a buffer area at least 200 feet in

diameter around the cavity trees; trees on the edge of the buffer area are marked with signs. Fixed activity such as storage of construction materials, operation of concrete batch plants, or parking vehicles is not authorized inside the buffer area. Molesting the birds or damaging their habitat is a violation of the Endangered Species Act. Conviction can subject the violator to severe civil and criminal penalties.

7.4.3 Endangered Plants

Endangered plants are dependent for their survival upon specific environmental conditions such as soil type, slope aspect, moisture, and light. Their habitat is managed by the PWBC Natural Resources Division, Endangered Species Branch. Each colony site is protected by a buffer area at least 200 feet in diameter. Trees on the edge of the buffer area are marked with signs. Fixed activity such as storage of construction materials, operation of concrete batch plants, or parking vehicles is prohibited inside the buffer area. Damaging the habitat of endangered plants is a violation of the Endangered Species Act. Conviction can subject the violator to severe civil and criminal penalties.

7.5 Protection of Air Resources

The Contractor shall keep construction activities under surveillance, management, and control to minimize pollution of air resources, to include all necessary permits for equipment and control equipment. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with all State of North Carolina (NCAC Title 15A Subchapter 2D and 2Q) and Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency (EPA) shall be maintained for all construction operations and activities. The Contractor shall have sufficient functional equipment available to accomplish the task.

7.5.1 Particulates

Dust particles, aerosols, and gaseous byproducts from all construction activities and the processing and preparation of materials, such as from asphaltic batch plants and abrasive blasting activities (NCAC 15A 2D.0541) shall be controlled at all times.

7.5.2 Odors

Odors shall be controlled at all times for all construction activities, processing, and preparation of materials.

7.5.3 Air Quality

Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the construction activities shall be monitored by the Contractor when directed by the Contracting Officer.

7.6 Reduction of Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize disturbances caused by excessive noise. Equipment shall have properly operating noise-muffling devices for the entire length of the contract.

7.7 Application of Pesticides

The Contractor shall apply all pesticides in accordance with the requirements of the Federal Insecticide, Fungicide, and Rodenticide Act, using pesticides approved by the EPA and following the instructions on the manufacturer's label. Application of termiticides during construction, if applicable, will be addressed in technical provision section 02315 - Excavation, Filling, and Backfilling for Buildings in Paragraph 16, Soil Treatment.

7.7.1 Licensing and Certification

All pesticide applications shall be performed by a Contractor certified in the EPA category or categories which cover the work to be performed and shall hold a valid business license. For work at Fort Bragg, the Contractor shall be certified and licensed by the State of North Carolina. The Contractor shall present evidence of such licensing and certification to the Contracting Officer for approval prior to award of the contract.

8. POST-CONSTRUCTION CLEANUP

The Contractor shall be responsible to clean up all areas affected by the construction and restore them back to at least their original condition to include landscaping; planting of trees, grass, and shrubs damaged by construction; and raking and disposal of debris such as roofing shingles, paper, nails, glass, sheet metal, bricks, and waste concrete. Backfilled areas shall be machine compacted and replanted with grass. Construction debris shall be removed and properly disposed of. Culverts and drainages with sediment from the construction area shall be cleared routinely to maintain proper drainage and recleaned prior to completion of the contract.

9. RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the Environmental Protection Plan submitted for approval to the Contracting Officer. This work will be accomplished at the Contractor's expense.

10. MAINTENANCE OF POLLUTION CONTROL FACILITIES

The Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the contract or for the length of time construction activities produce the particular pollutant.

10.1 Containment Berms

The Contractor shall build a containment berm around temporary aboveground fuel storage tanks. The bermed area shall be large enough to contain 125 percent of the volume of the storage tanks if there is a leak. The Contractor shall not install any temporary underground storage tanks.

10.2 Erosion Control Devices

The Contractor shall immediately repair any damaged erosion control structures, such as silt fences, and remove accumulated sediment.

10.3 Storm Drains

The Contractor shall ensure sediment and other debris does not **enter** storm drains. The Contractor shall be responsible for removing sediment and other debris from storm drains after each rain event and a final removal at completion of contract.

11. TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL

The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers and instruments required for monitoring purposes) to ensure adequate and continuous environmental pollution control. Such training shall be completed before contract work begins.

SECTION 02 56 14

CLAY BARRIER LAYER
04/06

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 within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 1587	(2008) Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
ASTM D 2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2488	(2009) Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 3740	(2008) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4220	(1995; R 2007) Preserving and Transporting Soil Samples
ASTM D 4318	(2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 5084	(2003) Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

ASTM D 6938	(2007a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D 698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

1.2 UNIT PRICES (OMITTED)

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 Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Protection
Equipment

Materials Handling Plan describing the following: processing and placement of the clay; type, model number, weight and critical dimensions of equipment to be used for soil processing, compaction, scarification, and smooth rolling; method of protecting clay from changes in moisture content and freezing after placement.

Commercial Testing Laboratory

Name and qualifications of the proposed commercial testing laboratory.

SD-06 Test Reports

Borrow Source Assessment; G
Assessment Tests; G
Moisture Content and Density Tests of In-Place Clay; G
Hydraulic Conductivity Tests of In-Place Clay; G

Borrow Source Assessment Report at least 15 days prior to clay placement. No clay shall be placed until the Borrow Source Assessment Report is approved. The report shall include the following: location of each borrow source; plan view and estimated available quantity of clay; locations and logs of subsurface explorations; laboratory test results; moisture-density curves showing the "Acceptable Zone" of moisture contents and densities which achieve the required hydraulic conductivity for each principal type of material or combination of materials.

Submit 6 copies of results to Engineer within 24 hours of conclusion of physical testing including calibration curves and the results of calibration tests.

1.4 EQUIPMENT

Equipment used to place the clay barrier layer shall not brake suddenly, turn sharply, or be operated at speeds exceeding 5.0 miles per hour.

1.4.1 Compaction Equipment

Compaction equipment shall consist of tamping foot rollers which have a minimum weight of 40,000 pounds. At least one tamping foot shall be provided for each 110 square inches of drum surface. The length of each tamping foot, from the outside surface of the drum, shall be equal to or greater than the loose lift thickness. During compaction operations, the spaces between the tamping feet shall be maintained clear of materials which would impair the effectiveness of the tamping foot rollers.

1.4.2 Scarification Equipment

Disks, rotor tillers, or other approved means shall be provided to scarify the surface of each lift of clay if deemed necessary by CQA Consultant prior to placement of the next lift. The scarification equipment shall be capable of uniformly disturbing the upper 1 inch of the clay surface to provide good bonding between lifts.

1.4.3 Steel Wheeled Rollers (OMITTED)

1.4.4 Hand Operated Tampers

Hand operated tampers shall consist of rammers or other impact type equipment. Vibratory type equipment will not be allowed.

PART 2 PRODUCTS

2.1 CLAY

Clay shall be free of roots, debris, organic or frozen material, and shall have a maximum clod size of 2 inches at the time of compaction. Clay material shall comply with the criteria listed in Table 1 unless approved by Engineer.

TABLE 1
REQUIRED PHYSICAL PROPERTIES OF CLAY

Property	Test Value	Test Method
Max. particle size (inches)	1	ASTM D 422
Min. percent passing No. 4 sieve	80	ASTM D 422
Min. percent passing No. 200 sieve	25	ASTM D 1140
Min. liquid limit	35	ASTM D 4318
Min. plasticity index	10	ASTM D 4318
Max. plasticity index	40	ASTM D 4318

PART 3 EXECUTION

3.1 BORROW SOURCE ASSESSMENT

It is anticipated that the clay barrier layer required for this project will be obtained from the Fort Bragg borrow pit. See Section 01 00 05 and 31 00 00 for additional information related to borrow pit development.

Borrow source assessment tests shall be performed on each principal type or combination of materials proposed for use in the clay barrier layer to assure compliance with specified requirements and to develop compaction requirements for placement. A minimum of one set of borrow assessment tests shall be performed for each borrow source proposed. A set of borrow source assessment tests shall consist of classification testing, moisture-density (compaction) testing, and hydraulic conductivity testing.

3.1.1 Classification Testing

Test pits placed in a grid pattern shall be used to characterize each proposed borrow source. The test pits shall extend to the full depth of the proposed borrow source. Visual classification as described in ASTM D 2488 shall be performed over the full depth of each test pit by a qualified geologist or geotechnical engineer. Soils shall be grouped into "principal types" based on visual classification. Classification testing shall be performed on representative samples of each principal type or combination of materials. At a minimum, one set of classification tests shall be performed per 6500 cubic yards of proposed borrow. Classification testing shall consist of liquid and plastic limits in accordance with ASTM D 4318 and particle size analysis in accordance with ASTM D 422. Moisture content testing of proposed borrow shall be performed at a frequency of once per 2600 cubic yards in accordance with ASTM D 2216.

3.1.2 Compaction Testing

A representative sample from each principal type or combination of borrow materials shall be tested to establish compaction curves using , ASTM D 698 and ASTM D 1557. A minimum of one set of compaction curves shall be developed per 6,500 cubic yards of each proposed borrow material. A minimum of 5 points shall be used to develop each compaction curve. The compaction curves for each principal type or combination of borrow materials shall be plotted on a single graph of dry density versus moisture content.

3.1.3 Hydraulic Conductivity Testing

A set of hydraulic conductivity tests shall be performed on representative samples of each principal type or combination of borrow materials. A minimum of one set of tests shall be performed per 6,500 cubic yards of proposed borrow material. A set of tests shall consist of one hydraulic conductivity test run on a representative sample corresponding to each point from each compaction curve at or above ASTM D 1557 optimum moisture content. Hydraulic conductivity testing referenced in this section shall be conducted in accordance with ASTM D 5084. In addition, the following procedures shall be adhered to when performing the hydraulic conductivity testing:

a. Saturation of test specimens shall be verified by determination of the B coefficient. The B coefficient must be at least 0.95. The B coefficient is defined as the change in pore water pressure

divided by the change in confining pressure.

b. During consolidation of the test specimens, outflow volumes versus time shall be recorded on a semi-log graph to confirm primary consolidation has been completed prior to permeation of the specimens.

c. The permeant used for back pressure saturation and permeation shall be 0.01 molar calcium chloride solution created from deaired, distilled water as specified in ASTM D 5084.

d. The average effective confining pressure shall be 3 psi.

3.1.4 Acceptable Zone Development

An "Acceptable Zone" of moisture contents and densities shall be developed and displayed with the compaction curve graphs for each principal type of borrow material or combination of borrow materials. The "Acceptable Zone" shall consist of moisture-density values that meet the following requirements:

a. Maximum Allowable Hydraulic Conductivity = 1 x 10 to the -5 cm per second.

b. The minimum allowable moisture content shall be no less than optimum moisture content based on ASTM D 1557.

c. The minimum allowable density shall be no less than 90 percent of maximum dry density based on ASTM D 698.

3.1.5 Chemical Contamination Testing

Borrow used for the clay barrier layer shall be free of contamination.

3.1.6 Commercial Testing Laboratory

Tests for the clay barrier layer shall be performed by an approved testing laboratory furnished by the Contractor. The laboratory will have a quality system in place for personnel, equipment, reporting procedures, record keeping, and equipment calibration that ensures the laboratory is capable of accurately performing the specified testing. The quality system shall be in accordance with ASTM D 3740 or as approved by a Government Inspector.

3.2 INSTALLATION

3.2.1 Clay Placement

Prior to clay placement, ensure that a minimum of 6 inches of intermediate cover exists over the area where clay will be placed. Add intermediate cover as needed to meet minimum thickness and provide a smooth, even subgrade. Compact as necessary to provide a suitable surface for clay placement. Compaction requirements, if any, for intermediate cover shall be determined by Contractor during test fill construction. (See Section 02 66 10, TEST FILL.) Remove rocks, roots, and sticks greater than 1-inch in diameter from intermediate cover surface prior to clay placement.

Prior to full-scale clay placement, perform test fill in accordance with Section 02 66 10, TEST FILL.

Clay shall be placed to the lines, grades, and thickness shown on the drawings. The clay shall be placed in loose lifts not to exceed 8 inches in thickness. In areas where hand operated tampers must be used, the loose lift thickness shall not exceed 4 inches. Grade stakes shall not be driven into the clay layer.

3.2.2 Moisture Control

Clay shall be placed and compacted within the "Acceptable Zone" moisture content range in the approved Borrow Source Assessment Report. The moisture content shall be maintained uniform throughout each lift. Water added shall be thoroughly incorporated into the clay to ensure uniformity of moisture content prior to compaction.

3.2.3 Compaction

Clay shall be compacted to meet the density requirements in the approved Borrow Source Assessment Report and by at least 5 passes of the approved compaction equipment over all areas of each lift. For self-propelled compactors, one pass is defined as one pass of the entire vehicle. For towed rollers, one pass of the drum constitutes a pass. Hand operated tampers shall be used in areas where standard compaction equipment cannot be operated.

3.2.4 Scarification

Scarification shall be performed on all areas of the upper surface of each clay lift prior to placement of the next lift. Scarification shall be accomplished with approved equipment. The final lift shall not be smooth rolled. At a minimum, the final lift shall be roughened with the tracks of a bulldozer to provide adquate interface with the overlyng erosion layer.

3.2.5 Repair of Voids

Voids created in the clay barrier layer during construction (including, but not limited to, penetrations for test samples, grade stakes, and other penetrations necessary for construction) shall be repaired by removing sand or other non-clay material, placing clay backfill in lifts no thicker than 3 inches and tamping each lift with a steel rod. Each lift shall be tamped a minimum of 25 times altering the location of the rod within the void for each blow. Other ruts and depressions in the surface of the lifts shall be scarified, filled, and then compacted to grade.

3.3 CONSTRUCTION TOLERANCES

The minimum thickness of the completed clay barrier layer shall be 18 inches.

3.4 CONSTRUCTION TESTS

3.4.1 Clay Material Tests

During construction of the clay barrier layer, representative samples shall be taken for testing at the frequencies listed in Table 2 after a loose lift of clay has been placed. Test results shall meet the requirements listed in Table 1.

TABLE 2
CLAY MATERIAL PROPERTIES

Property	Frequency	Test Method
Particle size analysis (Note 1)	1,000 cubic yards	ASTM D 422
Atterberg limits (Note 1)	1,000 cubic yards	ASTM D 4318
Compaction (Note 2)	6,500 cubic yards	ASTM D 698

Note 1: At least one test shall be performed each day that soil is placed.
Note 2: Compaction test results shall be compared to previous results on the same material type to verify the compaction characteristics have remained the same.

3.4.2 Moisture Content and Density Tests of In-Place Clay

Moisture content and density tests shall be performed in a grid pattern. The grid pattern shall be staggered for successive lifts so that sampling points are not at the same location in each lift. Moisture content and density tests shall be performed in accordance with Table 3.

TABLE 3
MOISTURE CONTENT AND DENSITY TESTS OF IN-PLACE CLAY

Property	Frequency Per Lift	Test Method
Rapid Moisture Content	8,500 square feet	ASTM D 6938
Standard Moisture Content	1 for every 10 rapid tests	ASTM D 2216
Rapid Density	8,500 square feet	ASTM D 6938
Standard Density	1 for every 20 rapid tests	ASTM D 1556 or ASTM D 2167

3.4.2.1 Rapid Tests

Each day that clay is compacted, a minimum of one set of moisture content and density tests shall be performed using standard procedures. Rapid tests shall be checked at the frequencies shown in Table 3. Standard tests shall be performed at locations which are as close as possible to the location of the rapid tests being checked.

3.4.2.2 Nuclear Density and Moisture Content Tests

Nuclear density readings shall be taken in the direct transmission mode. When ASTM D 6938 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 6938 results in a wet unit weight of soil and when using this method

ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 6938; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.

3.4.2.3 Test Results

The field moisture content and density test results shall be plotted on the "Acceptable Zone" plot that corresponds to the appropriate material type being tested. If test results are not within the "Acceptable Zone" for moisture content or density, 3 additional tests shall be performed near the location of the failed parameter. If all retests pass, no additional action shall be taken. If any of the retests fail, the lift of soil shall be repaired out to the limits defined by passing tests for that parameter. The area shall then be retested as directed. Repairs to the clay layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.4.3 Hydraulic Conductivity Tests of In-Place Clay

Undisturbed samples shall be taken for hydraulic conductivity testing at a frequency of once per 40,000 square feet for each lift of clay placed. Samples shall be cut from the lift in accordance with ASTM D 1587 and transported in the vertical position in accordance with ASTM D 4220, Group C. Each undisturbed sample shall be tested for hydraulic conductivity in accordance with ASTM D 5084, moisture content in accordance with ASTM D 2216, particle size analysis in accordance with ASTM D 422, and liquid and plastic limits in accordance with ASTM D 4318. Hydraulic conductivity testing shall be conducted in accordance with the requirements in paragraph Hydraulic Conductivity Testing. If any test result is greater than the "Maximum Allowable Hydraulic Conductivity", modifications shall be proposed and approved for future placement of clay of that type. If the hydraulic conductivity of any test is more than one-half of one order of magnitude greater than the "Maximum Allowable Hydraulic Conductivity",3 additional tests shall be performed near the location of the original failed test. If all retests pass, no additional action shall be taken. If any of the retests fail, the area shall be repaired out to the limits defined by passing hydraulic conductivity tests. The area shall then be retested as directed. Repairs to the clay layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.4.4 Quality Assurance Samples

Quality assurance samples may be taken at locations as directed by the Owner or his representative. Samples shall be cut from the lift in accordance with ASTM D 1587 and shipped in the vertical position in accordance with ASTM D 4220, Group C.

3.5 PROTECTION

3.5.1 Moisture Content

After placement, moisture content shall be maintained or adjusted to meet the acceptable zone criteria.

3.5.2 Erosion

Erosion that occurs in the clay layer shall be repaired and grades re-established.

3.5.3 Freezing and Desiccation

Freezing and desiccation of the clay layer shall be prevented. If freezing or desiccation occurs, the affected soil shall be removed or reconditioned as directed.

3.5.4 Retests

Areas that have been repaired shall be retested as directed. Repairs to the clay layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.6 Surveying

Survey clay lbarrier layer in accordance with requirements of the Construction Quality Assuance (CQA) Plan for Closure. Provide as-built surveys to Engineer within one (1) week of completion of clay barrier layer to facilitate certification.

-- End of Section --

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SECTION 02 66 00

EROSION LAYER AND TOPSOIL FOR LANDFILL COVER
02/10

PART 1 GENERAL

1.1 UNIT PRICES (OMITTED)

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2487	(2006e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2974	(2007a) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4318	(2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4972	(2001; R 2007) pH of Soils

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials Handling Plan

Materials handling plan describing placement and compaction procedures. The plan shall also describe equipment to be used (including ground pressures).

SD-04 Samples

Erosion Layer

Topsoil

SD-06 Test Reports

Borrow Source Assessment Report; G
Erosion Layer and Topsoil Material Tests
Moisture Content and Density Tests of In-Place Erosion Layer

Submit 6 copies of test results to Engineer within 24 hours of conclusion of physical tests including calibration curves and the results of calibration tests.

PART 2 PRODUCTS

2.1 Erosion Layer

Erosion Layer shall comply with the criteria listed in Table 1 and shall be free of debris, frozen materials, angular rocks, roots, and organics. Submit a minimum of 50 pounds of erosion layer from each proposed borrow source to the Government's designated laboratory at least 15 days prior to placement.

2.2 TOPSOIL

Topsoil shall consist of natural, friable soil that is representative of soils in the vicinity which produce heavy growths of crops, grass, or other vegetation and is reasonably free from underlying subsoil, clay lumps, objectionable weeds, litter, brush, matted roots, toxic substances, or any material that might be harmful to plant growth or be a hindrance to grading, planting, or maintenance operations. Submit a minimum of 5 pounds of topsoil from each proposed borrow source to the Government's designated laboratory at least 15 days prior to placement. Topsoil shall also comply with the criteria listed in Table 1.

TABLE 1
REQUIRED PHYSICAL PROPERTIES OF EROSION LAYER AND TOPSOIL

Property	Test Value	Test Method
Erosion Layer		
Soil classification	Lean clay (CL) Clayey sand (SC) Silty sand (SM) Poorly graded sand with silt (SP-SM) Poorly graded sand with clay (SP-SC)	ASTM D 2487
Max. particle size (inches)	1.0	ASTM D 422
Topsoil		
Max. particle size (inches)	1	ASTM D 422
pH	5-7	ASTM D 4972
Organic content (%)	<5 (Erosion Layer) 5-20 (Topsoil)	ASTM D 2974

2.3 EQUIPMENT

Equipment used to place the erosion and topsoil layers shall be as described in the approved Materials Handling Plan, including ground

pressures. Equipment shall not accelerate or brake suddenly, turn sharply, or be operated at speeds exceeding 5.0 miles per hour.

PART 3 EXECUTION

3.1 BORROW SOURCE ASSESSMENT REPORT

It is anticipated that the erosion layer and topsoil required for this project will be obtained from the Fort Bragg borrow pit or on-site borrow soutces. See Sections 01 00 05 and 31 00 00 for additional information related to borrow pit development.

Submit a Borrow Source Assessment Report at least 15 days prior to erosion layer and topsoil placement. No erosion layer or topsoil shall be placed until the Borrow Source Assessment Report is approved. The report shall include the following: location of each borrow source; estimated quantity of borrow available; logs of subsurface explorations; and laboratory test results.

3.1.1 Erosion Layer

3.1.1.1 Classification Testing

Borrow source assessment tests shall be performed on each principal type or combination of materials proposed for use in the erosion layer to ensure compliance with specified requirements. At least one set of borrow assessment tests shall be performed on each borrow source proposed for use. A set of borrow source assessment tests shall consist of Atterberg limits (ASTM D 4318), particle size analysis (ASTM D 422), and moisture content (ASTM D 2216). Based on borrow source assessment testing, soils shall be classified in accordance with ASTM D 2487.

3.1.1.2 Moisture-Density (Compaction) Testing

Moisture-density (compaction) testing is not required for the erosion layer or topsoil. Compaction for these layers will be limited to what can be accomplished using dozer treads to achieve a uniform surface without large clods or voids.

3.1.2 Topsoil

Testing shall be performed on representative samples of each principal type or combination of topsoil materials. At least one set of tests shall be performed on each borrow source proposed. Testing shall consist of the determination of maximum particle size in accordance with ASTM D 422, pH in accordance with ASTM D 4972, and organic content in accordance with ASTM D 2974.

3.1.3 Chemical Contamination Testing

Borrow used for the erosion layer and topsoil layers shall be free of contamination.

3.2 INSTALLATION

3.2.1 Erosion Layer Placement

No equipment shall be operated directly on the top surface of the low-permeability barrier layer without permission from the Contracting

Officer. Erosion layer shall be pushed out over low-permeability barrier layer in an upward tumbling motion so that the underlying soil layer is not damaged or displaced. Soil shall not be dropped directly onto low-permeability barrier layer from a height greater than 3 feet.

3.2.1.1 Lift Thickness of Erosion Layer

The entire 12-inch compacted thickness of erosion layer may be placed in a single lift. Compaction shall consist of a minimum of 2 passes over all areas with dozer treads.

3.2.2 Topsoil Placement

Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading. Topsoil shall be placed in one lift and shall be evenly spread to a final compacted thickness of 6 inches. Topsoil shall be traffic compacted using approved placement equipment.

3.3 CONSTRUCTION TOLERANCES

Finished surfaces shall be uniformly graded and shall be free from depressions, mounds, or windrows. The minimum thickness of the completed combined erosion and topsoil layers shall be 18 inches. Rigid grade stakes shall not be driven into the erosion layer to control placement.

3.4 CONSTRUCTION TESTS

3.4.1 Erosion Layer and Topsoil Material Tests

No select fill or topsoil shall be placed until the Borrow Source Assessment Report is approved. During construction of the erosion and topsoil layers, representative samples shall be taken for testing at the frequencies listed in Table 2 from the borrow source prior to placement. Test results must comply with the requirements listed in Part 2 Products or the material will be rejected for use. Submit test results as specified.

TABLE 2
EROSION LAYER AND TOPSOIL MATERIAL TESTING FREQUENCIES

Property	Frequency	Test Method
Erosion Layer		
Grain size analysis	2,000 cubic yards	ASTM D 422
Atterberg limits	2,000 cubic yards	ASTM D 4318
Topsoil		
Grain size analysis	2,000 cubic yards	ASTM D 422
pH	2,000 cubic yards	ASTM D 4972
Organic content	2,000 cubic yards	ASTM D 2974

3.5 PROTECTION

3.5.1 Damage

Erosion rills or other damage that occurs shall be repaired and grades re-established. Repairs to the erosion layer or topsoil layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.5.2 Stockpiles

Storage or stockpiling of material on the completed surface of the erosion or topsoil layers will not be permitted.

3.6 Surveying

Survey clay barrier layer in accordance with requirements of the Construction Quality Assurance (CQA) Plan for Closure. Provide as-built surveys to Engineer within one (1) week of completion of clay barrier layer to facilitate certification.

-- End of Section --

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SECTION 02 66 10

TEST FILL
02/10

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 within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4318	(2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4643	(2008) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D 5084	(2003) Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 6938	(2007a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D 698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

1.2 SYSTEM DESCRIPTION

The Contractor shall submit construction plan for the test fill. Test fill construction shall not begin until the test fill construction plan is approved. The materials proposed for use in the test fill and interface friction testing shall also be approved prior to the start of test fill construction. The plan shall include, but shall not be limited to, the following items:

a. Proposed locations.

b. Proposed modifications to the test fill design;

c. Placement sequence;

d. Surface water control and diversion;

e. Equipment to be used including operating speeds, traffic patterns, and number of passes;

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Construction Plan
A plan describing the proposed test fill, as specified.

QC Inspector
Qualifications of the QC inspector.

SD-06 Test Reports

Weekly Reports
Final Report
Weekly report due within 3 days of the end of the week in which data was obtained. Final report within 7 days of the completion of the test fill. The Contractor shall allow 7 days for review and approval of the final report.

1.4 QUALITY ASSURANCE

The QC inspector shall be present during test fill construction, shall review the Contractor's test data, and shall ensure that the Contractor has constructed each layer of the test fill as specified.

PART 2 PRODUCTS

2.1 INTERMEDIATE COVER

Intermediate cover shall consist of soils typically used at the facility for intermediate cover. Contractor shall place additional intermediate cover as needed to maintain a minimum 6-inch thickness and maintain a smooth even surface beneath the test fill. Compaction requirements for the intermediate cover shall be determined by Contractor as part of test fill construction.

2.2 CLAY (LOW-PERMEABILITY)BARRIER LAYER

The clay (low-permeability) barrier layer shall consist of an 18 inch compacted clay layer as specified in Section 02 56 14 CLAY BARRIER LAYER and as shown on the drawings.

2.3 EQUIPMENT

The test fill shall be constructed to demonstrate that the proposed equipment and procedures are acceptable for construction of the full scale landfill low-permeability barrier layer. Equipment used shall be as specified in the sections referenced.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Location

Construct the test fill on a portion of the sideslope within the designated closure area. The location shall be approved by Engineer prior to construction. Photographs shall be made during construction of each layer of the test fill to document construction techniques.

3.1.2 Size

The top surface of the test fill shall be a minimum of 100 feet long and 70 feet wide. The prepared intermediate cover layer shall extend a minimum of 5 feet beyond the edge of the upper surface of the test fill.

3.1.3 Slope

The completed slope of each layer in the test fill shall be 3 horizontal on 1 vertical.

3.2 PLACEMENT

3.2.1 Clearing and Grubbing

Clear and grub the area beneath the test fill and 10 feet beyond the edges of the test fill in accordance with Section 31 11 00 CLEARING AND GRUBBING.

3.2.2 Subgrade Compaction

After clearing and grubbing, the existing landfill surface beneath the test fill and 10 feet beyond the edges of the test fill shall be compacted as described in Section 02 56 14 CLAY (LOW PERMEABILITY) BARRIER LAYER, Part 3.2.

3.2.3 Drainage Controls

Before beginning construction, construct drainage controls around the test fill to protect it from erosion damage. The drainage control shall be maintained until completion of the post-construction monitoring period.

3.2.4 Anchor Trench (OMITTED)

3.2.5 Test Fill Placement

All components of the test fill shall be constructed as described in the specification sections previously referenced.

3.2.6 Survey Control Points

Contractor shall establish suitable control points to verify that required

thicknesses are achieved and to document extent of completed test fill.

3.2.7 Permanent Bench Mark

Surveys shall be tied to a permanent bench mark outside the boundaries of the landfill.

3.3 TESTS

Each layer of the test fill shall be tested as specified below. Rapid methods may be used to perform moisture and density tests in accordance with ASTM D 6938, or ASTM D 4643. However, at least 1 density test per lift shall be performed using the methods described in ASTM D 1556 or ASTM D 2167 and at least 1 moisture content test per lift shall be performed using the methods described in ASTM D 2216.

3.3.1 Intermediate Cover Tests

Contractor shall determine whether minimum compaction requirements need to be established for intermediate cover in order to provide a suitable subgrade for for clay (low-permeability) barrier layer. If Contractor determines minimum compaction requirements need to be established, a minimum of 2 sets of classification tests shall be performed on each lift of intermediate cover placed. Classification tests shall be performed in accordance with ASTM D 422 and ASTM D 4318. A minimum of 1 laboratory test shall also be performed on the intermediate cover soil in accordance with ASTM D 698 A minimum of 5 density and 5 moisture content tests shall be performed per lift.

3.3.2 Clay (Low-Permeability) Barrier Layer Tests

The QC Inspector shall inspect the clay barrier layer during construction to verify material and placement methods are acceptable. A minimum of 5 3-inch Shelby tube samples shall be taken from the completed clay layer at locations directed by the QC inspector. Shelby tube samples shall be extruded and visually examined by the QC inspector for signs of inadequate bonding between lifts. A set of classification tests and a hydraulic conductivity test shall be performed on each Shelby tube sample taken. Classification tests shall be performed in accordance with ASTM D 422 and ASTM D 4318. Hydraulic conductivity tests shall be performed in accordance with ASTM D 5084. A minimum of 5 field density tests and 5 moisture content tests shall be performed on each lift of clay placed.

3.3.3 Erosion Layer Tests

The erosion layer is not required to be installed as part of the test fill construction. Erosion layer placement within the test fill area may be deferred until general erosion layer placement. See 02 66 00 EROSION LAYER AND TOPSOIL FOR LANDFILL COVER.

3.3.4 Post-Construction Monitoring

The test fill shall be monitored for a minimum of 5 days following construction. The QC Inspector shall inspect the test fill daily and report its condition in the Construction Quality Control Daily Reports. After every precipitation event, the QC inspector shall inspect the condition of the test fill.

3.3.5 Weekly Reports

Weekly reports shall include test results and survey data related to test fill construction and post-construction monitoring during the previous 7 days. The QC inspector shall certify that the weekly reports are accurate. Submit weekly reports within 3 days of the end of the week in which data was obtained.

3.3.6 Final Report

The final report shall include the following: construction and monitoring test results; and conclusions related to test fill construction and monitoring. The QC inspector shall review the final report and certify its accuracy. A copy of the photographs of the test fill construction and monitoring shall be included.

3.4 APPROVAL

Full-scale construction shall not begin until the Contracting Officer has approved the final report. The test fill shall be rejected if the Contractor's placement methods result in damage to system components, Clay (Low-Permeability) Barrier Layer maximum hydraulic conductivity requirements are not met, or there is down-slope movement of any of the test. If rejected, the test fill shall be removed. A new test fill construction plan shall be submitted and another test fill shall be constructed and monitored at no additional cost to the Government. Only materials, methods, and equipment used in the approved test fill shall be used for full-scale construction.

3.5 INCORPORATION INTO FINAL COVER

After approval of the final post-construction monitoring report, the Contractor may incorporate the test fill into the final cover of the landfill. The edges of the Clay (Low-Permeability) Barrier Layer within the test fill shall be cut back to allow adjacent lifts of barrier layer to adequately overlap and tie into the existing soil.

-- End of Section --

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SECTION 02 92 01FB

EROSION CONTROL AND TURF SEEDING

DESCRIPTION OF WORK: This work shall consist of complete ground preparation and establishment of a permanent cover of grass on all open earth areas and all disturbed areas within the limits of construction. The work shall conform to this specification and shall be carefully coordinated with the site grading operations and erosion control work shown on the drawings and/or as covered in the specifications.

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.

AGRICULTURAL MARKETING SERVICE (AMS)

AMS Seed Act (1995) Federal Seed Act Regulations Part 201

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 977 (1998) Emulsified Asphalt

STATE OF NORTH CAROLINA

North Carolina Seed Law
North Carolina Commercial Fertilizer Law
North Carolina Liming Materials and Landplaster Act
North Carolina Department of Transportation Standard Specifications for Roads and Structures, 1984 or Later Edition

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 Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Seed; GA

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.

SD-11 Closeout Submittals

Records and Test Data, Quality Control; FIO

1.3 (OMITTED)

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 (Omitted)

1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.3 (Omitted)

1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. Open soil amendment containers or wet soil amendments shall be rejected. Unacceptable materials shall be removed from the job site.

1.4.3 Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants.

1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.5 Time Limitation

Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with the AMS Seed Act and applicable state seed laws.

2.1.2 Permanent Seed Species, Mixtures and Rates of Application

Erosion Control Mix, March 1 through August 31 - Summer

Botanical Name	Common Name	Rate (lb/acre)
Cynodon dactylon	Common Bermudagrass (hulled)	50
Setaria italica	Brown Top Millet, German Millet, or	50
Brachiaria ramosum	Foxtail Millet	50

Erosion Control Mix, September 1 through February 28 - Winter

Botanical Name	Common Name	Rate (lb/acre)
Cynodon dactylon	Common Bermudagrass (hulled)	25
Cynodon dactylon	Common Bermudagrass (unhulled)	25
Triticum spelta	Roane Soft Red Winter Wheat	50

Turf Mix, March 1 through August 31 - Summer

Botanical Name	Common Name	Rate (lb/acre)
Cynodon dactylon	Common Bermudagrass (hulled)	50
Setaria italica	Brown Top Millet, German Millet, or	50
Brachiaria ramosum	Foxtail Millet	50

Turf Mix, September 1 through February 28 - Winter

Botanical Name	Common Name	Rate (lb/acre)
Cynodon dactylon	Common Bermudagrass (hulled)	50
Cynodon dactylon	Common Bermudagrass (unhulled)	50
Triticum spelta	Roane Soft Red Winter Wheat	50

2.1.3 Temporary Seed Species

Temporary seed species and rates for surface erosion control or turfed areas shall be as follows.

March 1 through August 31 - Summer

Botanical Name	Common Name	Rate (lb/acre)
Setaria italica	Brown Top Millet, German Millet, or	65
Brachiaria ramosum	Foxtail Millet	65

September 1 through February 28 - Winter

Botanical Name	Common Name	Rate (lb/acre)
Triticum spelta	Roane Soft Red Winter Wheat	120

2.1.4 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture.

2.1.5 Seed Mixing

The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.

2.1.6 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.2 (OMITTED)

2.3 SOIL AMENDMENTS

Soil amendments shall consist of lime and fertilizer meeting the following requirements.

2.3.1 Lime

Lime shall be agricultural grade, dolomitic limestone meeting requirements of the North Carolina Liming Materials and Landplaster Act and of ASTM C 602.

2.3.2 Fertilizer

Fertilizer shall be commercial grade, free flowing, uniform in composition and shall conform to applicable state regulations. Granular fertilizer shall conform to the North Carolina Commercial Fertilizer Law and shall bear the manufacturer's guaranteed statement of analysis. Granular fertilizer shall contain a minimum percentage by weight of 10 percent nitrogen, 20 percent phosphoric acid, and 20 percent potash. When slow release nitrogen forms are used in the fertilizer mixture, they shall be derived from sulfur-coated urea, urea formaldehyde, plastic or polymer-coated prills, or isobutylene diurea. Upon approval by the Contracting Officer, a different analysis of fertilizer may be used, provided the 1-2-2 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as a 10-20-20 analysis.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

2.4.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice, furnished in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment.

2.4.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other herbaceous mowings, furnished in an air-dry condition suitable for placing with commercial mulch-blowing equipment.

2.4.3 Wood Cellulose Fiber

Wood cellulose fiber mulch shall be used only in hydroseeding applications. It shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

2.5 ASPHALT ADHESIVE

Asphalt adhesive shall conform to the following: Emulsified asphalt, conforming to ASTM D 977, Grade SS-1; or to North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures, grade CRS-1 or CRS-1H.

2.6 WATER

Water shall be the responsibility of the Contractor, unless otherwise noted. Water shall not contain elements toxic to plant life.

2.7 (OMITTED)

2.8 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

2.8.1 Surface Erosion Control Straw or Excelsior Blanket

2.8.1.1 Straw Net Blanket

Straw blanket material manufactured for erosion control purposes. It shall be produced of 100% agriculture straw. It shall have a consistent thickness with the straw evenly distributed over the entire area of the mat. The top and bottom sides shall be covered with lightweight photodegradable polypropylene netting having an approximate 1/2 inch x 1/2 inch mesh. The blanket shall be sewn together with cotton thread. Each blanket roll shall be 6.5 feet in width, and 83.5 feet in length and weight 30 pounds (+ or - 10%)

2.8.1.2 Excelsior Blanket

Blanket shall be machine produced mat of wood excelsior formed from a web of interlocking wood fibers; covered on one side with either knitted straw blanket-like mat construction; covered with biodegradable plastic mesh; or interwoven biodegradable thread, plastic netting, or twisted kraft paper cord netting.

2.8.2 Surface Erosion Control Coconut Fiber Blanket

Coconut fiber erosion control blanket material manufactured for erosion control purposes. It shall be produced of 100% coconut fiber. It shall have a consistent thickness with the straw evenly distributed over the entire area of the mat. The top and bottom sides shall be covered with lightweight photodegradable polypropylene netting having an approximate 1/2 inch x 1/2 inch mesh. The blanket shall be sewn together with cotton thread. Each blanket roll shall be 6.5 feet in width, and 83.5 feet in length and weight 30 pounds (+ or - 10%)

2.8.3 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLING SEED TIME AND CONDITIONS

3.1.1 Seeding Time

Seed shall be installed from March 1 through August 31 for summer establishment; and from September 1 through February 28 for winter establishment, in accordance with paragraph SEED.

3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval.

3.2 SITE PREPARATION

3.2.1 Finished Grade

The Contractor shall verify that finished grades are as indicated on drawings, and that smooth grading and compaction requirements have been completed prior to the commencement of the seeding operation.

3.2.2 Application of Soil Amendments

3.2.2.1 Applying Lime

The application rate shall be 2000 pounds per acre, or 50 lb per 1000 square feet. Lime shall be incorporated into the soil to a minimum of 2 inches and maximum 4 inches.

3.2.2.2 Applying Fertilizer

The application rate shall be 425 pounds per acre, or 10 pounds per 1000 square feet. Fertilizer shall be incorporated into the soil to a minimum of 2 inches and a maximum of 4 inches or may be incorporated as part of the tillage or hydroseeding operation. An additional 425 pounds per acre, or 10 pounds per 1000 square feet, shall be applied when permanent grass is one inch tall. When slow release nitrogen forms are used in the fertilizer mixture, a single application of 850 pounds per acre may be incorporated into the soil to a maximum 4-inch depth or may be incorporated as part of the tillage or hydroseeding operation.

3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 4-inch depth. On slopes 3-horizontal-to-1-vertical and steeper, the soil shall be tilled to a minimum 2-inch depth by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Existing dirt trails and open areas which are to be planted with pines shall be tilled for the top 12 inches. Lime and fertilizer may be applied during this procedure.

3.2.4 Prepared Surface

3.2.4.1 Preparation

The prepared surface shall be a maximum 1-inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris.

3.2.4.2 Turf Area Debris

Debris and stones over a minimum 5/8 inch in any dimension shall be removed from the surface.

3.2.4.3 Erosion Control Area Debris

Debris and stones over a minimum 3 inches in any dimension shall be removed from the surface.

3.2.4.4 Protection

Areas with the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

3.3 INSTALLATION

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.3.1 Installing Seed

Seeding method shall be Broadcast Seeding, and Drill Seeding. Hydroseeding shall only be allowable on slopes steeper than 1 horizontal to 1 vertical. Seeding procedure shall ensure even coverage. Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used because of the difficulty in achieving even coverage, unless otherwise approved. If used, absorbent polymer powder shall be mixed with the dry seed at the rate recommended by the manufacturer.

3.3.1.1 Broadcast Seeding

Seed shall be uniformly broadcast at the rate shown in paragraph SEED, using broadcast seeders. Seed shall not be broadcast by hand. Half the total rate of seed application shall be broadcast in 1 direction, with the remainder of the seed rate broadcast at 90 degrees from the first direction. Seed shall be covered a maximum 1/4 inch depth by disk harrow, cultipacker, or other approved device.

3.3.1.2 Drill Seeding

Seed shall be uniformly drilled to a maximum 1/4 inch depth and at the rate shown in paragraph SEED, using equipment having drills a maximum 5 inches distance apart. Row markers shall be used with the drill seeder. Half the total rate of seed application shall be drilled in 1 direction, with the remainder of the seed rate drilled at 90 degrees from the first direction. The drilling equipment shall be maintained with half full seed boxes during the seeding operations.

3.3.2 Hydroseeding

Hydroseeding shall only be used on slopes steeper than 1 horizontal to 1 vertical. Seed shall be mixed to ensure broadcast at the rates shown in paragraph SEED. Seed and fertilizer shall be added to water and thoroughly mixed to meet the rates specified, or fertilizer may be applied separately in accordance with paragraph SITE PREPARATION. The time period for the seed to be held in the slurry shall be a maximum 24 hours. After the seed, fertilizer, and water have been thoroughly mixed to produce a homogeneous slurry, one third of the wood cellulose and tackifier, at the rates recommended by the manufacturer, shall be added to two thirds of the seed, fertilizer and water slurry and applied. The remaining two thirds of the mulch and tackifier shall be mixed with the remaining one third of the seed slurry and applied in a second application. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled. Lime shall not be applied with a hydroseeder, but only in accordance with paragraph LIME.

3.3.3 Mulching

3.3.3.1 Hay or Straw Mulch

Straw mulch shall be spread uniformly at the rate of 2 tons per acre. Hay mulch shall be spread uniformly at the rate of 3 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be

completely excluded from penetrating to the ground surface, with no bare spot larger than a quarter. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.3.3.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.3.3.3 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier shall be uniformly sprayed at a rate between 10 to 13 gallons per 1000 square feet. Sunlight shall not be completely excluded from penetrating to the ground surface.

3.3.3.4 Wood Cellulose Fiber

Hydroseeding shall only be used on slopes steeper than 1 horizontal to 1 vertical. Wood cellulose fiber shall be applied as part of the hydroseeding operation. The mulch shall be mixed and applied in accordance with the manufacturer's recommendations or 2000 pounds per acre, whichever is greater.

3.3.4 Watering Seed

Watering shall be started immediately after completing the seeding of an area. Water shall be applied to supplement rainfall at a rate sufficient to ensure moist soil conditions to a minimum 1-inch depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.4 SURFACE EROSION CONTROL

3.4.1 Surface Erosion Control Material

Where indicated or as directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.

3.4.2 Temporary Seeding

Bare or disturbed areas that will be left over 15 days, or areas where directed during contract delays affecting the seeding operation, shall be seeded in accordance with temporary seed species and rates listed under paragraph SEED.

3.5 (OMITTED)

3.6 (OMITTED)

3.7 RESTORATION AND CLEAN UP

3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding operation shall be restored to original condition at Contractor's expense.

3.7.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.9 SEED ESTABLISHMENT PERIOD

3.9.1 Quality Control

During construction, an established system of quality control shall be maintained. To assure compliance with contract requirements and the maintenance of records of all materials, equipment, and construction operations, quality control shall include but not be limited to the following:

Seeding -- Specified species planted at proper rates; preparation of planting bed as to thoroughness of tillage, leveling and depth of planting.

Mulching -- Types and rates of application.

Satisfactory stand of grass -- Coverage of the planted species at the end of the specified growth period, and the maintenance procedures, including supplemental fertilization.

A copy of all records and test data required herein, and the records of corrective action taken, shall be furnished to the Contracting Officer.

3.9.2 Satisfactory Stand of Grass Plants, Turf or Erosion Control Area

A stand of turf is considered acceptable when the new growing sprouts of permanent grass are visible at the surface showing not less than 40 seedlings of permanent grass at least 2 inches long in each square foot, where no gaps larger than 2 inches in diameter occur anywhere in the seeded area, and where the total bare spots do not exceed 2 percent of the total seeded area. Permanent grass is defined as Common Bermuda or Centipede.

3.9.3 Maintenance During Establishment Period

Maintenance of the seeded areas shall include protecting embankments and ditches from surface erosion; maintaining erosion control materials and

mulch; protecting installed areas from traffic; mowing; watering; and post-fertilization.

3.9.3.1 Mowing

a. Turf Areas: Turf areas shall be mowed to a minimum 3-inch height when the turf is a maximum 4 inches high. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

b. Erosion Control Areas: Erosion control areas shall be mowed to a minimum 4 inch height when the plants are a maximum 8 inches high. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

3.9.3.2 Post-Fertilization

After the permanent grass has been accepted, and between the dates of April 15 and October 15, apply 425 pounds of fertilizer per acre.

3.9.3.3 Repair or Reinstall

Unsatisfactory stand of grass plants and mulch shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

3.9.3.4 Warranty

There is no 1-year warranty for maintenance after acceptance of grass.

Section No.: 02921B/S
Dated: June 2001
Notice/Date:

SUBMITTAL REGISTER DATA

Spec & Paragraph Number	Description of Submittal	Type of Submittal*									Classification	
		1	2	3	4	5	6	7	8	9	FIO	GA
02921B 2.1	Seed							X				D
02921B, 3.9.1	Records and Test Data (Quality Control)									X	X	

*1 = Data 3 = Instructions 5 = Statements 7 = Certificates 9 = Records
2 = Drawings 4 = Schedules 6 = Report 8 = Samples

SECTION 31 00 00

EARTHWORK
08/08

PART 1 GENERAL

1.1 MEASUREMENT PROCEDURES (OMITTED)

1.2 PAYMENT PROCEDURES (OMITTED)

1.3 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are approximately as indicated on drawings. Contractor shall verify surface conditions prior to bidding and make any necessary adjustments to his bid to reflect actual conditons at the time of bidding.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Ground water will not be encountered within the depth of the excavation.

d. Material character is indicated by the boring logs.

e. Hard materials and rock will not be encountered in excavations.

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop
AASHTO T 224	(2001; R 2004) Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557	(2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 2487	(2006e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4318	(2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 6938	(2007a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D 698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

1.5 DEFINITIONS

1.5.1 Satisfactory Materials

Satisfactory materials for general fill comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, ML, and CL-ML. Satisfactory materials for grading comprise stones less than 3 inches.

1.5.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.5.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.5.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch

sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.5.5 Overhaul (OMITTED)

1.5.6 Topsoil

Material suitable for topsoils obtained from offsite areas is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.5.7 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 3 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.5.8 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.5.9 Unstable Material

Unstable material are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.5.10 Select Granular Material

1.5.10.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, OR SP, by ASTM D 2487 where indicated. The liquid limit of such material must not exceed 35 percent when tested in accordance with ASTM D 4318. The plasticity index must not be greater than 12 percent when tested in accordance with ASTM D 4318, and not more than 35 percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D 1140.

1.5.11 Initial Backfill Material (OMITTED)

1.5.12 Expansive Soils (OMITTED)

1.5.13 Nonfrost Susceptible (NFS) Material (OMITTED)

1.5.14 Pile Supported Structure (OMITTED)

1.6 SYSTEM DESCRIPTION

Subsurface soil boring logs are available for the facility and may be requested by the Contractor prior to bidding. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.6.1 Classification of Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.7 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals
Proposed source of borrow material; G
Borrow plan approvals by Owner of borrow sourcce; G

Submit 15 days prior to starting work.

SD-03 Product Data

Procedure and location for disposal of unused satisfactory material. Advance notice on the opening of excavation or borrow areas.

SD-06 Test Reports

Within 24 hours of conclusion of physical tests, 6 copies of test results, including calibration curves and results of calibration tests. Results of testing at the borrow site.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS (OMITTED)

2.2 BURIED WARNING AND IDENTIFICATION TAPE (OMITTED)

2.3 DETECTION WIRE FOR NON-METALLIC PIPING (OMITTED)

2.4 MATERIAL FOR RIP-RAP

Provide filter fabric and rock conforming to NCDOT Standard Specifications, latest version.

2.4.1 Rock

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Do not permit the inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines.

2.5 CAPILLARY WATER BARRIER (OMITTED)

2.6 PIPE CASING (OMITTED)

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 4 inch. Spread topsoil on areas already graded and prepared for topsoil, or transport and deposit in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inch in diameter, and other materials that would interfere with planting and maintenance operations.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the Drawings. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material to grades shown. Dispose excavated material as shown or as directed. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as

directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of structures.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. 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 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.

3.2.4 Dewatering (OMITTED)

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 4 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inch inside diameter, and do not exceed 36 inch plus pipe outside diameter for sizes larger than 24 inch inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 3 inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 4 inch below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove

such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures sufficient to leave at least 12 inch clear between the outer structure surfaces and the face of the excavation or support members. Remove unstable material.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation (OMITTED)

3.3 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Obtain borrow material from on-site excavation areas or approved borrow sources. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, excavate borrow pits and other excavation areas providing adequate drainage. Transport overburden and other spoil material to designated spoil areas or otherwise dispose of as directed. Provide neatly trimmed and drained borrow pits after the excavation is completed. Ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.Do not exceed permitted depths or limits of borrow pits.

3.5 SHORING (OMITTED)

3.6 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory and unsatisfactory as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.7 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE (OMITTED)

3.8 GROUND SURFACE PREPARATION

3.8.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.8.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.9 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removed from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and

bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.10 BURIED TAPE AND DETECTION WIRE (OMITTED)

3.11 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed as specified in paragraph GROUND SURFACE PREPARATION. Provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.11.1 Trench Backfill

Backfill trenches to the grade shown.

3.11.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.11.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.

3.11.1.3 Bedding and Initial Backfill

Provide bedding of the type and thickness recommended by the pipe manufacturer. Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Provide plastic piping with bedding to spring line of pipe.

3.11.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, railroads and airfields, with satisfactory material. Place backfill material and compact as follows:

a. Roadways, Railroads, and Airfields: Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Deposit backfill in layers of a maximum of 12 inch loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Apply this requirement to all

other areas not specifically designated above.

3.11.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.12 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.12.1 Rip-Rap Construction

Construct rip-rap on filter fabric in accordance with NCDOT Standard Specificaton Section 868 in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.12.1.1 Bedding Placement

Finish subgrade to present even surface free from mounds and windrows. Spread filter fabric on prepared subgrade as indicated.

3.12.1.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.13 EMBANKMENTS

3.13.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 12 inch in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise brake up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.14 SUBGRADE PREPARATION

3.14.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade with six passes of a dump truck loaded with 4 cubic yards of soil or a 15 ton or pneumatic-tired roller. Operate the roller or truck in a systematic manner to ensure the number of passes over all areas, and at speeds between 2-1/2 to 3-1/2 mph. When proof rolling, provide one-half of the passes made with the roller in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material as directed by the Contracting Officer and replace with fill and backfill material.

3.14.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inch below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified.

3.14.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least 90 percent of laboratory maximum density per ASTM D 698.

3.15 SHOULDER CONSTRUCTION (OMITTED)

3.16 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-establish grades to the required elevations and slopes.

3.16.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do no disturb the finished subgrade by traffic or other operation. Protect and maintain the finsihed subgrade in a satisfactory condition

until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.16.2 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.17 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inch depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 6 inches and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas.

3.18 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer. Determine field in-place density in accordance with ASTM D 6938. When ASTM D 6938 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D 1556. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D 6938; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.18.1 Fill and Backfill Material Gradation

One test per 1,000 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM D 422.

3.18.2 In-Place Densities

a. One test per 2,500 square feet, or fraction thereof, of each lift of fill or backfill areas.

3.18.3 Check Tests on In-Place Densities

If ASTM D 6938 is used, check in-place densities by ASTM D 1556 as follows:

a. One check test per lift for each 2,500 square feet, or fraction thereof, of each lift of fill or backfill.

3.18.4 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.18.5 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 6,500 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.18.6 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.18.7 Displacement of Pipes

After other required tests have been performed and the trench backfill compacted to the finished grade surface, inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.19 DISPOSITION OF SURPLUS MATERIAL

Place surplus soil in soil stockpile shown in Drawings. Dispose of other materials in accordance with the requirements of Section 01005, GENERAL AND SPECIAL PROVISIONS.

3.20 Surveying

Survey basegrade of new landfill cells in accordance with requirements of the Construction Quality Assuance (CQA) Plan for New Construction. Provide as-built surveys to Engineer within one (1) week of completion of basegrade to facilitate certification

-- End of Section --

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SECTION 31 05 22

GEOTEXTILES USED AS FILTERS
08/08

PART 1 GENERAL

1.1 UNIT PRICES (OMITTED)

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 123	(2009) Terminology Relating to Textiles
ASTM D 4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Geotextile

Geotextile samples for testing, if requested, to determine compliance with the requirements in this specification, a minimum of 60 days prior to the beginning of installation of the same textile. Upon delivery of the geotextile, submit duplicate copies of the written certificate of compliance signed by a legally authorized official of the manufacturer. The certificate shall state that the geotextile shipped to the site meets the NCDOT Standard Specification. Upon request, supply quality control and quality assurance tests for the geotextile. Provide all samples from the same production lot as will be supplied for the contract, of the full manufactured width of the geotextile by at least 10 feet long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 5 feet. Samples submitted for testing shall be identified by manufacturer's lot designation. For needle punched geotextile, the manufacturer shall certify that the geotextile has been inspected using permanent on-line metal detectors and does not contain any needles.

SD-07 Certificates

Geotextile

Manufacturer's certification of the geotextile material. All brands of geotextile and all seams to be used will be accepted on the basis of mill certificates or affidavits. Submit duplicate copies of the mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver only approved geotextile rolls to the project site. All geotextile shall be labeled, shipped, stored, and handled in accordance with ASTM D 4873. No hooks, tongs, or other sharp instruments shall be used for handling geotextile.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Geotextile

2.1.1.1 General

Provide geotextile that is a woven pervious sheet of plastic yarn as defined by ASTM D 123 matching or exceeding the minimum average roll values for NCDOT Type 2 geotextile per Standard Specification 1056.

2.1.1.2 Geotextile Fiber

Fibers used in the manufacturing of the geotextile shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, polyesters, or polamides. Add stabilizers and/or inhibitors to the base polymer, if necessary to make the filaments resistant to deterioration caused by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Finish the edges of the geotextile to prevent the outer fiber from pulling away from the geotextile.

2.1.2 Seams (OMITTED)

2.1.3 Securing Pins

Secure the geotextile to the embankment or foundation soil by pins to prevent movement prior to placement of revetment materials. Other appropriate means to prevent movement such as staples, sand bags, and stone could also be used. Insert securing pins through both strips of overlapped geotextile along the line passing through midpoints of the overlap. Remove securing pins as placement of revetment materials are placed to prevent tearing of geotextile or enlarging holes. Maximum spacing between securing pins depends on the steepness of the embankment slope. The maximum pins spacing shall be equal to or less than the values listed in TABLE 1. When windy conditions prevail at the construction site, increase the number of pins upon the demand of the Contracting Officer. Anchor terminal ends of the geotextile with key trench or apron at crest, toe of the slope and upstream and downstream limits of installation.

TABLE 1
MAXIMUM SPACING FOR SECURING PINS

EMBANKMENT	SPACING, feet
STEEPER THAN 1V ON 3H	2
1V ON 3H TO 1V ON 4H	3
FLATTER THAN 1V ON 4H	5

2.2 INSPECTIONS, VERIFICATIONS, AND TESTING

2.2.1 Manufacturing and Sampling

Geotextiles shall meet the requirements of NCDOT Type 2 geotextile.

2.2.2 Site Verification and Testing (OMITTED)

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Prepare surface, on which the geotextile will be placed, to a relatively smooth surface condition in accordance with the applicable portion of this specification and shall be free from obstruction, debris, depressions, erosion feature, or vegetation. Remove any irregularities so as to ensure continuous, intimate contact of the geotextile with all the surface. Any loose material, soft or low density pockets of material, shall be removed; erosion features such as rills, gullies etc. shall be graded out of the surface before geotextile placement.

3.2 INSTALLATION OF THE GEOTEXTILE

3.2.1 General

Place the geotextile in the manner and at the locations shown. At the time of installation, reject the geotextile if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage.

3.2.2 Placement

Place the geotextile with the long dimension parallel to the direction of water flow where applicable and laid smooth and free of tension, stress, folds, wrinkles, or creases. Place the strips to provide a minimum width of 12 inches of overlap for each joint. Adjust the actual length of the geotextile used based on initial installation experience. Temporary pinning of the geotextile to help hold it in place until the overlying material is placed will be allowed. Remove the temporary pins as the overlying material is placed to relieve high tensile stress which may occur during placement of material on the geotextile. Perform trimming in such a manner that the geotextile is not damaged in any way.

3.3 PROTECTION

Protect the geotextile at all times during construction from contamination by surface runoff; remove any geotextile so contaminated and replaced with uncontaminated geotextile. Replace any geotextile damaged during its installation or during placement of overlying material at no cost to the Government. Schedule the work so that the covering of the geotextile with a layer of the specified material is accomplished within 7 calendar days after placement of the geotextile. Failure to comply shall require replacement of geotextile. Protect the geotextile from damage prior to and during the placement of riprap or other materials. This may be accomplished by limiting the height of drop to less than 1 foot, by placing a cushioning layer of sand or gravel on top of the geotextile before placing the material, or other methods deemed necessary. Care should be taken to ensure that the utilized cushioning materials will not impede the flow of water. Before placement of riprap or other materials, demonstrate that the placement technique will not cause damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile.

3.4 PLACEMENT OF CUSHIONING MATERIAL

Perform placing of cushioning material in a manner to ensure intimate contact of the geotextile with the prepared surface and with the cushioning material. The placement shall also be performed in a manner that will not damage the geotextile including tear, puncture, or abrasion. On sloping surfaces place the cushioning material from the bottom of the slopes upward. During placement, the height of the drop of riprap material shall not be greater than 12 inches. Uncover any geotextile damaged beneath the cushioning material, as necessary, and replace at no cost to the Government.

3.5 OVERLAPPING AND SEAMING

3.5.1 Overlapping

The overlap of geotextile rolls shall be 12 inches. Appropriate measures will be taken to ensure required overlap exists after cushion placement.

3.5.2 Sewn Seams (OMITTED)

3.6 FIELD TESTING (OMITTED)

-- End of Section --

SECTION 31 11 00

CLEARING AND GRUBBING
08/08

PART 1 GENERAL

1.1 SUBMITTALS (OMITTED)

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS (OMITTED)

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Protection shall be in accordance with Section 02013, ENVIRONMENTAL PROTECTION DURING CONSTRUCTION. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01005, GENERAL AND SPECIAL PROVISIONS for additional utility protection.

3.2 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights

indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated for removal shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 PRUNING

Trim trees designated to be left standing within the cleared areas of dead branches 1 1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1 1/4 inches in diameter with an approved tree wound paint.

3.5 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.6 DISPOSAL OF MATERIALS

3.6.1 Saleable Timber (OMITTED)

3.6.2 Nonsaleable Materials

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations shall be disposed of in accordance with Section 01005, GENERAL AND SPECIAL PROVISIONS.

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES
08/09

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT (OMITTED)

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 294	(2008) Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter

ASTM INTERNATIONAL (ASTM)

ASTM D 1557	(2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2321	(2005) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 3350	(2008) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 6938	(2007a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM F 477	(2008) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Placing Pipe

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-07 Certificates

Resin Certification
Determination of Density

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated on the Drawings and shall conform to the requirements specified.

2.1.1 Concrete Pipe (OMITTED)

2.1.2 Clay Pipe (OMITTED)

2.1.3 Corrugated Steel Pipe (OMITTED)

2.1.4 Corrugated Aluminum Alloy Pipe (OMITTED)

2.1.5 Structural Plate, Steel Pipe, Pipe Arches and Arches (OMITTED)

2.1.6 Structural Plate, Aluminum Pipe, Pipe Arches and Arches (OMITTED)

2.1.7 Ductile Iron Culvert Pipe (OMITTED)

2.1.8 Cast-Iron Soil Piping (OMITTED)

2.1.9 Perforated Piping (OMITTED)

2.1.10 PVC Pipe (OMITTED)

2.1.11 PE Pipe

Submit the pipe manufacturer's resin certification, indicating the cell classification of PE used to manufacture the pipe, prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D 3350.

2.1.11.1 Smooth Wall PE Pipe (OMITTED)

2.1.11.2 Corrugated PE Pipe

AASHTO M 294, Type S. For slow crack growth resistance, acceptance of resins shall be determined by using the notched constant ligament-stress (NCLS) test meeting the requirements of AASHTO M 294. Pipe walls shall have the following properties:

Nominal Size (in.)	Minimum Wall Area (square in/ft)	Minimum Moment of Inertia of Wall Section (in to the 4th/in)
12	1.50	0.024
15	1.91	0.053
18	2.34	0.062
24	3.14	0.116
30	3.92	0.163
36	4.50	0.222
42	4.69	0.543
48	5.15	0.543
54	5.67	0.800
60	6.45	0.800

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be made of polyethylene by same manufacturer as pipe.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete (OMITTED)

2.3.2 Mortar (OMITTED)

2.3.3 Precast Concrete Segmental Blocks (OMITTED)

2.3.4 Brick (OMITTED)

2.3.5 Precast Reinforced Concrete Manholes (OMITTED)

2.3.6 Prefabricated Corrugated Metal Manholes (OMITTED)

2.3.7 Frame and Cover for Gratings (OMITTED)

2.3.8 Joints

2.3.8.1 Corrugated PE Plastic Pipe

Pipe joints shall be water tight and shall conform to the requirements in AASHTO M 294. Water tight joints shall be made using a PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F 477.

2.4 STEEL LADDER (OMITTED)

2.5 DOWNSPOUT BOOTS (OMITTED)

2.6 RESILIENT CONNECTORS (OMITTED)

2.7 HYDROSTATIC TEST ON WATERTIGHT JOINTS (OMITTED)

2.8 EROSION CONTROL RIPRAP

See Section 31 00 00, EARTHWORK.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be as shown on the Drawings.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under

the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 31 00 00 EARTHWORK.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the manufacturer's recommendations.

3.3.1 Corrugated PE Pipe

Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's recommendations.

3.4 JOINTING (OMITTED)

3.5 DRAINAGE STRUCTURES (OMITTED)

3.6 STEEL LADDER INSTALLATION (OMITTED)

3.7 BACKFILLING

3.7.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of

pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe for flexible pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 6 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.7.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 6 inches. Use select granular material for this entire region of backfill for flexible pipe installations.

3.7.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.7.4 Compaction

3.7.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.7.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for

cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.7.5 Determination of Density

Testing is the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 6938. When ASTM D 6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 6938 results in a wet unit weight of soil and ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.8 PIPELINE TESTING

3.8.1 Leakage Tests (OMITTED)

3.8.2 Deflection Testing (OMITTED)

3.8.3 Post-Installation Inspection

One hundred percent of all flexible pipes shall be checked for rips, tears, joint separations, soil migration through the joint, cracks, localized bucking, bulges, settlement and alignment.

a. Replace pipes having cracks or deflection greater than recommended by the pipe manufacturer.

b. Reports: Final post installation inspection report shall include: pipe location identification, inspector name, deviation from design, grade, deviation from line, deflection and deformation of flexible pipe systems, inspector notes, condition of joints, condition of pipe wall (e.g. distress, cracking, wall damage dents, bulges, creases, tears, holes, etc.).

3.9 FIELD PAINTING (OMITTED)

-- End of Section --

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

CONSTRUCTION QUALITY ASSURANCE PLAN (New Construction)

MAY 2010

Prepared for:

DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
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Project No. F9 00026-8

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TABLE OF CONTENTS

SECTION 1.0 GENERAL 1

1.1 Background Information 1
1.2 Definitions Relating to Construction Quality 1
1.2.1 Construction Quality Assurance (CQA) 1
1.2.2 Construction Quality Control (CQC) 1
1.2.3 CQC/CQA Certification Document 1
1.2.4 Discrepancies Between Documents 2
1.3 Parties to Construction Quality Assurance 2
1.3.1 Description of the Parties 2
1.3.2 Qualifications of the Parties 4
1.4 Scope of Construction Quality Assurance Plan 4
1.5 Units 4
1.6 References 4
1.7 Site and Project Control 5
1.7.1 CQA/CQC Resolution Meeting 5
1.7.2 CQA/CQC Preconstruction Meeting 5
1.7.3 CQA/CQC Progress Meetings 6
1.7.4 Problem or Work Deficiency Meetings 6

SECTION 2.0 SUBGRADE CONSTRUCTION QUALITY ASSURANCE 7

2.1 Introduction 7
2.2 Earthwork Construction 7
2.2.1 Subgrade Material 7
2.2.2 Structural/Controlled Fill 7
2.3 Soils Testing 7
2.3.1 Test Methods 7
2.3.2 Soils Testing Requirements 7
2.4 Soils Construction Quality Assurance 7
2.4.1 Monitoring 8
2.4.2 Construction Quality Assurance Judgmental Testing 8
2.4.3 Perforations in Subgrade 8
2.4.4 Deficiencies 8

SECTION 3.0 SURVEYING CONSTRUCTION QUALITY CONTROL 10

3.1 Introduction 10
3.2 Survey Control 10
3.3 Surveying Personnel 10
3.4 Precision and Accuracy 10
3.5 Lines and Grades 10
3.6 Frequency and Spacing 11
3.7 Tolerances 11
3.8 Documentation 11

TABLE OF CONTENTS

SECTION 4.0 CONSTRUCTION QUALITY ASSURANCE DOCUMENTATION 12

4.1 Documentation 12
4.2 Recordkeeping 12
4.2.1 Memorandum of Discussion with CQC Consultant 12
4.2.2 CQA Observation Logs and Testing Data Sheets 13
4.2.3 CQA Construction Problem and Solution Data Sheets 13
4.3 CQA Photographic Reporting Data Sheets 14
4.4 Design and/or Project Technical Specification Changes 14
4.5 CQA Progress Reports 14
4.6 Signature and Final Report 14
4.7 Storage of Records 15

Figure 1-1 CQA/CQC Lines of Authority and Communication 3

SECTION 1.0 GENERAL

1.1 Background Information

This Construction Quality Assurance (CQA) Plan has been prepared to provide the Owner, Engineer, and CQA Consultant the means to govern the construction quality and to satisfy landfill certification requirements under current solid waste management regulations.

More specifically, this CQA Plan addresses the soils component of the subgrade. The subgrade, as referenced herein, generally consists of at least four feet of soil above long-term seasonal high groundwater, with the upper two feet meeting current solid waste management regulations.

The CQA Plan is divided into the following sections.

- Section 1.0 – General
- Section 2.0 – Subgrade Construction Quality Assurance
- Section 3.0 – Surveying Construction Quality Control
- Section 4.0 – Construction Quality Assurance Documentation

1.2 Definitions Relating to Construction Quality

1.2.1 Construction Quality Assurance (CQA)

In the context of this Plan, construction quality assurance is defined as a planned and systematic program employed by the Owner to assure conformity of the subgrade, with Contract Drawings, and the project specifications. CQA is provided by the CQA Consultant as a representative of the Owner and is independent from the Contractor and all manufacturers. The CQA program is designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

1.2.2 Construction Quality Control (CQC)

Construction Quality Control refers to actions taken by manufacturers, fabricators, installers, or the Contractor to ensure that the materials and the workmanship meet the requirements of this CQA Plan and the project specifications. In the case of the subgrade, CQC is provided by the Contractor's CQC Consultant.

1.2.3 CQC/CQA Certification Document

At the completion of construction and prior to placement of waste in the landfill, a certification document will be prepared by the CQA Consultant and will be submitted to state solid waste regulators. The certification report will include all CQC testing performed by the CQC Consultant and all CQA conformance testing performed by the CQA Consultant.

1.2.4 Discrepancies Between Documents

The CQA Plan is intended to be a supporting document to improve the overall documentation of the Work. The CQA Plan is less specific than the project specifications, and conflicts may exist between the documents. The Contractor is instructed to bring discrepancies to the attention of the Engineer or CQA Consultant for resolution. The Engineer has the sole authority to determine resolution of discrepancies existing within the Contract Documents. Unless otherwise determined by the Engineer, the more stringent requirement shall be the controlling resolution.

1.3 Parties to Construction Quality Assurance

1.3.1 Description of the Parties

The parties to Construction Quality Assurance and Quality Control include the Owner, Project Manager, Engineer, Contractor, CQA Consultant, Soils CQA Laboratory, CQC Consultant, and Soils CQC Laboratory. The lines of authority and communications between each of the parties involved in the CQA and CQC are illustrated in Figure 1.

1.3.1.1 Owner

The Owner is Fort Bragg, who owns and is responsible for the facility.

1.3.1.2 Project Manager

The Project Manager is the official representative of the Owner. The Project Manager serves as communications coordinator for the project, initiating the resolution, preconstruction, and construction meetings outlined in Section 1.7. The Project Manager shall also be responsible for proper resolution of all quality issues that arise during construction.

1.3.1.3 Engineer

The Engineer is responsible for the engineering design, drawings, plans and project specifications for the subgrade.

1.3.1.4 Contractor

The Contractor is responsible for the construction project. The Contractor is responsible for submittal coordination and the overall CQC on the project.

1.3.1.5 Construction Quality Assurance Consultant

The CQA Consultant is a representative of the Owner and is responsible for observing, testing, and documenting activities related to the CQC/CQA of the earthworks at the site. The CQA Consultant is also responsible for issuing a facility certification report, sealed by a Professional Engineer registered in North Carolina.

1.3.1.6 Soils Construction Quality Assurance Laboratory

The Soils Construction Quality Assurance Laboratory is a party, independent from the Owner that is responsible for conducting geotechnical tests on conformance samples of

soils in the subgrade. The Soils CQA Laboratory service cannot be provided by any party involved with the Contractor.

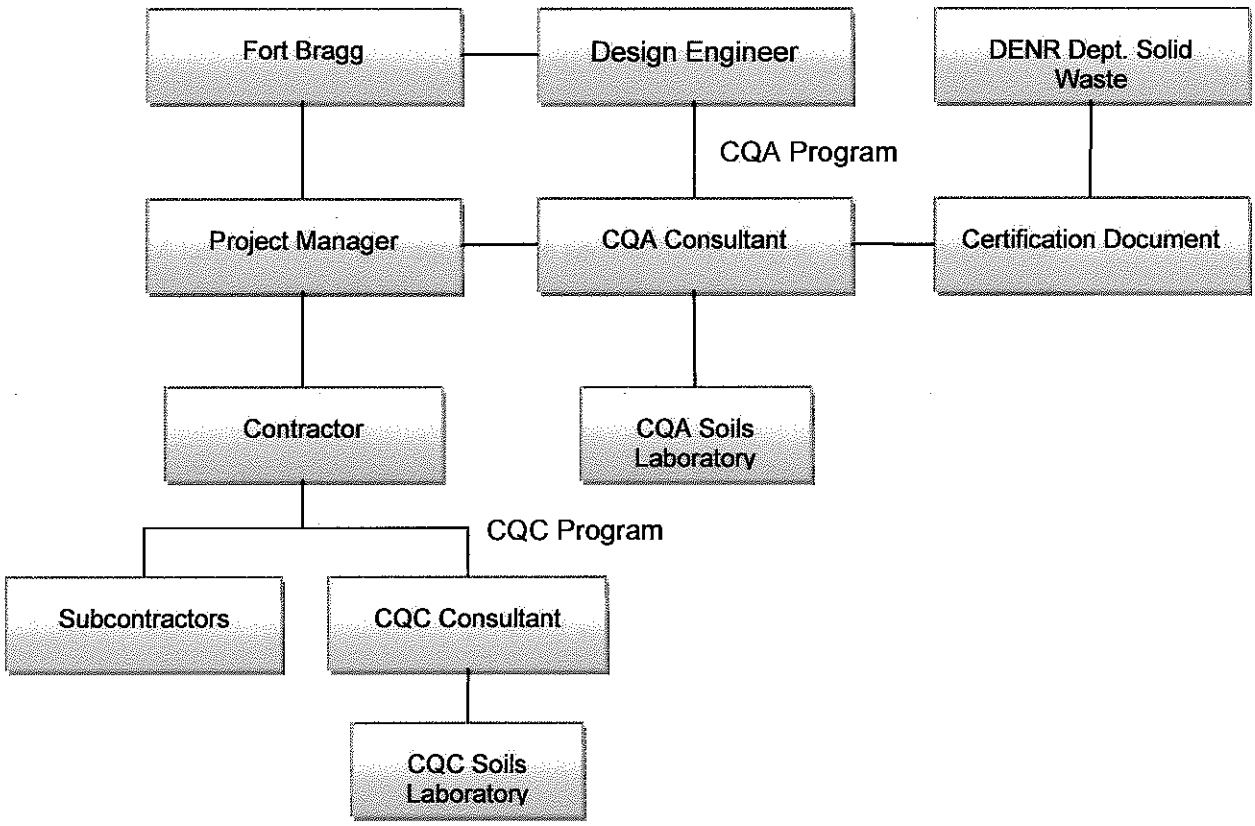
1.3.1.7 Construction Quality Control Consultant

The CQC Consultant is a representative of the Contractor and is responsible for the earthwork and subgrade quality control sampling and testing. The term CQC Consultant shall be used to designate the Engineer in charge of the quality control work. The personnel of the CQC Consultant also includes Quality Control Monitors who are also located at the site for construction observation and monitoring. The CQC Consultant is responsible for the timely conveyance of CQC testing results to the CQA Consultant.

1.3.1.8 Soils Construction Quality Control Laboratory

The Soils Construction Quality Control Laboratory is a party, independent from the Contractor, that is responsible for conducting geotechnical tests on samples of soils in the subgrade.

Figure 1-1 CQA/CQC Lines of Authority and Communication



1.3.2 Qualifications of the Parties

The following qualifications are required for parties involved with the manufacture, fabrication, installation, transportation, and CQC/CQA of all materials for the subgrade. Where applicable, these qualifications must be submitted by the Contractor to the Project Manager for review and approval.

1.3.2.1 Contractor

Qualifications of the Contractor are specific to the construction contract and independent of this CQA Plan.

1.3.2.2 Construction Quality Assurance Consultant

The CQA Consultant will act as the Owner's CQA Representative and will report to the Project Manager. The CQA Consultant will perform conformance testing to satisfy the requirements of this CQA Plan, will observe the CQC work performed by the CQC Consultant, and will prepare the certification document incorporating both CQA and CQC test data. The CQA Consultant will have experience in the CQC/CQA aspects of landfill construction and soils testing, and be familiar with ASTM and other related industry standards. The activities of the CQA Consultant will be performed under the supervision of a Registered Professional Engineer.

1.3.2.3 Construction Quality Control Consultant

The CQC Consultant will be a party, independent from the Contractor. The CQC Consultant will be experienced with soils. The CQC Consultant will satisfy the requirements of the project specifications and be approved by the Project Manager. The activities of the CQC Consultant will be performed under the supervision of a Registered Professional Engineer.

1.4 Scope of Construction Quality Assurance Plan

The scope of this CQA Plan includes the CQA of the subgrade for the subject facility. The CQA for the selection, evaluation, and placement of the soils is included in the scope. This document is intended to be used in concert with the CQC requirements presented in the project specifications.

1.5 Units

In this CQA Plan, all properties and dimensions are expressed in U.S. units.

1.6 References

The CQA Plan includes references to the most recent version of the test procedures of the American Society of Testing and Materials (ASTM) and the American Association of State Highway and Transportation Officials (AASHTO).

1.7 Site and Project Control

To guarantee a high degree of quality during installation, clear, open channels of communication are essential. To that end, meetings are critical.

1.7.1 CQA/CQC Resolution Meeting

Prior to field mobilization by the Contractor, a Resolution Meeting will be held. This meeting will include all parties then involved, including the Project Manager, the CQA Consultant, the Engineer, the Contractor, and the CQC Consultant.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems which might cause difficulties and delays in construction, and, above all, review the CQA and CQC Plans for all of the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted by all.

This meeting should include all of the following activities:

- Communicate to all parties any relevant documents.
- Review critical design details of the project.
- Review the site-specific CQA and CQC Plans.
- Make any appropriate modifications to the CQA and CQC Plans to ensure that they specify all testing activities that are necessary.
- Reach a consensus on the CQA/CQC quality control procedures, especially on methods for determining acceptability of the soils.
- Select testing equipment and review protocols for testing and placement of general earthwork materials.
- Confirm methods for the subgrade material selection testing.
- Confirm the methods for documenting and reporting; for distributing documents and reports; and confirm the lines of authority and communication.

The meeting will be documented by the Project Manager and minutes will be transmitted to all parties.

1.7.2 CQA/CQC Preconstruction Meeting

A Preconstruction Meeting will be held at the site prior to construction of the subgrade. At a minimum, the meeting will be attended by the Project Manager, Engineer, the CQA Consultant, the Contractor, and the CQC Consultant.

Specific topics considered for this meeting include:

- Make any appropriate modifications to the CQA and CQC Plans.
- Review the responsibilities of each party.
- Review lines of authority and communication.

- Review methods for documenting and reporting, and for distributing documents and reports.
- Establish protocols for testing.
- Establish protocols for handling deficiencies, repairs, and retesting.
- Review the time schedule for all operations.
- Outline procedures for packaging and storing archive samples.
- Review repair procedures.
- Establish soil stockpiling locations (if any).

The meeting will be documented by the Project Manager and minutes will be transmitted to all parties. The Resolution Meeting and the Preconstruction Meeting may be held as one meeting or separate meetings, depending on the direction of the Project Manager.

1.7.3 CQA/CQC Progress Meetings

Periodic progress meetings will be held between the Project Manager, CQA Consultant, Contractor, CQC Consultant, and representatives from any other involved parties. These meetings will discuss current progress, planned activities for the next week, and any new business or revisions to the work. The CQA Consultant will log any problems, decisions, or questions arising at this meeting in his daily report. Any matter requiring action which is raised in this meeting will be reported to the appropriate parties.

Meeting frequency will depend on the schedule of the project and the mutual agreement of all parties involved.

1.7.4 Problem or Work Deficiency Meetings

A special meeting will be held when and if a problem or deficiency is present or likely to occur. At a minimum, the meeting will be attended by all interested parties, the Contractor, the Project Manager, and the CQA Consultant. If the problem requires a design modification, the Engineer should also be present. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency.
- Review alternative solutions.
- Implement an action plan to resolve the problem or deficiency.

The meeting will be documented by the Project Manager and minutes will be transmitted to affected parties.

SECTION 2.0 SUBGRADE CONSTRUCTION QUALITY ASSURANCE

2.1 Introduction

This section of the CQA Plan addresses the soil of the subgrade, and outlines the soils CQA program to be implemented with regard to materials confirmation, laboratory and field confirmation test requirements, overview and interfacing with the Contractor's CQC Program, and resolution of problems.

2.2 Earthwork Construction

2.2.1 Subgrade Material

The subgrade material below the controlled fill will be prepared by the Contractor prior to the placement of fill. The CQC Consultant will provide soil classification testing of the subgrade at the frequency specified in the project specifications. The CQA Consultant will observe the proofroll by the Contractor, review the test data provided by the CQC Consultant, and provide verification that the subgrade is acceptable. The CQA Consultant may conduct confirmation testing as deemed appropriate.

2.2.2 Structural/Controlled Fill

The Contractor shall place fill in accordance with the project specifications. The CQC Consultant shall provide testing of the controlled fill material in accordance with the project specifications. The CQA Consultant will provide confirmation testing of the controlled fill as deemed appropriate.

2.3 Soils Testing

2.3.1 Test Methods

All testing used to evaluate the suitability or conformance of soils materials will be carried out in accordance with the project specifications.

2.3.2 Soils Testing Requirements

The soil CQC testing must comply with the minimum frequencies presented in the project specifications. The frequency of CQA testing required will be determined by the CQA Consultant in light of the potential variability of materials and the acceptance/failure rate of the CQC testing.

2.4 Soils Construction Quality Assurance

CQA will be performed on all components of the subgrade construction. CQA evaluation will consist of: (1) monitoring the work and observing the CQC testing; and (2) performing laboratory and field conformance tests as deemed necessary. Laboratory CQA conformance tests may be conducted on

samples taken at the excavation, borrow source, and stockpile prior to construction. Field CQA conformance tests may be conducted during the course of the work.

2.4.1 Monitoring

The CQA Consultant shall monitor and document the construction of the subgrade. Monitoring the construction work for the subgrade includes the following:

- Observing CQC testing to determine the water content and other physical properties of the subgrade during excavation or compaction and compilation of the data.
- Monitoring the loose thickness of lifts as placed.
- Monitoring the action of the compaction and/or heavy hauling equipment on the construction surface (i.e., penetration, pumping, cracking. etc.).
- Monitoring the number of passes used to compact each lift.

2.4.2 Construction Quality Assurance Judgmental Testing

During construction, the frequency of conformance testing may be increased at the discretion of the CQA Consultant when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- The rollers slip during rolling operation.
- The lift thickness is greater than specified.
- The fill material is at an improper moisture content.
- Fewer than the specified number of roller passes are made.
- Dirt-clogged rollers are used to compact the material.
- The rollers may not have used optimum ballast.
- The fill materials differ substantially from those specified.
- The degree of compaction is doubtful.

2.4.3 Perforations in Subgrade

Perforations that must be filled will include, but not be limited to, the following:

- Soil classification sampling locations; and/or
- Thickness checks.

Unless otherwise noted, or as directed by the Project Manager, all perforations of the subgrade will be backfilled in accordance with project specifications. The CQA Consultant will observe and confirm that adequate procedures are being employed.

2.4.4 Deficiencies

If a defect is discovered in the earthwork product, the CQC Consultant will immediately determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQC Consultant will determine the extent of the deficient area by additional tests,

observations, a review of records, or other appropriate means. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQC Consultant will define the limits and nature of the defect.

2.4.4.1 Notification

After determining the extent and nature of a defect, the CQC Consultant will notify the Project Manager, the CQA Consultant, and Contractor and schedule appropriate retests when the work deficiency is corrected. The CQA Consultant shall observe all retests on defects.

2.4.4.2 Repairs and Retesting

The Contractor will correct the deficiency to the satisfaction of the CQA Consultant. If a project specification criterion cannot be met, or unusual weather conditions hinder work, then the CQC Consultant will develop and present to the Project Manager and CQA Consultant suggested solutions for approval.

All retests recommended by the CQC Consultant must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency. The CQA Consultant will verify that all installation requirements are met and that all submittals are provided.

2.4.4.3 Penalties

Refer to Specifications.

SECTION 3.0 SURVEYING CONSTRUCTION QUALITY CONTROL

3.1 Introduction

Surveying of lines and grades is conducted on an ongoing basis during construction of the subgrade. Close CQC of the surveying is absolutely essential to ensure that slopes are properly constructed. The surveying conducted at the site shall be performed by the Contractor.

3.2 Survey Control

Permanent benchmarks and baseline control points are to be established for the site at locations convenient for daily tie-in. The vertical and horizontal controls for this benchmark will be established in accordance with normal land surveying standards.

3.3 Surveying Personnel

The Contractor's survey crew will consist of a Senior Surveyor, and as many Surveying CQC Monitors as are required to satisfactorily undertake the requirements for the work. All Surveying CQC personnel will be experienced in the provision of these services, including detailed, accurate documentation.

All surveying will be performed under the direct supervision of a Registered Professional Engineer (PE) or Licensed Land Surveyor (LLS) licensed in the state in which the project is located. The Licensed Land Surveyor may be the Senior Surveyor.

3.4 Precision and Accuracy

A wide variety of survey equipment is available to meet the requirements of this project. The survey instruments used for this work should be sufficiently precise and accurate to meet the needs of the project. All survey instruments should be capable of reading to a precision of 0.01 foot and with a setting accuracy of 20 seconds. (5.6×10^{-3} degrees).

3.5 Lines and Grades

The following surfaces shall be surveyed to verify the lines and grades achieved during construction. The survey should at least include (as deemed appropriate by the Engineer and CQA Consultant):

- Limits of construction.
- One or more construction baselines.
- A working grid with a sufficient number of benchmarks.
- Surface of the subgrade.
- All existing structures.
- Elevations of and locations of temporary berms.
- Top/toe of all perimeter berms, roads, and channels.
- Drainage controls.

Laser planes are highly recommended for achieving the correct lines and grades during construction of each surface. Topography should be 2-foot contours with 1-foot accuracy.

3.6 Frequency and Spacing

All surveying will be carried out immediately upon completion of a given installation to facilitate progress and avoid delaying commencement of the next installation. In addition, spot checks, as determined by the Senior Surveyor, CQA Consultant, or Project Manager, during construction may be necessary to assist the Contractor in complying with the required grades.

The following spacings and locations will be provided by the CQC Surveyor, as a minimum, for survey points:

- Surfaces with slopes less than 10 percent will be surveyed on a square grid not wider than 50 feet.
- On slopes greater than 10 percent, a square grid not wider than 50 feet will be used, but, in any case, a line of survey points at the crest, midpoint, and toe of the slope will be taken.
- A line of survey points no farther than 100 feet apart will be taken along any slope break (this will include the inside edge and outside edge of any bench on a slope).

3.7 Tolerances

Except for the subgrade where no minus tolerances are acceptable, the following are maximum tolerances for survey points:

- On surfaces, the maximum tolerances shall be 0.2 foot. This tolerance must be set to the record elevation of the surface below it and not the design elevation.

3.8 Documentation

All field survey notes will be retained by the Senior Surveyor. The results from the field surveys will be documented on a set of Survey Record (As-Built) Drawings by the Contractor for submittal to the CQA Consultant. The Contractor shall certify to the CQA Consultant and Engineer that the results of the survey demonstrates compliance with the Contract Documents. These drawings shall, at a minimum, show the final elevations and locations of all surfaces and appurtenances surveyed in Section 3.5 of this CQA/CQC Plan.

SECTION 4.0 CONSTRUCTION QUALITY ASSURANCE DOCUMENTATION

4.1 Documentation

An effective CQA plan depends largely on recognition of all construction activities that should be monitored and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The CQA Consultant will document that all quality assurance requirements have been addressed and satisfied.

This CQA plan integrates the testing and inspection performed by the CQC Consultant in accordance with the project specifications with the CQA overview and conformance testing performed by the CQA Consultant, in accordance with this CQA Plan.

The CQA Consultant will provide the Project Manager with the CQC Consultant's daily and weekly reports including signed descriptive remarks, data sheets, and logs to verify that all CQC monitoring activities have been carried out. The CQA Consultant will also provide the Project manager with a weekly report summarizing CQA activities and identifying potential quality assurance problems. The CQA Consultant will also maintain at the job site a complete file of Plans, Reports, project specifications, a CQA Plan, checklists, test procedures, daily logs, and other pertinent documents.

4.2 Recordkeeping

The CQC Consultant's reporting procedures will include preparation of a daily report which, at a minimum, will consist of: a) field notes, including memoranda of meetings and/or discussions with the Contractor; b) observation logs and testing data sheets; and c) construction problem and solution data sheets. The daily report must be completed at the end of each CQC Consultant's shift, prior to leaving the site. This information will be submitted weekly to and reviewed by the CQA Consultant.

The CQC Consultant's weekly reports must summarize the major events that occurred during that week. Critical problems that occur shall be communicated verbally to the Project Manager. The CQC Consultant's weekly report must be submitted to the CQA Consultant no later than the Monday following the week reported.

The CQA Consultant's weekly report must summarize the CQC Consultant's weekly and daily reports, CQA conformance testing activities, construction problems that occurred, and the resolution of construction problems. The CQA Consultant's weekly report should identify all potential or actual compliance problems outstanding. The CQA Consultant's weekly report must be submitted to the Project Manager on the Wednesday following the week reported.

4.2.1 Memorandum of Discussion with CQC Consultant

A report will be prepared summarizing each discussion between the CQA Consultant and the CQC Consultant. At a minimum, the report will include the following information:

- Date, project name, location, and other identification.
- Name of parties to discussion at the time.

- Relevant subject matter or issues.
- Activities planned and schedule.
- Signature of the CQA Consultant.

4.2.2 CQA Observation Logs and Testing Data Sheets

CQA observation logs and conformance testing data sheets will be prepared by the CQA Consultant on a weekly basis. At a minimum, these logs and data sheets will include the following information:

- An identifying sheet number for cross referencing and document control.
- Date, project name, location, and other identification.
- Data on weather conditions.
- A reduced-scale Site Plan showing all proposed work areas and test locations.
- Descriptions and locations of ongoing construction.
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented.
- Locations where tests and samples were taken.
- A summary of test results.
- Calibrations or recalibrations of test equipment, and actions taken as a result of recalibration.
- Off-site materials received, including quality verification documentation.
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality; and the CQA Consultant's signature.

4.2.3 CQA Construction Problem and Solution Data Sheets

CQA sheets describing special construction situations will be cross-referenced with specific CQA observation logs and testing data sheets, and must include the following information, where available:

- An identifying sheet number for cross referencing and document control.
- A detailed description of the situation or deficiency.
- The location and probable cause of the situation or deficiency.
- How and when the situation or deficiency was found or located.
- Documentation of the response to the situation or deficiency.
- Final results of any responses.
- Any measures taken to prevent a similar situation from occurring in the future.
- The signature of the CQA Consultant, and signature of the Project Manager indicating concurrence if required by this CQA Plan.

The Project Manager will be made aware of any significant recurring nonconformance with the project specifications. The Project Manager will then determine the cause of the non-conformance and recommend appropriate changes in procedures or specification. When this type

of evaluation is made, the results will be documented, and any revision to procedures or project specifications will be approved by the Owner and Engineer.

4.3 CQA Photographic Reporting Data Sheets

Photographic reporting data sheets, where used, will be cross-referenced with CQA observation logs and testing data sheets and/or CQA construction problem and solution data sheets. Digital photographs shall be taken at regular intervals during the construction process and in all areas deemed critical.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file will contain color prints; digital photograph files will also be stored on compact disc (CD) or other digital medium in chronological order. These records will be presented to the Project Manager upon completion of the project.

In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities. The Project Manager may require that a portion of the documentation be recorded by photographic means in conjunction with video taping.

4.4 Design and/or Project Technical Specification Changes

Design and/or project specification changes may be required during construction. In such cases, the CQA Consultant will notify the Project Manager and the Engineer. The Project Manager will then notify the appropriate agency, if necessary.

Design and/or project specification changes will be made only with the written agreement of the Project Manager and the Engineer, and will take the form of an addendum to the project specifications. All design changes shall include a detail (if necessary) and state which detail it replaces in the plans.

4.5 CQA Progress Reports

The CQA Consultant will prepare a summary progress report each week, or at time intervals established at the pre-construction meeting. As a minimum, this report will include the following information:

- A unique identifying sheet number for cross-referencing and document control;
- The date, project name, location, and other information;
- A summary of work activities during progress reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period;
- Summary of all test results, failures and retests, and signature of the CQA Consultant.

4.6 Signature and Final Report

At the completion of each major construction activity at the landfill unit, the CQA Consultant will certify all required forms, observation logs, field and laboratory testing data sheets including sample location plans, construction problems and solution data sheets. The CQA Consultant will also provide a final report which will certify that the work has been performed in compliance with the CQA Plan, the

conditions of the permit to construct, the requirements of applicable rules and regulations, and acceptable engineering practices.

The CQA Consultant will also provide summaries of all the data listed above with the report. The Record Drawings will include scale drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, etc.). All surveying and base maps required for development of the Record Drawings will be done by the Construction Surveyor. These documents will be certified by the Contractor and CQC Consultant and delivered to the CQA Consultant and included as part of the CQA documentation (Certification) report.

It may be necessary to prepare interim certifications, as allowed by the regulatory agency to expedite completion and review.

4.7 Storage of Records

All handwritten data sheet originals, especially those containing signatures, will be stored by the Project Manager in a safe repository on site. Other reports may be stored by any standard method which will allow for easy access. All written documents will become property of the Owner.

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

CONSTRUCTION QUALITY ASSURANCE PLAN (CLOSURE)

MAY 2010

Prepared for:

DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

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TABLE OF CONTENTS

SECTION 1.0 GENERAL 1

1.1 Introduction 1
1.2 Definitions Relating to Construction Quality 1
1.2.1 Construction Quality Assurance (CQA) 1
1.2.2 Construction Quality Control (CQC) 1
1.2.3 CQC/CQA Certification Document 1
1.2.4 Discrepancies Between Documents 2
1.3 Parties to Construction Quality Assurance 2
1.3.1 Description of the Parties 2
1.3.2 Qualifications of the Parties 4
1.4 Scope of Construction Quality Assurance Plan 4
1.5 Units 4
1.6 References 4
1.7 Site and Project Control 5
1.7.1 CQA/CQC Resolution Meeting 5
1.7.2 CQA/CQC Preconstruction Meeting 5
1.7.3 CQA/CQC Progress Meetings 6
1.7.4 Problem or Work Deficiency Meetings 6

SECTION 2.0 BARRIER LAYER CONSTRUCTION QUALITY ASSURANCE 7

2.1 Introduction 7
2.2 Earthwork Construction 7
2.2.1 Subgrade Material 7
2.2.2 Structural/Controlled Fill 7
2.3 Barrier Layer System 7
2.3.1 Barrier Layer Subgrade 7
2.3.2 Barrier Layer Material 7
2.4 Soils Testing 8
2.4.1 Methods 8
2.4.2 Soils Testing Requirements 8
2.5 Soils Construction Quality Assurance 8
2.5.1 Monitoring 8
2.5.2 Construction Quality Assurance Judgmental Testing 9
2.5.3 Perforations in Barrier Layer 9
2.5.4 Deficiencies 9

SECTION 3.0 EROSION LAYER CONSTRUCTION QUALITY ASSURANCE 11

3.1 Introduction 11
3.2 Erosion Layer Material 11
3.3 Related Materials 11
3.3.1 Topsoil Layer Material 11
3.4 Materials Testing 11

TABLE OF CONTENTS

3.4.1 Test Methods 11
3.4.2 Material Testing Requirements 11
3.5 Erosion Layer Construction Quality Assurance 11
3.5.1 Monitoring 12
3.5.2 Deficiencies 12

SECTION 4.0 SURVEYING CONSTRUCTION QUALITY CONTROL 13

4.1 Introduction 13
4.2 Survey Control 13
4.3 Surveying Personnel 13
4.4 Precision and Accuracy 13
4.5 Lines and Grades 13
4.6 Frequency and Spacing 14
4.7 Tolerances 14
4.8 Documentation 14

SECTION 5.0 CONSTRUCTION QUALITY ASSURANCE DOCUMENTATION 15

5.1 Documentation 15
5.2 Recordkeeping 15
5.2.1 Memorandum of Discussion with CQC Consultant 15
5.2.2 CQA Observation Logs and Testing Data Sheets 16
5.2.3 CQA Construction Problem and Solution Data Sheets 16
5.3 CQA Photographic Reporting Data Sheets 17
5.4 Design and/or Project Technical Specification Changes 17
5.5 CQA Progress Reports 17
5.6 Signature and Final Report 17
5.7 Storage of Records 18

Figure 1-1 CQA/CQC Lines of Authority and Communication 3

SECTION 1.0 GENERAL

1.1 Introduction

This Construction Quality Assurance (CQA) Plan (Plan) has been prepared to provide the Owner, Engineer, and CQA Consultant the means to govern the construction quality and to satisfy landfill certification requirements under current solid waste management regulations.

More specifically, this Plan addresses the soils component of the closure cap system. The cap system, as referenced herein, generally consists of a compacted low-permeability barrier layer and an erosion layer.

The Plan is divided into the following sections:

- Section 1.0 – General
- Section 2.0 – Barrier Layer Construction Quality Assurance
- Section 3.0 – Erosion Layer Construction Quality Assurance
- Section 4.0 – Surveying Construction Quality Control
- Section 5.0 – Construction Quality Assurance Documentation

1.2 Definitions Relating to Construction Quality

1.2.1 Construction Quality Assurance (CQA)

In the context of this Plan, CQA is defined as a planned and systematic program employed by the Owner to assure conformity of the cap system installation with Contract Drawings and the project specifications. CQA is provided by the CQA Consultant as a representative of the Owner and is independent from the Contractor and all manufacturers. The CQA program is designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

1.2.2 Construction Quality Control (CQC)

Construction Quality Control (CQC) refers to actions taken by manufacturers, fabricators, installers, or the Contractor to ensure that the materials and the workmanship meet the requirements of this Plan and the project specifications. In the case of the cap system, CQC is provided by the Contractor's CQC Consultant.

1.2.3 CQC/CQA Certification Document

At the completion of construction, a certification document will be prepared by the CQA Consultant and be submitted to state solid waste regulators. The certification report will include all CQC testing performed by the CQC Consultant, and all CQA conformance testing performed by the CQA Consultant.

1.2.4 Discrepancies Between Documents

The Plan is intended to be a supporting document to improve the overall documentation of the Work. The Plan is less specific than the project specifications, and conflicts may exist between the documents. The Contractor is instructed to bring discrepancies to the attention of the Engineer or CQA Consultant for resolution. The Engineer has the sole authority to determine resolution of discrepancies existing within the Contract Documents. Unless otherwise determined by the Engineer, the more stringent requirement shall be the controlling resolution.

1.3 Parties to Construction Quality Assurance

1.3.1 Description of the Parties

The parties to CQA and CQC include the Owner, Project Manager, Engineer, Contractor, CQA Consultant, Soils CQA laboratory, CQC Consultant, and Soils CQC laboratory. The lines of authority and communications between each of the parties involved in the CQA and CQC are illustrated in Figure 1.

1.3.1.1 Owner

The Owner is Fort Bragg, who owns and is responsible for the facility.

1.3.1.2 Project Manager

The Project Manager is the official representative of the Owner. The Project Manager serves as communications coordinator for the project, initiating the resolution, preconstruction, and construction meetings outlined in Section 1.7. The Project Manager shall also be responsible for proper resolution of all quality issues that arise during construction.

1.3.1.3 Engineer

The Engineer is responsible for the engineering design, drawings, plans, and project specifications for the cap system.

1.3.1.4 Contractor

The Contractor is responsible for the construction of the project. The Contractor is responsible for submittal coordination and the overall CQC on the project.

1.3.1.5 Construction Quality Assurance Consultant

The CQA Consultant is a representative of the Owner and is responsible for observing, testing, and documenting activities related to the CQC/CQA of the earthworks at the site, and the installation of the cap system. The CQA Consultant is also responsible for issuing a facility certification report, sealed by a Professional Engineer registered in North Carolina.

1.3.1.6 Soils Construction Quality Assurance Laboratory

The soils CQA laboratory is a party, independent from the Owner, that is responsible for conducting geotechnical tests on conformance samples of soils used in the cap system.

The soils CQA laboratory service cannot be provided by any party involved with the Contractor.

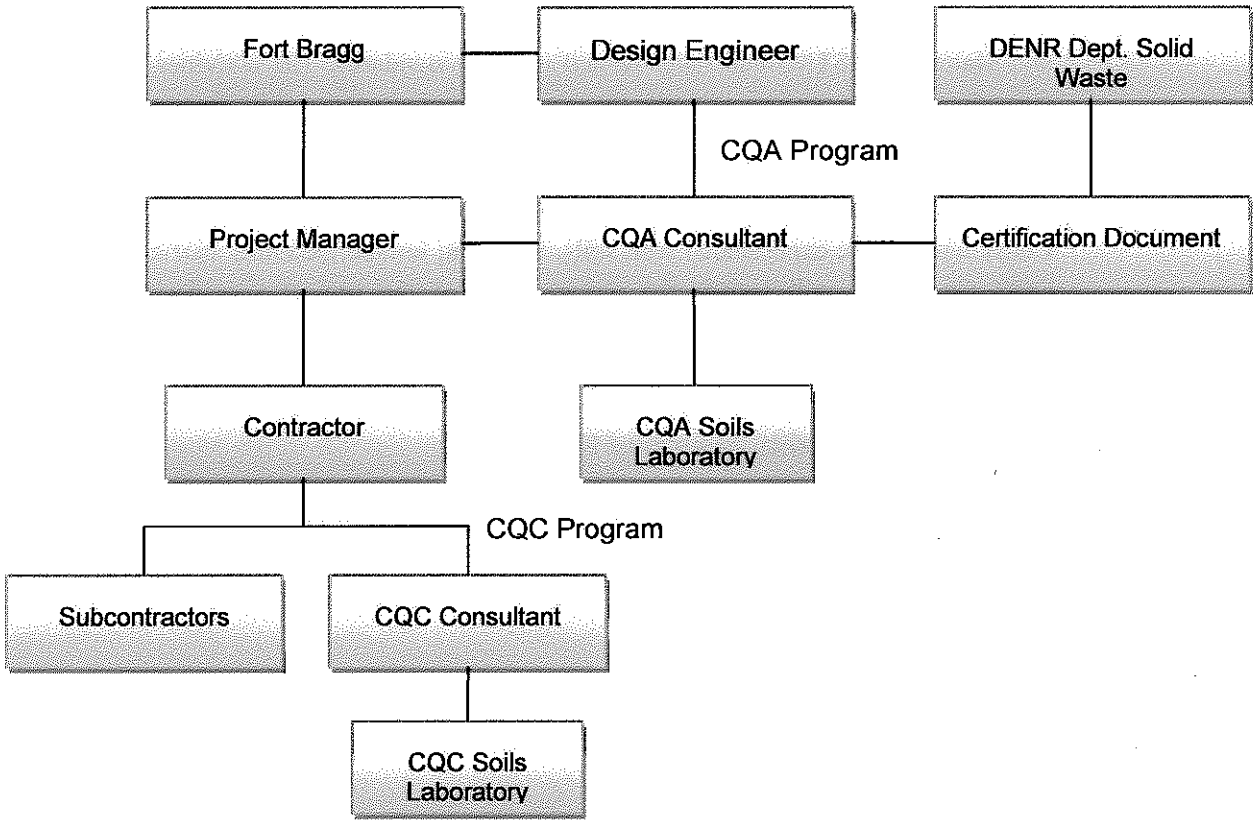
1.3.1.7 Construction Quality Control Consultant

The CQC Consultant is a representative of the Contractor and is responsible for the earthwork and soil liner quality control sampling and testing. The term CQC Consultant shall be used to designate the Engineer in charge of the quality control work. The personnel of the CQC Consultant also includes quality control monitors, who are located at the site for construction observation and monitoring. The CQC Consultant is responsible for the timely conveyance of CQC testing results to the CQA Consultant.

1.3.1.8 Soils Construction Quality Control Laboratory

The Soils CQC laboratory is a party, independent from the Contractor, that is responsible for conducting geotechnical tests on samples of soils used in the cap system.

Figure 1-1 CQA/CQC Lines of Authority and Communication



1.3.2 Qualifications of the Parties

The following qualifications are required of parties involved with the manufacture, fabrication, installation, transportation, and CQC/CQA of all materials for the cap system. Where applicable, these qualifications must be submitted by the Contractor to the Project Manager for review and approval.

1.3.2.1 Contractor

Qualifications of the Contractor are specific to the construction contract and independent of this CQA Plan.

1.3.2.2 Construction Quality Assurance Consultant

The CQA Consultant will act as the Owner's CQA Representative and will report to the Project Manager. The CQA Consultant will perform conformance testing to satisfy the requirements of this Plan, will observe the CQC work performed by the CQC Consultant, and will prepare the certification document incorporating both CQA and CQC test data. The CQA Consultant will have experience in the CQC/CQA aspects of landfill cap system construction and soils testing, and be familiar with American Society of Testing and Materials (ASTM) and other related industry standards. The activities of the CQA Consultant will be performed under the supervision of a registered Professional Engineer.

1.3.2.3 Construction Quality Control Consultant

The CQC Consultant will be a party, independent from the Contractor. The CQC Consultant will be experienced with soils, including low-permeability barrier layers. The CQC Consultant will satisfy the requirements of the project specifications and be approved by the Project Manager. The activities of the CQC Consultant will be performed under the supervision of a registered Professional Engineer.

1.4 Scope of Construction Quality Assurance Plan

The scope of this Plan includes the CQA of the soil components of the cap system for the subject facility. The CQA for the selection, evaluation, and placement of the soils is included in the scope. This document is intended to be used in concert with the CQC requirements presented in the project specifications.

1.5 Units

In this Plan, all properties and dimensions are expressed in United States units.

1.6 References

The Plan includes references to the most recent version of the test procedures of the American Society of Testing and Materials (ASTM) and the American Association of State Highway and Transportation Officials (AASHTO).

1.7 Site and Project Control

To guarantee a high degree of quality during installation, clear, open channels of communication are essential. To that end, meetings are critical.

1.7.1 CQA/CQC Resolution Meeting

Prior to field mobilization by the Contractor, a Resolution Meeting will be held. This meeting will include all parties then involved, including the Project Manager, the CQA Consultant, the Engineer, the Contractor, and the CQC Consultant.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems, which might cause difficulties and delays in construction, and, above all, review the CQA and CQC Plans to all of the parties involved. It is imperative that the rules regarding testing, repair, etc., be known and accepted by all.

This meeting should include all of the following activities.

- Communicate to all parties any relevant documents.
- Review critical design details of the project.
- Review the site-specific CQA and CQC Plans.
- Make any appropriate modifications to the CQA and CQC Plans to ensure that they specify all testing activities that are necessary.
- Reach a consensus on the CQA/CQC quality control procedures, especially on methods for determining acceptability of the soils.
- Review the proposed cap system.
- Select testing equipment and review protocols for testing and placement of general earthwork materials.
- Confirm methods for the soil cap material selection testing, acceptable zone determinations, and test strip installation.
- Confirm the methods for documenting and reporting; for distributing documents and reports; and confirm the lines of authority and communication.

The meeting will be documented by the Project Manager and minutes will be transmitted to all parties.

1.7.2 CQA/CQC Preconstruction Meeting

A Preconstruction Meeting will be held at the site prior to placement of the cap system. At a minimum, the meeting will be attended by the Project Manager, Engineer, CQA Consultant, Contractor, and the CQC Consultant.

Specific topics considered for this meeting include the following.

- Make any appropriate modifications to the CQA and CQC Plans.
- Review the responsibilities of each party.
- Review lines of authority and communication.

- Review methods for documenting and reporting, and for distributing documents and reports.
- Establish protocols for testing.
- Establish protocols for handling deficiencies, repairs, and retesting.
- Review the time schedule for all operations.
- Outline procedures for packaging and storing archive samples.
- Review repair procedures.
- Establish soil stockpiling locations (if any).

The meeting will be documented by the Project Manager and minutes will be transmitted to all parties. The Resolution Meeting and the Preconstruction Meeting may be held as one meeting or separate meetings, depending on the direction of the Project Manager.

1.7.3 CQA/CQC Progress Meetings

Periodic progress meetings will be held between the Project Manager, CQA Consultant, Contractor, CQC Consultant, and representatives from any other involved parties. These meetings will discuss current progress, planned activities for the next week, and any new business or revisions to the work. The CQA Consultant will log any problems, decisions or questions arising at this meeting in his daily report. Any matter requiring action which is raised in this meeting will be reported to the appropriate parties.

Meeting frequency will depend on the schedule of the project and the mutual agreement of all parties involved.

1.7.4 Problem or Work Deficiency Meetings

A special meeting will be held when and if a problem or deficiency is present or likely to occur. At a minimum, the meeting will be attended by all interested parties, the Contractor, the Project Manager, and the CQA Consultant. If the problem requires a design modification, the Engineer should also be present. The purpose of the meeting is to define and resolve the problem or work deficiency as follows.

- Define and discuss the problem or deficiency.
- Review alternative solutions.
- Implement an action plan to resolve the problem or deficiency.

The meeting will be documented by the Project Manager and minutes will be transmitted to affected parties.

SECTION 2.0 BARRIER LAYER CONSTRUCTION QUALITY ASSURANCE

2.1 Introduction

This section of the Plan addresses the low-permeability barrier layer component of the cap system, and outlines the soils CQA program to be implemented with regard to materials confirmation, laboratory and field confirmation test requirements, overview and interfacing with the Contractor's CQC Program, and resolution of problems.

2.2 Earthwork Construction

2.2.1 Subgrade Material

The subgrade material below the controlled fill will be prepared by the Contractor prior to the placement of fill. The CQC Consultant will provide density testing of the pre-fill subgrade at the frequency specified in the project specifications. The CQA Consultant will observe the proofroll by the Contractor, review the density test data provided by the CQC Consultant, and provide verification that the pre-fill subgrade is acceptable. The CQA Consultant may conduct confirmation density testing as deemed appropriate.

2.2.2 Structural/Controlled Fill

The Contractor shall place fill in accordance with the project specifications. The CQC Consultant shall provide testing of the controlled fill material in accordance with the project specifications. The CQA Consultant will provide confirmation testing of the controlled fill as deemed appropriate.

2.3 Barrier Layer System

2.3.1 Barrier Layer Subgrade

If required, testing will be conducted by the CQC Consultant as observed by the CQA Consultant. The subgrade material below the barrier layer is composed of intermediate cover soil. The surface of the subgrade will be prepared prior to the construction of the soil liner. The CQC Consultant and CQA Consultant will visually examine the surface of the subgrade to verify that any potentially deleterious materials have been removed.

2.3.2 Barrier Layer Material

The barrier layer material shall be placed and compacted in accordance with the project specifications. The CQC Consultant shall conduct field density and moisture tests at the frequency presented in the project specifications. The CQA Consultant may provide conformance tests at a frequency of approximately 10 percent of the required CQC tests. Additional CQA conformance testing may be performed at the discretion of the CQA Consultant.

Hydraulic conductivity, Atterberg Limits, and percent fines testing of the barrier layer material shall be performed by the CQC Consultant in accordance with the project specifications. Additional CQA conformance testing may be performed at the discretion of the CQA Consultant.

Thickness measurements shall be conducted in accordance with the project specifications by the CQC Consultant and observed by the CQA Consultant.

2.4 Soils Testing

2.4.1 Methods

All testing used to evaluate the suitability or conformance of soils materials will be carried out in accordance with the project specifications.

2.4.2 Soils Testing Requirements

The soil CQC testing must comply with the minimum frequencies presented in the project specifications. The frequency of CQA testing required will be determined by the Engineer in light of the potential variability of materials and the acceptance/failure rate of the CQC testing.

2.5 Soils Construction Quality Assurance

CQA will be performed on all soil components of the cap construction. CQA evaluation will consist of: (1) monitoring the work and observing the CQC testing; and (2) performing laboratory and field conformance tests as deemed necessary. Laboratory CQA conformance tests may be conducted on samples taken at the borrow source and stockpile prior to construction. Field CQA conformance tests may be conducted during the course of the work.

2.5.1 Monitoring

The CQA Consultant shall monitor and document the construction of all soil components. Monitoring the construction work for the subgrade and the barrier layer component of the cap system includes the following.

- Observing CQC testing to determine the water content and other physical properties of the barrier layer component of the cap system during compaction and compilation of the data.
- Monitoring the loose thickness of lifts as placed.
- Monitoring the action of the compaction and/or heavy hauling equipment on the construction surface (i.e., penetration, pumping, cracking. etc.).
- Monitoring the number of passes used to compact each lift.

2.5.2 Construction Quality Assurance Judgmental Testing

During construction, the frequency of conformance testing may be increased at the discretion of the CQA Consultant when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when any of the following conditions exist.

- The rollers slip during rolling operation.
- The lift thickness is greater than specified.
- The fill material is at an improper moisture content.
- Fewer than the specified number of roller passes are made.
- Dirt-clogged rollers are used to compact the material.
- The rollers may not have used optimum ballast.
- The fill materials differ substantially from those specified.
- The degree of compaction is doubtful.

2.5.3 Perforations in Barrier Layer

Perforations that must be filled will include, but not be limited to, the following.

- Nuclear density test probe locations.
- Permeability sampling locations.
- Thickness checks.

Unless otherwise noted, or as directed by the Project Manager, all perforations of the barrier layer by probes or sample tubes will be backfilled in accordance with project specifications. The CQA Consultant will observe and confirm that adequate procedures are being employed.

2.5.4 Deficiencies

If a defect is discovered in the earthwork product, the CQC Consultant will immediately determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQC Consultant will determine the extent of the deficient area by additional tests, observations, a review of records, or other appropriate means. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQC Consultant will define the limits and nature of the defect.

2.5.4.1 Notification

After determining the extent and nature of a defect, the CQC Consultant will notify the Project Manager, the CQA Consultant, and Contractor and schedule appropriate retests when the work deficiency is corrected. The CQA Consultant shall observe all retests on defects.

2.5.4.2 Repairs and Retesting

The Contractor will correct the deficiency to the satisfaction of the CQA Consultant. If a project specification criterion cannot be met, or unusual weather conditions hinder work, then the CQC Consultant will develop and present to the Project Manager and CQA Consultant suggested solutions for approval.

All retests recommended by the CQC Consultant must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency. The CQA Consultant will verify that all installation requirements are met and that all submittals are provided.

2.5.4.3 Penalties

Refer to Specifications.

SECTION 3.0 EROSION LAYER CONSTRUCTION QUALITY ASSURANCE

3.1 Introduction

This section of the Plan addresses the erosion layer of the cap system and outlines the CQA program to be implemented with regard to materials confirmation, laboratory and field test requirements, overview and interfacing with the Contractor's CQC Program, and resolution of problems.

3.2 Erosion Layer Material

The erosion layer shall be placed and compacted in accordance with the project specifications. The CQC Consultant will provide gradation and thickness testing of the material at the frequency specified in the project specifications. The CQA Consultant will observe that placement of the material is accomplished in a manner to protect the barrier layer, and review the gradation and thickness test data provided by the CQC Consultant. The CQA Consultant may conduct confirmation gradation and thickness testing as deemed appropriate.

3.3 Related Materials

3.3.1 Topsoil Layer Material

The topsoil layer shall be placed in accordance with the project specifications. The CQC Consultant will provide gradation and thickness testing of the material at the frequency specified in the project specifications. The CQA Consultant will observe that placement of the material is accomplished in a manner to protect the erosion layer, and review the gradation and thickness test data provided by the CQC Consultant. The CQA Consultant may conduct confirmation gradation and thickness testing as deemed appropriate.

3.4 Materials Testing

3.4.1 Test Methods

All testing used to evaluate the suitability or conformance of erosion layer materials will be carried out in accordance with the project specifications.

3.4.2 Material Testing Requirements

The material CQC testing must comply with the minimum frequencies presented in the project specifications. The frequency of CQA testing will be determined by the CQA Consultant in light of the potential variability of the materials and the acceptance/failure rate of the CQC testing.

3.5 Erosion Layer Construction Quality Assurance

CQA will be performed the erosion layer. CQA evaluation will consist of: (1) monitoring the work and observing the CQC testing; and (2) performing laboratory and field conformance tests. Laboratory CQA

conformance tests may be conducted on samples taken at the borrow source, and stockpile prior to construction. Field conformance tests may be conducted during the course of the work.

3.5.1 Monitoring

The CQA Consultant shall monitor and document the construction of the erosion layer. Monitoring the construction work for the natural materials of the erosion layer includes the following.

- Reviewing CQC testing for gradation and other physical properties of the natural materials and compilation of the data.
- Monitoring the minimum vertical buffer maintained between field equipment and pipes.
- Monitoring the placement of the natural material to ensure that it does not damage the piping in any way.
- Monitoring material placement to ensure that the underlying barrier layer is not damaged.

3.5.2 Deficiencies

If a defect is discovered in the earthwork product, the CQC Consultant will immediately determine the extent and nature of the defect and report it to the CQA Consultant. If the defect is indicated by an unsatisfactory test result, the CQC Consultant will determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate.

3.5.2.1 Notification

After determining the extent and nature of a defect, the CQC Consultant will notify the Project Manager and Contractor and schedule appropriate retests when the work deficiency is corrected. The CQA Consultant shall observe all retests on defects.

3.5.2.2 Repairs and Retesting

The Contractor will correct the deficiency to the satisfaction of the CQA Consultant. If a project specification criterion cannot be met, or unusual weather conditions hinder work, then the CQC Consultant will develop and present to the Project Manager suggested solutions for his approval.

All retests recommended by the CQC Consultant must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency. The CQA Consultant will verify that all installation requirements are met and that all submittals are provided.

3.5.2.3 Penalties

Refer to Specifications.

SECTION 4.0 SURVEYING CONSTRUCTION QUALITY CONTROL

4.1 Introduction

Surveying of lines and grades is conducted on an ongoing basis during construction of the cap system. Close CQC of the surveying is absolutely essential to ensure that slopes are properly constructed. The surveying conducted at the site shall be performed by the Contractor.

4.2 Survey Control

Permanent benchmarks and baseline control points are to be established for the site at locations convenient for daily tie-in. The vertical and horizontal controls for this benchmark will be established in accordance with normal land surveying standards.

4.3 Surveying Personnel

The Contractor's survey crew will consist of a senior surveyor, and as many surveying CQC monitors as are required to satisfactorily undertake the requirements for the work. All surveying CQC Personnel will be experienced in the provision of these services, including detailed, and accurate documentation.

All surveying will be performed under the direct supervision of a registered Professional Engineer (PE) or Licensed Land Surveyor (LLS) licensed in the state in which the project is located. The Licensed Land Surveyor may be the senior surveyor.

4.4 Precision and Accuracy

A wide variety of survey equipment is available to meet the requirements of this project. The survey instruments used for this work should be sufficiently precise and accurate to meet the needs of the project. All survey instruments should be capable of reading to a precision of 0.01-foot and with a setting accuracy of 20 seconds (5.6×10^{-3} degrees).

4.5 Lines and Grades

The following surfaces shall be surveyed to verify the lines and grades achieved during construction. The survey should at least include (as deemed appropriate by the Engineer and CQA Consultant).

- Limits of construction
- One or more construction baselines
- A working grid with a sufficient number of benchmarks
- All existing structures
- All new structures
- Surface of subgrade (points)
- Surface of low-permeability barrier layer (points)
- Surface of the erosion layer (topography)

- Utilities
- Elevations and locations of temporary berms
- Layer thickness verifications
- Top/toe of all perimeter berms, roads, and channels
- Erosion and sediment control features
- Drainage features
- All pipes, culverts, manholes, etc. (include x, y, z)

Laser planes are highly recommended for achieving the correct lines and grades during construction of each surface. Topography should be 2-foot contours with a 1-foot accuracy.

4.6 Frequency and Spacing

All surveying will be carried out immediately upon completion of a given installation to facilitate progress and avoid delaying commencement of the next installation. In addition, spot checks, as determined by the senior surveyor, CQA Consultant, or Project Manager, during construction may be necessary to assist the Contractor in complying with the required grades.

The following spacing and locations will be provided by the CQC surveyor, as a minimum, for survey points.

- Surfaces with slopes less than 10 percent will be surveyed on a square grid not wider than 100 feet.
- On slopes greater than 10 percent, a square grid not wider than 100 feet will be used; however in any case, a line of survey points at the crest, midpoint, and toe of the slope will be taken.
- A line of survey points no farther apart than 100 feet will be taken along any slope break (this will include the inside edge and outside edge of any bench on a slope).

4.7 Tolerances

Except for the barrier layer and erosion layer components where no minus tolerances are acceptable, following is the maximum tolerance for survey points.

- On surfaces, the maximum tolerances shall be 0.2 foot. This tolerance must be set to the record elevation of the surface below it and not the design elevation.

4.8 Documentation

All field survey notes will be retained by the senior surveyor. The results from the field surveys will be documented on a set of Survey Record (As-Built) Drawings by the Contractor for submittal to the CQA Consultant. The Contractor shall certify to the CQA Consultant and Engineer that the results of the survey demonstrates compliance with the Contract Documents. These drawings shall, at a minimum, show the final elevations and locations of all surfaces and appurtenances surveyed in Section 4.5 of this Plan.

SECTION 5.0 CONSTRUCTION QUALITY ASSURANCE DOCUMENTATION

5.1 Documentation

An effective Plan depends largely on recognition of all construction activities that should be monitored and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of QA activities. The CQA Consultant will document that all QA requirements have been addressed and satisfied.

This Plan integrates the testing and inspection performed by the CQC Consultant in accordance with the project specifications with the CQA overview and conformance testing performed by the CQA Consultant, in accordance with this Plan.

The CQA Consultant will provide the Project Manager with the CQC Consultant's daily and weekly reports including signed descriptive remarks, data sheets, and logs to verify that all CQC monitoring activities have been carried out. The CQA Consultant will also provide the Project Manager with a weekly report summarizing CQA activities and identifying potential QA problems. The CQA Consultant will also maintain, at the job site, a complete file of plans, reports, project specifications, a CQA Plan, checklists, test procedures, daily logs, and other pertinent documents.

5.2 Recordkeeping

The CQC Consultant's reporting procedures will include preparation of a daily report which, at a minimum, will consist of: a) field notes, including memoranda of meetings and/or discussions with the Contractor; b) observation logs and testing data sheets; and c) construction problem and solution data sheets. The daily report must be completed at the end of each CQC Consultant's shift, prior to leaving the site. This information will be submitted weekly to the CQA Consultant for review.

The CQC Consultant's weekly reports must summarize the major events that occurred during that week. Critical problems that occur shall be communicated verbally to the Project Manager or CQA Consultant immediately, as well as being included in the weekly reports. The CQC Consultant's weekly report must be submitted to the CQA Consultant no later than the Monday following the week reported.

The CQA Consultant's weekly report must summarize the CQC Consultant's weekly and daily reports, CQA conformance testing activities, construction problems that occurred, and the resolution of construction problems. The CQA Consultant's weekly report should identify all potential or actual compliance problems outstanding. The CQA Consultant's weekly report must be submitted to the Project Manager on the Wednesday following the week reported.

5.2.1 Memorandum of Discussion with CQC Consultant

A report will be prepared summarizing each discussion between the CQA Consultant and the CQC Consultant. At a minimum, the report will include the following information.

- Date, project name, location, and other identification.
- Name of parties to discussion at the time.

- Relevant subject matter or issues.
- Activities planned and schedule.
- Signature of the CQA Consultant.

5.2.2 CQA Observation Logs and Testing Data Sheets

CQA observation logs and conformance testing data sheets will be prepared by the CQA Consultant on a weekly basis. At a minimum, these logs and data sheets will include the following information.

- An identifying sheet number for cross-referencing and document control.
- Date, project name, location, and other identification.
- Data on weather conditions.
- A reduced-scale Site Plan showing all proposed work areas and test locations.
- Descriptions and locations of ongoing construction.
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented.
- Locations where tests and samples were taken.
- A summary of test results.
- Calibrations or recalibrations of test equipment, and actions taken as a result of recalibration.
- Off-site materials received, including quality verification documentation.
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality; and the CQA Consultant's signature.

5.2.3 CQA Construction Problem and Solution Data Sheets

CQA sheets describing special construction situations will be cross-referenced with specific CQA observation logs and testing data sheets, and must include the following information, where available.

- An identifying sheet number for cross-referencing and document control
- A detailed description of the situation or deficiency.
- The location and probable cause of the situation or deficiency.
- How and when the situation or deficiency was found or located.
- Documentation of the response to the situation or deficiency.
- Final results of any responses.
- Any measures taken to prevent a similar situation from occurring in the future.
- The signatures of the CQA Consultant and the Project Manager, indicating concurrence, if required by this Plan.

The Project Manager will be made aware of any significant recurring nonconformance with the project specifications. The Project Manager will then determine the cause of the non-conformance and recommend appropriate changes in procedures or specification. When this type

of evaluation is made, the results will be documented, and any revision to procedures or project specifications will be approved by the Owner and Engineer.

5.3 CQA Photographic Reporting Data Sheets

Photographic reporting data sheets, where used, will be cross-referenced with CQA observation logs and testing data sheets and/or CQA construction problem and solution data sheets. Digital photographs shall be taken at regular intervals during the construction process and in all areas deemed critical.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file will contain color prints; digital photograph files will be stored on compact disc (CD) or other digital medium in chronological order. These records will be presented to the Project Manager upon completion of the project.

In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities. The Project Manager may require that a portion of the documentation be recorded by photographic means in conjunction with videotaping.

5.4 Design and/or Project Technical Specification Changes

Design and/or project specification changes may be required during construction. In such cases, the CQA Consultant will notify the Project Manager and the Engineer. The Project Manager will then notify the appropriate agency, if necessary.

Design and/or project specification changes will be made only with the written agreement of the Project Manager and the Engineer, and will take the form of an addendum to the project specifications. All design changes shall include a detail (if necessary) and state which detail it replaces in the plans.

5.5 CQA Progress Reports

The CQA Consultant will prepare a summary progress report each week, or at time intervals established at the pre-construction meeting. As a minimum, this report will include the following information;

- A unique identifying sheet number for cross-referencing and document control.
- The date, project name, location, and other information.
- A summary of work activities during progress reporting period.
- A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period.
- Summary of all test results, failures and retests, and signature of the CQA Consultant.

5.6 Signature and Final Report

At the completion of each major construction activity at the Landfill, the CQA Consultant will certify all required forms, observation logs, field and laboratory testing data sheets including sample location plans, construction problems, and solution data sheets. The CQA Consultant will also provide a final report, which will certify that the work has been performed in compliance with the CQA Plan, the conditions of

the permit to construct, the requirements of applicable rules and regulations, and acceptable engineering practices.

The CQA Consultant will also provide summaries of all the data listed above with the report. The Record Drawings will include scale drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, etc.). All surveying and base maps required for development of the Record Drawings will be done by the Construction surveyor. These documents will be certified by the Contractor and CQC Consultant and delivered to the CQA Consultant and included as part of the CQA documentation (Certification) report.

It may be necessary to prepare interim certifications, as allowed by the regulatory agency to expedite completion and review.

5.7 Storage of Records

All handwritten data sheet originals, especially those containing signatures, will be stored by the Project Manager in a safe repository on site. Other reports may be stored by any standard method which will allow for easy access. All written documents will become property of the Owner.

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

OPERATIONS PLAN

MAY 2010

Prepared for:

DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

Prepared by:

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TABLE OF CONTENTS

SECTION 1.0 INTRODUCTION 1

SECTION 2.0 STANDARD OPERATING PROCEDURES 2

2.1 Hours and Days of Operations 2
2.2 Weighing Procedures 2
2.3 Wastes Accepted 2
2.4 Unacceptable Waste 2
2.5 Filling Procedures 3
2.6 Cover Material Requirements 3
2.7 Air Criteria 4
2.8 Security and Facility Access 4
2.9 Erosion Control 4
2.10 Drainage Control 4
2.11 Recordkeeping 5
2.12 Methane Monitoring Program 5

SECTION 3.0 WASTE SCREENING PROCEDURES 6

3.1 Waste Receiving and Inspection 6
3.2 Waste Screening Record Keeping Procedures 6

SECTION 4.0 PROGRESSION OF FILL 7

SECTION 5.0 CONCRETE AND MATERIALS RECYCLING 8

SECTION 6.0 WORKER SAFETY AND TRAINING 9

6.1 Operations Training 9
6.2 Safety Equipment 9
6.3 Fires and Natural Disasters 9
6.3.1 Emergency Protocol 9
6.3.2 Follow-up Procedures 9

SECTION 7.0 LANDFILL EMERGENCY ACTION PLAN 10

7.1 Purpose 10
7.2 Definitions 10
7.3 Responsible Persons 10
7.4 Emergency Response Telephone Numbers 10
7.5 Emergencies 11
7.5.1 Fires and Explosions 11
7.5.2 Tornado and Hurricane 11
7.5.3 Evacuation 11

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SECTION 1.0 INTRODUCTION

The purpose of this document is to identify protocol for the overall operation and maintenance of the Fort Bragg Construction and Demolition (C&D) Landfill (Landfill), which is owned by Fort Bragg Garrison Command and operated by the Fort Bragg Directorate of Public Works (DPW). This Operations Plan (Plan) provides details of the procedures and policies that shall be implemented throughout the life of the Landfill.

SECTION 2.0 STANDARD OPERATING PROCEDURES

2.1 HOURS AND DAYS OF OPERATIONS

The Landfill is open for operation between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday. The landfill accepts waste between the hours of 7:30 a.m. and 3:00 p.m. Monday through Friday. The observed holidays are New Year's Day, Independence Day, Thanksgiving Day, and Christmas Day.

Special notices are to be posted at the scale house advising users of the observed holidays. Such notices are posted at least one week in advance of the observed holiday.

2.2 WEIGHING PROCEDURES

All vehicles entering the Landfill are required to stop at the scale house, which is located at the entrance to the facility. All refuse transportation vehicles are weighed on permanent scales, and the content of the load is assessed. The weighmaster requests from the driver of the vehicle, a description of the waste and a pre-assigned security code to ensure that unacceptable waste is not entering the Landfill.

2.3 WASTES ACCEPTED

This solid waste management facility is approved to receive only the following waste.

- Land-Clearing Debris as defined in General Statutes 130A-290.
- Asphalt in accordance with General Statutes 130A-294(m).
- Construction and Demolition Debris defined as solid waste resulting solely from construction, remodeling, repair, or demolition operations on pavement, buildings, or other structures.
- Inert Debris defined as soil waste, which is virtually inert, such as brick, concrete, rock, and uncontaminated soil.
- Asbestos will be accepted if packed in accordance with 40 CFR 61 and must be placed in designated areas only.

2.4 UNACCEPTABLE WASTE

The following wastes are prohibited from disposal at the Landfill.

- Whole Scrap Tires
- Petroleum Contaminated Soil
- Medical Waste
- Polychlorinated Biphenyls (PCBs)
- Radioactive Waste & Materials
- Septage
- Used Oil
- Sanitary Waste including garbage as defined in G.S. 130A-290(a)(7) and municipal solid waste as defined in G.S. 130A-290(a)(18a)

- Yard Waste/Yard Trash
- White Goods
- Batteries of Any Type Including Lead Acid Batteries
- Hazardous Waste
- Military Equipment including vehicles and vehicle parts, radios and communication equipment, administrative equipment such as computers, filing cabinets, and office equipment, camouflage netting, tents, canvas, clothing, etc.
- Industrial Solid Waste
- Special Wastes (Spoiled Food, Animal Carcasses, Abattoir Waste, Hatchery Waste, or Animal Waste)
- Liquid Waste
- Ammunition Residue, Linking Metals, Brass Cartridges and Casings, and Metal Containers
- Wastewater Treatment Sludges except as approved by the North Carolina Department of Environment and Natural Resources (NCDENR)
- Barrels and drums shall not be disposed of unless they are empty and perforated sufficiently to ensure that no liquid or hazardous waste is contained therein, except fiber drums containing asbestos. They must also be triple rinsed and marked accordingly.
- Wooden Pallets
- Railroad ties and treated wood except as allowed under 15A NCAC 13B .0542(e)(15).

2.5 FILLING PROCEDURES

Waste transportation vehicles will arrive at the working face in random intervals. There may be several vehicles unloading waste at one time, while other vehicles are waiting. Waste unloading in the Landfill is controlled to prevent disposal in locations other than those specified by the site management. This control confines the working face to the minimum area required, which improves the overall Landfill aesthetics and minimizes the amount of cover soil required. Normally, only one working face is active on any given day. The waste shall be unloaded, spread in lifts, and compacted.

Appropriate methods will be implemented to prevent the scattering of debris by the wind. Any windblown materials will be returned to the areas of operation by the operator at the conclusion of each day.

2.6 COVER MATERIAL REQUIREMENTS

Waste shall be covered at a minimum of once per week with at least six inches of suitable cover soil and when the waste disposal area (working face) exceeds one-half acre. Cover will be placed at more frequent intervals if necessary to control disease vectors, fires, odors, blowing litter, and scavenging. Areas that will not have additional waste placed on them for three months or more, but where final elevations have not been reached, shall be covered and seeded. Wastewater treatment sludges may be used as soil conditioners and are restricted to the vegetative growth layer (top 6 inches). Within six months of termination of disposal operations, the final cover system shall be installed.

2.7 AIR CRITERIA

Air quality will be maintained to ensure that the Landfill does not violate any applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the U.S. EPA Administrator pursuant to Section 110 of the Clean Air Act, as amended.

Open burning of solid waste generally will be prohibited at the Landfill. Any infrequent burning must be approved by NCDENR. Fire protection for the Landfill will be provided by the Fort Bragg Fire Department. The Fort Bragg Fire Department can be contacted through the 911 system or by calling 432-0911. The primary fire control policy will be notification of the Fort Bragg Fire Department and waiting for them to respond to the notification. Additionally, Underwriters Laboratory (UL) fire extinguishers will be located in the scale-house area.

Fires that occur at a Landfill require verbal notice to NCDENR within 24 hours and written notification shall be submitted within 15 days. NCDENR's phone numbers are 919-508-8400 in Raleigh and 910-433-3351 in Fayetteville (Drew Hammonds).

2.8 SECURITY AND FACILITY ACCESS

The Landfill will be adequately secured by means approved by NCDENR to prevent unauthorized entry. All vehicles entering the landfill for disposal must have a pre-assigned security code. A Certified Landfill Operations Specialist will be provided by the DPW at the site at all times while the Landfill is open for use to ensure compliance with operational requirements.

Access to the site is of all-weather construction and will be maintained in good condition. Dust control measures shall be implemented when necessary.

Signs providing information on dumping procedures, the hours during which the site is open for use, the permit number, and other pertinent information are posted at the site entrance. Signs are posted stating that no hazardous, liquid, or municipal solid waste can be received. Traffic signs or markers are provided as necessary to promote an orderly traffic pattern to and from the discharge area and to maintain efficient operating conditions. The removal of solid waste from a Landfill is prohibited unless DPW approves, and the removal is not performed on the working face.

2.9 EROSION CONTROL

The drawings indicate the extent of the erosion and sedimentation control devices including stabilized channels, retention pond, surface water diversion berms, and vegetative cover. All devices have been sized to accommodate a 25-year, 24-hour storm event. These measures are in accordance with the Erosion and Sediment Control Plan approved by the NCDENR Division of Land Resources on August 19, 2004.

2.10 DRAINAGE CONTROL

Drainage control and water protection requirements are detailed on the Construction Documents. Surface water is diverted as far as practical from the operational area. No surface water will be impounded over

or in any waste. All surface runoff from the operational area will drain through open ditches and short culverts to the retention pond in the northwest corner of the site. No drainage will leave the permitted area. The facility is covered under the generic National Pollutant Discharge Elimination System (NPDES) permit for point source discharges associated with construction activities (Permit No. NCG010000).

2.11 RECORDKEEPING

DPW will record and retain the records at the DPW Environmental Office and/or Landfill Office. In an operating record, the following information as it becomes available is recorded:

- Inspection records, waste determination record, and training procedures required by North Carolina Solid Waste Management Rules.
- Amounts by weight of waste received at the facility to include source of generation.
- Water monitoring results as required in the Groundwater and Surface Water Monitoring Plan and permits.
- Any demonstration, certification, finding, monitoring, testing, or analytical data required by North Carolina Solid Waste Management Rules.
- Any closure or post-closure monitoring, testing, or analytical data required by North Carolina Solid Waste Management Rules.
- Contingency Plans.
- Notation of date and time of placement of cover material.
- All audit records, compliance records, and inspection records.

2.12 METHANE MONITORING PROGRAM

Routine monitoring for gas migration will be performed on a quarterly basis to ensure that the following compliance levels for methane concentration are not exceeded: 1) the concentration of methane gas generated by the facility does not exceed 25 percent of the lower explosive limit (LEL) for methane in facility structures (1.25 percent methane); and 2) the concentration of methane gas migrating from the Landfill does not exceed the LEL for methane at the facility property boundary (5 percent methane).

If concentrations are measured at greater than 25 percent of the LEL for methane in facility structures, then the Landfill must immediately take all necessary steps to ensure protection of human health and notify NCDENR. Within seven days of detection, the methane gas levels identified and a description of the steps taken to protect human health shall be placed in the operating record. Within 60 days of detection, a remediation plan describing the nature and extent of the problem and the proposed remedy for methane gas releases shall be placed in the operating record; subsequently, the remediation plan shall be implemented; and NCDENR shall be notified.

SECTION 3.0 WASTE SCREENING PROCEDURES

In order to prevent unacceptable waste from entering the Landfill, a screening procedure has been implemented. Trained personnel are to inspect waste received at the scale-house entrance and any waste taken to the working face. These individuals are trained to spot indications of suspicious waste that include hazardous placards or markings, liquids, powders or dusts, sludges, bright or unusual colors, drums or commercial-size containers, and chemical odors. Screening procedures for visual characteristics of prohibited wastes are an on-going part of the Landfill operation.

3.1 WASTE RECEIVING AND INSPECTION

Approximately one percent of the Landfill traffic will be selected for screening per quarter. Selected vehicles are directed to an area that is adjacent to the working face and are unloaded. Waste is carefully spread using the appropriate equipment. An employee trained to identify unacceptable material will inspect the waste discharged at the screening site. If unacceptable waste is found, including waste generated outside the service area, the load will be isolated and secured. The Landfill Manager or the Solid Waste Manager will then notify officials with NCDENR's Division of Solid Waste Management within 24 hours of the attempted disposal to inform them of the unacceptable waste and determine the appropriate course of action. The hauler/contractor is responsible for removing unacceptable waste from the Landfill property.

3.2 WASTE SCREENING RECORD KEEPING PROCEDURES

The following records are kept on-site to document all inspections:

- The date and times waste was received for inspection.
- Source and type of waste.
- Vehicle and driver identification.
- All observations made by the inspector.
- Final disposition of waste after inspection.

SECTION 4.0 PROGRESSION OF FILL

The boundaries of the phases are shown on the drawings. The purpose of the boundaries is to illustrate the general concept and progression of filling. Filling of each phase will begin only when the phase is excavated to the designed base grade and then certified by survey.

Each phase should be filled from the high end to allow stormwater to drain freely into the retention pond. Waste should be placed in uniform lifts that are as thin as practical and compacted to maximize the Landfill capacity. The area of the working face will vary depending on disposal demand but should be kept as small as practical to limit the requirement for cover soil. Waste should be placed in approximately ten-foot high lifts across a phase and provide adequate maneuvering room for building subsequent lifts.

A 20-foot buffer should be maintained free of waste along the inside toe of the northern slope to allow for the expansion of the Landfill into subsequent phases without having to re-handle the waste.

SECTION 5.0 CONCRETE AND MATERIALS RECYCLING

Waste delivered to the Landfill that is suitable for recycling will be directed to the designated recycling area. All materials determined to be recyclable shall be weighed and recorded.

SECTION 6.0 WORKER SAFETY AND TRAINING

All Landfill operating personnel shall receive training, safety equipment, and supervision necessary to carry out their assigned duties.

6.1 OPERATIONS TRAINING

Landfill personnel will be trained to recognize commercial/industrial, hazardous, liquid and municipal and excluded wastes. A supervisor with Manager of Landfill Operations (MOLO) certification will be present at all times while the landfill is operating. All training certificates will be placed in the operating records of the facility.

6.2 SAFETY EQUIPMENT

All employees will be provided the following safety equipment: hard hat, safety vest, safety shoes, face mask, gloves, fire extinguisher, Landfill Emergency Action Plan, and a first-aid kit. All employees will be trained in the proper use of safety equipment.

6.3 FIRES AND NATURAL DISASTERS

6.3.1 Emergency Protocol

In the event of a fire or other natural disaster, all staff should follow the protocol outlined in the Landfill Emergency Action Plan. This plan was designed to meet the requirements of OSHA 1910.38a and 1910.120. It is incorporated herein.

6.3.2 Follow-up Procedures

The fire department will be notified in cases of emergency. The NCDENR Solid Waste Section will be notified by telephone within 24 hours of an emergency response by the fire department to the facility. A follow-up letter detailing the nature of the emergency and any action taken will be mailed to the section within 15 days of an emergency response.

SECTION 7.0 LANDFILL EMERGENCY ACTION PLAN

7.1 PURPOSE

The Landfill Emergency Action Plan is to provide all employees with the proper information to protect themselves, co-workers, and the public in the event of an emergency. This plan is designed to meet the requirements of OSHA 1910.38(a) and 1910.120.

7.2 DEFINITIONS

Emergencies shall include such events as serious fires, explosions, tornadoes, hurricanes, or releases of hazardous or toxic materials. This Plan will detail the appropriate emergency action for each.

Serious fires shall be any fire that is not extinguishable by a portable fire extinguisher, a fire within a confined space, which would require entering the space to extinguish it, or a fire involving explosive or toxic materials.

Assembly point shall be the area in which all employees gather in the event of an emergency.

7.3 RESPONSIBLE PERSONS

In the case of emergency evacuation, each section supervisor is responsible for accountability of his/her employees and all visitors.

Every employee is responsible for his/her safety and for preventing job-related accidents or injuries by complying with all workplace safety policies and related procedures.

7.4 EMERGENCY RESPONSE TELEPHONE NUMBERS

◈ Emergency (Fire/Police)	Land Line – 911 Cell – 1-910-432-0911
◈ Fayetteville Regional Office, Division of Environmental Management	1- 910-433-3300
◈ National Response Center	1-800-424-8802
◈ NC Emergency Management	1-919-733-3867
◈ Chemtrac	1-800-424-9300
◈ State Emergency Number (after hours)	1-919-733-3942
◈ Poison Control Center	1-800-222-1222

**If possible, consult your supervisor before using the numbers listed.*

7.5 EMERGENCIES

7.5.1 Fires and Explosions

In the event of a fire or explosion, all personnel shall evacuate the area with caution. There are no specific escape route assignments during the initial evacuation. **The assembly area is at the front entrance of the Landfill.**

7.5.2 Tornado and Hurricane

In the event of a tornado or hurricane with sufficient warning, all Landfill personnel shall move with caution to the nearest secure public structure. In the event of a tornado without warning, personnel should temporarily retreat to the Transfer Station. There are no specific escape route assignments during the initial evacuation.

7.5.3 Evacuation

a. To alert other personnel on the Landfill site, the highest ranking person shall notify the employees by two-way radio.

b. Under no circumstances shall an employee remain in a hazardous area to operate equipment. Evacuation is mandatory.

c. Employee Accounting:

   (1) In the event of an emergency, the Landfill Supervisor(s) (in his/her absence, the senior operator), will take charge at the assembly point and account for all persons at the Landfill site.

   (2) The highest ranking supervisor(s) at the assembly point will be responsible for the accounting of all persons on site. Once everyone has been accounted for, no one may leave the assembly point without the assembly point supervisor's permission.

   (3) All persons should reach the assembly point within ten minutes of the alarm. All persons unaccounted for after this time will be assumed to be down and their names and last known location will be provided to the fire/rescue personnel by the assembly point supervisor.

d. Assigned Responsibilities:

   In the event of an emergency evacuation, the following personnel shall have these responsibilities:

   (1) Person discovering the emergency condition:

      i. Shall report the situation to 911.

      ii. Shall take first aid kit to the assembly point.

   (2) Landfill Supervisor(s) or senior person:

      i. Report to the assembly point and begin accounting for persons on site.

ii. Coordinate actions with emergency response personnel.

iii. Report all missing persons.

e. Employees are not required to administer medical attention but may offer first aid normally given to any accident victim. Only properly trained personnel shall attempt rescue of an employee in a hazardous atmosphere.

f. The preferred means of reporting an emergency is by telephone (i.e., call 911). The least preferred method of reporting is by word of mouth. Under these conditions, no employee shall drive for help until weather conditions are safe for transit by automobile. In all cases, be sure to give emergency personnel an address; phone number; injuries, if any are known; and type of emergency.

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

POST-CLOSURE PLAN

MAY 2010

Prepared for:

DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

Prepared by:

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TABLE OF CONTENTS

SECTION 1.0 POST-CLOSURE PLAN 1

1.1 Introduction 1
1.2 Post-Closure Contact 1
1.3 Description of Use 1
1.4 Maintenance 1
1.4.1 Repair of Security Control Devices 1
1.4.2 Erosion Damage Repair 2
1.4.3 Correction of Settlement, Subsidence, and Displacement 2
1.4.4 Repair of Run-On/Run-Off Control Structures 2
1.4.5 Gas Venting System 2
1.4.6 Groundwater Monitoring System 2
1.5 Monitoring Plan 3
1.5.1 Inspection Frequencies 3
1.5.2 Quarterly Inspections 3
1.5.3 Semiannual Inspections 3
1.6 Engineering Certification 4
1.7 Cost Estimate of Post Closure Care Activities 4

Table 1-1 Post-Closure Inspection Frequencies 3
Table 1-2 Post-Closure Cost Estimate 4

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SECTION 1.0 POST-CLOSURE PLAN

1.1 Introduction

This Post-Closure Plan has been developed to outline steps to be taken to ensure the environmental soundness of the Fort Bragg C&D Landfill (Landfill) during its post-closure care period. The post-closure care period will last at least 30 years after closure completion and at a minimum will consist of the following.

- Maintaining integrity and effectiveness of final cover system.
- Performing groundwater monitoring.
- Maintaining and operating a gas monitoring system.
- Maintaining run-on/run-off controls.

No wastes will remain exposed after closure of the unit. Access to the closed site by the public will be restricted. Any proposed use will be evaluated to determine its potential for posing a significant health hazard.

1.2 Post-Closure Contact

All correspondence and questions concerning the post-closure care of the unit should be directed to:

Director, DPW Engineering Division
DPW
Attn: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
(910) 396-0321

1.3 Description of Use

After the unit is officially closed in accordance with the Closure Plan, the area will be allowed to return to a natural vegetative state. The landfill surface will be periodically mowed to prevent the growth of species that could damage the cap system. Fort Bragg will maintain control of the property and prevent public access to it during the post-closure period.

There will be an access road on the cap to allow proper maintenance during post-closure. Final location of the access will be determined as a part of the final closure design for the facility.

1.4 Maintenance

1.4.1 Repair of Security Control Devices

All security control devices will be inspected and maintained as necessary to ensure access to the site is controlled. Locks, vehicular gates, and fencing will be replaced if functioning improperly.

Warning signs will be kept legible at all times and will be replaced if damaged by inclement weather, vandalism, etc.

1.4.2 Erosion Damage Repair

If erosion of the final cover occurs during post-closure, the affected area will be repaired and re-seeded as necessary. Excessive slopes will be flattened if possible by adding clean fill material. If necessary, erosion control fabrics will be used to expedite rapid revegetation of slopes and to secure topsoil in place. Rough surfaces, which cause isolated erosion areas will be smoothed and re-seeded as necessary.

1.4.3 Correction of Settlement, Subsidence, and Displacement

Minimum post settlement slopes of five percent will be maintained in order to prevent ponding and allow for proper drainage without infiltration. If vertical or horizontal displacement occurs due to differential settlement, cracks will be filled with appropriate material and final cover will be reestablished. Excessive vertical displacement is not anticipated.

1.4.4 Repair of Run-On/Run-Off Control Structures

All side slope swales, diversion berms, downpipes, and perimeter channels will be repaired, cleaned or realigned in order to maintain original condition. Any culverts that are damaged will be replaced.

1.4.5 Gas Venting System

The landfill gas venting system will be inspected and maintained. Proper operation of the system is verified through testing at the landfill gas monitoring probes.

1.4.6 Groundwater Monitoring System

Procedures outlined in the Water Quality Monitoring Plan or subsequent revision will take precedence; however, a brief description is as follows. All groundwater monitoring wells have been installed with concrete pads and protective casings to prevent accidental damage by vehicles and equipment. The wells are also equipped with a locking cap to discourage vandalism. Groundwater wells will be inspected regularly (at the time of sampling) to ensure integrity. Persons inspecting a well should look for signs of well tampering, cracking or degradation, and determine whether the well needs to be replaced. If the decision is made to replace and abandon a well, the replacement well should be installed 5 to 10 feet from the abandoned well in accordance with previous well specifications. Well abandonment should be accomplished by pulling the casing out and grouting the hole.

1.5 Monitoring Plan

The closed landfill shall be monitored for 30 years. A series of inspections shall be scheduled to ensure the integrity and effectiveness of the cap system, storm water control system, groundwater monitoring system, gas venting system, and to protect human health and the environment.

1.5.1 Inspection Frequencies

Inspections to be conducted during the post-closure care period will occur regularly as follows.

Table 1-1 Post-Closure Inspection Frequencies

Inspection Activity	Years 1-3	Years 4-30
Security Control Devices	Quarterly	Quarterly
Cover Drainage System Functioning	Quarterly*	Semiannually
Gas Venting System	Quarterly	Semiannually
Groundwater Monitoring System	Semiannually	Semiannually
Erosion Damage	Quarterly*	Semiannually
Cover Settlement, Subsidence, and Displacement	Quarterly*	Semiannually
Vegetative Cover Condition	Quarterly*	Semiannually
Stormwater Control System	Quarterly*	Semiannually
Benchmark Integrity	Annually	Annually

* These items will also be inspected within five days of each major storm event (i.e., 1 inch or greater in any 24-hour period.

A copy of the Post-Closure Inspection Checklist is included at the end of this Post-Closure Plan.

1.5.2 Quarterly Inspections

Quarterly inspections of the closed site will include examination of the security control devices for signs of deterioration or vandalism to ensure access to the site is limited to authorized persons. The disposal area will be checked to ensure that the integrity of the final cover system is maintained; erosion damage is repaired; vegetative cover persists; and that cover settlement, subsidence, and displacement are minimal. Drainage ditches will be cleared of litter and debris and benchmark integrity will be noted and maintained.

1.5.3 Semiannual Inspections

Semiannual inspections of the site during the post-closure period will be conducted by the Owner or Owner's representative with attention paid to the integrity of the final cover system. This includes inspection for erosion damage, a good stand of vegetative cover, and cover settlement, subsidence, and displacement. Drainage ditches will be cleared of litter and debris, benchmark integrity will be noted and maintained as well as the integrity of the groundwater and gas monitoring systems.

Groundwater monitoring will continue on a regular basis throughout the post-closure care period. The parameters chosen for analysis will be no less than the requirements of regulatory agencies. Groundwater monitoring wells will be inspected in accordance with the post-closure inspection protocol. A report of findings will be made to the responsible party via the Post-Closure Inspection Checklist, including any recommendations for actions necessary to ensure the site continues to meet the closure performance standard. The engineer will also receive copies of the quarterly inspection reports and respond to any comments that demand immediate attention.

1.6 Engineering Certification

Based on the monitoring reports and semiannual site visits, annual certifications by the owner or owner's representative will be placed in the operating record. They will certify that the post closure plan is being followed, noting discrepancies along with the corrective actions undertaken. At the end of the post-closure period, the individual certifications will be compiled into a final document and forwarded to NCDENR.

1.7 Cost Estimate of Post Closure Care Activities

Table 1-2 gives a cost estimate of the Post Closure Care activities.

Table 1-2 Post-Closure Cost Estimate

Item Description	Quantity	Unit	Unit Price	Total
Security Fence Repair	30	Year	$ 2,000	$ 60,000
Erosion, Settlement Repair & Revegetation				
Years 0-5	5	Year	$ 40,000	$ 200,000
Years 6-10	5	Year	$ 20,000	$ 100,000
Years 11-30	20	Year	$ 5,000	$ 100,000
Sediment Cleanout	100	Hours	$ 100	$ 10,000
Seeding	30	Acres	$ 2,000	$ 60,000
(2 acres/year for 30 years)				
Mowing	1,440	Acres	$ 40	$ 57,600
(2 times/year over 24 acres for 30 years)				
Gas Monitoring[1]	60	Sampling Events	$ 500	$ 30,000
Groundwater Monitoring[2]	60	Sampling Events	$ 5,000	$ 300,000
Site Inspections				
Years 0-5[3]	20	Events	$ 2,000	$ 40,000
Years 6-30[4]	50	Events	$ 2,000	$ 100,000
Electricity/Lighting	30	Year	$ 4,000	$ 120,000
Post Closure Certification (at year 30)	1	Each	$ 25,000	$ 25,000
Subtotal				$ 1,202,600
30-Year Total Cost				**$ 1,202,600**
Average Annual Cost				$ 40,087

Notes:

[1]There are 15 gas monitoring locations that will be sampled semiannually for 30 years.

[2]There are 13 groundwater monitoring locations that will be sampled semiannually for 30 years.

[3]Site inspections will occur quarterly for years 0 - 5.

[4]Site inspections will occur semiannually for years 6 - 30.

FIGURE 1
POST-CLOSURE INSPECTION CHECKLIST

Location: _____

Date: _____ Time: _____

Weather: _____ Completed By: _____

	Yes	No
I. Security Control Devices		
Are security control devices in place and functioning?	☐	☐
Are all warning signs prominent and legible?	☐	☐
Are there any signs of unauthorized entry on the site?	☐	☐
Are there signs of illegal dumping on site?	☐	☐
II. Final Cover System		
Is the final cover free of erosion and depressions?	☐	☐
Is there leachate seeping from the final cover? (If yes, make note of location in comment section below).	☐	☐
Is the vegetative cover continuous and in good condition, free of bare spots?	☐	☐
Does the site require mowing? (If yes, mow grass and note in comment section below).	☐	☐
Is there ponding of water on final cover system?	☐	☐
III. Groundwater Monitoring Wells		
Is the casing upright and unobstructed?	☐	☐
Is the outer casing secure and locked?	☐	☐
Is the ID tag present and legible?	☐	☐
IV. Miscellaneous		
Are all benchmarks visible and intact?	☐	☐
Are all ditches free of debris and litter?	☐	☐
Are any odors present which may indicate landfill gas migration?	☐	☐

POST-CLOSURE INSPECTION CHECKLIST (continued)

Comments

Please use the section below to comment on any area not covered above and also to note any areas of concern or needing immediate attention.

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

CLOSURE PLAN

MAY 2010

Prepared for:

DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

Prepared by:

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TABLE OF CONTENTS

SECTION 1.0 CLOSURE PLAN 1

1.1 Cap System Background 1
1.2 Cap System Design 1
1.3 Maximum Final Contours 2
1.4 Cap System Material Requirements 2
1.5 Erosion Control Measures 2
1.6 Settlement Subsidence and Displacement 2
1.7 Gas Venting System 3
1.8 Schedule for Closure 3
1.9 Notice of Closure and Date of Final Waste Acceptance 3
1.10 Implementation of Closure Plan 3
1.11 Closure Verification 3
1.12 Cost Estimate of Closure Activities 4

Table 1-1 Closure Cost Estimate 4

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SECTION 1.0 CLOSURE PLAN

1.1 Cap System Background

In compliance with the state Solid Waste Management Rule15A NCAC 13B .0543, the Fort Bragg C&D Landfill (Landfill) will place a final cap system over all waste placed in the approximately 45 acre footprint of the landfill. The layers of the cap system will be designed and constructed with a low-permeability barrier layer under an erosion layer. It is estimated that the remaining landfill volume as of October 8, 2009 is approximately 1,882,000 cy (gross capacity) or 1,544,000 cy (net operating volume). The maximum area requiring a cap at any one time is approximately 24 acres which encompasses Phase I and Phase II. Final cover will be constructed prior to expansions into Phase III and IV resulting in final cover areas less than 24 acres when these phases are in operation.

1.2 Cap System Design

Prior to closure, the cap system design will be checked, revised, and updated as appropriate. Compacted soil layers will be incorporated in the cap system design to provide protection throughout the 30-year post-closure period. The system will consist of two layers (bottom up): the low-permeability barrier layer and the erosion layer. The barrier layer is designed to reduce infiltration into the Landfill, thus minimizing leachate and the potential for groundwater contamination. The erosion layer is designed to provide vegetation and minimize erosion.

The Landfill may use on- or off-site borrow material for the barrier layer and erosion layer. Should on-site borrow material be used, it will come from a clay stockpile located on the Lamont Road borrow area. The compacted soil liner will consist of no less than 18 inches of soil having permeability equal to or less than 1×10^{-5} cm/sec. In order to assure that the material meets the permeability criteria, the soil will be tested prior to use and during placement. Testing requirements are outlined in the Construction Quality Assurance (CQA) Plan (Closure) and the Technical Specifications. Construction methods for the barrier layer shall be based upon the type and quality of the borrow source and shall be verified in the field by constructing test pad(s). A professional engineer shall certify that the barrier layer installation conforms to the plans approved by the NCDENR Division of Solid Waste Management.

The erosion layer will consist of no less than 18 inches of earthen material capable of sustaining native plant growth. It is anticipated that this layer will consist of 18 inches of suitable on-site or off-site borrow material.

The materials of the erosion layer will be selected considering soil type, nutrient levels, pH, erodibility, sideslope drainage, and other factors. The vegetation will be selected based upon the following characteristics.

- Species of grasses which are locally adapted and resistant to drought or temperature extremes.
- Having roots which will not disrupt the low-permeability barrier layer.
- Ability to thrive in low nutrient soil and develop a good stand to resist erosion.

- Survive and function with little or no maintenance.

All cover material will be free of putrescible material, solid waste, vegetation, large rocks, construction debris, frozen soil, and other deleterious materials.

1.3 Maximum Final Contours

The maximum final contours for closure are shown on the drawings. These contours represent the top of the erosion layer and have been established to reflect maximum C&D waste elevations, intermediate cover material (representing a total of 6 inches after compaction), and the final cover system (representing a total of 3 feet). Actual elevations at closure may be less than those shown if warranted by operational considerations.

The Landfill is designed to have minimum top slopes of five percent and maximum side slopes of 3H:1V. Final contours have been established to allow the Landfill's surface water to drain off the final cover while limiting erosion potential. Surface water runoff from the top slopes is intercepted by diversion berms to prevent concentrated flow (maximum length of sheet flow is approximately 300 feet) and is subsequently directed off of the cover via downpipes. The side slopes incorporate a system of drainage swales to limit surface water flow length. The vertical spacing of the side slope swales is approximately 30 feet. The side slope swales will drain into downpipes. The surface waters will be conveyed by the perimeter drainage channel or downpipes to the retention basin located on the northern portion of the property.

1.4 Cap System Material Requirements

Based on 18 inches of low-permeability barrier layer placed over the entire 45-acre landfill footprint, approximately 109,000 cy of compacted soil are required for the first layer of the cap system. A minimum of 109,000 CY is required for the erosion layer.

1.5 Erosion Control Measures

As shown in the drawings, a system of drainage channels, pipes, and a retention basin will be used to protect the environment from sediment-laden runoff. The existing retention basin currently serves, and is anticipated to continue serving, the entire Landfill. Drainage flows to the retention basin are not anticipated to increase significantly due to the lateral expansion of the landfill. Drainage calculations may be found in Appendix A.

1.6 Settlement Subsidence and Displacement

Landfill compaction methods, which include the use of steel-wheeled compaction equipment to spread and compact in layers, combined with an adequate number of passes over each layer of waste, will be utilized to reduce voids and minimize differential settlement. Proper placement of daily, intermediate, and final cover will reduce the moisture content of the waste prior to site closure and further reduce

settlement. Final slopes of the landfill have been developed to allow for this anticipated subsidence so that long-term positive drainage of the fill will not be hindered.

1.7 Gas Venting System

A passive gas venting system will be installed under the cap to allow movement of gas generated from the completed fill area and minimize pressure exerted on the cap in accordance with15A NCAC 13B .0543(c)(2)(B). The gas venting system will consist of horizontal well trenches spaced approximately one per acre that will vent to the atmosphere. Details of the proposed passive gas venting system are provided on Sheet 12 of 14 of the drawings provided with this permit application.

1.8 Schedule for Closure

The closure activities will begin no later than 30 days after the known final receipt of waste. The design of the Landfill, in combination with the maintenance plan, should assure a fairly uncomplicated closure period. Areas at final design grade will be closed within 180 days unless an extension has been requested and received which identified the need for an increase schedule in accordance with 15A NCAC 13B .0543(c)(6).

1.9 Notice of Closure and Date of Final Waste Acceptance

A sign indicating the anticipated date of closure and the date of final waste acceptance will be conspicuously posted at the facility at least 30 days in advance. The Landfill may take other steps to notify contractors and military personnel of the planned closure. Prior to beginning closure of the unit or portions thereof, the NCDENR Department of Solid Waste Management will be notified that a notice of intent to close has been placed in the operating record.

1.10 Implementation of Closure Plan

The closure plan will be implemented no more than 30 days from the date of final waste acceptance and completed in accordance with state regulations.

1.11 Closure Verification

The following procedures will be implemented following closure.

- A Construction Quality Assurance (CQA) report shall be submitted to the NCDENR Division of Solid Waste Management. This CQA report shall describe the observations and tests used before, during, and upon completion of construction to ensure that the construction materials meet the cap design specifications and the construction and certification requirements. The CQA report shall contain as-built drawings.

- A signed certification from an independent registered professional engineer verifying that closure has been completed in accordance with the closure plan will be submitted to the NCDENR Division of Solid Waste Management and a copy will be placed in the operating record.
- Within 90 days, a survey plat prepared by a professional land surveyor registered by the state, indicating the location and dimensions of landfill disposal areas, will be recorded with the Cumberland County Register of Deeds.
- A notation shall be recorded on the deed notifying any potential purchaser of the property that the land has been used as a solid waste management unit and that future use is restricted under 15A NCAC 13B .0543(c)(8). A copy of the deed notation as recorded shall be filed with the operating record.

1.12 Cost Estimate of Closure Activities

Table 1-1 gives a cost estimate for closure construction at the Landfill based on the maximum anticipated closure area of 24 acres at any one time.

Table 1-1 Closure Cost Estimate

Item Description	Quantity	Unit	Unit Price[1]	Total
Mobilization, CQC, Project Administration, Bonds	$ 1,779,616		4%	$ 71,184.64
Number of Acres to Construct:	24.0	Acres		
Surveying and Control	24.0	Acres	$ 3,500	$ 84,000
Erosion and Sediment Control and Maintenance	24.0	Acres	$ 10,000	$ 240,000
Grading Preparation	24.0	Acres	$ 5,900	$ 141,600
Miscellaneous Structural Fill	10,000	CY	$ 5.00	$ 50,000
Construct Compacted Soil Liner[2] (18" thick)	58,100	CY	$ 10.00	$ 581,000
Construct Erosion Layer (18" thick)	58,100	CY	$ 7.00	$ 406,700
Construct Gas Venting System	24.0	Acres	$ 2,500	$ 60,000
Construct Diversion Berms	1,100	LF	$ 39	$ 42,900
Construct Sideslope Swales	2,910	LF	$ 23	$ 66,930.00
Construct Perimeter Channel (assume all excavation)	2,000	LF	$ 18	$ 36,000.00
Construct Rip Rap Channel Outlets	114	Tons	$ 54	$ 6,156
Rip Rap Aprons[3]	95	Tons	$ 54	$ 5,130
Construct Downpipes	640	LF	$ 25	$ 16,000
Furnish and Install Seeding and Mulching	24.0	Acres	$ 1,800	$ 43,200
Subtotal				$ 1,850,900
Contingency	5.1%			$ 94,400
Engineering	24.0	Acres	$ 2,000	$ 48,000
Construction Management	2%			$ 37,000
CQA	24.0	Acres	$ 5,000	$ 120,000
Total costs				**$ 2,150,300**
Cost per Acre				$ 89,596

Notes:

[1] Unit Prices are estimated in 2010 dollars.

[2] Soil Liner is 1 x 10^{-5} cm/sec material.

[3] 3 Rip Rap Aprons at 540 ft^3 or Rip Rap per Apron at a density of 3,150 pounds per cubic yard.

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

WATER QUALITY MONITORING PLAN

MAY 2010

Prepared for:

DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

Prepared by:

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TABLE OF CONTENTS

SECTION 1.0 WATER QUALITY MONITORING PLAN 1

1.1 Purpose and Intent 1
1.2 Current Water Quality Monitoring 1
1.3 Description of Plan Components 2
1.3.1 Main Components 2
1.3.2 Water Quality Data Collection 3
1.3.3 Sample Parameters and Frequency 4
1.4 Detection Monitoring Reporting 5
1.5 Assessment and Corrective Action Program 5

Table 1-1 Monitoring Well Summary 1

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SECTION 1.0 WATER QUALITY MONITORING PLAN

1.1 Purpose and Intent

The purpose of this Water Quality Monitoring Plan (Plan) is to provide a program that describes the collection and evaluation of ground-water monitoring samples collected from compliance wells installed in the uppermost aquifer at the Lamont Road Construction and Demolition Debris (C&D) Landfill. The intent of this Plan is to provide detection monitoring throughout the active life and post closure care period for the C&D Landfill (Landfill) at Fort Bragg, North Carolina.

This Plan was prepared in accordance with the rules codified under North Carolina Solid Waste Management Rules 15A NCAC 13B .0544, Monitoring Plans and requirements for C&DLF Facilities under the guidance of a North Carolina Licensed Engineer, and will be effective in providing early detection of any release of hazardous constituents (from any point in this lateral expansion) to the uppermost aquifer, so as to be protective of public health and the environment.

1.2 Current Water Quality Monitoring

Water quality is currently monitored at the active Landfill area. The monitoring is in compliance with the NCDENR approved Water Quality Monitoring Plan produced by HDR Engineering, Inc. of the Carolinas, dated April 2004 (revised August 2004). No changes to the approved plan are requested as part of this permit application.

The water quality monitoring system currently includes a total of eleven downgradient ground-water monitoring wells and two upgradient wells. Table 1-1 presents the wells included in the monitoring network. There are no new monitoring wells proposed for the facility. Groundwater flow for the facility and the lateral expansion is primarily northwest (refer to Sheet 14 of 14, Monitoring Plan, of this permit application).

Table 1-1 Monitoring Well Summary

Boring/ Well ID	Gradient	Total Depth (bls)	Screen Length (feet)	Screen Elevation (feet MSL)	Aquifer
MW-3s	Down	67	10	342 - 352	Shallow
MW-3	Down	123	10	287 - 297	Deep
MW-4	Up	82	20	359 - 379	Shallow
MW-6	Down	94	15	334 - 349	Shallow
MW-7	Up	130	10	305 - 315	Shallow
MW-8	Down	85	15	291 - 306	Shallow
MW-9	Down	135.90	--	--	Deep
MW-9s	Down	60	10	297 - 307	Shallow
MW-9d	Down	85	5	271 - 276	Deep
MW-10	Down	83	14	345 - 359	Shallow
MW-14R	Down	54	10	139 - 149	Shallow

Boring/ Well ID	Gradient	Total Depth (bls)	Screen Length (feet)	Screen Elevation (feet MSL)	Aquifer
MW-15R	Down	46	10	314 - 324	Shallow
MW-16	Down	42	10	332 - 342	Shallow

bls =below land surface
MSL = mean sea level

1.3 Description of Plan Components

1.3.1 Main Components

The following is a brief description of the main components of this Plan. Surface water is not intended to be monitored as there is not a stream to sample.

1.3.1.1 Background Well

Using the historical water-table elevation data collected during multiple ground-water monitoring events at the Landfill, two background compliance wells were selected on the basis of hydraulic position in relation to the solid waste management unit. The background wells MW-4 and MW-7 are hydraulically "upgradient" of the unit. The location of these wells is exhibited on Sheet 14 of 14, Monitoring Plan.

1.3.1.2 Downgradient (Detection) Wells

The hydrogeologic and geologic characteristics of the Landfill and surrounding land, as well as the quantity, quality, and direction of groundwater flow were evaluated to determine the appropriate selection of downgradient (detection) wells. In addition to the above criteria, the distance of each compliance well relative to the waste unit at full buildout (less than 250 feet) and the boundary of the property (50 feet or greater) were also considered. See Sheet 14 of 14, Monitoring Plan.

For most wells, a distance of approximately 150 feet from waste at full buildout was achieved. The majority of wells are between 100 and 160 feet from the waste. Exceptions to this were made for MW-15R and MW-16 due to conflicts with current landfill infrastructures.

The number and location of the monitoring wells was selected based on several considerations. First, knowledge of ground-water flow at the proposed expansion area, as described in the Design Hydrogeologic Report prepared by HDR Engineering, Inc. of the Carolinas dated April 2004, indicates that these wells encompass the downgradient area of both the existing waste unit boundary and the lateral expansion. Second, each shallow well was completed in the uppermost aquifer, with well screens that span the water table in addition to some deeper wells. Third, a more than adequate lateral spacing of these wells was chosen based on their close proximity to each other and the fine-grained nature of the aquifer in which dispersion is high. Fourth, the distance of each well from the waste boundary, when compared with average ground water flow rates in the uppermost

aquifer (see Design Hydrogeologic Report), provides adequate warning of possible contamination without sacrificing the ability to place new wells further downgradient in the event assessment monitoring becomes necessary.

1.3.2 Water Quality Data Collection

The following data will be collected and reported during the period of performance for this Plan. A brief discussion on the collection and analysis of these data is provided in the sections that follow.

1.3.2.1 Ground-Water Level Data Measurements

Static ground-water levels (and total well depth) will be obtained from the proposed ground-water compliance monitoring wells immediately prior to purging for each required water quality sampling event. An electronic water level meter capable of measuring differences in water levels of 0.01 feet will be used to obtain these measurements.

All measurements will be taken from a reference point at the top of each PVC well casing, which has an elevation established by a North Carolina (NC) registered land surveyor. The horizontal position of each well was established using North Carolina Plane Coordinates. These data will be used to calculate the volume of standing water in each well and will provide information concerning well integrity (e.g., identifying the presence of excessive siltation and casing breaches). All measuring equipment will be decontaminated before use at each well as established by Environmental Protection Agency (EPA) Region IV in the Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996; Section B.2.4 as follows.

- Wash with detergent and tap water.
- Rinse with tap water.
- Rinse with analyte free water.

1.3.2.2 Ground-Water Direction and Flow Measurements

Water table elevations will be calculated for each monitoring well using the surveyed top-of-casing elevations prepared by a NC registered land surveyor. Calculated potentiometric surface elevations for each sampling event will be placed on a scaled base map of the facility beside each respective monitoring point and contoured to produce a potentiometric surface map depicting potential ground-water flow direction(s) across the expansion area in the upper most aquifer.

In addition, estimated groundwater flow velocities for each compliance monitoring point will be calculated for each water quality sampling event. An estimated seepage (pore water) velocity at each monitoring well will be calculated to evaluate potential contaminant migration based upon the following information.

- Static water table potentiometric data.
- Effective porosities for each well.
- Hydraulic conductivities determined from slug tests of each well.
- The calculated hydraulic gradients at each monitoring well for the respective sample event.

1.3.3 Sample Parameters and Frequency

1.3.3.1 Analytical Methods

All water quality samples will be analyzed for the detection monitoring constituents listed in 15A NCAC 13B .0544(b)(1)(D) which includes the parameters listed in 40 CFR Part 258 Appendix I (Volatile Organic Compounds), mercury, chloride, manganese, sulfate, iron, specific conductance, pH, temperature, alkalinity, and total dissolved solids using approved EPA methods. Prior to ground-water quality sampling, each well will be purged of three to five well volumes recording field measurements (pH, temperature, and specific conductance, alkalinity) after each volume to determine stabilization so that a representative sample can be collected. These measurements will be obtained from a field-calibrated instrument in accordance with the manufacturers' specifications and industry standards. Purging and sampling will be performed using pre-sealed disposable Teflon bailers.

Sampling personnel will wear disposable nitrile gloves during all purging and sampling procedures. New gloves will be worn for each location. Field meters will be decontaminated in a similar manner to the water level meter.

All samples will be transferred directly to the appropriate laboratory-prepared sample containers on ice, in a manner which minimizes sample agitation and cross-contamination. More volatile sample parameters (i.e., volatile organics) will be collected first with the less sensitive parameters (i.e., metals) being the last parameter sampled. A chain-of-custody record will accompany the samples during each sampling event to document changes in the custody of the samples during shipment from the site to a state certified laboratory.

One trip blank will be prepared by the laboratory during each sampling event to provide quality assurance/quality control (QA/QC) evaluation of decontamination procedures, sample handling procedures, and container shipping procedures to be analyzed for volatile organics only. Laboratory analytical results will be reported at state mandated PQL's for each parameter.

1.3.3.2 Water Quality Sampling Frequency

The water quality samples from all sample points will be collected on a semiannual basis.

1.4 Detection Monitoring Reporting

A report will be prepared which will summarize the sampling events including field observations relating to the condition of the monitoring wells; field data; laboratory data; sampling methodologies; QA/QC data; information on groundwater flow direction; and calculations of groundwater flow rate; and any constituent exceedance over the background levels.

1.5 Assessment and Corrective Action Program

The Fort Bragg Directorate of Public Works (DPW) will commence an Assessment and Corrective Action Program in accordance with 15A NCAC 13B 0.545 if one or more of the analyzed constituents are detected above the current groundwater quality standards in accordance with 15A NCAC 02L .0202 unless it can be demonstrated that the exceedence(s) is from a source other than from the landfill, is a result of natural variation of ground-water quality, or is the result of an error in sampling or analysis.

C&D LANDFILL
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PHASE II
SUBSURFACE
INVESTIGATION

MARCH 2004

Prepared for:
DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

Prepared by:
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HDR

March 26, 2004

Mr. George Whitley
XVIII Airborne Corps and Fort Bragg
Attn: AFZA-PW-CB
Building 3-1634 Butner Road
Ft. Bragg, NC 28310

Re: LCID/C&D Landfill Expansion
Phase II Subsurface Investigation
HDR Project No. 11236-5059-018

Dear Mr. Whitley:

This letter report was prepared to summarize the soil test results conducted at or around the proposed subgrade elevations of Phase II for the proposed Land Clearing and Inert Debris and Construction and Demolition (LCID/C&D) Landfill Expansion.

Background

A Construction Permit Application has been prepared for submittal to the North Carolina Department of Environment and Natural Resources (NCDENR) Waste Management Division for the LCID/C&D Landfill Expansion (Expansion). The Expansion will occur in three five-year phases of which the first two phases include excavation to meet subgrade elevations, while the third phase will occur over the existing LCID Landfill. It is anticipated that Phase I of the proposed Expansion will be constructed in 2004/2005.

NCDENR has proposed new regulations for C&D landfills, which may take effect in 2004/2005. The current version of proposed regulation 15A NCAC 13B .0540(2)(b) will require that the soils comprising the landfill subgrade have a soil classification of SC, ML, CL, MH, and/or CH as identified by the Unified Soil Classification System (USCS). In order to finalize the phasing development of the Expansion and to meet the proposed new regulations, the soils in the Phase II footprint were sampled and tested to identify their respective soil classifications.

Sampling

Proposed new regulation 15A NCAC 13B .0540(2)(b) does not dictate the testing frequency required to determine the USCS classification of the soil subgrade for a C&D landfill. However, discussions regarding testing frequency with Ms. Ellen Lorscheider (NCDENR), resulted in approximately six (6) sample points (one per acre) within the Phase II footprint would be sufficient for determining suitability of the in-situ soils. Six sample points were randomly selected within the Phase II footprint and are shown on the attached drawing. Each sample was taken at the proposed subgrade elevation using a drill rig. Table 1 summarizes the sample location and depth of sample.

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Table 1. Sample Locations.

Sample ID	Northing	Easting	Existing Surface Elevation (Ft MSL)	Proposed Subgrade Elevation (Ft MSL)	Depth to Sample (Ft)
B-1	508466	1978138	395	380	14
B-2	508525	1977980	387	358	28
B-3	508331	1977981	386	370	24
B-4	508362	1977694	358	357	2
B-5	508093	1977643	373	362	14
B-6	508100	1978042	367	365	2

Soil Characteristics

The two tests conducted to determine the USCS classification of the in-situ soil in Phase II were Atterberg Limits (ASTM D 4318) and Sieve Analyses (ASTM D 422). Utilizing the results of both tests, the in-situ soil at all sample locations was classified as a clayey sand (SC), thus meeting the proposed new regulation. Table 2 summarizes the soil test results (test results attached).

Table 2. Sample Test Results.

Sample ID	USCS	Water Content	Liquid Limit	Plastic Limit	Plastic Index	Passing #200	Description
B-1	SC	15.5%	49	21	28	34.9%	Tan Clayey Sand
B-2	SC	18.5%	47	20	27	27.6%	Dark Tan Clayey Sand
B-3	SC	17.4%	40	19	21	46.6%	Tan/White Clayey Sand
B-4	SC	9.8%	47	19	28	15.9%	Tan Clayey Sand
B-5	SC	13.9%	32	19	13	35.0%	Brown Clayey Sand
B-6	SC	9.8%	34	18	16	34.5%	Brown Clayey Sand

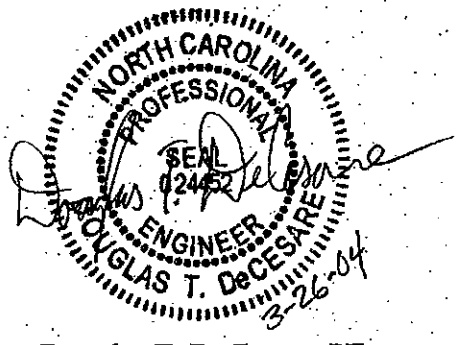
Conclusions and Recommendations

Based on the soils observed in the field and the test results, the in-situ soil within the Phase II footprint will meet proposed regulation 15A NCAC 13B .0540(2)(b), thus having no impact on the phasing of the Expansion. The phases of the Expansion were delineated as shown in the Construction Permit Application to allow an adequate staging area within the landfill facility for operations and to minimize construction costs associated with each phase. We recommend that you continue with the phasing plan as proposed in the Construction Permit

Application. This phasing plan progresses laterally every five years rather than vertically to provide adequate staging at the facility.

If you should have any questions, concerns, or comments regarding this information, please do not hesitate to contact me.

Sincerely,



Douglas T. DeCesare, PE
Project Engineer

DTD/

Attachments

cc: Mr. Joe Readling (HDR) w/o attachments

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Geotechnics

.....GEOTECHNICAL, GEOENVIRONMENTAL, AND GEOSYNTHETIC LABORATORIES

LABORATORY TEST REPORT

March 22, 2004

Project No.: .000000000005059

Mr. Doug DeCesare
HDR Engineering
3725 National Drive, Suite 103
Raleigh, NC 27612-4879

Geotechnics No.: 2004-530-01

RE: Soils Testing – FORT BRAGG LCID/C&D LANDFILL EXPANSION

Transmitted herein are the results of the soils testing performed for the above referenced project verified on the Project Verification Form, submitted March 11, 2004 The testing was performed in accordance with the ASTM methods listed on the enclosed data sheets. The remainder of these samples will be held in sample storage for a minimum of 90 days before being discarded.

Disclaimer

The test results are believed to be representative of the samples submitted but are indicative only of the specimens which were evaluated. Geotechnics has no direct knowledge of the origin of the samples, implies no position with regard to the disposition of the test results, i.e. pass/fail, and makes no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization of the Client and Geotechnics. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please do not hesitate to contact our office.

Respectively submitted,

Dave A. Jenks
Laboratory Manager

RECEIVED
MAR 24 2004
HDR
RALEIGH, NC

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INTEGRITY IN TES

ATTERBERG LIMITS

ASTM D 4318-98 / AASHTO T89 (SOP - S4A)

Client	HDR RALEIGH	Boring No.	B-1
Client Reference	FORT BRAGG CID/C&D LF EX.	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	1
Lab ID	2004-530-01-01	Soil Description	**TAN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Wet method)

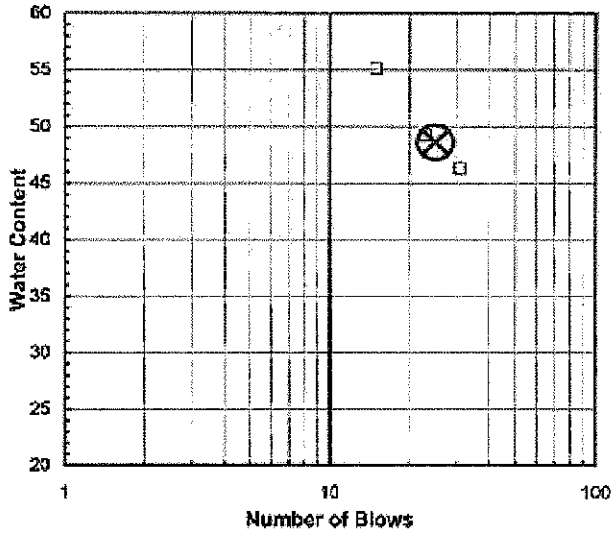
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	P	W	A-K	**U**
Wt. of Tare & WS (gm)	36.52	36.82	36.75	**L**
Wt. of Tare & DS (gm)	29.79	29.68	29.24	**T**
Wt. of Tare (gm)	15.24	15.16	15.60	**I**
Wt. of Water (gm)	6.7	7.1	7.5	**P**
Wt. of DS (gm)	14.6	14.5	13.6	**O**
				I
Moisture Content (%)	**46.3**	**49.2**	**55.1**	**N**
Number of Blows	**31**	**23**	**15**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	A-C	M	
Wt. of Tare & WS (gm)	22.75	21.50	
Wt. of Tare & DS (gm)	21.54	20.41	
Wt. of Tare (gm)	15.58	15.15	
Wt. of Water (gm)	1.2	1.1	
Wt. of DS (gm)	6.0	5.3	
Moisture Content (%)	**20.3**	**20.7**	**-0.4**

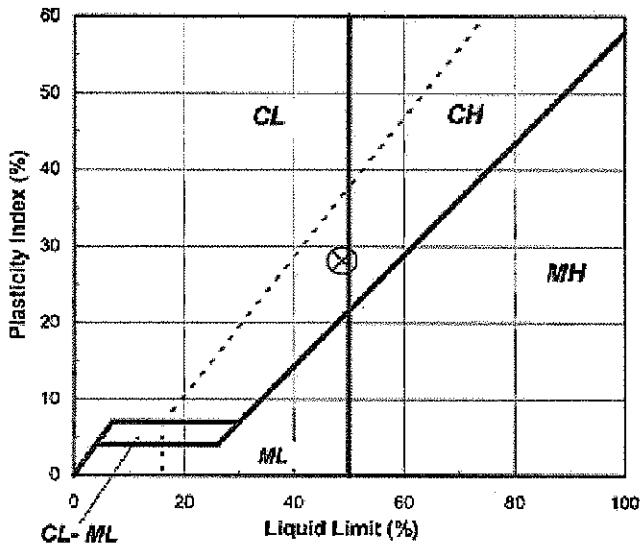
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**49**
Plastic Limit (%)	**21**
Plasticity Index (%)	**28**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By *ETS* *Date* *3/15/2004* *Checked By* JDR *Date* 3-17-04

page 1 of 1 **DCN:** CT-S4B **DATE:** 10/8/2001 **REVISION:** 2

\\Davejones1\C\2004 Projects\2004-530 HDR\[2004-530-01-01 Limit.xls]Sheet1

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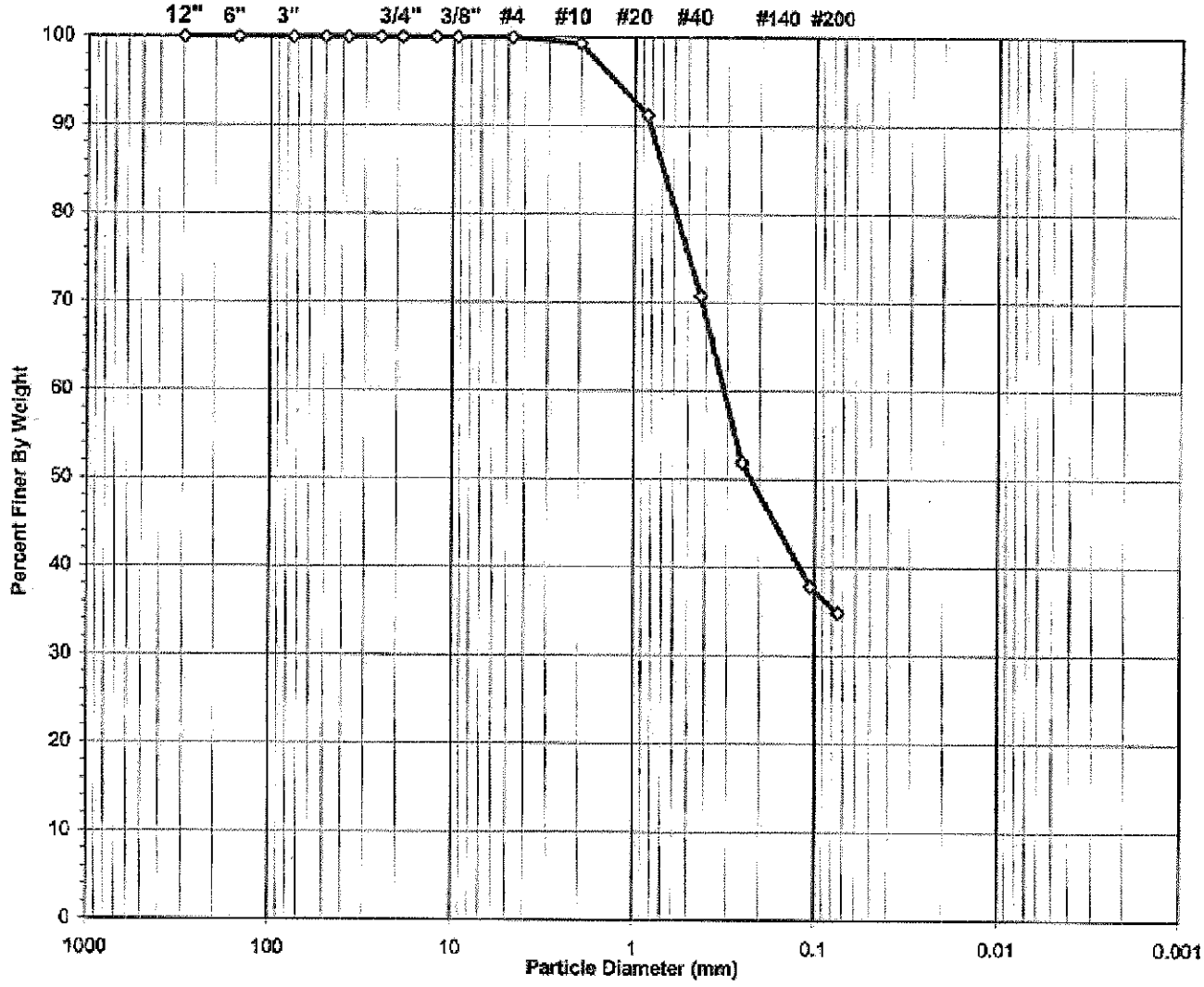
Geotechnics
INTEGRITY IN TESTING

SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-1
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	1
Lab ID	2004-530-01-01	Soil Color	**TAN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By JDR Date 03/16/04 Checked By ETS Date 3/17/04

DCN: GT-S3C DATE 6-25-98 REVISION: 2

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Gotechnics
INTEGRITY IN TES

WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-1
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	1
Lab ID	2004-530-01-01	Soil Color	TAN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	G-5	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	630.60	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	565.90	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	149.11	Weight of Tare (gm)	NA
Weight of Water (gm)	64.70	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	416.79	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**15.5**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	416.79
Dry Weight - 3/4" Sample (gm)	271.5	Weight of minus #200 material (gm)	145.27
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	271.52
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	0.00	0.0	0.0	100.0	100.0
1 1/2"	37.5	0.00	0.0	0.0	100.0	100.0
1"	25.0	0.00	0.0	0.0	100.0	100.0
3/4"	19.0	0.00	0.0	0.0	100.0	100.0
1/2"	12.50	0.00	0.0	0.0	100.0	100.0
3/8"	9.50	0.00	0.0	0.0	100.0	100.0
#4	4.75	0.00	0.0	0.0	100.0	100.0
#10	2.00	2.90	0.7	0.7	99.3	99.3
#20	0.850	33.67	8.1	8.8	91.2	91.2
#40	0.425	85.32	20.5	29.2	70.8	70.8
#60	0.250	78.70	18.9	48.1	51.9	51.9
#140	0.106	58.48	14.0	62.2	37.8	37.8
#200	0.075	12.45	3.0	65.1	34.9	34.9
Pan	-	145.27	34.9	100.0	-	-

Tested By JDR Date 03/16/04 Checked By ejs Date 3/17/04

DCN: CT-S3C DATE 6-25-96 REVISION: 2

C:\2004 Projects\2004-530 HDR\[2004-530-01-06 SIEVE.XLS]Sheet1

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INTEGRITY IN TESTING

ATTERBERG LIMITS

ASTM D 4318-98 / AASHTO T89 (SOP - S4A)

Client	HDR RALEIGH	Boring No.	B-2
Client Reference	FORT BRAGG CID/C&D LF EX.	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	2
Lab ID	2004-530-01-02	Soil Description	**DARK TAN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Wet method)

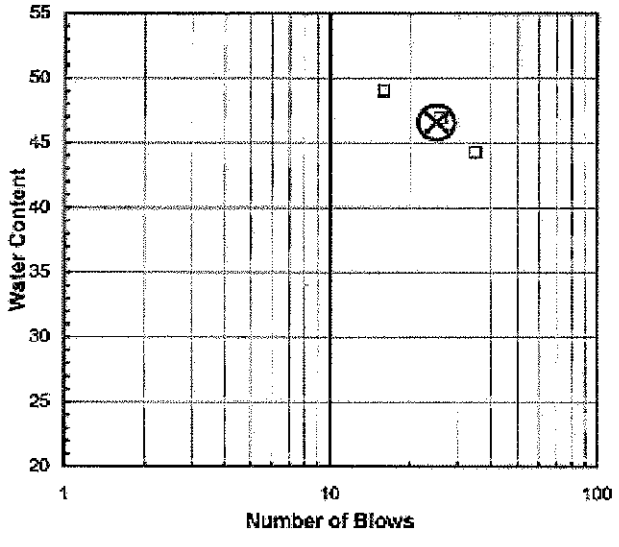
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	F	A	A-I	M U L T I P O I N T
Wt. of Tare & WS (gm)	37.28	38.07	38.73	
Wt. of Tare & DS (gm)	30.53	30.78	31.11	
Wt. of Tare (gm)	15.27	15.23	15.56	
Wt. of Water (gm)	6.8	7.3	7.6	
Wt. of DS (gm)	15.3	15.6	15.6	
Moisture Content (%)	**44.2**	**46.9**	**49.0**	
Number of Blows	**35**	**26**	**16**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	E	A-B	
Wt. of Tare & WS (gm)	22.97	21.79	
Wt. of Tare & DS (gm)	21.70	20.75	
Wt. of Tare (gm)	15.35	15.62	
Wt. of Water (gm)	1.3	1.0	
Wt. of DS (gm)	6.4	5.1	
Moisture Content (%)	**20.0**	**20.3**	**-0.3**

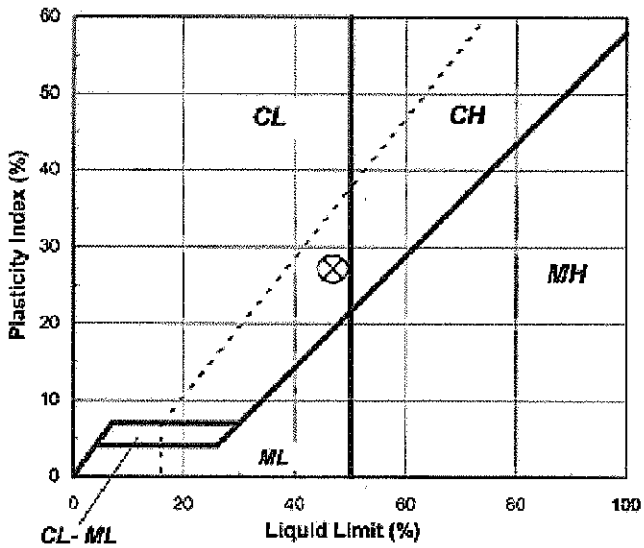
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**47**
Plastic Limit (%)	**20**
Plasticity Index (%)	**27**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By *ETS* *Date* *3/15/2004* *Checked By* JDR *Date* 3-17-04

page 1 of 1 **DCN:** CT-S4B **DATE:** 10/8/2001 **REVISION:** 2

\\Davejenks1\C\2004 Projects\2004-530 HDR\[2004-530-01-02 Limit.xls]Sheet1

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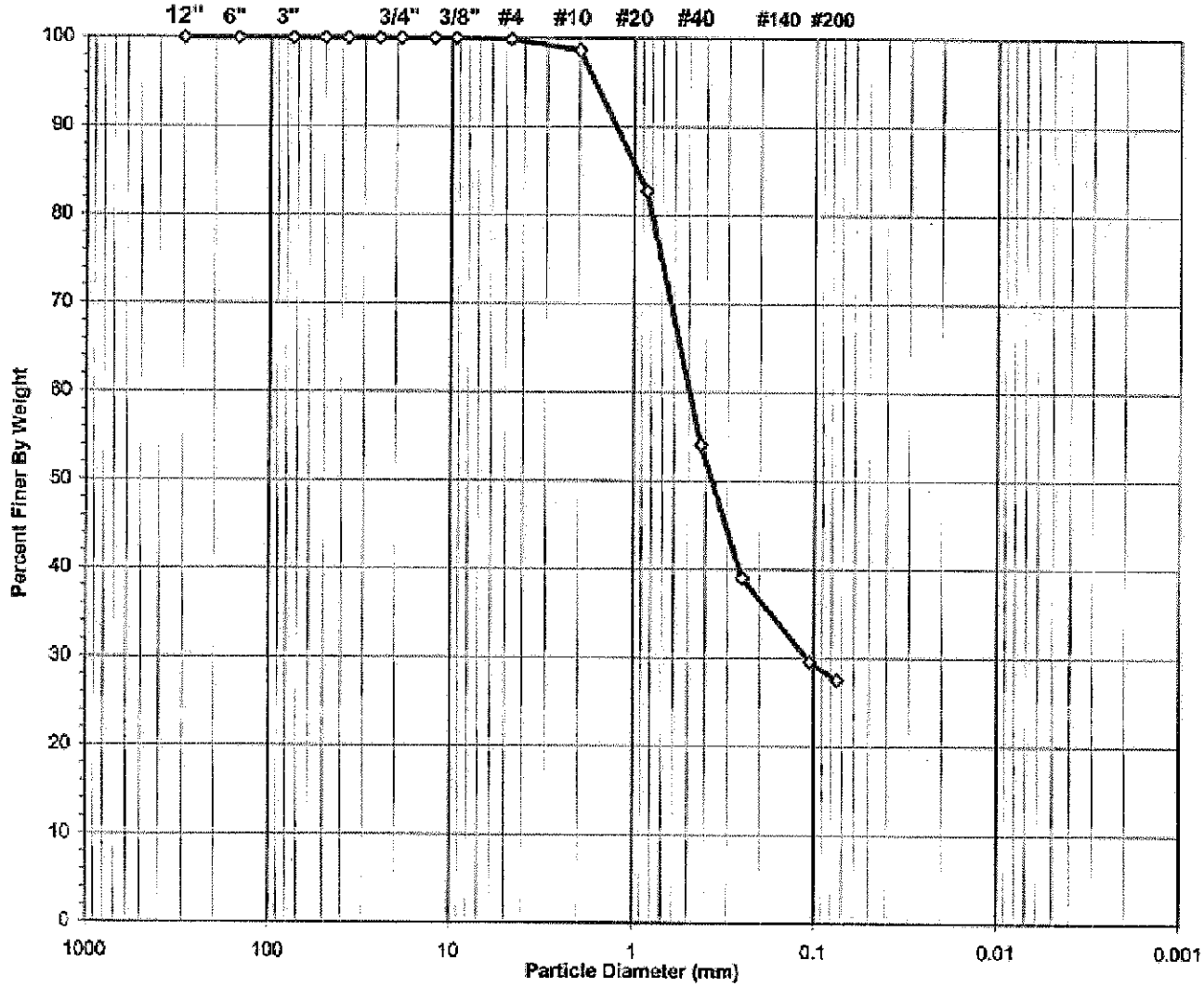
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-2
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	2
Lab ID	2004-530-01-02	Soil Color	**DARK TAN**

USCS	*SIEVE ANALYSIS*		*HYDROMETER*
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By JDR Date 03/16/04 Checked By ers Date 3/17/04

DCN: CT-S3C DATE 6-25-96 REVISION: 2

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Geotechnics
INTEGRITY IN TESTING

WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-2
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	2
Lab ID	2004-530-01-02	Soil Color	**DARK TAN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	G-2	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	697.00	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	612.40	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	154.98	Weight of Tare (gm)	NA
Weight of Water (gm)	84.60	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	457.42	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**18.5**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	457.42
Dry Weight - 3/4" Sample (gm)	331.3	Weight of minus #200 material (gm)	126.08
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	331.34
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	0.00	0.0	0.0	100.0	100.0
1 1/2"	37.5	0.00	0.0	0.0	100.0	100.0
1"	25.0	0.00	0.0	0.0	100.0	100.0
3/4"	19.0	0.00	0.0	0.0	100.0	100.0
1/2"	12.50	0.00	0.0	0.0	100.0	100.0
3/8"	9.50	0.00	0.0	0.0	100.0	100.0
#4	4.75	0.63	0.1	0.1	99.9	99.9
#10	2.00	5.52	1.2	1.3	98.7	98.7
#20	0.850	72.70	15.9	17.2	82.8	82.8
#40	0.425	131.12	28.7	45.9	54.1	54.1
#60	0.250	69.16	15.1	61.0	39.0	39.0
#140	0.106	42.92	9.4	70.4	29.6	29.6
#200	0.075	9.29	2.0	72.4	27.6	27.6
Pan	-	126.08	27.6	100.0	-	-

Tested By JDR Date 03/16/04 Checked By efs Date 3/17/04

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ATTERBERG LIMITS

ASTM D 4318-98 / AASHTO T89 (SOP - S4A)

Client	HDR RALEIGH	Boring No.	B-3
Client Reference	FORT BRAGG CID/C&D LF EX.	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	3
Lab ID	2004-530-01-03	Soil Description	**TAN/WHITE-GRAY LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.

(Minus No. 40 sieve material, Wet method)

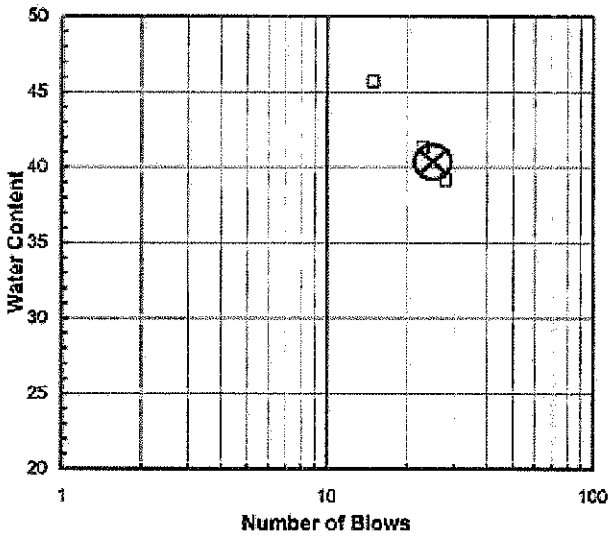
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	V	A-D	R	U
Wt. of Tare & WS (gm)	40.59	40.07	36.87	L
Wt. of Tare & DS (gm)	33.48	32.88	30.07	T
Wt. of Tare (gm)	15.31	15.46	15.18	I
Wt. of Water (gm)	7.1	7.2	6.8	P
Wt. of DS (gm)	18.2	17.4	14.9	O
				I
Moisture Content (%)	**39.1**	**41.3**	**45.7**	N
Number of Blows	**28**	**23**	**15**	T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	Q	D	
Wt. of Tare & WS (gm)	24.32	21.24	
Wt. of Tare & DS (gm)	22.87	20.26	
Wt. of Tare (gm)	15.18	15.19	
Wt. of Water (gm)	1.5	1.0	
Wt. of DS (gm)	7.7	5.1	
Moisture Content (%)	**18.9**	**19.3**	**-0.5**

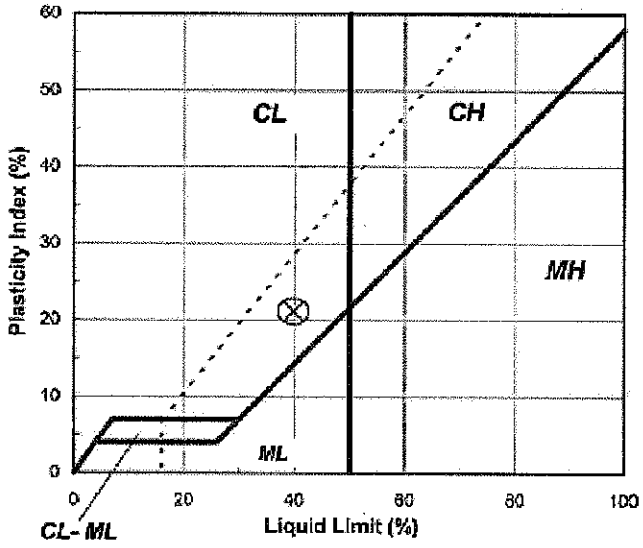
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**40**
Plastic Limit (%)	**19**
Plasticity Index (%)	**21**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By ETS *Date* 3/15/2004 *Checked By* JDR *Date* 3-17-04

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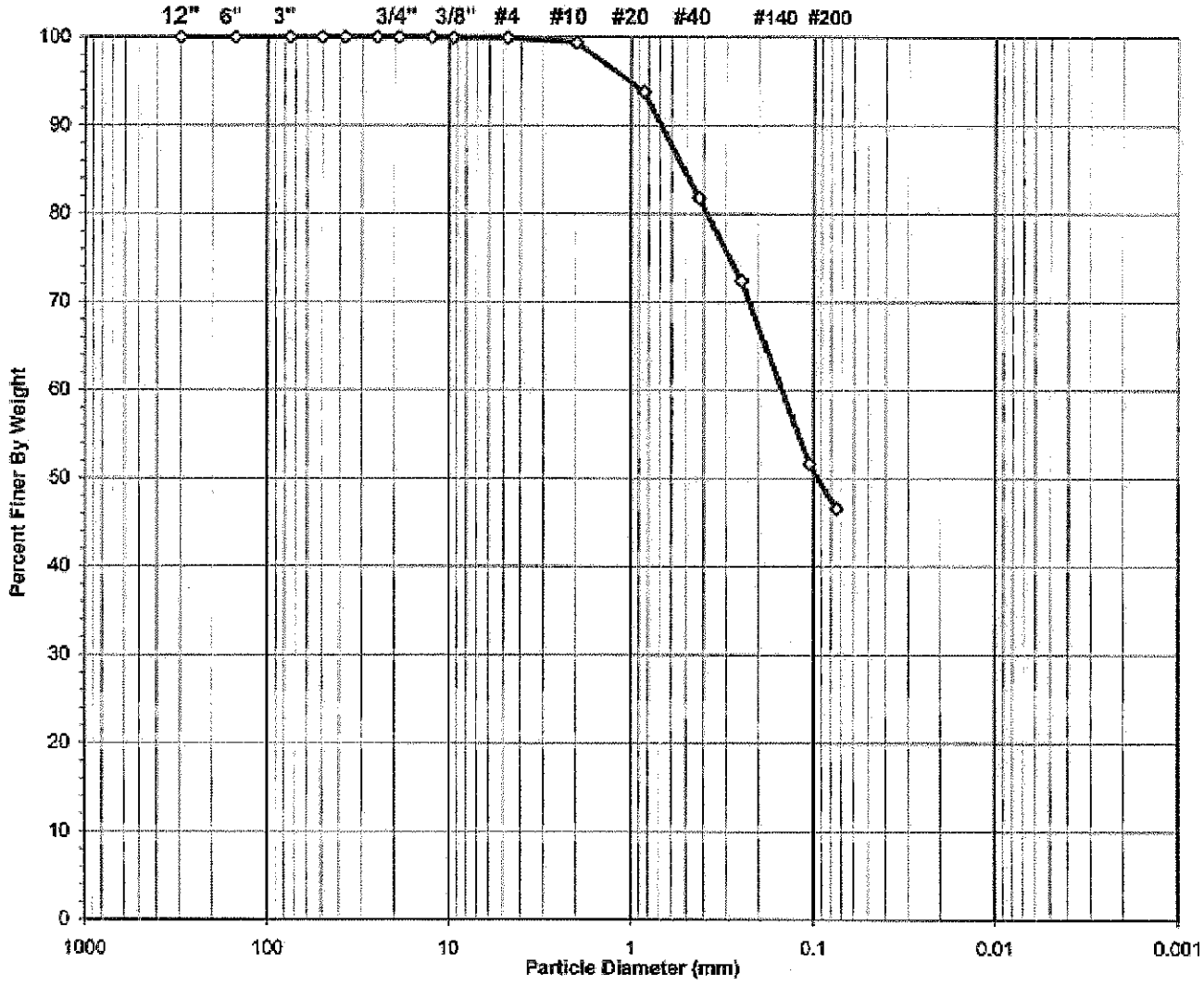
Gotechnics
INTEGRITY IN TESTING

SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-3
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	3
Lab ID	2004-530-01-03	Soil Color	**TAN/WHITE**

USCS	*SIEVE ANALYSIS*		*HYDROMETER*
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By JDR Date 03/16/04 Checked By [illegible] Date 3/17/04

DCN: CT-S3C DATE 5-25-93 REVISION: 2

C:\2004 Projects\2004-530 HDR\[2004-530-01-03 SIEVE.XLS]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-3
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	3
Lab ID	2004-530-01-03	Soil Color	**TAN/WHITE**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	H-1	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	745.30	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	657.10	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	151.22	Weight of Tare (gm)	NA
Weight of Water (gm)	88.20	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	505.88	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**17.4**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	505.88
Dry Weight - 3/4" Sample (gm)	270.1	Weight of minus #200 material (gm)	235.79
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	270.09
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated **Percent Finer (%)**
12"	300	0.00	0.0	0.0	100.0	**100.0**
6"	150	0.00	0.0	0.0	100.0	**100.0**
3"	75	0.00	0.0	0.0	100.0	**100.0**
2"	50	0.00	0.0	0.0	100.0	**100.0**
1 1/2"	37.5	0.00	0.0	0.0	100.0	**100.0**
1"	25.0	0.00	0.0	0.0	100.0	**100.0**
3/4"	19.0	0.00	0.0	0.0	100.0	**100.0**
1/2"	12.50	0.00	0.0	0.0	100.0	**100.0**
3/8"	9.50	0.28	0.1	0.1	99.9	**99.9**
#4	4.75	0.00	0.0	0.1	99.9	**99.9**
#10	2.00	2.86	0.6	0.6	99.4	**99.4**
#20	0.850	27.91	5.5	6.1	93.9	**93.9**
#40	0.425	60.91	12.0	18.2	81.8	**81.8**
#60	0.250	47.68	9.4	27.6	72.4	**72.4**
#140	0.106	104.85	20.7	48.3	51.7	**51.7**
#200	0.075	25.60	5.1	53.4	46.6	**46.6**
Pan	-	235.79	46.6	100.0	-	-

Tested By JDR Date 03/16/04 Checked By ejs Date 3/17/04

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geotechnics
INTEGRITY IN TESTING

ATTERBERG LIMITS

ASTM D 4318-98 / AASHTO T89 (SOP - S4A)

Client	HDR RALEIGH	Boring No.	B-4
Client Reference	FORT BRAGG CID/C&D LF EX.	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	4
Lab ID	2004-530-01-04	Soil Description	**TAN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Wet method)

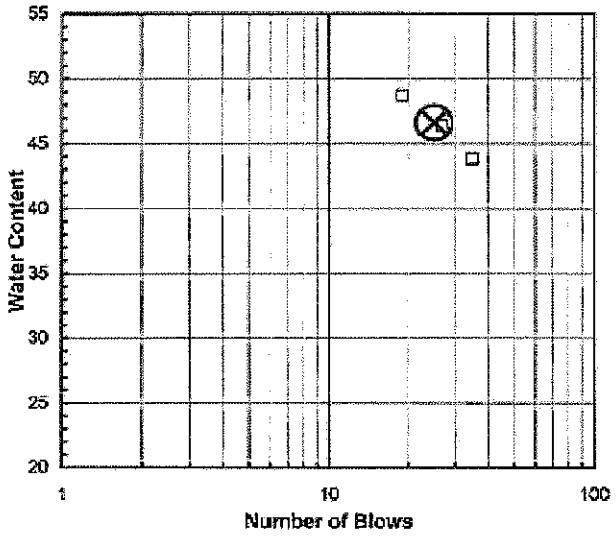
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	A-F	A-G	A-O	M
Wt. of Tare & WS (gm)	36.68	40.16	40.13	U
Wt. of Tare & DS (gm)	29.76	32.37	32.61	L
Wt. of Tare (gm)	15.54	15.55	15.43	T
Wt. of Water (gm)	6.9	7.8	7.5	I
Wt. of DS (gm)	14.2	16.8	17.2	P
				O
Moisture Content (%)	**48.7**	**46.3**	**43.8**	I
Number of Blows	**19**	**27**	**35**	N
				T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	J	X	
Wt. of Tare & WS (gm)	22.74	21.53	
Wt. of Tare & DS (gm)	21.53	20.48	
Wt. of Tare (gm)	15.16	15.21	
Wt. of Water (gm)	1.2	1.1	
Wt. of DS (gm)	6.4	5.3	
Moisture Content (%)	**19.0**	**19.9**	**-0.9**

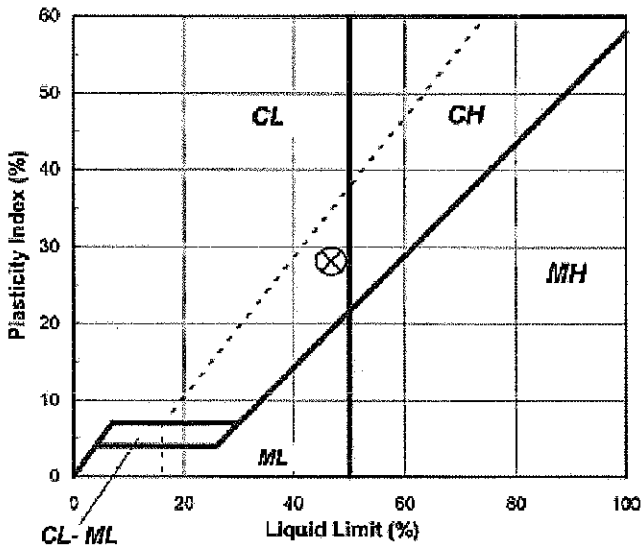
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**47**
Plastic Limit (%)	**19**
Plasticity Index (%)	**28**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By *ETS* *Date* *3/15/2004* *Checked By* JDR *Date* 3-17-04

page 1 of 1 **DCN:** CT-S4B **DATE:** 10/8/2001 **REVISION:** 2

\\Davejonks1\C\2004 Projects\2004-530 HDR\2004-530-01-04 Limit.xls]Sheet1

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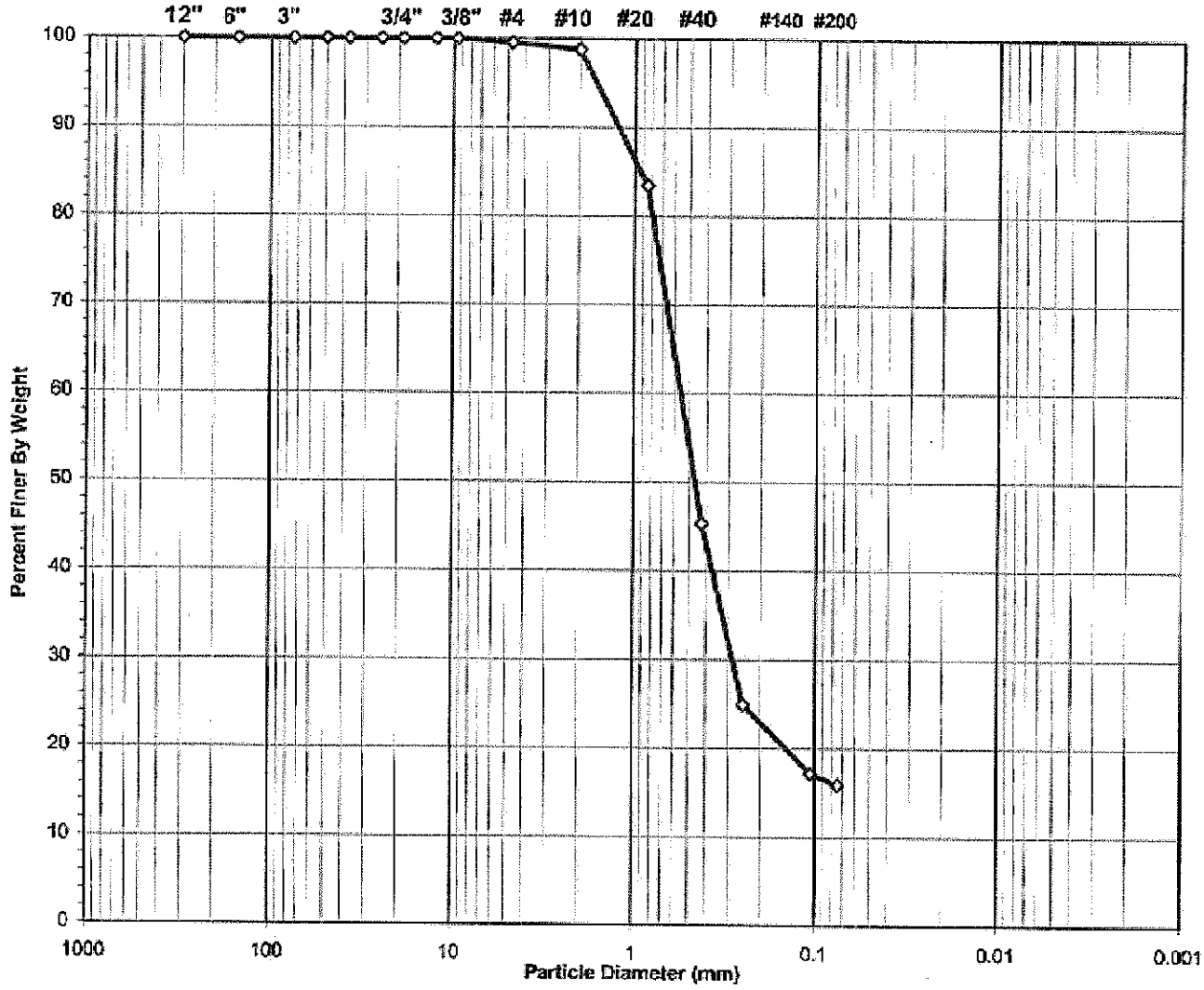
Gotechnics
INTEGRITY IN TE

SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-4
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	4
Lab ID	2004-530-01-04	Soil Color	**TAN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By JDR Date 03/16/04 Checked By eds Date 3/17/04

DCN: CT-S3C DATE 6-25-98 REVISION: 2

C:\2004 Projects\2004-530 HDR\2004-530-01-06 SIEVE.XLS]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-4
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	4
Lab ID	2004-530-01-04	Soil Color	**TAN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	H-2	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	743.20	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	690.60	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	153.65	Weight of Tare (gm)	NA
Weight of Water (gm)	52.60	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	536.95	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**9.8**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	536.95
Dry Weight - 3/4" Sample (gm)	451.4	Weight of minus #200 material (gm)	85.52
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	451.43
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	**100.0**
6"	150	0.00	0.0	0.0	100.0	**100.0**
3"	75	0.00	0.0	0.0	100.0	**100.0**
2"	50	0.00	0.0	0.0	100.0	**100.0**
1 1/2"	37.5	0.00	0.0	0.0	100.0	**100.0**
1"	25.0	0.00	0.0	0.0	100.0	**100.0**
3/4"	19.0	0.00	0.0	0.0	100.0	**100.0**
1/2"	12.50	0.00	0.0	0.0	100.0	**100.0**
3/8"	9.50	0.00	0.0	0.0	100.0	**100.0**
#4	4.75	2.40	0.4	0.4	99.6	**99.6**
#10	2.00	4.00	0.7	1.2	98.8	**98.8**
#20	0.850	82.29	15.3	16.5	83.5	**83.5**
#40	0.425	204.81	38.1	54.7	45.3	**45.3**
#60	0.250	109.50	20.4	75.1	24.9	**24.9**
#140	0.106	41.52	7.7	82.8	17.2	**17.2**
#200	0.075	6.91	1.3	84.1	15.9	**15.9**
Pan	-	85.52	15.9	100.0	-	-

Tested By JDR Date 03/16/04 Checked By EJS Date 3/17/04

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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Geotechnics
INTEGRITY IN TEST

ATTERBERG LIMITS

ASTM D 4318-98 / AASHTO T89 (SOP - S4A)

Client	HDR RALEIGH	Boring No.	B-5
Client Reference	FORT BRAGG CID/C&D LF EX.	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	5
Lab ID	2004-530-01-05	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Wet method)

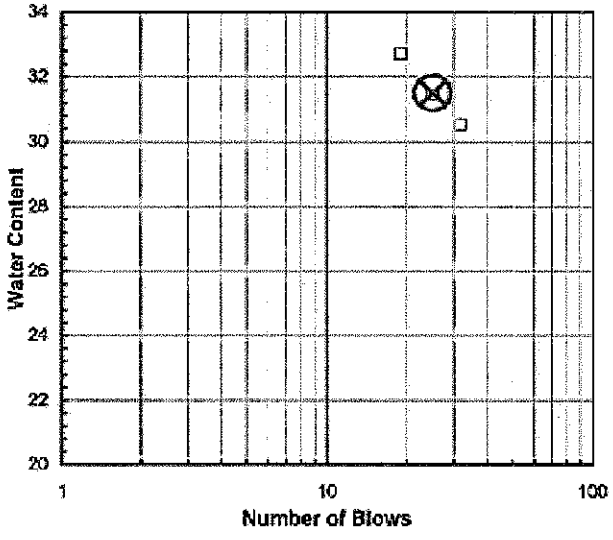
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	A-S	L	A-U	U
Wt. of Tare & WS (gm)	41.40	42.64	40.55	L
Wt. of Tare & DS (gm)	35.34	36.09	34.41	T
Wt. of Tare (gm)	15.48	15.26	15.63	I
Wt. of Water (gm)	6.1	6.6	6.1	P
Wt. of DS (gm)	19.9	20.8	18.8	O
				I
Moisture Content (%)	**30.5**	**31.4**	**32.7**	N
Number of Blows	**32**	**25**	**19**	T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	A-Q	A-N	
Wt. of Tare & WS (gm)	24.96	21.59	
Wt. of Tare & DS (gm)	23.46	20.64	
Wt. of Tare (gm)	15.55	15.45	
Wt. of Water (gm)	1.5	0.9	
Wt. of DS (gm)	7.9	5.2	
Moisture Content (%)	**19.0**	**18.3**	**0.7**

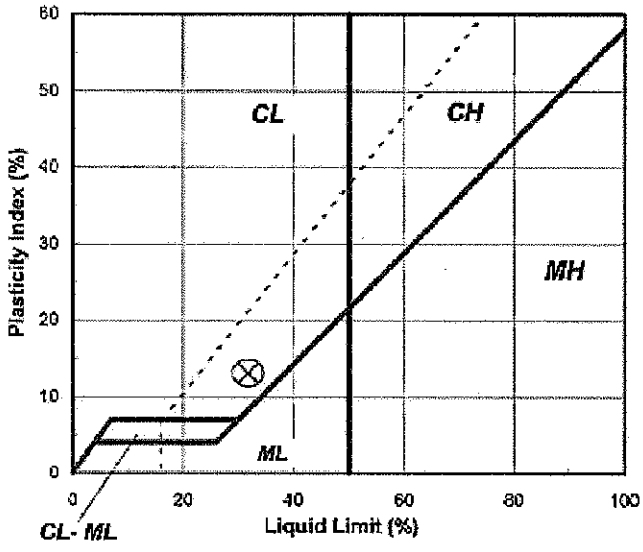
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**32**
Plastic Limit (%)	**19**
Plasticity Index (%)	**13**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By ETS *Date* 3/15/2004 *Checked By* DJC *Date* 3-17-04

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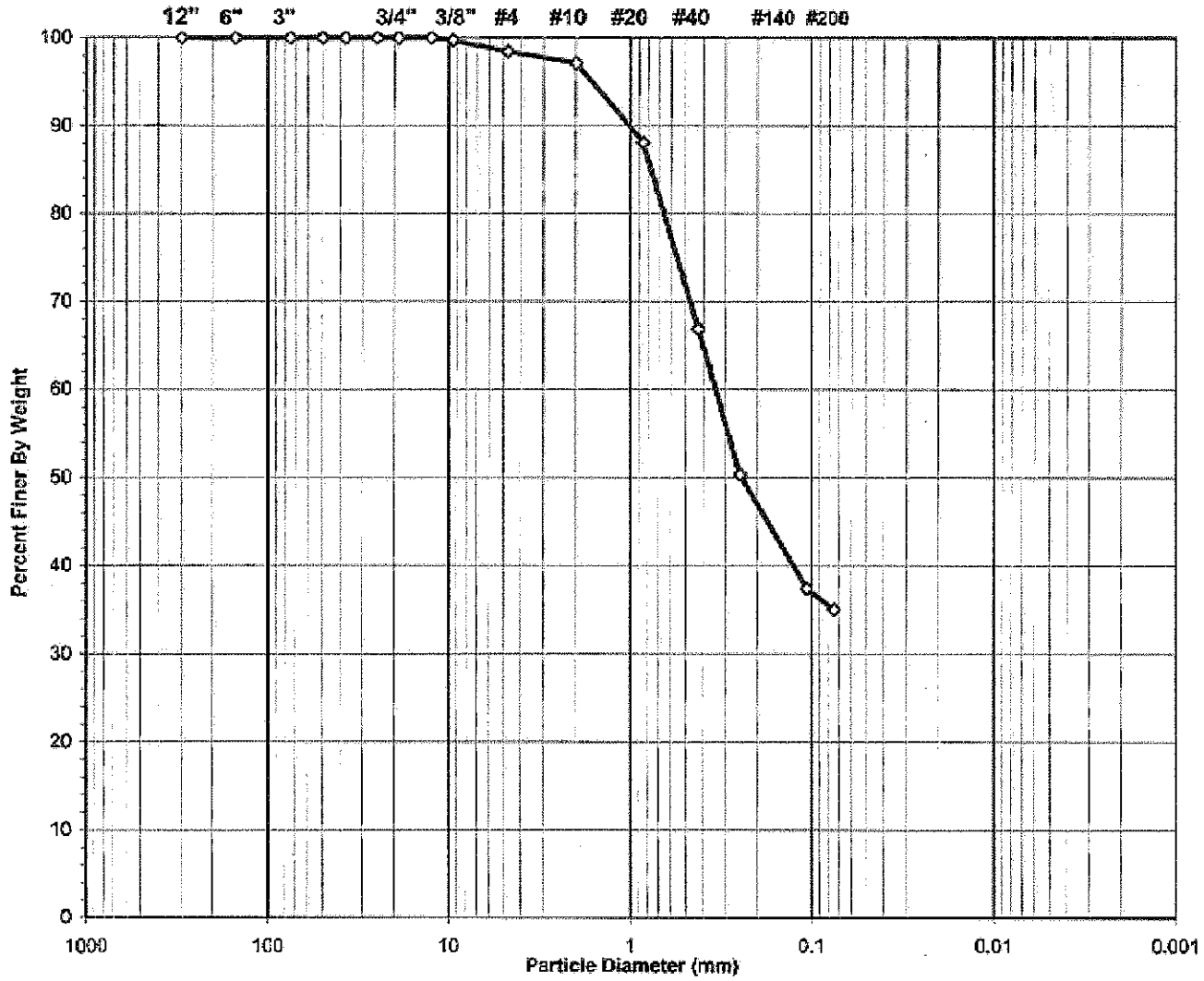
Geotechnics
INTEGRITY IN TESTING

SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-5
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	5
Lab ID	2004-530-01-05	Soil Color	BROWN

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By JDR Date 03/16/04 Checked By [illegible] Date 3/17/04

DCN: GT-S3C DATE 6-25-98 REVISION: 2

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Geotechnics
INTEGRITY IN TEST

WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-5
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	5
Lab ID	2004-530-01-05	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	G-14	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	717.10	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	648.10	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	153.33	Weight of Tare (gm)	NA
Weight of Water (gm)	69.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	494.77	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**13.9**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	494.77
Dry Weight - 3/4" Sample (gm)	321.4	Weight of minus #200 material (gm)	173.41
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	321.36
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated **Percent Finer** (%)
12"	300	0.00	0.0	0.0	100.0	**100.0**
6"	150	0.00	0.0	0.0	100.0	**100.0**
3"	75	0.00	0.0	0.0	100.0	**100.0**
2"	50	0.00	0.0	0.0	100.0	**100.0**
1 1/2"	37.5	0.00	0.0	0.0	100.0	**100.0**
1"	25.0	0.00	0.0	0.0	100.0	**100.0**
3/4"	19.0	0.00	0.0	0.0	100.0	**100.0**
1/2"	12.50	0.00	0.0	0.0	100.0	**100.0**
3/8"	9.50	1.50	0.3	0.3	99.7	**99.7**
#4	4.75	6.23	1.3	1.6	98.4	**98.4**
#10	2.00	6.38	1.3	2.9	97.1	**97.1**
#20	0.850	44.74	9.0	11.9	88.1	**88.1**
#40	0.425	104.93	21.2	33.1	66.9	**66.9**
#60	0.250	81.93	16.6	49.7	50.3	**50.3**
#140	0.106	63.95	12.9	62.6	37.4	**37.4**
#200	0.075	11.70	2.4	65.0	35.0	**35.0**
Pan	-	173.41	35.0	100.0	-	-

Tested By JDR Date 03/16/04 Checked By ebs Date 3/17/04

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Geotechnics
INTEGRITY IN TESTING

ATTERBERG LIMITS

ASTM D 4318-98 / AASHTO T89 (SOP - S4A)

Client	HDR RALEIGH	Boring No.	B-6
Client Reference	FORT BRAGG CID/C&D LF EX.	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	6
Lab ID	2004-530-01-06	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.

(Minus No. 40 sieve material, Wet method)

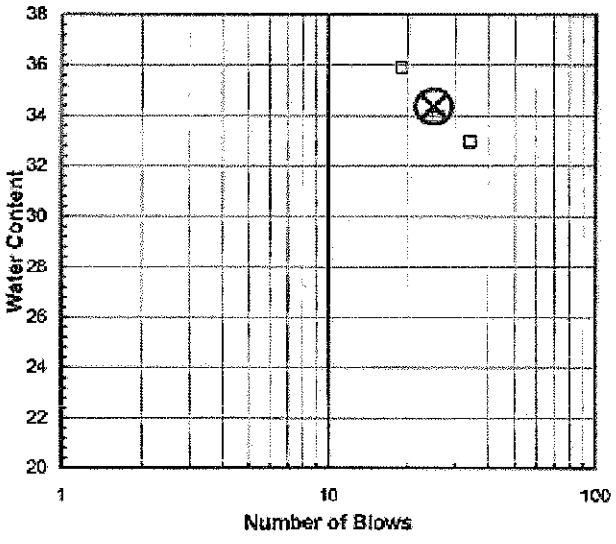
Liquid Limit Test	1	2	3	MULTIPOINT
Tare Number	S	A-P	U	
Wt. of Tare & WS (gm)	39.68	38.68	36.94	
Wt. of Tare & DS (gm)	33.61	32.84	31.20	
Wt. of Tare (gm)	15.19	15.62	15.20	
Wt. of Water (gm)	6.1	5.8	5.7	
Wt. of DS (gm)	18.4	17.2	16.0	
Moisture Content (%)	**33.0**	**33.9**	**35.9**	
Number of Blows	**34**	**26**	**19**	

Plastic Limit Test	1	2	Range
Tare Number	B	G	
Wt. of Tare & WS (gm)	24.49	22.76	
Wt. of Tare & DS (gm)	23.09	21.58	
Wt. of Tare (gm)	15.22	15.06	
Wt. of Water (gm)	1.4	1.2	
Wt. of DS (gm)	7.9	6.5	
Moisture Content (%)	**17.8**	**18.1**	**-0.3**

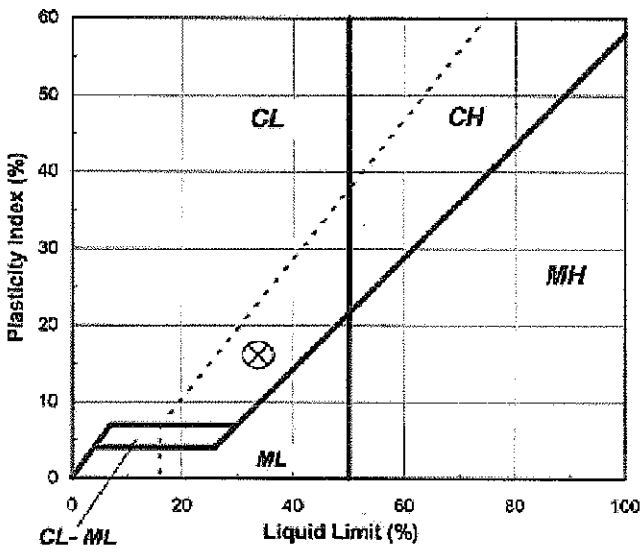
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**34**
Plastic Limit (%)	**18**
Plasticity Index (%)	**16**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By ETS *Date* 03/15/04 *Checked By* DNT *Date* 3-22-04

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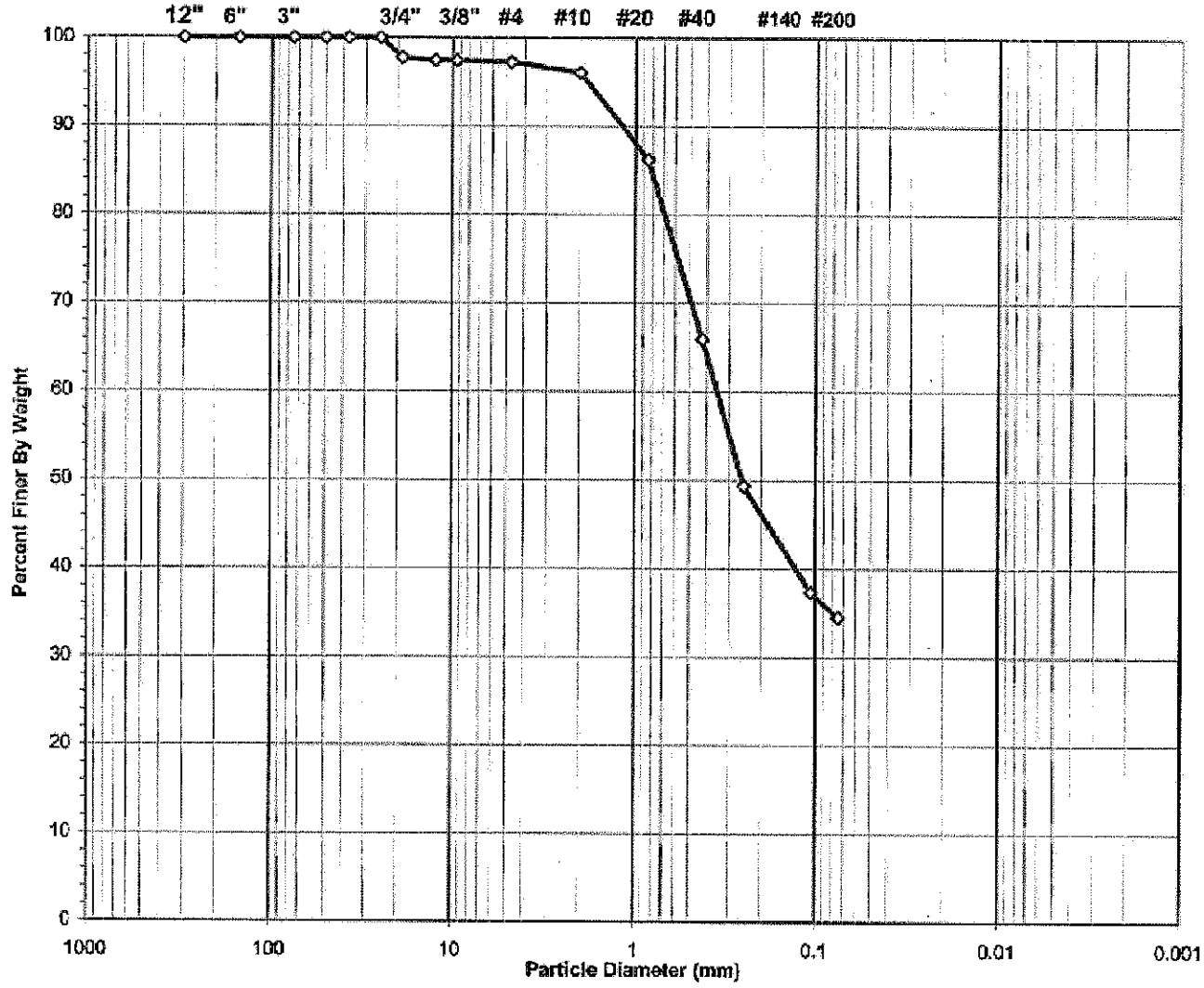
Geotechnics
INTEGRITY IN TE

SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-6
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	6
Lab ID	2004-530-01-06	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By JDR Date 03/16/04 Checked By ets Date 3/17/04

DCN: CT-S3C DATE 8-25-98 REVISION: 2

C:\2004 Projects\2004-530 HDR\2004-530-01-06 SIEVE.XLS\Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	HDR RALEIGH	Boring No.	B-6
Client Reference	FORT BRAGG CID/C&D LF EXPANSION	Depth (ft)	NA
Project No.	2004-530-01	Sample No.	6
Lab ID	2004-530-01-06	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	G-1	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	841.50	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	779.70	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	152.07	Weight of Tare (gm)	NA
Weight of Water (gm)	61.80	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	627.63	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**9.8**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	627.63
Dry Weight - 3/4" Sample (gm)	396.9	Weight of minus #200 material (gm)	216.77
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	410.86
Dry Weight + 3/4" Sample (gm)	14.01		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated **Percent Finer (%)**
12"	300	0.00	0.0	0.0	100.0	**100.0**
6"	150	0.00	0.0	0.0	100.0	**100.0**
3"	75	0.00	0.0	0.0	100.0	**100.0**
2"	50	0.00	0.0	0.0	100.0	**100.0**
1 1/2"	37.5	0.00	0.0	0.0	100.0	**100.0**
1"	25.0	0.00	0.0	0.0	100.0	**100.0**
3/4"	19.0	14.01	2.2	2.2	97.8	**97.8**
1/2"	12.50	2.05	0.3	2.6	97.4	**97.4**
3/8"	9.50	0.00	0.0	2.6	97.4	**97.4**
#4	4.75	1.07	0.2	2.7	97.3	**97.3**
#10	2.00	7.44	1.2	3.9	96.1	**96.1**
#20	0.850	61.63	9.8	13.7	86.3	**86.3**
#40	0.425	127.46	20.3	34.0	66.0	**66.0**
#60	0.250	104.01	16.6	50.6	49.4	**49.4**
#140	0.106	75.29	12.0	62.6	37.4	**37.4**
#200	0.075	17.90	2.9	65.5	34.5	**34.5**
Pan	-	216.77	34.5	100.0	-	-

Tested By JDR Date 03/16/04 Checked By cfs Date 3/17/04

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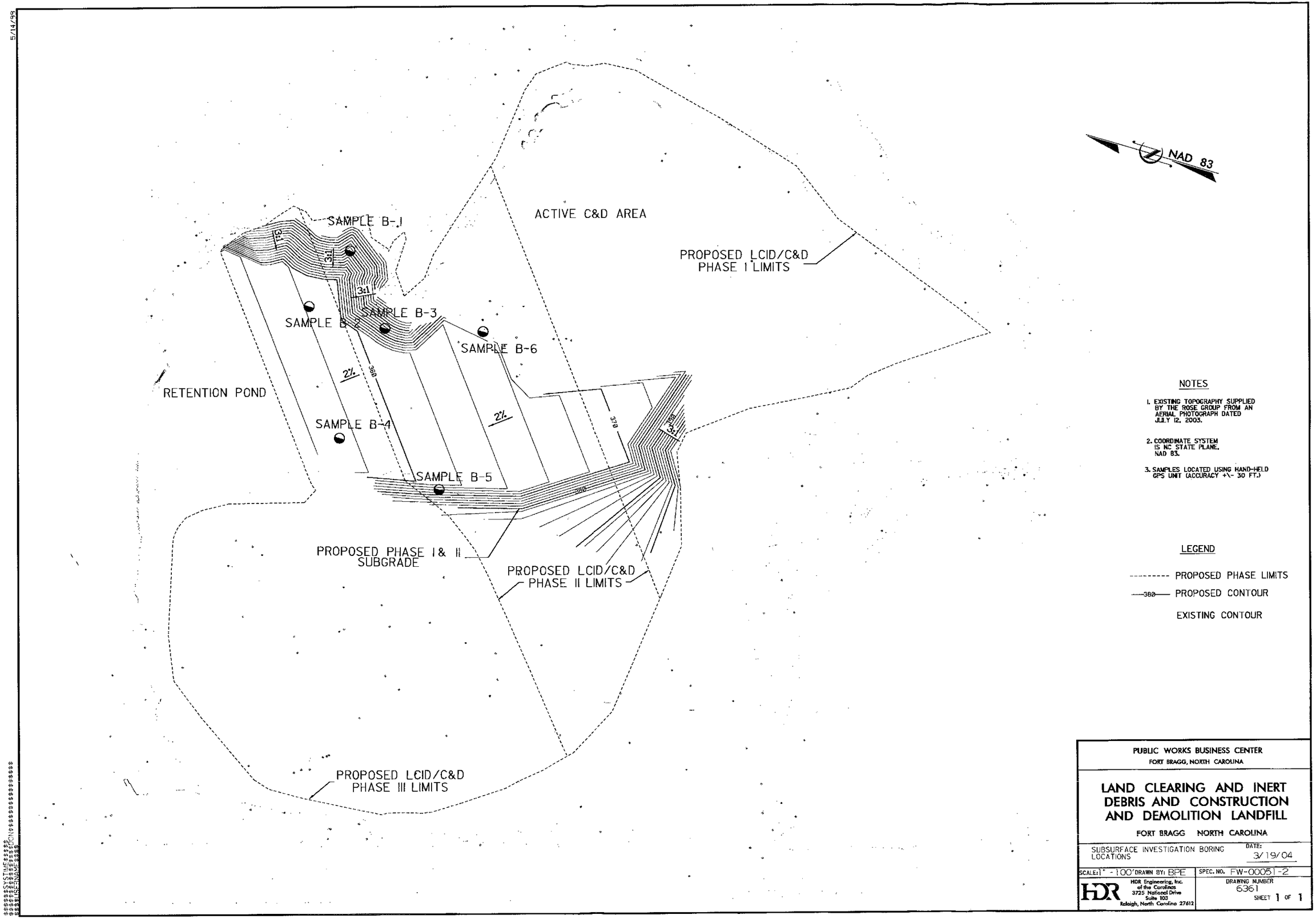


NOTES

1. EXISTING TOPOGRAPHY SUPPLIED BY THE ROSE GROUP FROM AN AERIAL PHOTOGRAPH DATED JULY 12, 2003.
2. COORDINATE SYSTEM IS NC STATE PLANE, NAD 83.
3. SAMPLES LOCATED USING HAND-HELD GPS UNIT (ACCURACY +\- 30 FT.)

LEGEND

--------- PROPOSED PHASE LIMITS

—380— PROPOSED CONTOUR

EXISTING CONTOUR

PUBLIC WORKS BUSINESS CENTER
FORT BRAGG, NORTH CAROLINA

LAND CLEARING AND INERT DEBRIS AND CONSTRUCTION AND DEMOLITION LANDFILL

FORT BRAGG NORTH CAROLINA

SUBSURFACE INVESTIGATION BORING LOCATIONS

DATE: 3/19/04

SCALE: 1" - 100' DRAWN BY: BPE

SPEC. NO. FW-00051-2

HDR Engineering, Inc. of the Carolinas
3725 National Drive
Suite 103
Raleigh, North Carolina 27612

DRAWING NUMBER 6361

SHEET 1 OF 1

C&D LANDFILL
FT BRAGG
NORTH CAROLINA

LANDFILL GAS MONITORING PLAN

MARCH 2011

Prepared for:
DPW Engineering Division
Attention: AFZA-PW-C
Building 3-1933 Butner Road
Fort Bragg, NC 28310-5000
Project No. F9 00026-8

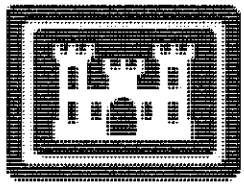
Prepared by:
US Army Corps of Engineers
Savannah District
Hazardous, Toxic & Radioactive Waste Section
CESAS-EN-GH
110 W. Oglethorpe Avenue
Savannah, GA 31401

LANDFILL GAS MONITORING PLAN

FOR

THE LAMONT ROAD LCID (CLOSED) AND C&D LANDFILLS
NCDENR LANDFILL PERMIT #26-08

FORT BRAGG, NORTH CAROLINA



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FEBRUARY 2011

SECTION 1.0 INTRODUCTION 2

1.1 Background 2
1.2 Site Hydrogeology 2
1.3 Regulatory Limits 2

SECTION 2.0 LANDFILL GAS MONITORING 3

2.1 Landfill Gas Monitoring Probe Locations 3
2.2 Structure Sampling 3
2.3 Landfill Gas Monitoring Frequency 3

SECTION 3.0 LANDFILL GAS SAMPLING PROCEDURES 4

3.1 Detection Equipment Used 4
3.2 Landfill Gas Sampling Procedure 4

SECTION 4.0 RECORD KEEPING AND REPORTING 5

4.1 Landfill Gas Monitoring Data Form 5
4.2 Sampling Reports 5
4.3 Permanent Record Keeping 5

SECTION 5.0 CONTINGENCY PLAN 6

SECTION 6.0 CERTIFICATION OF PROFESSIONAL GEOLOGIST 7

SECTION 7.0 CERTIFICATION OF REGISTERED LAND SURVEYOR 8

ATTACHMENTS

Attachment A – Gas Monitoring Well Locations
Attachment B – Potentiometric Surface Map
Attachment C – Gas Monitoring Well Construction Diagrams and Boring Logs
Attachment D – Stopcock Diagram
Attachment E – Example Field Form

SECTION 1.0 INTRODUCTION

1.1 Background

The purpose of this Landfill Gas Monitoring Plan (Plan) is to provide a program for the quarterly monitoring of landfill gas at the Lamont Road Construction and Demolition Debris (C&D) Landfill within the Fort Bragg Military Reservation in Cumberland County, North Carolina.

This Plan was prepared in accordance with the rules codified under North Carolina Solid Waste Management Rules 15A NCAC 13B .0543, Closure and Post-Closure Requirements for C&DLF Facilities, and .0544, Monitoring Plans and Requirements for C&DLF Facilities, under the guidance of a North Carolina Professional Geologist (or a professional who is exempt from North Carolina Registration as defined in Chapter 89E-9 of the North Carolina General Statutes) and should provide early detection of significant landfill gas releases so as to be protective of public health and the environment.

1.2 Site Hydrogeology

A Design Hydrogeologic Report for the Lamont Road C&D Landfill was submitted with the April 2004 construction permit application which was subsequently approved by NCDENR in September 2004. The following description of site hydrogeology is summarized from 2004 Hydrogeologic Report.

Based on field and laboratory data collected at the site, the uppermost aquifer is comprised of a medium dense to very dense sand unit consisting predominantly of a tan to reddish-brown and gray silty sand with intermittent clay and extends from the ground surface to a depth of at least 125 feet below land surface. The predominant soil classification for this unit is poorly graded sand (SP) with lesser amounts of silty sand (SM). Ground water is first encountered in this unconsolidated residual soil unit over the entire study area. The aquifers within these soils are recharged by precipitation that infiltrates the unsaturated zone to the water table.

In general, the flow of ground water occurs from higher elevations onsite to lower elevations flowing northwest under unconfined (water table) conditions. The horizontal components of groundwater flow are shown by the potentiometric surface contours superimposed on the Monitoring Plan which is attached to the back of this document. Generally, the landfill expansion subgrades are 14 feet above the estimated water table elevations and therefore maintain the minimum 4-foot separation requirement. The locations of the gas monitoring wells are included in Attachment A. A potentiometric surface map generated from data collected during November 2010 is included at Attachment **B**.

1.3 Regulatory Limits

This Plan is designed in accordance with Rule 15A NCAC 13B .0544(d) to ensure that the concentration of methane gas or other explosive gases generated by the facility does not exceed 25 percent of the lower explosive limit in on-site facility structures, the concentration of methane gas or other explosive gases does not exceed the lower explosive limit for methane or other explosive gases at the facility property boundary, and the facility does not release methane gas or other explosive gases in any concentration that can be detected in offsite structures.

2.1 Landfill Gas Monitoring Probe Locations

The locations of the existing network of landfill gas monitoring probes are shown on the attached Monitoring Plan. The network consists of 13 probes spaced around the perimeter of the landfill. Locations were based on the ability to adequately monitor the potential for off-site landfill gas migration and site accessibility. Probe depths were based on site geology, depth to groundwater, and surface water features. All locations are readily accessible using four-wheel drive vehicles (see Attachment A). Table 2-1 lists the gas probe ID, depth, screen length, and depth to groundwater for each probe within the network. The boring logs and well construction diagrams are included as Attachment C.

Table 2-1 Monitoring Probe Summary

Probe ID	Total Depth (feet bls)	Screen Length (feet)	Depth to Groundwater (feet bls)
GP-1	30	25	NE
GP-2	25	20	NE
GP-3	60	55	NE
GP-4	60	55	NE
GP-5	60	55	NE
GP-6	60	55	NE
GP-7	60	55	NE
GP-8	30	25	NE
GP-9	30	25	NE
GP-10	30	25	NE
GP-11	30	25	NE
GP-12	30	25	NE
GP-13	30	25	NE

bls =below land surface, NE= Not Encountered

2.2 Structure Sampling

There are three on-site structures currently monitored for explosive gases. These include the scale house, a maintenance building also known as Building 0-3533, and the office trailer. The transfer station located on-site is an open structure that is well ventilated and therefore is not susceptible to the build-up of explosive gases.

2.3 Landfill Gas Monitoring Frequency

The on-site gas probes and structures included in this Plan are monitored quarterly in accordance with Rule 15A NCAC 13B .0544(d).

SECTION 3.0 LANDFILL GAS SAMPLING PROCEDURES

3.1 Detection Equipment Used

The landfill gas monitoring will be performed using a Landtec GEM™2000 portable gas analyzer (GEM™2000), or equivalent type meter. The selected meter shall be capable of measuring percent oxygen, percent carbon dioxide, and percent methane and shall have a current factory calibration.

Field calibrations should be performed before the landfill gas monitoring begins. Per the manufacturer's recommendations for the GEM™2000 a zero calibration for methane shall be used for most cases. If the ambient operating temperature is expected to change by more than 20 degrees Fahrenheit during the time that the meter shall be used, a span calibration should be performed per the manufacturer's recommendations. The span-calibration gas used for the span calibration shall be selected based on the expected levels of methane.

Before performing the zero calibration, the user should supply the zero calibration gas to the meter for a minimum of two minutes. The user should ensure that the meter has stabilized at its lowest value and should then select the zero function from the field calibration menu.

Before performing the span calibration, the user should supply the certified know span calibration gas to the meter for a minimum of two minutes. The user shall edit the target calibration values to match the supplied gas. This shall be performed each time the meter is calibrated (even if the same calibration gas is used), as it is important to confirm that the concentration of the calibration used matches the calibration values. The user should ensure that the meter has stabilized and should then select the appropriate calibration function from the field calibration menu.

3.2 Landfill Gas Sampling Procedure

The landfill gas monitoring will be performed in the afternoon when gas pressures are likely to be high. The GEM™2000 will be turned on and allowed to warm up prior to gas sampling. The meter will perform a series of self-tests that will take approximately 30 seconds to complete. Any errors that are identified during the self-tests shall be noted on the sampling log and corrected. The field personnel shall perform a field calibration (Section 3.1) after the completion of the unit self-test.

The sample tube shall be purged for at least one minute prior to connecting the sample tube to the stopcock. Then the tube will be connected to the stopcock, the valve will be opened, and the initial reading will be recorded. The gas monitoring will continue until the readings have stabilized for 5 seconds (considered to be +/- 0.5% by volume for each of the gases). Once the readings have stabilized, the final readings will be recorded, the stopcock will be closed, and the tubing will be disconnected from the valve. These steps will then be repeated at each sampling location. A diagram of the stopcock valve installed on each of the wells is included as Attachment D.

SECTION 4.0 RECORD KEEPING AND REPORTING

4.1 Landfill Gas Monitoring Data Form

A sample landfill gas monitoring form is included as Attachment E.

4.2 Sampling Reports

The landfill gas monitoring reports will be prepared in accordance with Rule 15A NCAC 13B. In general, the reports will detail the methods used for sampling, exceptions noted during sampling, and the results of each sampling event. The monitoring that is performed concurrently with the requisite semi-annual groundwater sampling will be included in the groundwater monitoring reports. The reports for stand-alone events will be presented as a short letter report that includes the date, methods, exceptions, and results of the sampling. The reports will be signed, certified, and stamped by a North Carolina licensed professional geologist or engineer except when the person who performs those actions is exempt as defined in Chapter 89E-9 of the North Carolina General Statutes. Each of the reports will be accompanied by NCDENR Environmental Monitoring Report Form.

4.3 Permanent Record Keeping

The daily activities performed during each of the sampling events will be entered into a field logbook. Information entered into the field book will be done so with an indelible marker (one that cannot be washed off with water). Mistakes will be crossed out with a single line and initialed. A copy of the field book will be maintained in the project file.

A copy of the landfill gas methane monitoring reports (described in Section 4.2) will be maintained in the operating record for the landfill. The operating record will be maintained at the facility or an approved location near the facility in accordance with Rule 15A NCAC 13B.

SECTION 5.0 CONTINGENCY PLAN

If methane or explosive gas levels exceeding the regulatory limits specified in Subparagraph (d)(1) of Rule 15A NCAC 13B .0544 are detected, the owner and operator will take the following measures to notify the state and address the exceedance:

- The operator will immediately take all steps necessary to ensure protection of human health;
- The operator will notify the Division within seven days of detection;
- The operator will place in the operating record the methane or explosive gas levels detected and a description of the steps taken to protect human health;
- The operator will create a remediation plan to address the methane within 60 days of detection (the plan will describe the nature and extent of the problem and will detail the proposed remedy) and will place a copy of the plan in the operating record; and
- The operator will implement the remediation plan and notify the Division that the plan has been implemented.

SECTION 6.0 CERTIFICATION OF PROFESSIONAL GEOLOGIST

The landfill gas monitoring plan for this facility has been prepared by a qualified geologist who is licensed to practice in the State of North Carolina or is exempt as defined in Chapter 89E-9 of the North Carolina General Statutes. The plan has been prepared based on first-hand knowledge of site conditions and familiarity with North Carolina solid waste rules and industry standard protocol. This certification is made in accordance with North Carolina Solid Waste Regulations, indicating this Landfill Gas Monitoring Plan should provide early detection of any release of hazardous constituents to the uppermost aquifer, so as to be protective of public health and the environment. No other warranties, expressed or implied, are made.

Signed _____

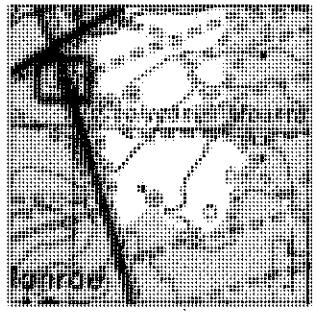
Printed Kevin G. Haborak, P.G.

Date 2/24/17

SECTION 7.0 CERTIFICATION OF REGISTERED LAND SURVEYOR

Coordinates and elevations for each of the gas probes were obtained at the time of installation in 2005. This information is provided in the gas monitoring well construction diagrams provided in Attachment C.

ATTACHMENT A – GAS MONITORING WELL LOCATIONS



METHANE MONITORING
WELL LOCATIONS

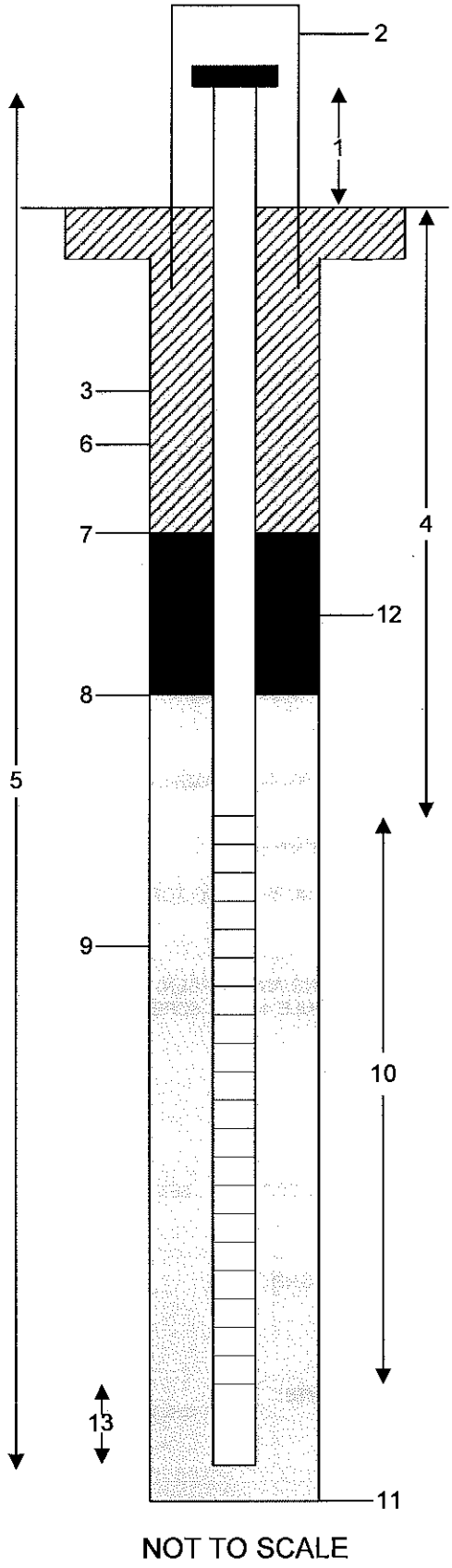
LAMONT STREET LANDFILL
FT. BRAGG, NC

ATTACHMENT B – POTENTIOMETRIC SURFACE MAP

ATTACHMENT C – GAS MONITORING WELL CONSTRUCTION DIAGRAMS AND BORING LOGS

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-1**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.695' W079° 04.657'

ELEVATION TOP OF CASING: 380'

ELEVATION GROUND SURFACE: 377'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

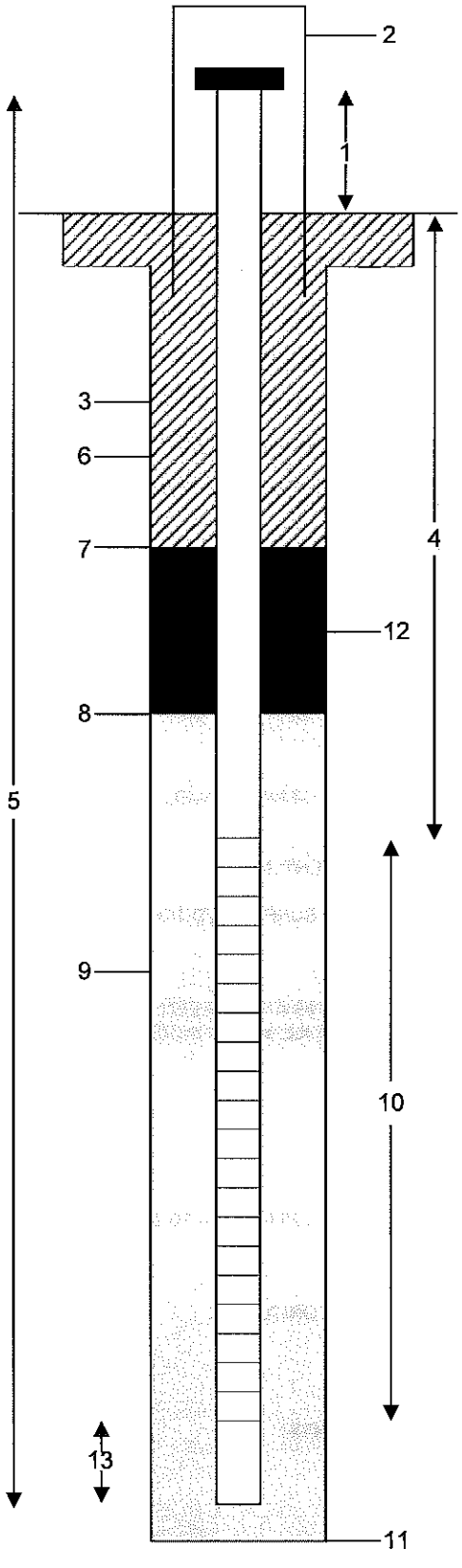
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 33.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 25.0' / 5.0' – 30.0'
11. BORING DEPTH: 31.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-2**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.624' W079° 04.503'

ELEVATION TOP OF CASING: 400'

ELEVATION GROUND SURFACE: 397'

INSTALLATION DATE:

START: 4/28/05 COMPLETE: 4/28/05

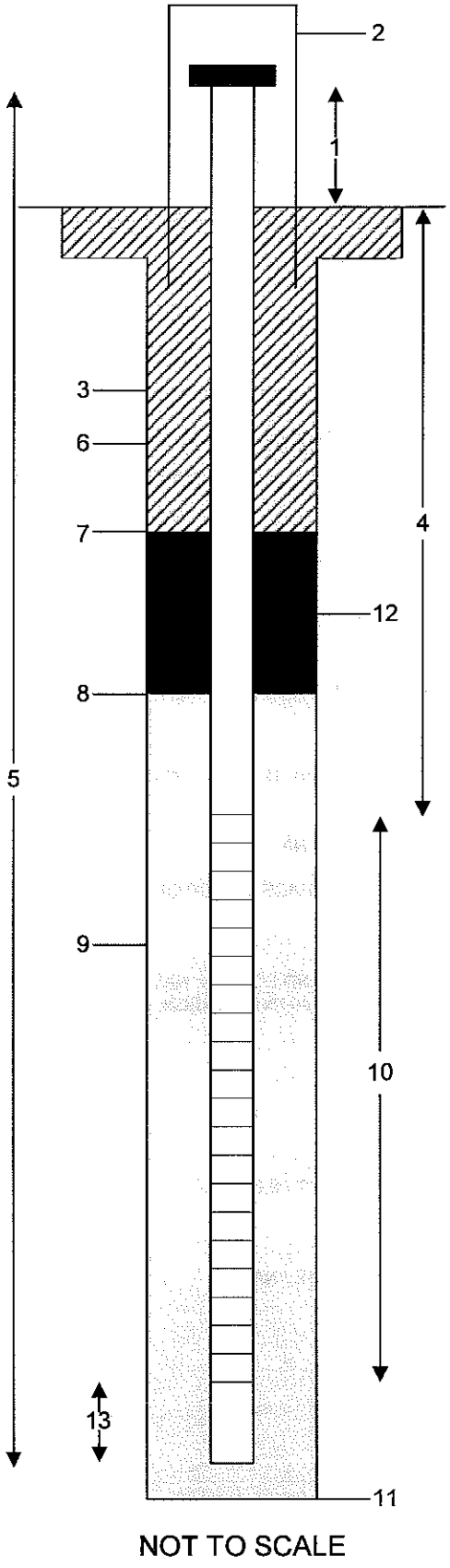
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 28.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 20.0' / 5.0' – 25.0'
11. BORING DEPTH: 26.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-3**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.554' W079° 04.397'

ELEVATION TOP OF CASING: 431'

ELEVATION GROUND SURFACE: 428'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

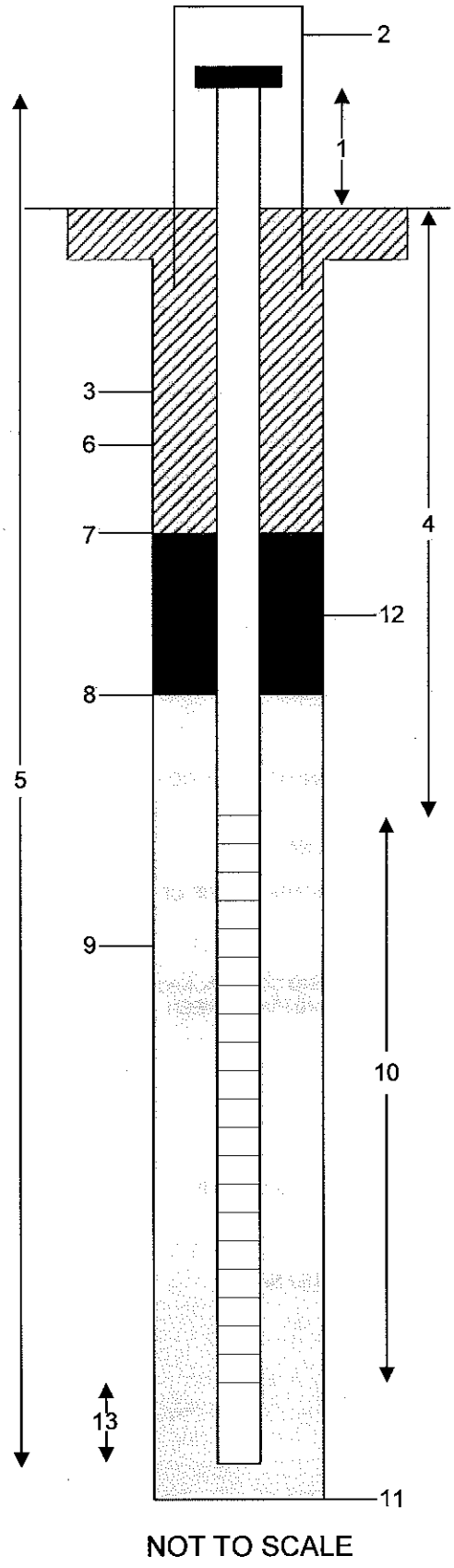
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 63.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 55.0' / 5.0' – 60.0'
11. BORING DEPTH: 61.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-4**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.573' W079° 04.282'

ELEVATION TOP OF CASING: 560'

ELEVATION GROUND SURFACE: 557'

INSTALLATION DATE:

START: 4/28/05 COMPLETE: 4/28/05

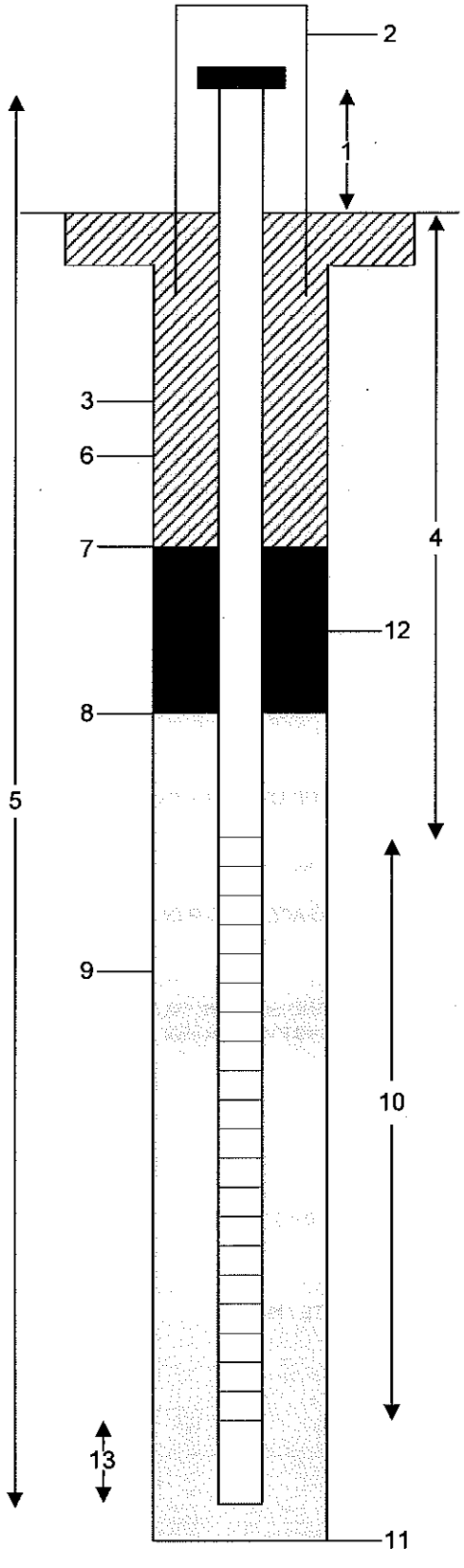
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 63.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 55.0' / 5.0' – 60.0'
11. BORING DEPTH: 61.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-5**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.635' W079° 04.279'

ELEVATION TOP OF CASING: 448'

ELEVATION GROUND SURFACE: 445'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

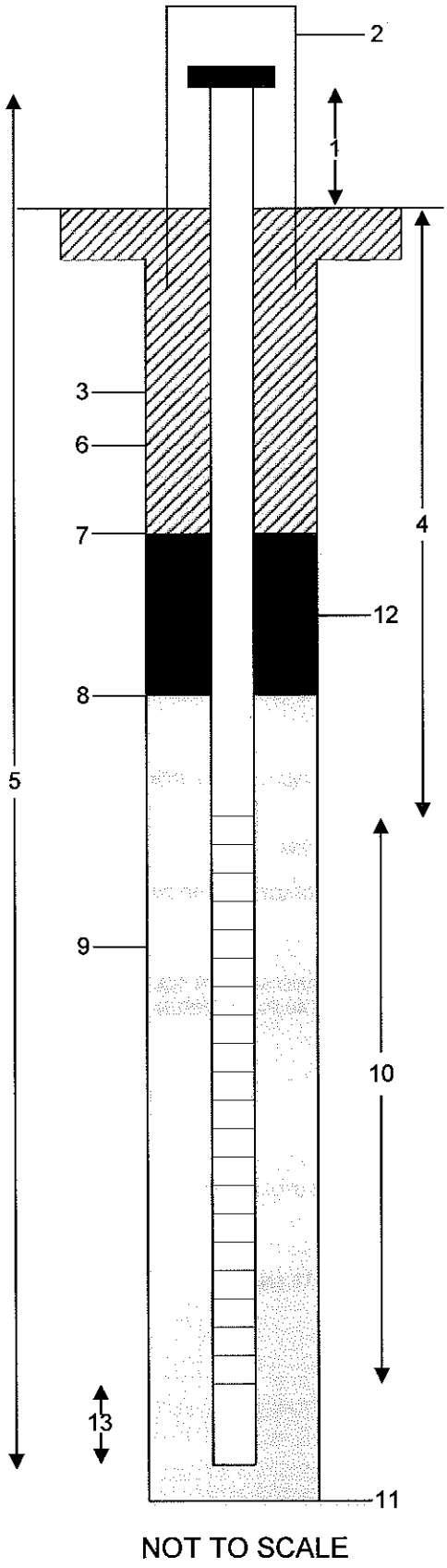
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 63.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 55.0' / 5.0' – 60.0'
11. BORING DEPTH: 61.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-6**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.687' W079° 04.256'

ELEVATION TOP OF CASING: 435'

ELEVATION GROUND SURFACE: 432'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

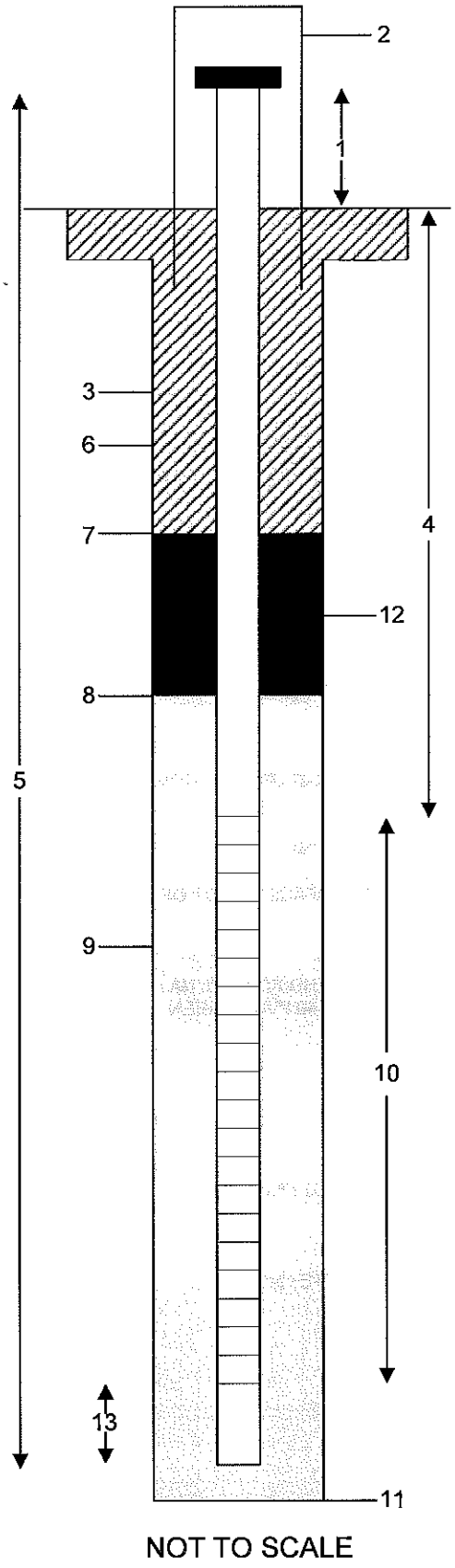
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 63.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 55.0' / 5.0' – 60.0'
11. BORING DEPTH: 61.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-7**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.801' W079° 04.277'

ELEVATION TOP OF CASING: 409'

ELEVATION GROUND SURFACE: 406'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

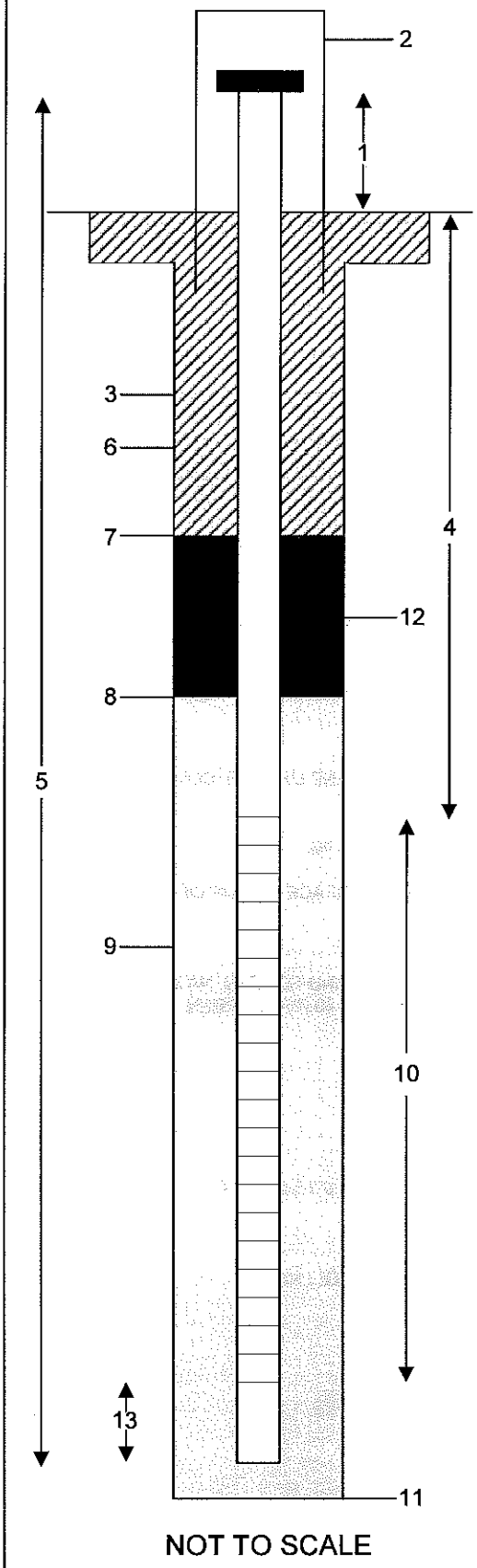
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 63.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 55.0' / 5.0' – 60.0'
11. BORING DEPTH: 61.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-8**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.850' W079° 04.386'

ELEVATION TOP OF CASING: 456'

ELEVATION GROUND SURFACE: 453'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

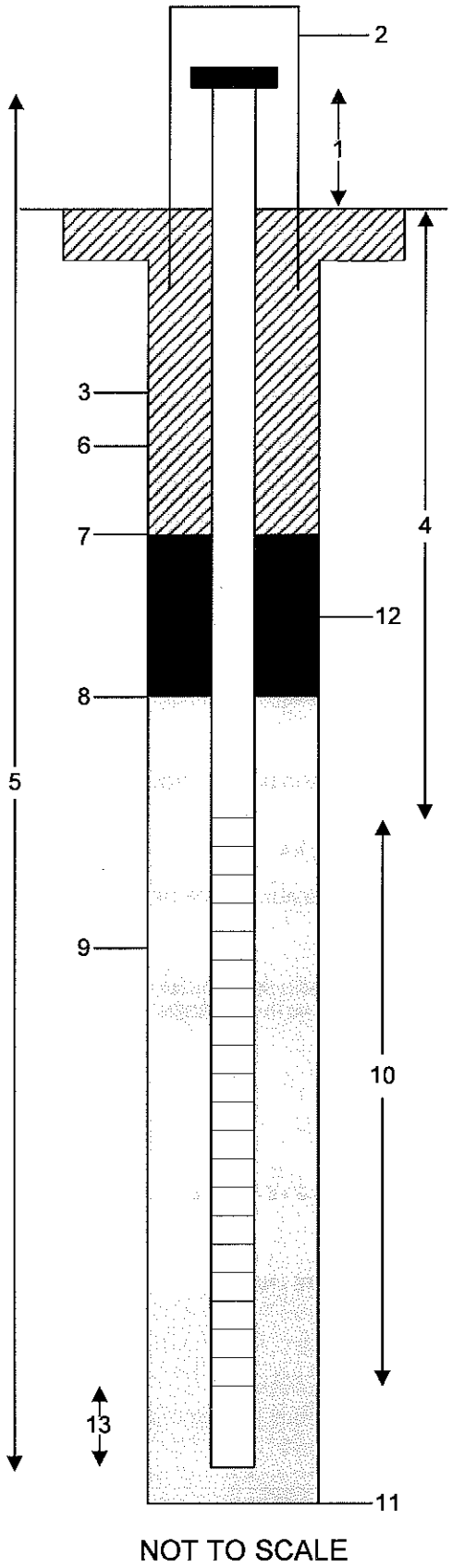
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 33.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 25.0' / 5.0' – 30.0'
11. BORING DEPTH: 31.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-9**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.896' W079° 04.573'

ELEVATION TOP OF CASING: 503'

ELEVATION GROUND SURFACE: 500'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

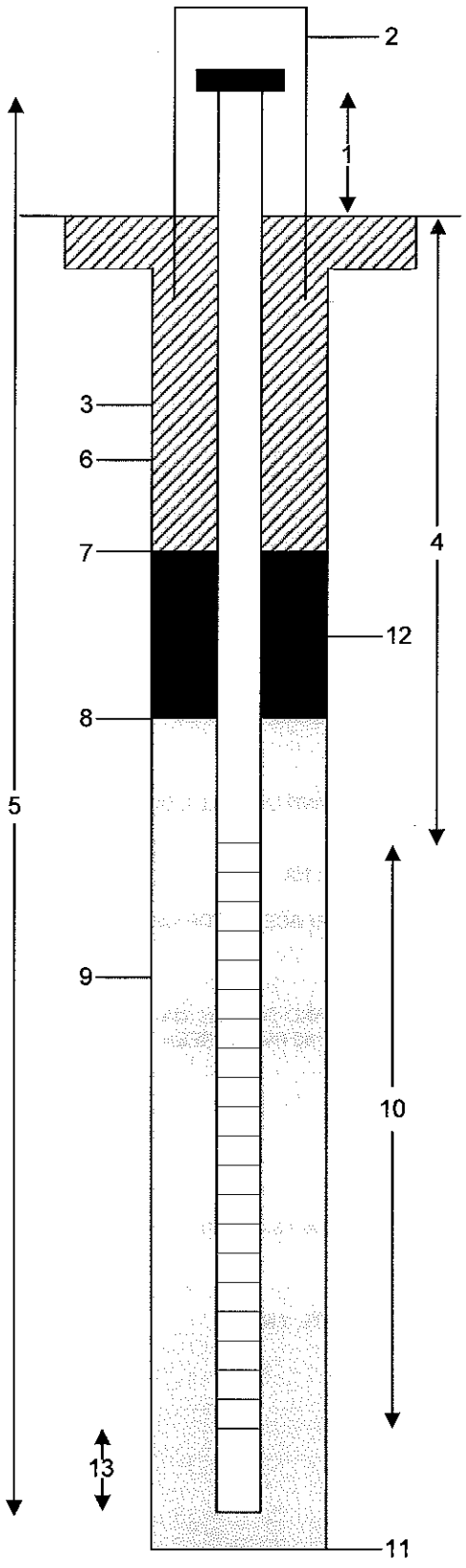
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 33.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 25.0' / 5.0' – 30.0'
11. BORING DEPTH 31.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-10**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.856' W079° 04.641'

ELEVATION TOP OF CASING: 322'

ELEVATION GROUND SURFACE: 319'

INSTALLATION DATE:

START: 4/28/05 COMPLETE: 4/28/05

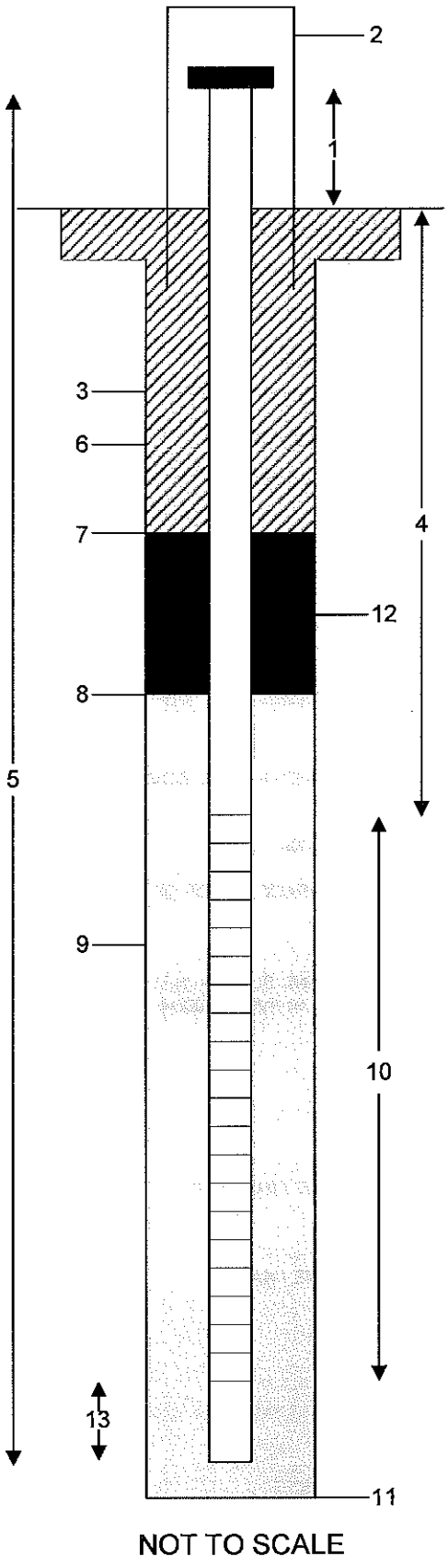
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 33.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 25.0' / 5.0' – 30.0'
11. BORING DEPTH: 31.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-11**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.815' W079° 04.665'

ELEVATION TOP OF CASING: 386'

ELEVATION GROUND SURFACE: 383'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

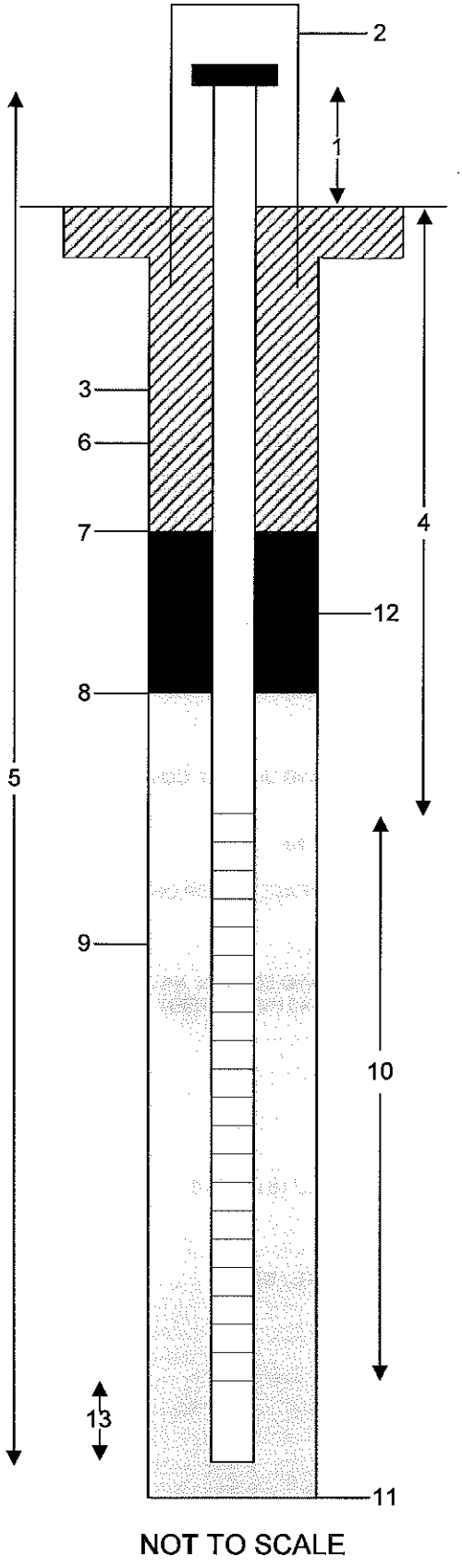
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 33.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 25.0' / 5.0' – 30.0'
11. BORING DEPTH: 31.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-12**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.769' W079° 04.668'

ELEVATION TOP OF CASING: 365'

ELEVATION GROUND SURFACE: 362'

INSTALLATION DATE: START: 4/28/05 COMPLETE: 4/28/05

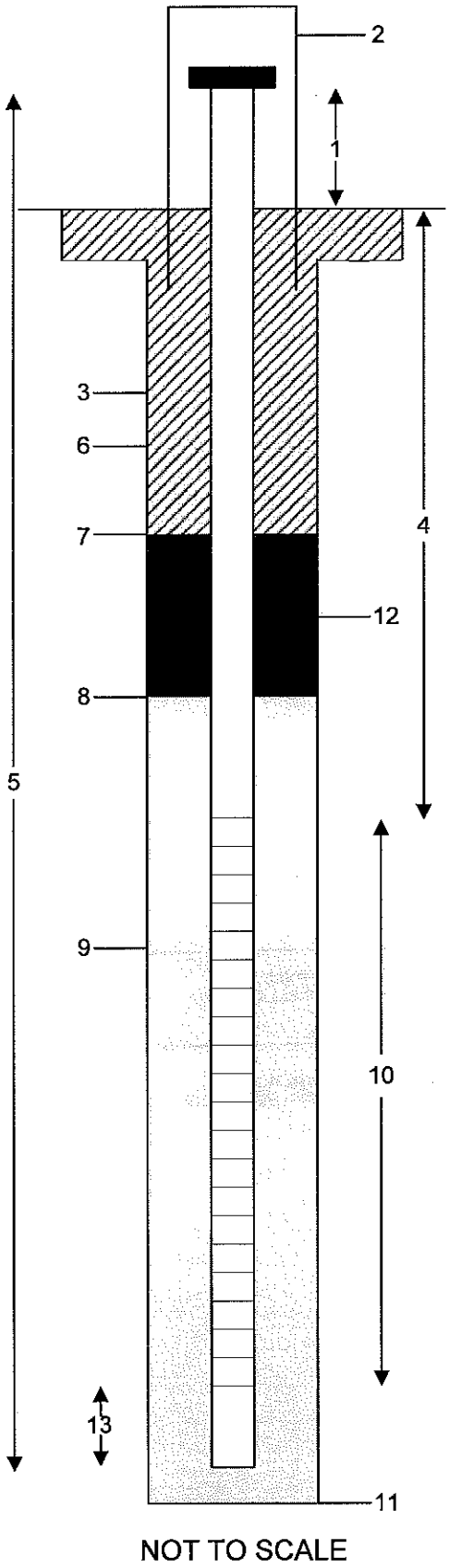
WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 33.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 25.0' / 5.0' – 30.0'
11. BORING DEPTH: 31.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

MONITORING WELL COMPLETION FORM

HOLE NO. **GP-13**



NOT TO SCALE

COMPANY NAME: FORT BRAGG

SHEET 1 OF 1 SHEETS

DRILLING CONTRACTOR: AMERICAN ENVIRONMENTAL DRILLING, INC.

PROJECT: LAMONT LANDFILL

LOCATION: FORT BRAGG, NORTH CAROLINA

NAME OF DRILLER / INSPECTOR: L. MARTIN SHAVER

COORDINATES: N35° 08.712' W079° 04.647'

ELEVATION TOP OF CASING: 380'

ELEVATION GROUND SURFACE: 377'

INSTALLATION DATE:

START: 4/28/05 COMPLETE: 4/28/05

WELL CONSTRUCTION DETAILS

1. HEIGHT OF CASING ABOVE GROUND: 3.0'
2. TYPE OF WELL PROTECTION: 4" X 4" X 5' STAND UP WELL COVER ON A 22" X 22" X 6" CONCRETE PAD
3. GROUT MIXTURE / METHOD OF PLACEMENT: NA
4. LENGTH OF RISER PIPE FROM GROUND SURFACE TO TOP OF SCREEN: 5.0'
5. TOTAL LENGTH OF PIPE: 33.0'
6. DIAMETER OF BORING / PVC WELL CASING AND SCREEN: NA / 1.0" SCHEDULE 40 PVC CASING AND 0.010" SLOT SCHEDULE 40 PVC SCREEN.
7. DEPTH TO TOP OF SEAL: 3.0'
8. DEPTH TO TOP OF FILTER PACK: 4.0'
9. TYPE OF FILTER PACK: #2 SAND
10. LENGTH OF SCREEN / DEPTH INTERVAL: 25.0' / 5.0' – 30.0'
11. BORING DEPTH: 31.0'
12. TYPE OF SEAL / QUANTITY USED: BENTONITE / NA
13. LENGTH OF SUMP: NA

COMMENTS:

VOS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 964-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev:377' N35°08.695' W079°04.657
(degrees/minutes/seconds)
Latitude/longitude source: ☒GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code Phone number

4. DATE DRILLED 4-28-2005
5. TOTAL DEPTH 30'
6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒
7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118
9. YIELD (gpm) METHOD OF TEST
10. WATER ZONES (depth):

11. DISINFECTION: Type Amount

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft.	1"	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

GROUT:

	Depth		Material	Method
From 0'	To 3'	Ft.	Grout	Pour
From 3'	To 4'	Ft.	Bentonite	Pour

13. SCREEN:

	Depth		Diameter	Slot Size	Material
From 5'	To 30'	Ft.	1" in.	.010 in.	PVC
From	To	Ft.	in.	in.	

14. SAND/GRAVEL PACK:

	Depth		Size	Material
From 4'	To 31'	Ft.	#2	Sand
From	To	Ft.		

DEPTH / DRILLING LOG

From	To	Formation Description
0'	9'	Orange Sandy Clay
9'	14'	Tan Sandy Clay
14'	16'	Yellow Sandy Clay
16'	30'	Orange Sandy Clay

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#1

DO HERBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

V05-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2966

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.397' N35°08.624' W079°04.503
(degrees/minutes/seconds)
Latitude/longitude source: ☒GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( )-
Area Code Phone number

4. DATE DRILLED 4-28-2005
5. TOTAL DEPTH 25'
6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒
7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118
9. YIELD (gpm) METHOD OF TEST
10. WATER ZONES (depth):
11. DISINFECTION: Type Amount

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0'	3'	Fill Dirt
3'	7'	Orange Sandy Clay
7'	18'	Tannish Sandy Clay
18'	25'	Orange Sandy Clay

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft.	1"	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

GROUT:

	Depth		Material	Method
From 0'	To 3'	Ft.	Grout	Pour
From 3'	To 4'	Ft.	Bentonite	Pour

13. SCREEN:

	Depth		Diameter	Slot Size	Material
From 5'	To 25'	Ft.	1" in.	.010 in.	PVC
From	To	Ft.	in.	in.	

14. SAND/GRAVEL PACK:

	Depth		Size	Material
From 4'	To 26'	Ft.	#2	Sand
From	To	Ft.		

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#2

DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

VOS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev:428' N35°08.554' W079°04.397'
(degrees/minutes/seconds)
Latitude/longitude source: ☐GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code- Phone number

4. DATE DRILLED 4-28-2005
5. TOTAL DEPTH 60'
6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒
7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118
9. YIELD (gpm) METHOD OF TEST
10. WATER ZONES (depth):
11. DISINFECTION: Type Amount

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0'	2'	Fill Dirt
2'	19'	Orange Sandy Clay
19'	36'	Brown/Orange Sandy Clay
36'	60'	Orange Sandy Clay

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From	+3'	To 5'	Ft. 1"	SCH40	PVC
From		To	Ft.		
From		To	Ft.		

GROUT:

	Depth		Material	Method
From	0'	To 2'	Ft. Grout	Pour
From	2'	To 4'	Ft. Bentonite	Pour

13. SCREEN:

	Depth		Diameter	Slot Size	Material
From	5'	To 60'	Ft. 1" in.	.010 in.	PVC
From		To	Ft. in.	in.	

14. SAND/GRAVEL PACK:

	Depth		Size	Material
From	4'	To 61'	Ft. #2	Sand
From		To	Ft.	

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#3

DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE 4-28-2005

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

VDS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC. PHONE # (910) 944-3148

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.557' N35°08.573' W079°04.282'
(degrees/minutes/seconds)
Latitude/longitude source: ☐ GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( )-
Area Code- Phone number

4. DATE DRILLED 4-28-2005
5. TOTAL DEPTH 60'
6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒
7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118
9. YIELD (gpm) METHOD OF TEST
10. WATER ZONES (depth):
11. DISINFECTION: Type Amount

DRILLING LOG

DEPTH From	DEPTH To	Formation Description
0'	2'	Fill Dirt
2'	19'	Orange Sandy Clay
19'	36'	Brown/Orange Sandy Clay
36'	60'	Orange Sandy Clay

12. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	+3'	5'	Ft. 1"	SCH40	PVC
			Ft.		
			Ft.		

GROUT:

	Depth From	Depth To	Material	Method
	0'	3'	Ft. Grout	Pour
	3'	4'	Ft. Bentonite	Pour

13. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	5'	60'	Ft. 1" in.	.010 in.	PVC
			Ft. in.	in.	

14. SAND/GRAVEL PACK:

	Depth From	Depth To	Size	Material
	4'	61'	Ft. #2	Sand
			Ft.	

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#4

DO HERBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2008

VOS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC. PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.445' N35°08.635' W079°04.279'
(degrees/minutes/seconds)
Latitude/longitude source: ☐GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code Phone number

4. DATE DRILLED 4-28-2005

5. TOTAL DEPTH 60'

6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒

7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118

9. YIELD (gpm) METHOD OF TEST

10. WATER ZONES (depth):

11. DISINFECTION: Type Amount

12. CASING:

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft. 1"	SCH40	PVC
From	To	Ft.		
From	To	Ft.		

GROUT:

	Depth	Material	Method
From 0'	To 3'	Ft. Grout	Pour
From 3'	To 4'	Ft. Bentonite	Pour

13. SCREEN:

	Depth	Diameter	Slot Size	Material
From 5'	To 60'	Ft. 1" in.	.010 in.	PVC
From	To	Ft. in.	in.	

14. SAND/GRAVEL PACK:

	Depth	Size	Material
From 4'	To 61'	Ft. #2	Sand
From	To	Ft.	

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0'	2'	Fill Dirt
2'	19'	Orange Sandy Clay
19'	36'	Brown/Orange Sandy Clay
36'	60'	Orange Sandy Clay

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#5

DO HERBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

VOS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code- Phone number

4. DATE DRILLED 4-28-2005

5. TOTAL DEPTH 60'

6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒

7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118

9. YIELD (gpm) METHOD OF TEST

10. WATER ZONES (depth):

11. DISINFECTION: Type Amount

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft.	1"	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

GROUT:

	Depth		Material	Method
From 0'	To 3'	Ft.	Grout	Pour
From 3'	To 4'	Ft.	Bentonite	Pour

13. SCREEN:

	Depth		Diameter		Slot Size		Material
From 5'	To 60'	Ft.	1"	in.	.010	in.	PVC
From	To	Ft.		in.		in.	

14. SAND/GRAVEL PACK:

	Depth		Size	Material
From 4'	To 61'	Ft.	#2	Sand
From	To	Ft.		

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.432' N35°08.687' W079°04.256'
(degrees/minutes/seconds)
Latitude/longitude source: ☐ GPS ☐ Topographic map

DEPTH From	To	DRILLING LOG Formation Description
0'	2'	Fill Dirt
2'	19'	Orange Sandy Clay
19'	36'	Brown/Orange Sandy Clay
36'	60'	Orange Sandy Clay

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#6

DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE 4-28-2005

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

VOS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.406' N35°08.801' W079°04.277'
(degrees/minutes/seconds)
Latitude/longitude source: ☐ GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) .
Area Code- Phone number

4. DATE DRILLED 4-28-2005

5. TOTAL DEPTH 60'

6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒

7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118

9. YIELD (gpm) METHOD OF TEST

10. WATER ZONES (depth):

11. DISINFECTION: Type Amount

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft.	1"	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

GROUT:

	Depth		Material	Method
From 0'	To 3'	Ft.	Grout	Pour
From 3'	To 4'	Ft.	Bentonite	Pour

13. SCREEN:

	Depth		Diameter		Slot Size		Material
From 5'	To 60'	Ft.	1"	in.	.010	in.	PVC
From	To	Ft.		in.		in.	

14. SAND/GRAVEL PACK:

	Depth		Size	Material
From 4'	To 61'	Ft.	#2	Sand
From	To	Ft.		

DEPTH / DRILLING LOG

From	To	Formation Description
0'	2'	Fill Dirt
2'	19'	Orange Sandy Clay
19'	36'	Brown/Orange Sandy Clay
36'	60'	Orange Sandy Clay

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#7

DO HERBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV 07/2001

V05-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC. PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code - Phone number

4. DATE DRILLED 4-28-2005

5. TOTAL DEPTH 30'

6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒

7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0116

9. YIELD (gpm) METHOD OF TEST

10. WATER ZONES (depth):

11. DISINFECTION: Type Amount

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft.	1"	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

GROUT:

	Depth		Material	Method
From 0'	To 3'	Ft.	Grout	Pour
From 3'	To 4'	Ft.	Bentonite	Pour

13. SCREEN:

	Depth		Diameter		Slot Size		Material
From 5'	To 30'	Ft.	1"	in.	.010	in.	PVC
From	To	Ft.		in.		in.	

14. SAND/GRAVEL PACK:

	Depth		Size	Material
From 4'	To 31'	Ft.	#2	Sand
From	To	Ft.		

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.453' N35°08.850' W079°04.386
(degrees/minutes/seconds)
Latitude/longitude source: ☒ GPS ☐ Topographic map

DEPTH From	To	DRILLING LOG Formation Description
0'	9'	Orange Sandy Clay
9'	14'	Tan Sandy Clay
14'	16'	Yellow Sandy Clay
16'	30'	Orange Sandy Clay

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#8

DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

VOS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.500' N35°08.896' W079°04.573
(degrees/minutes/seconds)
Latitude/longitude source: ☒GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) .
Area Code - Phone number

4. DATE DRILLED 4-28-2005

5. TOTAL DEPTH 30'

6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒

7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118

9. YIELD (gpm) METHOD OF TEST

10. WATER ZONES (depth):

11. DISINFECTION: Type Amount

12. CASING:

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft. 1"	SCH40	PVC
From	To	Ft.		
From	To	Ft.		

GROUT:

	Depth	Material	Method
From 0'	To 3'	Ft. Grout	Pour
From 3'	To 4'	Ft. Bentonite	Pour

13. SCREEN:

	Depth	Diameter	Slot Size	Material
From 5'	To 30'	Ft. 1" in.	.010 in.	PVC
From	To	Ft. in.	in.	

14. SAND/GRAVEL PACK:

	Depth	Size	Material
From 4'	To 31'	Ft. #2	Sand
From	To	Ft.	

DEPTH / DRILLING LOG

From	To	Formation Description
0'	9'	Orange Sandy Clay
9'	14'	Tan Sandy Clay
14'	16'	Yellow Sandy Clay
16'	30'	Orange Sandy Clay

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#9

DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

V05-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.319' N35°08.856' W079°04.641
(degrees/minutes/seconds)
Latitude/longitude source: ☒GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code- Phone number

4. DATE DRILLED 4-28-2005
5. TOTAL DEPTH 30'
6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒
7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118
9. YIELD (gpm) METHOD OF TEST
10. WATER ZONES (depth):
11. DISINFECTION: Type Amount
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft.	1"	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

GROUT:

	Depth		Material	Method
From 0'	To 3'	Ft.	Grout	Pour
From 3'	To 4'	Ft.	Bentonite	Pour

13. SCREEN:

	Depth		Diameter	Slot Size	Material
From 5'	To 30'	Ft.	1" in.	.010 in.	PVC
From	To	Ft.	in.	in.	

14. SAND/GRAVEL PACK:

	Depth		Size	Material
From 4'	To 31'	Ft.	#2	Sand
From	To	Ft.		

DEPTH / DRILLING LOG Formation Description

From	To	Formation Description
0'	9'	Orange Sandy Clay
9'	14'	Tan Sandy Clay
14'	16'	Yellow Sandy Clay
16'	30'	Orange Sandy Clay

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#10

DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE 4-28-2005

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

VOS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.383' N35°08.815' W079°04.665
(degrees/minutes/seconds)
Latitude/longitude source: ☒GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code - Phone number

4. DATE DRILLED 4-28-2005

5. TOTAL DEPTH 30'

6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒

7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118

9. YIELD (gpm) METHOD OF TEST

10. WATER ZONES (depth):

11. DISINFECTION: Type Amount

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft.	1"	SCH40	PVC
From	To	Ft.			
From	To	Ft.			

GROUT:

	Depth		Material	Method
From 0'	To 3'	Ft.	Grout	Pour
From 3'	To 4'	Ft.	Bentonite	Pour

13. SCREEN:

	Depth		Diameter		Slot Size		Material
From 5'	To 30'	Ft.	1"	in.	.010	in.	PVC
From	To	Ft.		in.		in.	

14. SAND/GRAVEL PACK:

	Depth		Size	Material
From 4'	To 31'	Ft.	#2	Sand
From	To	Ft.		

DEPTH / DRILLING LOG Formation Description

From	To	Formation Description
0'	9'	Orange Sandy Clay
9'	14'	Tan Sandy Clay
14'	16'	Yellow Sandy Clay
16'	30'	Orange Sandy Clay

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#11

DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

VOS-140

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #1986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC PHONE # (910) 944-3148

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.362' N35°08.769' W079°04.668
(degrees/minutes/seconds)
Latitude/longitude source: ☒GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code- Phone number

4. DATE DRILLED 4-28-2005
5. TOTAL DEPTH 30'
6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒
7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118
9. YIELD (gpm) METHOD OF TEST
10. WATER ZONES (depth):
11. DISINFECTION: Type Amount

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0'	9'	Orange Sandy Clay
9'	14'	Tan Sandy Clay
14'	16'	Yellow Sandy Clay
16'	30'	Orange Sandy Clay

12. CASING:

	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft. 1"	SCH40	PVC
From	To	Ft.		
From	To	Ft.		

GROUT:

	Depth To	Material	Method
From 0'	To 3'	Ft. Grout	Pour
From 3'	To 4'	Ft. Bentonite	Pour

13. SCREEN:

	Depth To	Diameter	Slot Size	Material
From 5'	To 30'	Ft. 1" in.	.010 in.	PVC
From	To	Ft. in.	in.	

14. SAND/GRAVEL PACK:

	Depth To	Size	Material
From 4'	To 31'	Ft. #2	Sand
From	To	Ft.	

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#12

DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

VOS-146

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL NAME) (print) L. Martin Shaver CERTIFICATION #2986

WELL CONTRACTOR COMPANY NAME AMERICAN ENVIRONMENTAL DRILLING, INC. PHONE # (910) 944-3140

STATE WELL CONSTRUCTION PERMIT # (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
Nearest Town: Fayetteville County Cumberland
Lamont Road
(Street Name, Number, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☒ Slope ☐ Valley ☐ Flat
(check appropriate box)
Latitude/longitude of well location
Elev.377' N35°08.712' W079°04.647
(degrees/minutes/seconds)
Latitude/longitude source: ☒GPS ☐ Topographic map

3. OWNER: Director of public works US Army
Address: LCID & CND Landfill Lamont Road
(Street or Route No.)
Fort Bragg NC 28310
City or Town State Zip Code
( ) -
Area Code- Phone number

4. DATE DRILLED 4-28-2005
5. TOTAL DEPTH 30'
6. DOES WELL REPLACE EXISTING WELL? Yes ☐ No ☒
7. STATIC WATER LEVEL Below Top of Casing: N/A FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3' FT. Above Land Surface*
*Top of casing terminated at/below land surface requires a variance in accordance with 15A NCAC 2C .0118
9. YIELD (gpm) METHOD OF TEST
10. WATER ZONES (depth):
11. DISINFECTION: Type Amount
12. CASING

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From +3'	To 5'	Ft. 1"	SCH40	PVC
From	To	Ft.		
From	To	Ft.		

GROUT:

	Depth	Material	Method
From 0'	To 3'	Ft. Grout	Pour
From 3'	To 4'	Ft. Bentonite	Pour

13. SCREEN:

	Depth	Diameter	Slot Size	Material
From 5'	To 30'	Ft. 1" in.	.010 in.	PVC
From	To	Ft. in.	in.	

14. SAND/GRAVEL PACK:

	Depth	Size	Material
From 4'	To 31'	Ft. #2	Sand
From	To	Ft.	

DEPTH / DRILLING LOG

From	To	Formation Description
0'	9'	Orange Sandy Clay
9'	14'	Tan Sandy Clay
14'	16'	Yellow Sandy Clay
16'	30'	Orange Sandy Clay

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

15. REMARKS: GP#13

DO HERBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

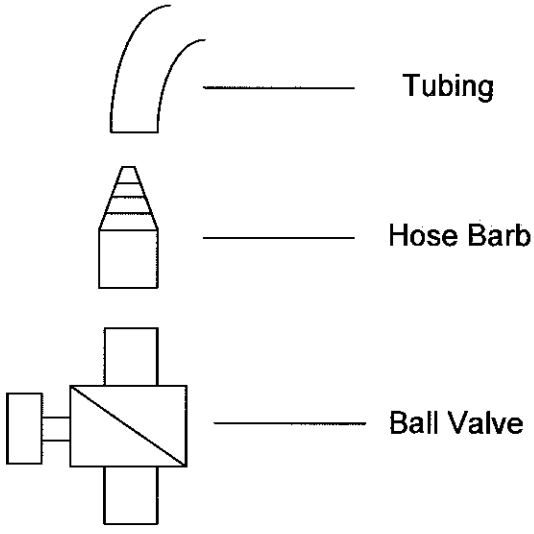
SIGNATURE OF PERSON CONSTRUCTING THE WELL 4-28-2005 DATE

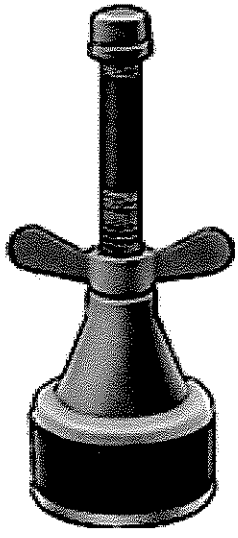
Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

ATTACHMENT D – STOPCOCK DIAGRAM

Generalized Schematic for Methane Well Cap





Long Stem Mechanical Test Plug with Bypass

Specifications:

Height: 10 in

Diameter: 1.75 to 2.25 in

Bypass: 0.5 in

Material: Cast Iron

Drawing not to scale

Army Corps of Engineers
Savannah District

Generalized Schematic for Methane Well Cap
Ft. Bragg – Lamont Landfill
February 2011

ATTACHMENT E – EXAMPLE FIELD FORM

Periodic Methane Monitoring Report

Monitoring Date:		**Facility Name:**	Lamont Road LCID and C&D Landfills
Facility Permit #'s:	#26G and #26-08	**Monitoring Personnel (Name/Position):**	
NC Landfill Rule:	0.0500	**Monitoring Personnel (Name/Position):**	
County (Location):	Cumberland	**Equipment Field Calibrated by:**	
Equipment Type:		**Manufacturer Cal/Service Date:**	
Equipment Serial #:		**Date/Time of Field Calibration:**	
Calibration Gas:		**Cal Gas Expiration Date:**	
Meter pump rate:			

Gas Monitoring Wells

Monitoring Point ID	Time	Initial %CH4	Initial %LEL	Purge Time	Stable %CH4	Stable %LEL	Stable %O2	Stable %CO2
GP-1								
GP-2								
GP-3								
GP-4								
GP-5								
GP-6								
GP-7								
GP-8								
GP-9								
GP-10								
GP-11								
GP-12								
GP-13								

Notes:

Facility Structures

Monitoring Point ID	Time	Initial %CH4	Initial %LEL	Purge Time	Stable %CH4	Stable %LEL	Stable %O2	Stable %CO2
Office								
Scale House								
O-3533								

Drawings identifying location where each building sampled (include north arrow):

Office

Scale House

O-3533

Climatic/Physical Conditions at Site

Samples must be collected under normal/average conditions of temperature, pressure, and climate for the season. Barhole punch sampling should not be performed during or immediately after rain events, or when soils are saturated or frozen. **All sampling must be performed after 12:00 pm** (subsurface gases have a diurnal cycle and generally are at a maximum during the afternoon), and preferably when barometric conditions are not rising (subsurface gas pressures will be less than atmospheric pressure under these conditions and gas will therefore not migrate), or representative samples may not be obtained. Barometric information can be obtained from many locations (i.e. http://weather.noaa.gov).

a. Soil Conditions: _____

b. Weather Conditions: _____

c. Temperature: _____

d. Barometric Conditions: Rising Falling Steady x Reading mmHg

e. Relative Humidity within range of 10%-90%? Value: _____

f. Condition and Access: Are all monitoring points identified in the field (signage) in accordance with approved monitoring plan; are they secured; has the owner/operator maintained access? If no, explain in space provided below.

g. If stressed vegetation is noted, describe the extent and location in the space provided below.

Description of Sampling Techniques: (e.g., wells are vented or not, barhole punch methodology, etc.)

Additional Comments:

Certification:

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

SIGNATURE

TITLE