Clayton, Sr., PE, Inc.
Civil & Environmental Engineering

July 26, 2013

PN: 03001E

Mr. Geoffrey H. Little
Environmental Engineer
Solid Waste Section
NCDENR
217 W Jones St
Raleigh, NC 27699

RE: Modification of Active C&D Landfill Fill Plan
Dunn-Erwin Landfill, Solid Waste Permit 43-02

C. T. Clayton, Sr., PE, Inc., on behalf of Harnett County, presents a proposed modification to the Dunn Erwin Active C&D Landfill fill plan. One hard copy and one digital copy of the package are attached.

Per our meeting on March 28, 2013, the County wishes to modify the final fill plan for the Active C&D cell to gain additional airspace and extend the life of the current cell. As such the following package has been prepared.

Should you need anything that is not contained in this package, please let me know either by email (tyrus@ctclayton.com) or by phone (910-897-7070) and I will respond promptly.

Sincerely,

NORTH CAROLINA PROFESSIONAL SEAL 026809 ENGINEER C. TYRUS CLAYTON, JR.

7-26-2013

C. Tyrus Clayton, Jr., PE
tyrus@ctclayton.com

enclosure

cc: file
Amanda Bader, PE, Harnett County

46 West Washington Street - Coats, North Carolina 27521
Phone: 910-897-7070 - Fax: 910-897-6767
Offices located in Coats and New Bern, North Carolina
License No. C-2570 - www.ctclayton.com

HARNETT COUNTY, NORTH CAROLINA
DUNN-ERWIN
CONSTRUCTION & DEMOLITION DEBRIS LANDFILL

REQUEST FOR FILL PLAN MODIFICATION
PERMIT# 43-02

Prepared for:

HARNETT COUNTY
Department of Solid Waste

Harnett COUNTY NORTH CAROLINA

ISSUED BY
C.T. CLAYTON, SR., P.E., INC.
PROJECT 03001E
July, 2013

NORTH CAROLINA PROFESSIONAL SEAL 028903 ENGINEER C. TYRUS CLAYTON, JR.

7/26/2013

Clayton, Sr., P.E., Inc.
Civil & Environmental Engineering

46 West Washington Street - Coats, North Carolina 27521
Phone: 910-897-7070 - Fax: 910-897-6767 – www.ctclayton.com
Offices located in Coats and New Bern, North Carolina
License No. C-2570

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SECTION 1.0 – INTRODUCTION

This plan has been prepared based on a need to increase the life and available airspace in the existing and active C&D landfill located at the Dunn Erwin Landfill Facility in Harnett County. The current C&D landfill is nearing capacity and it is more economical to modify the fill plan for the current cell than to construct a new unattached C&D landfill cell at the facility. As such, the following document details this modified fill plan.

SECTION 2.0 – PROPERTY INFORMATION & MAPS

General Information:

Landfill Name:
Dunn Erwin C&D Landfill – Permit #43-02

Landfill Address:
449 Daniel's Rd.
Dunn, N.C. 28334

Operator - Landowner - Permit/Invoice Recipient Contact:
Harnett County General Services
Mrs. Amanda Bader, PE, LEED AP, County Engineer
P.O. Box 940
103 E Ivey Street (Phys)
Lillington, NC 27546
910-893-7536

Engineer Contact:
C.T. Clayton, P.E., Inc.
Mr. Tyrus Clayton, Jr., P.E.
46 W. Washington Street
Coats, NC 27521
910-897-7070

Facility Description / Acreage:

The existing Dunn/Erwin C&D Landfill is located near the scale house on the existing 296 acre County landfill property. The existing landfill is located in northeastern Harnett County on Daniels Road. The closest town to its boundary is the town of Erwin, approximately 2 miles south of the landfill. The figure below is a location map for the Harnett County Dunn Erwin Landfill facility. The existing C&D landfill occupies approximately 14 acres within the confines of the existing landfill facility boundary. Property deeds and existing zoning information can be found in Appendix I and Appendix II.

VICINTY MAP

Site History

The existing Dunn-Erwin landfill has been in the same location since opening in 1978. The facility currently accepts construction and demolition (C&D) materials under Permit 43-02 and is a transfer station for municipal solid waste generated in the county. The last active MSW cell of the Dunn-Erwin Landfill was closed December, 1998, and capped to comply with regulations outlined under the guidance document 15A, NCAC 13B, Section .1627(c)(10). A mechanical gas venting system was installed in the area of the final cap overlying the emplaced municipal solid waste. The closed portion of the landfill consists of approximately 21 acres. C&D waste is currently being placed on the capped area, as per SWS approval.

SECTION 3.0 – OPERATIONS PLAN

An updated Operation Plan has been created for the **Dunn Erwin C&D Landfill** in accordance with NCDENR-SWS Rule 15A NCAC 13B .0566. as operated by Harnett County Department of Solid Waste. This plan discusses the operation of this solid waste management facility. The complete Operation Plan is found in Appendix III.

SECTION 4.0 – ENGINEERING PLAN

Attached in Appendix IV are drawings that present the details of the modified fill plan for the C&D Landfill. The original design of the MSW/Piggyback C&D landfill included a bowl shaped outer slope on the southern side of the landfill unit. This plan presents a modified design that includes the construction of a containment berm along the southern end of the landfill that will allow for a flatter slope and will offer approximately 3.5 years of additional life to this landfill unit (see Section 5).

The stormwater control system associated with this expansion was sized based on the 10-year 24-hour storm event. Stormwater and Erosion & Sediment Control calculations can be found in Appendix VIII.

Also, a Slope Stability Evaluation was completed by Smith Gardner, Inc. in May 2013 as part of the design process. The Evaluation indicates the stability of the proposed slope to be stable and meet the safety factors given. The recommendations of the Evaluation have been incorporated in to the Engineering Drawings and the CQA Plan for this proposed modification. The Slope Stability Evaluation can be found in Appendix V.

SECTION 5.0 – AIRSPACE ANALYSIS

The existing conditions of the C&D landfill were surveyed in September 2012 to facilitate an analysis of the available airspace and the approximate life left in the C&D Landfill with this modified fill plan. The analysis is presented on the following page.

The analysis anticipates that approximately 3.5 years of available airspace will be gained in the Dunn Erwin C&D Landfill. This estimate was generated based on an assumed average tonnage of 15,000 tons of C&D waste being received per year at the facility. This analysis also assumes the previously placed final cover on the existing slope will be wasted in place and not removed prior to additional waste placement. If this final cover is removed for reuse, additional airspace will be gained.

Change in Overall Landfill Unit Capacity

The MSW portion of this landfill unit began receiving waste in 1989 and converted to receiving C&D waste only in 1998. The overall capacity of this landfill unit (MSW and C&D) based on the last approved drawings was approximately 1,756,500 cubic yards. The proposed expansion will add an additional approximate 99,500 cubic yards of airspace to the landfill unit. This equals an increase of approximately 5.6% in overall landfill unit capacity.

Expected Life of Existing/Active C&D LF **2013 Modified Fill Plan**

Assume

1. 1,200 lbs * of C&D waste = 1 yd^3 of landfilled waste under normal compaction
2. Weekly Cover Soil Ratio 8:1 for every 8 cyd of C&D, 1 cyd of weekly cover soil
   8:1 = .125
3. Average waste intake for for life of the cell = 15,000 tons/year **

Design Info

Total Space =	124,076 cy	
3 ft Final Cover =	24,583 cy	***
Airspace Available =	99,493 cy	

Calculation of Life Expectancy of Existing/Active C&D LF

1) Total waste received per year = 15,000 tons

15,000 tons = 30,000,000 lbs

30,000,000 lbs = 25,000 cy of C&D waste

25,000 x .125 = 3125 cyds of weekly cover

Total Volume Used Per Year = 28,125 cy/year

2) Time left before design grade (minus final cover) is met

Airspace Available = 99,493 cyds

Time Left = 99,493 cyds / 28,125 cyds/year

Time Left = 3.54 years 42.5 months

15,500

* Based on compaction previously obtained during standard lift fill operation on this site.
** Estimate generated based on historical County scalehouse records
*** Assumes wasting existing final cover on back slope fill

SECTION 6.0 – CONSTRUCTION QUALITY ASSURANCE PLAN

Due to the importance of the proposed containment berm being built properly, a Construction Quality Assurance (CQA) Plan has been generated. The CQA Plan is found in Appendix VI. The CQA plan lists the testing procedures and responsibilities to be followed by those involved in the construction of the containment berm.

SECTION 7.0 – SEDIMENTATION & EROSION CONTROL PLAN

The Dunn Erwin Landfill facility operates under multiple Erosion and Sediment (E&S) Control plans for different activities within the facility. There is currently an approved E&S Control plan that covers the operation of the active C&D landfill. A revision to the plan has been submitted to the Division of Land Resources, Land Quality Section for review and approval. A copy of the E&S Control Plan approval letter will be provided to the Solid Waste Section upon receipt.

SECTION 8.0 – MODIFICATION TO THE UNIT LEACHATE MANAGEMENT PLAN

In 2010, the active C&D/closed MSW landfill began experiencing multiple leachate seeps around the perimeter slope. A particular problematic area was in the center of the bowl shaped southern slope. A trench drain and leachate sump were constructed to facilitate a leachate pump and haul program to reduce the risk of leachate leaving the landfill boundaries. In early 2013, a construction project began to convert this sump and two others on this landfill to in place pump systems that will eventually discharge to the County owned gravity sewer system.

The proposed fill plan modification will require altering the current design being constructed for this leachate sump. A portion of the leachate management design drawing set has been modified to account for this and the revised plan sheets are found in Appendix VII.

APPENDIX I

Property Deeds

KIMBERLY S. HARGROVE
REGISTER OF DEEDS, HARNETT
305 W CORNELIUS HARNETT BLVD
SUITE 200
LILLINGTON, NC 27546

PLEASE RETAIN YELLOW TRAILER PAGE

It is part of recorded document, and must be submitted with original for re-recording and/or cancellation.

****

Filed For Registration:	**03/03/2005 09:03:33 AM**
Book:	**RE 2049 Page: 178-181**
Document No.:	**2005003566**
	DEED 4 PGS $20.00
NC REAL ESTATE EXCISE TAX:	**$141.00**
Recorder:	**ELMIRA MCLEAN**

****

State of North Carolina, County of Harnett

The foregoing certificate of LINDA J. MORGAN Notary is certified to be correct. This 3 RD of March 2005

KIMBERLY S. HARGROVE , REGISTER OF DEEDS

By: Elmira McLean

Deputy/Assistant Register of Deeds

****

2005003566

2005003566

FOR REGISTRATION REGISTER OF DEEDS
KIMBERLY S. LANGDON
HARNETT COUNTY, NC
2005 MAR 03 09:03:33 AM
BK:2949 PG:178-181 FEE:$20.00
NC REV STAMP:$141.00
INSTRUMENT # 2005003566

07 1508 0054
07 1508 0053

3-3-05 BY SKB

NORTH CAROLINA GENERAL WARRANTY DEED

Excise Tax $141.00

Parcel Identifier No.: Tract 1: 07 1508 0054; Tract 2: 07 1508 0053

Verified by _____ County on the _____ day of _____, 2004
by _____

Mail after recording to Dwight W. Snow, Attorney at Law, P.O. Box 397, Dunn NC 28335
This instrument was prepared by Dwight W. Snow, Attorney at Law, P.O. Box 397, Dunn NC 28335

Brief Description for the index: Two Tracts – Thessie Daniel Farm

THIS DEED made this the 3rd day of March, 2005 by and between

GRANTOR	GRANTEE
JEANETTE DANIEL JOHNSON and husband, P.J. JOHNSON 317 Melvin Daniel Lane Dunn, N.C. 28334	COUNTY OF HARNETT P.O. Box 769 102 E. Front St. Lillington, N.C. 27546

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in Grove Township, Harnett County, North Carolina and more particularly described as follows:

SEE ATTACHED EXHIBIT "A"

The property hereinabove described was acquired by Grantor by instrument recorded in Book 759, Page 236, Harnett County Registry and Harnett County Estate File No. 99 E 536.

A map showing the above described property is recorded in Map No. _____, _____ County Registry.

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions hereinafter stated.

Title to the property hereinabove described is subject to the following exceptions:

a. General utility easements for phone and power purposes.
b. Roadways and rights-of-way of record and those visible by inspection of the premises.
c. Such facts as an environmental study on the subject property by an environmental engineer would reveal.
d. Such facts that would be revealed by a recent survey on the subject tract by a registered land surveyor.
e. 2005 Harnett County ad valorem taxes which are not yet due and payable and which will be the responsibility of the Grantee to pay when they become due.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal, or if corporate, has caused this instrument to be signed in its corporate name by its duly authorized officers and its seal to be hereunto affixed by authority of its Board of Directors, the day and year first above written.

(Corporate Name)

By:
_____ President

Jeanette Daniel Johnson (SEAL)
JEANETTE DANIEL JOHNSON

P.J. Johnson (SEAL)
P.J. JOHNSON

_____ (SEAL)

_____ (SEAL)

SEAL-STAMP NORTH CAROLINA, Cumberland County.
I, LINDA J. MORGAN, a Notary Public of the County and State aforesaid, certify that JEANETTE DANIEL JOHNSON and husband, P.J. JOHNSON, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.
Witness my hand and official stamp or seal, this 3rd day of March, 2005.

Official Seal
North Carolina • Cumberland County
LINDA J. MORGAN
Notary Public
My Commission Expires Dec. 2, 2007.

Linda J. Morgan
Notary Public

My commission expires:

****

SEAL-STAMP NORTH CAROLINA, _____ County.
I, a Notary Public of the County and State aforesaid, certify that _____ personally came before me this day and acknowledged that he/she is _____ of _____, a North Carolina corporation, and that he/she, as _____, being authorized to do so, executed the foregoing on behalf of the corporation.
Witness my hand and official stamp or seal, this ____ day of _____, 2004.

_____
Notary Public

My commission expires:

EXHIBIT "A"

TRACT 1:

BEGINNING at an iron stake in the edge of a small marsh area which said Beginning Point is also the northernmost point of the Thessie D. Daniel farm property as shown on that map recorded in Plat Cabinet 2, Slide 399, Harnett County Registry; thence from said Beginning Point South 52 degrees 48 minutes 36 seconds East 1513.41 feet to a found iron pipe in the centerline of NCSR 1721; thence running with the centerline of NCSR 1721 South 03 degrees 47 minutes 31 seconds West 232.84 feet to a set rebar; thence South 53 degrees 19 minutes 30 seconds East 51.91 feet to a point; thence North 71 degrees 16 minutes 16 seconds West 1657.83 feet to an iron stake; thence North 27 degrees 38 minutes 19 seconds East 729.00 feet to the Point of Beginning containing 16.97 acres more or less designated as Tract 1 on that map dated March 25, 2004 by Andrew H. Joyner, PLS which is recorded in Map No. 2004-251 Harnett County Registry.

The above described tract is the same property conveyed to Jeanette D. Johnson in that deed recorded in Book 513, Page 279 less that 1.43 acre portion designated as Tract 3 on that map recorded as Map No. 2004-251 Harnett County Registry which was conveyed to the County of Harnett in that deed recorded in Book 1922, Page 633 Harnett County Registry.

TRACT 2:

Being all that certain tract or parcel of land containing 47.55 acres, more or less, and situate on both sides of Secondary Road No. 1724 (said Secondary Road ends or terminates upon said tract of land) in Grove Township, Harnett County, North Carolina, and being more specifically shown upon a map of survey entitled "Division of Thessie Daniel Farm" as prepared by Artis P. Spence, Registered Land Surveyor, dated December 21, 1985, (said survey being from a boundary survey made in June of 1985) and more fully described upon the aforementioned survey as follows: BEGINNING at an iron stake in the original western line of the tract from which this parcel is carved, said point being a corner in the line of the lands of Stewart Turlington heirs and said beginning corner also being the Southwestern corner of an 18.38 acre tract of land heretofore conveyed to Jeanette D. Johnson (reference is made to deed recorded in Book 513, Page 279, Harnett County Registry); and runs thence as the Southern line of the 18.38 acre tract South 71 degrees 16 minutes 20 seconds East 1657.83 feet crossing Secondary Road No. 1721 to a point; thence South 53 degrees 19 minute 30 seconds East 388.37 feet to a found rebar; thence North 36 degrees 47 minutes 41 seconds East 190.44 feet to a found rebar; thence South 52 degrees 48 minutes 39 seconds East 1040.21 feet to an iron stake in or near a small branch area; thence as the original line South 34 degrees 32 minutes 26 seconds West 297.10 feet to an iron stake; thence continuing as the original line South 16 degrees 06 minutes 06 seconds East 93.60 feet to an iron stake; thence continuing as the original line South 37 degrees 22 minutes 09 seconds East 147.14 feet to an iron stake, being a corner between Tracts 1 and 2; thence as a new division line between Tracts 1 and 2 North 70 degrees 36 minutes 19 seconds West 3270.23 feet to an iron stake in the original western line of the tract from which this parcel is carved; thence as the original line North 27 degrees 38 minutes 19 seconds East 682.81 feet to the point and place of BEGINNING and containing 46.75 acres, more or less.

This is the same property that was devised to Jeanette D. Johnson in Article Five of the Last Will and Testament of Thessie D. Daniel which is filed in Estate File No. 99 E 536 less that 0.80 acre tract which is designated as Tract 4 in that map recorded as Map No. 2004-251 Harnett County Registry.

KIMBERLY S. HARGROVE
REGISTER OF DEEDS, HARNETT
305 W CORNELIUS HARNETT BLVD
SUITE 200
LILLINGTON, NC 27546

PLEASE RETAIN YELLOW TRAILER PAGE

It is part of recorded document, and must be submitted with original for re-recording and/or cancellation.

****

Filed For Registration:	**03/03/2005 09:03:33 AM**
Book:	**RE 2049 Page: 182-185**
Document No.:	**2005003567**
	DEED 4 PGS $20.00
NC REAL ESTATE EXCISE TAX:	**$109.00**
Recorder:	**ELMIRA MCLEAN**

****

State of North Carolina, County of Harnett

The foregoing certificate of LINDA J. MORGAN Notary is certified to be correct. This 3 RD of March 2005

KIMBERLY S. HARGROVE , REGISTER OF DEEDS

By: Elmira McLean

Deputy/~~Assistant~~ Register of Deeds

****

2005003567

2005003567

FOR REGISTRATION REGISTER OF DEEDS
KIMBERLY S. HARGROVE
HARNETT COUNTY, NC
2005 MAR 03 09:03:33 AM
BK:2049 PG:182-185 FEE:$20.00
NC REV STAMP:$109.00
INSTRUMENT # 2005003567

HARNETT CO. PTY TAX ID #
07-1508-0053-01

3-3-05 BY SKB

NORTH CAROLINA GENERAL WARRANTY DEED

Excise Tax $109.00

Parcel Identifier No.: 07 1508 0053 01

Verified by _____ County on the _____ day of _____, 2004
by _____

Mail after recording to Dwight W. Snow, Attorney at Law, P.O. Box 397, Dunn NC 28335
This instrument was prepared by Dwight W. Snow, Attorney at Law, P.O. Box 397, Dunn NC 28335

Brief Description for the index: 49.50 acre tract – Thessie Daniel Farm

THIS DEED made this the 3rd day of March, 2005 by and between

GRANTOR	GRANTEE
LYNDA DANIEL BUTLER and husband, ROBIE BUTLER 163 Melvin Daniel Lane Dunn, N.C. 28334	COUNTY OF HARNETT P.O. Box 759 102 E. Front St. Lillington, N.C. 27546

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in Grove Township, Harnett County, North Carolina and more particularly described as follows:

SEE ATTACHED EXHIBIT "A"

The property hereinabove described was acquired by Grantor by instrument filed in Harnett County Estate File No. 99 E 536.

A map showing the above described property is recorded in Map No. _____, _____ County Registry.

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free and clear of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions hereinafter stated.

Title to the property hereinabove described is subject to the following exceptions:

a. General utility easements for phone and power purposes.
b. Roadways and rights-of-way of record and those visible by inspection of the premises.
c. Such facts as an environmental study on the subject property by an environmental engineer would reveal.
d. Such facts that would be revealed by a recent survey on the subject tract by a registered land surveyor.
e. 2005 Harnett County ad valorem taxes which are not yet due and payable and which will be the responsibility of the Grantee to pay when they become due.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal, or if corporate, has caused this instrument to be signed in its corporate name by its duly authorized officers and its seal to be hereunto affixed by authority of its Board of Directors, the day and year first above written.

(Corporate Name)

By:
_____ President

Linda Daniel Butler (SEAL)
LYNDA DANIEL BUTLER

Robie Butler (SEAL)
ROBIE BUTLER

_____ (SEAL)

_____ (SEAL)

SEAL-STAMP NORTH CAROLINA, Cumberland County.
I, Linda J. Morgan, a Notary Public of the County and State aforesaid, certify that LYNDA DANIEL BUTLER and husband, ROBIE BUTLER, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 3rd day of March, 2005.

Official Seal
North Carolina • Cumberland County
LINDA J. MORGAN
Notary Public
My Commission Expires Dec. 2, 2007.

My commission expires:

Linda J. Morgan
Notary Public

****

SEAL-STAMP NORTH CAROLINA, _____ County.
I, a Notary Public of the County and State aforesaid, certify that _____ personally came before me this day and acknowledged that he/she is _____ of _____, a North Carolina corporation, and that he/she, as _____, being authorized to do so, executed the foregoing on behalf of the corporation.
Witness my hand and official stamp or seal, this ___ day of _____, 2004.

_____
Notary Public

My commission expires:

EXHIBIT "A"

All that certain tract or parcel of land containing 49.50 acres, more or less, and being shown as Tract No. 2 on that certain map of survey entitled "Division of Thessie Daniel Farm" as prepared by Artis P. Spence, Registered Land Surveyor, dated December 21, 1985, (said survey being from a boundary survey made in June of 1985) and more fully described upon the aforementioned survey as follows: BEGINNING at an iron stake in the western line of the tract from which this parcel is carved, said iron stake being a point in the Stewart Turlington heirs line and also being the southwestern corner of Tract No. 1 as shown on said division map and runs thence from said beginning point South 70 degrees 36 minutes 19 seconds East 3270.23 feet to an iron stake in the eastern line of the tract from which this parcel is carved, being the southeastern corner of Tract No. 1 as shown on said division map; thence as the original line South 37 degrees 22 minutes 09 seconds East 490.35 feet to a concrete monument on the edge of a hill; thence as the original line South 38 degrees 54 minutes 40 seconds West 397.08 feet to an iron stake, being a corner for Tracts 2 and 3 in said division; thence as the division line between Tracts 2 and 3 North 70 degrees 36 minutes 16 seconds West 3273.90 feet to an iron stake in the western line of the tract from which this parcel is carved; thence as the original line North 09 degrees 41 minutes 48 seconds West 75.76 feet to an iron stake in the edge of the swamp; thence continuing as the original line North 04 degrees 35 minutes 41 seconds West 600 feet to an iron stake on a ridge; thence continuing as the original line North 27 degrees 38 minutes 19 seconds East 15.43 feet to the point and place of BEGINNING and containing 49.50 acres, more or less.

This is the same property that was devised to Lynda Daniel Butler in Article Five of the Last Will and Testament of Thessie D. Daniel which is filed in Estate File No. 99 E 536 in the office of the Harnett County Clerk of Superior Court.

LDB RB

APPENDIX II

Zoning Letter

Harnett COUNTY NORTH CAROLINA

Planning Department

www.harnett.org

PO Box 65
108 E. Front St.
Lillington, NC 27546

Ph: 910-893-7525
Fax: 910-814-6459

September 13, 2012

Attn: Amanda Bader
Harnett County Engineer
102 East Front Street
Lillington, NC 27546

Property Owner: Harnett County
PIN(s)#: 1508-49-0386.000
1508-48-5635.000
1508-47-5974.000

To Whom It May Concern:

With regard to the above-referenced property (the "Property Owner"), please be advised as follows:

1. The Property is zoned **RA-30** (the "Zoning Classification"), and in this case the build out is a **Waste Related Transfer Station**. This use is grandfathered as a "**Legal Non-Conforming**" use of the property until such time that it is discontinued for a period of 180 days or more.

3. Attached hereto and incorporated herein by reference is a list of the permitted uses under the Zoning Classification **RA-30** (the "Permitted Uses");

4. The undersigned is unaware of any pending proceedings against the Property or its owner(s) for any building code or zoning ordinance violations and the undersigned is unaware that this department has received any complaints regarding violation or non-compliance with the regulations of the inspections department of the County of **Harnett NC**.

5. Assuming that the existing improvements on the Property (the "Improvements") are a Permitted Use under the Zoning Classification, the Improvements can be rebuilt in accordance with the Harnett County Unified Development Ordinance, in the event of partial or total destruction of the Improvements;

6. To the best of the undersigned's knowledge, upon due inquiry, all permits or governmental approvals required in connection with the operation of the Property are in place. Furthermore, all site plan requirements such as Parking, Lighting, and Access have been provided for and approved by the necessary bodies.

Sincerely,

Landon Chandler
Planner II
(910) 893-7525

Harnett County Unified Development Ordinance Use Table
(Adopted October 17, 2011)

Article V "Use Regulations" as shown

1.2 Table of Use Types & Regulations

	IND	L I	COMM	O&I	CONS	RA-40	RA-30	RA-20R	RA-20M	PARKING	USE GROUP LEVEL	BUILDING CODE CLASS
RESIDENTIAL USES												
Traditional Household Residential												
Single Family Dwellings (including modular homes)					P*	P	P	P	P	2 per dwelling unit	1	R 3
Manufactured Homes (on individual parcel)							C*	P*	P*	2 per dwelling unit	1	R 3
Multi-Section Manufactured Homes (on individual parcel)							P* C*	P*	P*	2 per dwelling unit	1	R-3
Multifamily Residential												
Duplex Development							C*	C*	P* C*	1.5 per bdrm + 1 per bdrm over 2	2	R-3
Condominium Development				P*			C*	C*	P* C*	1.5 per bedroom	2	R-2
Live/Work Development			C*	C*						As required by proposed uses	3	
Multifamily Dwelling (three (3) or more dwelling units on individual parcel)				P*			C*	C*	P* C*	1.5 per bdrm + 1 per bdrm over 2	2	R 2
Townhome Development				P*			C*	C*	P* C*	1.5 per bdrm + 1 per bdrm over 2	2	R-3
Two-Family Dwelling (duplex on individual parcel)							P	P	P	1.5 per bdrm + 1 per bdrm over 2	1	R-3
Group Residential												
Family Care Facility						P*	P*	P*	P*	1 per 5 beds	2	R-3
Group Care Facility			C*			C*	C*	C*	C*	1 per 5 beds	2	
ACCESSORY USES & STRUCTURES												
Customary Home Occupations						P*	P*	P*	P*		1	
Education: Typically Related Accessory Uses (ie- dormitories, modular units, stadiums, auditoriums, museums etc…)	P	P		P		P	P	P	P	see O&I District Regulations		
Junk Motor Vehicles (on private property)						P*	P*	P*	P*			
Kennel, Private Accessory						P*	P*	P*	P*		1	
Religious Structures Related Accessory Uses (ie- Rectories, Parsonages, Manses, Parish Houses, Cemeteries, Mausoleums)	C	C	P	P		P	P	P	P		2	
Solar Energy System	P*	P*	P*	P*		P*	P*	P*	P*			
Swimming Pools	P*	P*	P*	P*		P*	P*	P*	P*		1	
Wind Energy System	P*	P*	P*	P*		P*	P*	P*	P*			
AGRICULTURE & FORESTRY USES												
Bona Fide Farm & Agritourism	P	P	P		P	P	P	P	P		1	
Nursery					P*	P*	P*	P*	P*	1 per 500 sq. ft.	2	M
Preserves (Nature, Wildlife, or Forest)	P	P	P	P	P	P	P	P	P		1	
EDUCATIONAL & INSTITUTIONAL USES												
Continuing Care Retirement Community/Nursing Home	P	P	P	P		C	C	C	C	1 per employee (largest shift) + ½ per resident	2	
Crematorium	P	C	C			C	C	C	C	1 per employee		U

	IND	L I	COMM	O&I	CONS	RA-40	RA-30	RA-20R	RA-20M	PARKING	USE GROUP LEVEL	BUILDING CODE CLASS
Cemetery or Mausoleum, Commercial Use			C*			C*	C*	C*	C*		2	
Cemetery or Mausoleum, Private Use						P	P	P	P		2	
Funeral Home or Mortuary			P			C	C	C	C	1 per 4 seats OR 1 per 200 sq. ft.	2	A-3
Religious Structures	C*	P*	P*	P*		P*	P*	P*	P*	1 per 4 sanctuary seats	2	A-3
Daycare Facilities												
Adult Daycare	C*	P*	P*	C*		C*	C*	C*	C*	1 per employee + 1 per 8 clients	2	
Childcare Facility	C*	P*	P*	C*		C*	C*	C*	C*	1 per employee + 1 per 8 clients	2	
In-Home Childcare						P*	P*	P*	P*	As required by underlying use	1	R-3
Educational Services												
Colleges & Universities	P	P	C	P		P	P	P	P	5 per classroom + 1 per office	2	B
Learning Center		C	P	P						1 per employee + 1 per 8 clients	2	B
Research Laboratory	P	P	C	P						1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	3	
School, Private: Elementary, Middle, & High	C	C	C			P	P	P	P	2 per classroom	2	E
School, Public: Elementary, Middle, & High	C	C	C			P	P	P	P	5 per classroom	2	E
Trade School	P	P	P			C	C	C	C	5 per classroom + 1 per office	2	B
Truck Driving School	P	C	C							5 per classroom + 1 per office	4	B
Financial Services												
Automated Teller Machine (ATM)	P*	P*	P*	P*		P*	P*	P*	P*	2 per machine	2	
Financial Institutions (Banks, Credit Agencies, Investment Companies, etc)	C	P	P	P						1 per 200 sq. ft.	3	B
Health Services												
Emergency Services (ie- Police, Fire, Rescue, Ambulance Service)	P	P	P	P		P	P	P	P	1 per 350 sq. ft.	2	
Health Care Services (ie- Medical & Dental Clinic & Lab, Blood Bank, etc)	C	P	P	P		C	C	C	C	1 per 300 sq. ft.	3	B
Hospitals	P	P	P	P		P	P	P	P	2 per bed	3	I-2
Public Services												
Parks		P	P	P	P	P	P	P	P		1	
Public Library	P	P	P	P		P	P	P	P	1 per 300 sq. ft.	2	A-3
Social Institutions												
Community & Civic Centers		P	P			P	P	P	P	1 per 200 sq. ft.	2	A-3
Social Halls, Lodges, Fraternal Organizations, Clubs, & Similar Activities		P	P			C	C	C	C	1 per 200 sq. ft.	2	A-3
COMMERCIAL USES												
Existing Commercial Uses Applying for Permits to Expand				P			C	C	C	As required by underlying use	3	
Animal Services												
Kennels, Boarding Stables, & Other Similar Regulated Land Uses	C	C	C			C	C	C	C	1 per employee + 1 per kennel or pen	3	B
Veterinarian Service	C*	P*	C*	C*		C*	C*	C*	C*	1 per 300 sq. ft.	3	B
Zoo & Petting Zoo			C*				C*	C*	C*	1 per 4 persons (at max capacity)	4	
Eating & Drinking Services												
Bar, Tavern, & Entertainment Venue	P*	C*	P*							1 per 2 seats	3	A
Restaurant	P*	P*	P*	P*		C*	C*	C*	C*	1 per 4 seats + 1 per 2 employees	3	A
Lodging Services												
Bed & Breakfast						C*	C*	C*	C*	1 per room + 1 per employee	3	R
Boarding House			C*					C*	C*	1 per room + 1 per employee	3	R
Hotel or Motel	C	P	P	C						1 per room + 1 per 2 employees	3	R
Homeless Shelter	C*		C*				C*	C*	C*	1 per 400 sq. ft.	3	R
Recreational Vehicle Park			C*				C*	C*	C*		3	
Offices, General												

	IND	L I	COMM	O&I	CONS	RA-40	RA-30	RA-20R	RA-20M	PARKING	USE GROUP LEVEL	BUILDING CODE CLASS
Business Service Establishment	P	P	P	P						1 per 300 sq. ft.	3	B
Offices (Business or Professional)	P	P	P	P		C	C	C	C	1 per 200 sq. ft.	3	B
Offices (Governmental)	P	P	P	P		C	C	C	C	1 per 200 sq. ft.	3	B
Personal Services												
Laundry Mat	P	P	P	P		C	C	C	C	1 per 150 sq. ft.	3	
Massage & Bodywork Therapy Practice, Licensed			P*				C*	C*	C*	3 per licensed therapist	3	B
Massage & Bodywork Therapy Practice, Unlicensed	C*									1 per 300 sq. ft.	4	B
Personal Service Establishment	P	P	P			C	C	C	C	1 per 300 sq. ft.		B
Recreational Facilities												
Recreational Facility	C*	C*	C*	C*		C*	C*	C*	C*	1 per 4 persons (at max capacity)	3	A
Athletic Fields, Private			P* C*	P* C*		C*	P* C*	P* C*	P* C*	25 per field + 1 per 200 sq. ft.	3	A
Health & Training Center, Indoor	C	P	P	P						1 per 200 sq. ft.	2	A
Health & Training Center, Outdoor		C*	C*	C*						1 per 200 sq. ft.	2	A
Race Track	C*	C*	C*	C*		C*	C*	C*	C*	1 per participant + 1 per 3 seats	3	A
Recreation & Amusement Services		C	C							1 per 4 persons (at max capacity)	3	A
Recreational Day Camp		C*	C*			C*	C*	C*	C*	1 per employee + 1 per 8 clients	2	
Recreational Facility, Indoor		P	P	P		C	C	C	C	1 per 200 sq. ft.	2	A
Shooting Range, Indoor	P*	P*	P*	C*		C*	C*	C*	C*	1 per firing point	4	
Shooting Range, Outdoor	C*	C*	C*	C*		C*	C*	C*	C*	1 per firing point	4	
Retail Services												
Convenience Stores & Convenience Type Business Establishments	P*	P*	P*	P*		C*	C*	C*	C*	1 per 150 sq. ft.	3	M
Grocery Store		C	P	P		C	C	C	C	1 per 200 sq. ft.	3	M
Flea Markets, Rummage, Second Hand Sales & Activities, Indoor			P*				C*	C*	C*	1 per 300 sq. ft.	3	M
Flea Markets, Rummage, Second Hand Sales & Activities, Outdoor			P*							1 per 300 sq. ft.	3	M
Nursery, Retail		P	P			C	C	C	C	1 per 500 sq. ft.	3	M
Retail Sales (entirely within an enclosed building)	P*	P*	P*							1 per 300 sq. ft.	3	M
Retail Sales, Outdoor (primarily outside of an enclosed building)	P*	P*	P*							1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	3	M
Shopping Center		P*	P*							1 per 200 sq. ft.	3	
Sexually-Oriented Business (bookstore, motion picture, nightclub)	C*									1 per 300 sq. ft.	4	
Vehicle Services												
Automobile Repair Facility	P*	P*	P*	C*		C*	C*	C*	C*	3 per bay + 1 per employee	3	S
Car Wash	P*	P*	P*	C*		C*	C*	C*	C*	1 per employee + 1 per 200 sq. ft.	3	
Parking Lot	P	P	P	P				C	C		3	
Repossession Storage Facility (repot lot)	P*	C*	C*							1 per 200 sq. ft.	4	
Vehicle Sales, Leasing, & Rental		C*	P*							1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	3	B
INDUSTRIAL USES												
Existing Industrial Uses Applying for Permits to Expand			C				C	C	C	As required by underlying use	4	
Alternative Energy												
Ethanol Diesel & Biofuel Production	C*	C*								1 per 2 employees (largest shift)	4	H
Solar Energy Facility	P*	P*				C*	C*	C*	C*	1 per 2 employees (largest shift)	4	
Wind Energy Facility	P*	P*				C*	C*	C*	C*	1 per 2 employees (largest shift)	4	
Manufacturing												

	IND	L I	COMM	O&I	CONS	RA-40	RA-30	RA-20R	RA-20M	PARKING	USE GROUP LEVEL	BUILDING CODE CLASS
Manufacturing, Fertilizer	C*									1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	H
Manufacturing, General	P*	C*								1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	
Manufacturing, Light	P*	P* C*	P*	P*						1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	
Warehousing & Freight Handling												
Assembling, Processing Industries, Wholesale, & Warehouse	P*	C*	C*							1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	
Distribution Center	P*	C*	C*							1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	S
Storage, Recreational Vehicle & Travel Trailer						P*	P*	P*	P*	see Office, if applicable	3	
Storage, Self Mini-Warehouse	P*	P*	P*				C*	C*	C*	see Office, if applicable	3	S
Wholesale Trade												
Wholesale Storage of Gasoline or Bulk Terminal Plants	C*									1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	H-3
Waste Related												
Recycling Collection Centers (unmanned)	P*	P*	P*	P*		P*	P*	P*	P*	1 per unit	1	
Recycling Collection Centers & Solid Waste Container Sites (manned)	P	P					C	C	C	1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	
Recycling Plant	P	C	C							1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	
Solid Waste Disposal	C*	C*	C*			C*	C*	C*	C*	1 per 2 employees (largest shift)	4	
UTILITY USES												
Privately Owned Public Utility Structures & Facilities	P* C*	P* C*	P* C*	P* C*	P* C*	C* C*	C* C*	C* C*	C* C*	1 per 2 employees, if applicable	3	U
Publicly Owned Utility Structures & Facilities	P*	P*	P*	P*	P*	P*	P*	P*	P*	1 per 2 employees, if applicable	3	U
TEMPORARY USES												
Modular Classroom	P*	P*	P*	P*		P*	P*	P*	P*			E
Nonresidential Building, Temporary	P*	P*	P*	P*	P*	P*	P*	P*	P*			
Portable Food Sales		P*	P*	P*								
Residence, Temporary						P*	P*	P*	P*	2 per dwelling unit	1	
Roadside Stands						P*	P*	P*	P*		1	
Season Sales			P*			P*	P*	P*	P*		1	
Temporary Events	P*	P*	P*	P*		P*	P*	P*	P*		1	
Turkey Shoot, Temporary/Seasonal	C*	C*	C*	C*		C*	C*	C*	C*	1 per firing point	1	
Yard Sale						P*	P*	P*	P*		1	
OTHER USES												
Airports & Related Uses	P* C*	C*	C*	C*						1 per 300 sq. ft.	4	U
Comm. Towers: Microwave, TV, Telephone, Radio, & Cellular	C*	C*	C*	C*		C*	C*	C*	C*		4	U
Junkyards	C*									1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	
Manufactured Home Parks									C*	2 per dwelling unit	3	
Mining Activities	C*	C*	C*			C*	C*	C*	C*	1 per 2 employees (largest shift) OR 1 per 500 sq. ft.	4	
Outdoor advertising signs			P									
Planned Unit Development	C*	C*	C*			C*	C*	C*	C*	As required by underlying use	3	

APPENDIX III

Operations Plan

OPERATION PLAN

HARNETT COUNTY, NORTH CAROLINA
DUNN ERWIN LANDFILL
CONSTRUCTION AND DEMOLITION LANDFILL
PERMIT# 43-02

Prepared for:

HARNETT COUNTY
Department of Solid Waste

Harnett COUNTY NORTH CAROLINA

PREPARED BY
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PROJECT 03002E
July 2013

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Fire Occurrence Notification Form
Emergency Contacts
Routine Inspection Forms
Waste Screening Form

1.0 Operation plan

This C&D Landfill Operation Plan has been prepared in accordance with Rule 15A NCAC 13B. 0542. Harnett County shall maintain and operate the Dunn Erwin Construction and Demolition Landfill (DELF), in accordance with the design and drawings approved by the North Carolina Solid Waste Section (NCSWS), the permit to operate issued by the NCSWS, and the following requirements.

1.1 General Information

The Facility is operated in accordance with the conditions of Permit #43-02 issued by the State of North Carolina, Division of Waste Management, Solid Waste Section. Signs at the entrance announce the permit number, hours of operation, lists of acceptable and unacceptable waste and emergency contact name and telephone number. Signs within the facility direct traffic to designated areas to deposit waste.

All required records, correspondence, etc. that pertain to the operation and permit compliance of this facility will be stored at the office of Harnett County Department of Solid Waste located at:

Harnett County Department of Solid Waste
Attn: Amanda Bader, PE, LEED AP, County Engineer
PO Box 940
103 E Ivey Street
Lillington, NC 27546
(910) 893-7536
abader@harnett.org

In addition, copies of operational records and pertinent correspondence will be kept at the facility located at:

Dunn Erwin Landfill
Attn: Randy Smith, Solid Waste Operations Manager
446 Daniel's Road
Dunn, NC 28334
(910) 897-3222
rwsmith@harnett.org

Should this location change, the Owner will notify the NCDENR – Solid Waste Section of the change.

1.1.1 Hours of Operation

The Dunn Erwin C&D Landfill is open every day except Sundays and Holidays that are observed by the County. These hours may change in order to accommodate the conditions of unforeseen circumstances.

Hours are generally as follows:

Mon, Tue, Thur, Fri, & Sat 7:30 A.M. to 4:30 P.M.

Wed - 7:30 A.M. to 12:00 P.M.

Sun - CLOSED

1.2 Operations Description

Vehicles entering the facility are weighed just inside the gate and again as they leave in order to keep an account of the total waste received the type of waste and the origin of the waste. All this information is recorded and filed. In the interest of protecting public health and safeguarding the environment, the Solid Waste Department of Harnett County does require haulers to obtain permits. These permits are issued by the Solid Waste Department. These permits require the covering of transported materials, clear identification of trucks, and compliance with local and state law regarding the collection, transport, and disposal of solid waste.

Vehicles are directed to the active permitted C&D cell or MSW Transfer Station, recycling areas or individuals with small quantities of solid waste are sent to the convenience center immediately after the inbound scale to place it here and leave the facility.

A spotter directs haulers where to back into and loads are dumped on the active fill area. The spotter assures the orderly unloading and exiting for haulers which includes keeping large trucks with refuse bodies that unload quickly separated from smaller trucks that do not dump and with drivers generally with less experience in hauling waste who may have to unload by hand.

1.3 Waste Acceptance and Disposal Requirements

The Harnett County Dunn Erwin Landfill receives approximately 30,000 tons of waste per year from Harnett County (includes C&D, MSW, and Yard Waste). The waste stream consists of residential, industrial, institutional, and commercial wastes.

The incorporated Towns within the County provide collection and hauling solid waste management services to their residents themselves or by contracting with a private waste management company. Residents in the unincorporated areas of the county may use any of the 16 permitted private haulers or may personally take their garbage to the Dunn-Erwin Transfer/Landfill, the Dunn Erwin Transfer/Landfill, or one of the four collection centers operated by the County.

Waste is also collected by the County from four collection ("convenience") centers located in rural areas of the County. Any county resident may use the collection sites to drop off recyclable materials and residential waste at an annual cost per household. The resident must have the household identification sticker displayed when dropping off materials. The collection centers are staffed through a contract with Republic Waste Services. An attendant is at each center from 7:30 am to 5:30 pm, Monday through Saturday. Residential household solid waste is accepted at each center in a roll-off container. The contractor hauls this waste to the transfer facility. Recyclable materials of glass, newspaper and aluminum are also accepted.

1.3.1 Accepted Wastes

The Dunn Erwin C&D Landfill will accept construction/demolition debris, wastes acceptable for disposal in a land clearing-inert debris landfill, and other wastes specifically approved by the division. The DELF only accepts waste generated in Harnett County, and will not knowingly dispose of any type of C&D waste generated within the boundaries of a unit of local government that by ordinance prohibits generators or collectors of C&D waste from disposing of such waste.

Construction/demolition debris is defined in the General Statutes as waste or debris resulting solely from construction, remodeling, repair, or demolition operations on pavement, building, or other structures.

Land clearing debris is defined in the rules as waste that is generated solely through land clearing activities such as stumps, trees, limbs, brush, grass and other naturally occurring vegetative matter.

Disposal of yard trash will not be allowed in the DELF Facility. Yard trash is defined in the North Carolina General Statutes 130A-290 as "solid waste consisting solely of vegetative matter resulting from landscaping maintenance".

1.3.2 Material Processing

The Dunn Erwin C&D Landfill facility will engage in material processing of Land Clearing and Inert Debris from time to time in order to divert and reduce the amount of waste disposed of in the C&D landfill. The operations of the material processing will be as per the approved LCID Operations Plan.

1.3.3 Prohibited Wastes

- Containers such as tubes, drums, barrels, tanks, cans, bottles, unless they are empty and perforated to ensure that no liquid, hazardous or municipal solid waste is contained therein.
- Garbage as defined by Statute GS 130A-290
- All municipal solid waste (MSW).
- All industrial waste.

- All medical waste.
- Hazardous waste as defined within 15A NCAC 13A, including hazardous waste from conditionally exempt small quantity generators.
- Polychlorinated biphenyls (PCB) waste as defined in 40 CFR 761.
- Radioactive waste as defined by Statute 104E-5(14).
- All liquid wastes are banned from the DELF facility.

  NOTES: Liquid Waste means any waste material that is determined to contain "free liquids" as defined by Methods 9095 Paint Filter Liquids Test), as described in "Test Methods for evaluating solid Wastes, Physical/Chemical methods" (EPA Pub. No.SW-846).

  Paint Filter Liquids Test:

  The test is performed by placing a 100-milliliter sample of the waste in question, in a conical, 400-micron paint filter. The waste is considered to be a liquid if any liquid from the waste passes through the filter within five minutes.
- Waste prohibited in the Dunn Erwin C&D landfill by Statute GS 130A-309.10 of the North Carolina Solid Waste Management Rules. These waste include:
  - used oil
  - yard trash
  - white goods
  - antifreeze (ethylene glycol)
  - whole scrape tires
  - lead-acid batteries
  - aluminum cans
  - beverage containers that are required to be recycled under G.S. 18B-1006.1
  - motor vehicle oil filters
  - recyclable rigid plastic containers that have a neck smaller than the body of the container, and that accept a screw top, snap cap, or other closure

- re-usable wooden pallets, truck loads of pallets
- oyster shells
- Discarded computer equipment, as defined in G.S. 130A-309.91
- Discarded televisions, as defined in G.S. 130A-309.91.

- C&D waste that has been shredded, pulverized or processed to such an extent that the composition of the original waste cannot be determined, unless the waste is from a facility that received a permit from an authorized regulatory authority which specifies such activities are inspected by the authority and that the primary purpose is recycling and reuse of the C&D material.
- The following wastes are banned from the DELF if separate from C&D waste: light bulbs or lamps, lighting ballast or fixtures, thermostats and light switches, batteries, lead pipes, lead roof flashing, transformers, capacitors and copper chrome arsenate (CCA) and creosote treated woods.

A report shall be prepared for any attempted delivery of waste of which the C&D Landfill is not permitted to receive, including waste from outside the permitted C&D Landfill service area. The report will be forwarded to:

Department of Environment, Health and Natural Resources
Solid Waste Division
PO Box 27687
Raleigh, North Carolina 27611-8787
(919) 733-0692

1.4 Waste Screening

Waste is screened by all personnel that operate the Transfer Station not only for unacceptable waste but for the correct destination on the property to deposit the load. Beginning with the scale house attendant who asks the waste hauler what he is disposing to equipment operators and attendants who see the contents of the load when it is uncovered, it is everyone's responsibility to assure that the waste is disposed in the

correct location and rejected if it is unacceptable. There are five (5) certified transfer station operation specialists on staff. At least one (1) certified transfer operator is on site at all times during operational hours. Training is provided on spotting unacceptable waste during certification course. Also there is one (1) Certified Landfill Operator who was trained on spotting unacceptable waste. The loader operators and attendants who have not attended the Certification Courses have been trained by staff on spotting unacceptable waste. When unacceptable waste is identified and the hauler is still on site the hauler will be responsible for removal of the waste. If the hauler has left the site and cannot be identified then the County will be responsible for removal and proper disposal methods of the waste. Haulers who use the facility regularly generally know what waste is unacceptable and those who are not regular are informed by the signs at the gate and/or by information provided by the scale house attendant. Routine offenders can be turned over to the County's Environmental Officer / Sherriff Deputy for formal enforcement.

A minimum of two (2) incoming loads per week are randomly pulled aside and isolated from normal traffic for routine inspection. The inspection form is used to indicate if the load is within compliance and space is available to comment on non complying loads. Copies of the inspections are placed in the onsite operation file for a minimum of 3-years or per direction of the SWS. A blank form is attached.

Landfill attendants are constantly inspecting incoming loads for noncompliant non-hazardous waste such as tires, batteries, wood pallets, etc. Upon discovery these items are stockpiled temporarily off the working face of the landfill and relocated to the appropriate location at the convenience center or transfer station at the end of each working day.

If an unacceptable waste, and specifically hazardous waste, is found to be on the working face of the landfill, the general public will be evacuated from the immediate landfill area. An empty trailer will be hauled to the area and the waste will be placed into the trailer where it can be contained and confined. Harnett County Emergency Management will be notified upon discovery and may offer additional instruction.

The County has relationships with several professional, properly certified hazardous materials cleanup firms which are available for handle any spills, etc which may occur. The SWS will be notified on an appropriate form of any incident and a

description of the resolution.

Harnett County shall continue a program at the landfill for detecting and preventing the disposal of hazardous or liquid waste or any other waste that the DELF facility is not permitted to receive. Waste is screened by all personnel that operate the DELF facility not only for unacceptable waste but for the correct destination on the property to deposit the load. Beginning with the scale house attendant who asks the waste hauler what he is disposing to equipment operators and spotters who see the contents of the load.

The frequency of random inspections shall be based on the type and quantity of waste received daily, and the accuracy and confidence desired in conclusions drawn from inspection observations. All incoming waste of an unidentifiable nature or origin will be inspected. This shall include but not be limited to haulers with unknown service area, to loads brought to the facility in vehicles not typically used for disposal of C&D Waste, and to loads transported by previous would-be offenders. For waste of unidentifiable nature received from sources other than household (e.g., industrial or commercial establishments), the inspector should question the transporter about the source/composition of the materials. The program will include the following:

Landfill personnel will conduct random inspections of typical incoming loads. Inspections will occur at a designated site, adjacent to the working face of the landfill unit. The load will be carefully spread by a front-end loader with personnel trained to identify hazardous and liquid waste or any other unacceptable waste. A minimum of two (2) incoming loads per week are randomly pulled aside and isolated from normal traffic for routine inspection. The inspection form is used to indicate if the load is within compliance and space is available to comment on non complying loads. Copies of the inspections are placed in the onsite operation file for a minimum of 3-years or per direction of the SWS. A blank form is attached.

Harnett County will provide annual training to all landfill personnel in regard to recognizing hazardous and liquid waste.

1.5 Contingency Plan

Harnett County has developed a contingency plan to properly manage identified

hazardous or liquid waste. The plan involves the identification of the waste by inspection. If the inspector determines a load to be of a hazardous nature, the landfill will not accept the waste and require that hauler remove the waste from the facility. If the inspector determines a load of waste to include wastes that should not be disposed of in the DELF but can be disposed of in a permitted MSW Landfill, then the hauler will be required to load the waste back into his vehicle and transport the load to the MSW Transfer Facility.

Beginning with the scale house attendant who asks the waste hauler what he is disposing to equipment operators and spotters who see the contents of the load when it is uncovered, it is everyone's responsibility to assure that the waste is disposed in the correct location and rejected if it is unacceptable. There are five (5) certified transfer station operation specialists on staff. At least one (1) certified transfer operator is on site at all times during operational hours. Training was provided on spotting unacceptable waste during certification course. Also there is one (1) Certified Landfill Operator who was trained on spotting unacceptable waste. The loader operators and spotters who have not attended the Certification Courses have been trained by staff on spotting unacceptable waste. When unacceptable waste is identified and the hauler is still on site the hauler will be responsible for removal of the waste. If the hauler has left the site and cannot be identified then the County will be responsible for removal and proper disposal methods of the waste. Haulers who use the facility regularly generally know what waste is unacceptable and those who are not regular are informed by the signs at the gate and/or by information provided by the scale house attendant.

When possible, nonconforming waste delivered to the facility will be discovered by the personnel at the site, rejected before it is unloaded and the hauler will be directed to transport it off the property. Noise and odors are usually not a problem since there are no dwellings or directly adjacent the landfill operational areas. Unusual traffic patterns are avoided by use of signs within the facility to direct haulers to designated areas.

Equipment over and above the minimum required has been acquired to compensate for break downs. Refer to the list at the end of Section 6.6.

Long-term power outages would affect not only the immediate receiving and

transferring of waste, but record keeping and billing. If the outage is extensive, the facility may have to cease operation. In the event the facility would have to cease operations the County would notify the municipalities and waste haulers to direct them to another facility where they could dispose of their waste or to advise when the Harnett County Transfer Station facility would be back up in operation. This notification would be by phone and the use of the local media.

1.6 Personnel & Equipment

The following are responsible for the operation of the Harnett County Waste Handling Facility during daily operations:

- Director of Solid Waste - Manage Entire Operation
- Superintendent of Solid Waste - Manage Tipping Floor, Operators, Spotters
- Waste Enforcement Officer – (Sherriff Deputy) Prevent Illegal Dumping and Uncovered Loads
- Crew Leader (1) - Assists Superintendent in Management of Operations
- Solid Waste Mechanic (1) Trucks and Equipment Maintenance
- Scale House Attendant/Account Managers (2) Weigh Haulers In and Out
- Equipment Operators/Attendants (2) Operate Equipment and Direct Visitors for Proper Disposal

Five of these employees have completed operator's training courses approved by the Division of Solid Waste. At least one of these employees is present at the facility during operating hours. These employees will be provided a copy of the approved operations plan for them to become familiarized with.

The Solid Waste Superintendent performs daily, weekly, and monthly inspections which includes a variety of items to insure compliance with the

Landfill's Operating Permit. Some things included but not limited to are inspection of monitoring wells, erosion and sedimentation devices, weekly cover, edge of waste markers, litter, etc. A sample form is attached. Records are kept for a minimum of three years at the landfill office.

The Facility uses the following equipment for operations, maintenance and back-up:

- 70' X 10' Scale (inbound/outbound)
- Rubber-Tired Front End Loader (1) (for moving wastes on tipping floor)
- Transfer Trailers (property of the Contract Hauler) (Multiple)
- Yard Tractors (1) (for shifting trailers)
- Floor Wash down Equipment, hoses, shovels, brooms
- Dozer (2) (for C&D & general operations)
- Rubber Tire Backhoe (1) (backup for Rubber-Tired Front End Loader)
- Excavators (1) (for C&D & general operations)
- Farm Tractor with Pavement Brush (1)
- 13 Cubic Yard Pan (2)
- Sheepsfoot Waste Compactor

1.7 Cover Material Requirements

Harnett County shall cover the disposed waste with six (6) inches of earthen material once a week, or at more frequent intervals if necessary, to control disease, vectors, fire, odors, blowing litter, and scavenging.

As an alternative to the six inches of earthen material, Harnett County may use an alternative cover (AC) that has been approved by the Solid Waste Division.

The AC will only be placed in the vicinity of the active working face and primarily during wet weather conditions to assist in alleviating the muddy conditions that impede efficient operation. The AC will not be placed in areas that have a high potential for runoff, such as perimeter slopes. A full six (6) inch layer of native soil will continue to be placed in these areas in order to promote surface water runoff.

The weekly cover will reduce nuisances caused by odors, vectors, litter, etc., and will assist landfill operations during wet weather conditions. The soil component of the daily cover will create isolated pockets of waste within the cell to prevent and control landfill fires. However, as an additional precaution, a full six (6)-inch layer of soil will be used to cover the working face at least once each week. Using the AC material should not increase the potential for landfill fires, since the material will be placed in conjunction with a separate soil layer and will be predominately used in wet weather conditions.

The AC's will be placed to meet or exceed the performance criteria of an AC as outlined in Rule .1626 2 (b) by providing control of disease, vectors, fires, odors, blowing litter, and scavenging.

Harnett County shall cover all waste areas that will be inactive for more than twelve (12) months and have not reached final elevations with a minimum of one foot of intermediate cover.

1.8 Spreading and Compacting Requirements

Waste will be placed in the DELF in lifts of approximately five (5) to ten (10) feet thick. Following placement in the initial lift, the solid waste will be compacted as

densely as possible using compactors and/or dozers. Waste placement will be in lifts not to exceed 10 feet. In order to increase compaction, waste should be placed from the down gradient to the up gradient direction when possible. The working face shall be maintained in as small an area as possible to increase compaction and to reduce the amount of daily cover required.

1.9 Disease Vector Control & Wind Blown Waste

Harnett County will control the spread of disease vectors by maintaining weekly cover requirements and picking up windblown trash at the end of each day.

1.10 Air Quality

Harnett County shall operate the Dunn Erwin CDLF in compliance with all applicable requirements developed under the State Implementation Plan (SIP) approved or promulgated by the U.S. EPA Administrator pursuant to Section 110 of the Clean Air Act, as amended. The Harnett County landfill should not be required to obtain a Title V operating permit. Currently, the Dunn Erwin Landfill facility does not anticipate reaching an on-site volume of more than 2.5 million Megagrams of waste.

No open burning of solid waste shall be allowed at the landfill, except for the infrequent burning of land clearing debris that is generated by on-site clearing or debris from emergency clean-up operations. Any such infrequent burning will be approved by the local fire marshall and all local and state guidelines will be followed. The county will obtain all applicable permits prior to burning.

1.11 Dust Control

Dust generated due to landfill activities will be controlled. Dust will be controlled through the application of water by truck or other approved dust control products, if necessary. Removal of mud and dirt from the roads will also be a part of the dust control measures. Additionally, final cover will be vegetated as soon as practical in order to minimize the blowing of dust on-site.

1.12 Fire Control

If a hot load of waste is delivered to the landfill, the driver shall not be allowed to dump the load. The driver shall be directed to gravel or paved area East of the C&D waste area and instructed to dump the load there. The fire should be extinguished if possible, by either smothering it with soil or by utilizing the two inch water hydrant at the Transfer Station and the local fire department called immediately.

If a load of waste is unknowingly a "hot" load and is discharged onto the working face, it will immediately be smothered and extinguished by landfill personnel if possible and the local fire department will be called immediately. Equipment and a stockpile of soil shall be maintained in close proximity to the working face for controlling accidental fires.

The local fire department, which is approximately 5 miles from the Dunn Erwin Landfill, will also be contacted and informed of the potential fire hazards at the landfill. Arrangements will be made with the fire department to provide access to the landfill site. They will also be provided with operational information of the facility in case of emergency.

A secondary fire control policy consists of hose bibs located on the transfer station tipping floor and at the transfer trailer loading area. The hose bibs are provided for daily floor wash down maintenance, but may be used to control small fires if feasible, and until the Fire Department can arrive. A fire hydrant with a pumper nozzle is located along the landfill entrance road. In addition, Underwriters Laboratory (UL) fire extinguishers are located on the tipping floor, the transfer trailer loading area, and in the office. Buildings receiving waste are metal construction with concrete floors.

In accordance with Rule. .0505(10)(c), fires that occur at the Dunn Erwin Landfill Facility require verbal notice to the Division of Solid Waste within 24 hours and written notification shall be submitted within 15 days (example form is found in Appendix X). Verbal and written notification shall be submitted to the Raleigh Regional Waste Management Specialist:

Department of Environment and Natural Resources
Division of Waste Management, Solid Waste Division
1646 Mail Service Center
Raleigh, North Carolina 27699-1646
(919) 707-8200

1.13 Access and Safety Requirements

1.13.1 Access Restrictions

The site is currently enclosed by a fence with access controlled by means of gates. A security check station and weigh scales is located at the landfill entrance to evaluate waste stream and proper disposal. A properly trained and certified attendant will be on duty at the site at all times while it is open for public use to insure compliance with operation requirements. Restroom and maintenance facilities currently in place at the existing site will remain operational. Access roads to the site will be of all weather construction and maintained in good condition.

1.13.2 Signage

Signs providing information on disposal procedures, the hours which the site is open for public use, the permit number, stating that no hazardous or un-permitted waste can be received without written permission, stating that no liquid waste can be received for disposal, and other pertinent information will be posted at the site entrance. Most of these signs are located at the landfill entrance, which currently provides access to the MSW transfer station and also provides access to the DELF. Therefore traffic signs and markers shall be provided as necessary to promote an orderly traffic pattern and direct incoming vehicles to the proper dumping area (MSW, LCID, & C&D).

Adequate signage will be located along the access roads to direct vehicles to and from the discharge area and maintain efficient operating conditions. The scale house operator will give specific instructions to incoming waste loads as to the appropriate disposal area. A sign shall be placed in clear view of each incoming transporter, which shall read as follows:

<u>NOTICE:</u> RANDOM WASTE SCREENING PRACTICED HERE. WE

RESERVE THE RIGHT TO INSPECT ANY LOAD OR PORTION OF A LOAD ARRIVING AT OUR FACILITY. WE WILL REJECT ALL: HAZARDOUS WASTES, PCBs, LIQUIDS AND ANY UNACCEPTABLE WASTE AS DETERMINED BY OUR MANAGEMENT. YOUR PARTICIPATION IN THIS PROGRAM IS NOT OPTIONAL!

1.14 Erosion and Sedimentation Control Requirements

Existing and proposed erosion/sedimentation control structures include sediment basins, storm drains, temporary slope drains, check dams, and diversion ditches. Sedimentation basins will be checked after periods of significant runoff. Sediment will be removed from the basin to its original dimension when sediment accumulates to one half of design depth. The sedimentation basins, embankment, ditches, inlets and outlets will also be inspected for erosion damage. All necessary repairs will be made immediately. Any trash or debris within the riser pipes will be removed.

Stormwater will be collected by constructing benches on the finished cap at an interval as depicted on the approved Drawings. A series of pipes will be used to transport water from the upper benches to the lower benches and eventually to a periphery ditch that will transport the storm water to an existing sediment basin. Each pipe will be sized for the final-developed condition, since the landfill will produce peak runoff at the final-developed condition. All of the Stormwater management structures and erosion control details are shown on the approved Drawings.

The erosion control structures are designed and will be maintained to manage the runoff generated by the 24- hour, 10-year storm event and will conform to the requirements of the Sedimentation Pollution Control Law (15A NCAC 4).

Storm drain outlets and diversion ditches will be inspected for damage after each runoff event. Riprap will be placed in ditches and at pipe outlets to prevent erosion and washouts. Provisions for a vegetative ground cover sufficient to control erosion must be accomplished within seven (7) calendar days upon completion of any phase of DELF development. Temporary grassing will also be utilized as necessary to stabilize temporary slopes that are susceptible to erosion.

Embankment slopes shall be periodically inspected for erosion. The embankment slopes shall be mowed at a frequency sufficient to maintain a good stand of vegetation. The slopes shall be mowed once in any one (1) year period. The embankment slopes shall be re-fertilized in the second year unless vegetation growth is fully adequate. Any damaged areas will be reseeded, fertilized and mulched immediately. Seeding, fertilizing, and mulching shall be in accordance with the North Carolina Erosion and Sedimentation Control Guidelines.

1.15 Drainage Control and Water Protection Requirements

Surface water from outside the operation area will be diverted from the waste area by use of perimeter ditches. The perimeter ditches direct surface water to the sedimentation basins.

There shall be no discharge of pollutants from the landfill into waters of the U.S., including wetlands, that violates any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination Systems (NPDES) requirements, pursuant to Section 402.

Solid waste shall never be disposed of in standing water.

1.16 Leachate Management

Leachate seeps can occur due to a variety of circumstances. The goal in dealing with leachate seeps is to prevent seepage from leaving the limits of waste disposal areas and to minimize the potential for reoccurrence. If evidence of leachate seeps is observed, the Operator will take the following actions. Depending on the circumstances, various combinations of actions may be appropriate.

1. If leachate is observed outside of the limits of waste disposal areas, notify DENR.
2. Contain the flow of leachate using soil berms and/or excavation.
3. Excavate the area of seepage to attempt to allow flow into the underlying layers (i.e. break-up barriers that may be causing the seep.).
4. Run-on Control: Surface water run-on, when identified will be re-routed through the use of diversion berms and/or diversion ditches to prevent infiltration into the debris facility.
5. Surface Grading: Filling operations shall include grading with positive slopes (>5%) to promote runoff over the debris. At the end of

each day, any low areas should be filled with debris and/or soil to prevent potential impounding of surface water. Furthermore, in the case of impending storms, periodic cover should be advanced to provide a "soil seal" to further promote runoff and minimize infiltration.

6. Facility Inspections: On a periodic basis, site personnel should conduct "walk-over" inspections to identify areas of settlement which may create additional areas of "ponding". Any areas identified should be re-filled with debris and/or soil to further promote runoff. In the event, seeps are identified on the slopes or near the base of the facility, the area above the seeps shall be inspected for signs of inadequate cover or settlement and re-grading by placement of additional debris and/or soil
7. Leachate Diversion Trenches: In the event leachate seeps are identified along the outer slopes of the landfill or at the base, trenches are diverted back into the limits of waste by excavating trenches at and around the location of the seeps. These trenches are filled with a granular material to encourage the leachate to re-enter the waste containment area. Then the trench and seep area are covered with an impermeable type soil material (clay, silt, or clay mix) and compacted.
8. For contained leachate that will not flow into underlying layers, a pump may be required to route the leachate to an existing leachate collection area (pump station) or to a tanker truck.
9. The use of soil (particularly clay) to plug the seepage may also be successful in the case where flows are minor
10. Repair landfill cover as necessary.

The Dunn Erwin facility currently operates several leachate sump pump and haul stations to control leachate within the active C&D landfill and old closed MSW units. This system is operated per the Phase 1 of the Leachate Management Plan submitted and approved by the Solid Waste Section in August 2010 (SWS Doc ID# 11322). Permanent pumps are currently being installed as part of the Corrective Action Project at the DELF which includes sump pumps and a centralized pumping station to be operational late 2013.

1.17 Record Keeping Requirements

Landfill personnel shall record and retain the following information in an operating record at the landfill, or at an alternate location that has been approved by the Division:

- Inspection of existing facilities,

- Inspection records and waste determination records,
- Training received by landfill personnel,
- Waste amounts received by weight, which includes source or generation,
- Semi-annual monitoring of ground water wells, and
- Any demonstration, certification, finding, monitoring, testing, or other analytical data required by the North Carolina Solid Waste Management Rules (15A NCAC 13B).

The DELF obtains conducts a topographic survey of all the active landfill areas between May 1st and June 30th of each year in order to keep record of yearly contour transitions. An individual survey of the facility can be preformed within 60 days of receiving a request to do so from the Division. The results of this survey, which shall include a map and discussion of whether or not operations are being conducted in accordance with the approved design and operational plans, will be supplied to the Division within 90 days of receiving the original request.

This information shall be collected and documentation of such collection kept in the permanent record of the DELF or at an alternate location approved by the Division. The Operating Record, this Operations Plan, and a copy of the approved design drawings and construction drawings will remain at the Dunn Erwin Facility or approved alternate location at all times. This information will be readily available for inspection by the Solid Waste Section.

1.18 Operational Forms

In order to adequately operate the Dunn Erwin C&D Landfill and maintain proper records the following forms are available for use:

- Fire Occurrence Notification Form
- Routine Inspection Forms
- Waste Screening Forms

A copy of each of these forms follow.

SOLID WASTE MANAGEMENT FACILITY
FIRE OCCURRENCE NOTIFICATION
NC DENR Division of Waste Management
Solid Waste Section

Notify the Section verbally within 24 hours and submit written notification within 15 days of the occurrence.
(If additional space is needed, use back of this form.)

NAME OF FACILITY: _____ PERMIT # _____

DATE AND TIME OF FIRE: _____ @ _____

HOW WAS THE FIRE REPORTED AND BY WHOM:

LIST ACTIONS TAKEN:

WHAT WAS THE CAUSE OF THE FIRE:

DESCRIBE AREA, TYPE, AND AMOUNT OF WASTE INVOLVED:

WHAT COULD HAVE BEEN DONE TO PREVENT THIS FIRE:

DESCRIBE PLAN OF ACTIONS TO PREVENT FUTURE INCIDENTS:

NAME: _____ TITLE: _____ DATE: _____

****

THIS SECTION TO BE COMPLETED BY SOLID WASTE SECTION REGIONAL STAFF

DATE RECEIVED _____

List any factors not listed that might have contributed to the fire or that might prevent occurrence of future fires:

FOLLOW-UP REQUIRED:

☐ NO ☐ PHONE CALL ☐ SUBMITTAL ☐ MEETING ☐ RETURN VISIT BY:_____ (DATE)

ACTIONS TAKEN OR REQUIRED:

Revised 6/8/09

RANDOM WASTE SCREENING FORM

GENERAL INFORMATION (completed by transporter or landfill personnel)

Date & Time : _____

Transporter Name : _____

License Plate No. : _____

Drivers License No. : _____

Source of Waste : _____

Waste Description : _____

_____

_____

INSPECTION OBSERVATIONS (completed by landfill personel)

Hazardous waste labels or placards ?	YES / NO
PCB transformers, labels or placards ?	YES / NO
Lead-acid batteries ?	YES / NO
Unrinsed pesticide containers ?	YES / NO
Bulk or containerized liquids ?	YES / NO
Free liquids present ?	YES / NO
Sludges, pastes or slurries ?	YES / NO
Powders, dusts, smoke or vapors ?	YES / NO
Petroleum odors ?	YES / NO
Unusual odors ?	YES / NO
Other suspicious conditions ?	YES / NO

If YES, describe : _____

_____

_____

Photos Taken ? YES / NO (attach when available)

Will the wastes pass the Paint Filter Liquids Test ? YES / NO

Waste Accepted ? YES / NO

If NO, complete information of the back of this form

_____ _____

Signature (landfill personnel) Date

WASTE REJECTION INFORMATION (completed by landfill personnel only if waste is rejected)

Why was the waste rejected ?

_____

_____

_____

_____

_____

_____

What happened to the rejected waste ? (who took it where?)

_____

_____

_____

_____

_____

_____

Who was contacted at the SHWD ?

_____

Time : _____ AM / PM

Date : _____

ORIGINAL : Facility Records
COPY : Generator or Transporter

HARNETT COUNTY LANDFI DAILY/WEEKLY CHECK LIST

Inspector: _____

Inspection Dates: __/__/20__ to __/__/20__

Facility: DELF ACLF

Landfill Cell: ☐ Active C&D ☐ Active LCID ☐ Closed MSW/C&D(Weekly)

	DAILY OPERATION REQUIREMENTS	Mon	Tue	Wed	Thu	Fri	Sat	COMMENTS/NOTES (utilize back of form for more description as necessary)
Daily Inspection Items for Active Cells	Trucks using designated roads/approved parking areas per permit							
	Operations conducted during permitted operating hours							
	Access controlled per plan							
	Access road(s) maintained (erosion, dust, litter, mud, etc) per plan							
	Vehicles directed promptly to unloading area							
	Vehicles promptly unloaded							
	Inspection procedures implemented for prohibited wastes per plan							
	No unapproved wastes							
	Solid waste spread and compacted into layers per plan							
	No waste <15 ft. from edge of liner, berm, edge marked, etc.							
	Procedures followed for special handling and residual wastes							
	No open burning							
	Vectors minimized and controlled per plan							
	Odors minimized and controlled per plan							
	Other nuisances minimized and controlled per plan							
	Litter minimized and controlled per plan							
	Approved weekly cover placed							
Daily & Weekly Inspection Items- All Cells	Vegetation established and maintained per plan							
	Surface and groundwater pollution discharges prevented/controlled							
	Soil and erosion control BMPs are maintained per plan							
	Leachate popouts detected							
	Leachate popouts repaired							
	Flow from leachate management system monitored daily							
	Leachate management facilities operated and maintained							
	Landfill gas controlled per plan/ LFG Flare Operational							
	Daily operational records being made and maintained							
	Salvaged materials are stored in an approved area							
	Recyclable materials collection center maintained							
	No immediate threats to public health and safety							

Inspector Signature: _____ **Date:** _____

Key = Yes, No, NA (not applicable), ND (not determined)

(FRONT)

HARNETT COUNTY LANDFI DAILY/WEEKLY CHECK LIST

ADDITIONAL INSPECTION COMMENTS:

(BACK)

HARNETT COUNTY DUNN-ERWIN LANDFILL QUARTERLY INSPECTION CHECK LIST

Inspector: _____ **Quarterly Inspection Date:** ☐ Jan ☐ April ☐ July ☐ October 20 ____

GROUNDWATER, GAS, & SURFACE WATER INSPECTION

	WELL ID	Properly Locked?	ID Tag Present?	Well or Casing Damaged?	Well accessible and mowed?	Other Issue(s)?	COMMENTS/NOTES (utilize back of form for more description as necessary)
GROUNDWATER MONITORING WELLS	MW-1						
	MW-2						
	MW-3R						
	MW-4						
	MW-5						
	MW-6						
	MW-7B						
	MW-8						
	MW-9						
	MW-10						
	MW-11						
	MW-12						
	MW-13						
	MW-14						
	MW-15						
	MW-16						
	MW-23B						
	MW-31						
	MW-32						
	MW-33						
	MW-34						
	MW-35						
GEOPROBE WELLS	GP-24W						
	GP-25W						
	GP-27W						
	GP-28W						
	GP-30W						
	GP-33W						
	GP-34W						
	GP-35W						
	GP-36W						
	GP-37W						
	GP-38W						
GAS WELLS	GW-1						
	GW-2						
	GW-3						
	GW-4						
	GW-5						
SURFACE WATER	SW-1						
	SW-2						
	SW-3						

Key = Yes, No, NA (not applicable), ND (not determined)
Please be sure to complete the back of the form!

EDGE OF WASTE MARKER INSPECTION

LANDFILL CELL	All Markers in Place?	Markers Visible from Each Other?	Any Markers Damaged?	*Perimeter of LF maintained /mowed?*	***COMMENTS/NOTES*** *(utilize below for more description as necessary)*
ACTIVE C&D/ CLOSED MSW					
ACTIVE LCID					
CLOSED MSW					
CLOSED C&D					
ASBESTOS & TIRE MONOFILL					

Key = Yes, No, NA (not applicable), ND (not determined)

ADDITIONAL INSPECTION COMMENTS:

Inspector Signature: _____ **Date:** _____

APPENDIX IV

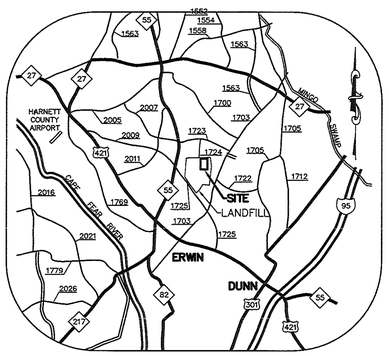
Engineering Drawings

DUNN-ERWIN LANDFILL

HARNETT COUNTY

C&D UNIT MODIFICATION PLAN

JULY 2013



VICINITY MAP
NOT TO SCALE

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
46 WEST WASHINGTON STREET
COATS, NORTH CAROLINA 27521
PHONE: 910-897-7070 FAX: 910-897-6767
License No. C-2570 www.ctclayton.com

SHEET INDEX

COVER SHEET
GRADING PLAN 1
DRAINAGE PLAN 2
SECTIONS AND DETAILS 3
HAUL ROAD PROFILE 4
DETAILS 5
DETAILS 6
DETAILS 7

DESIGNED WLF
DRAWN WLF
CHECKED CTC Jr.
PROJ. ENG. CTC Jr.

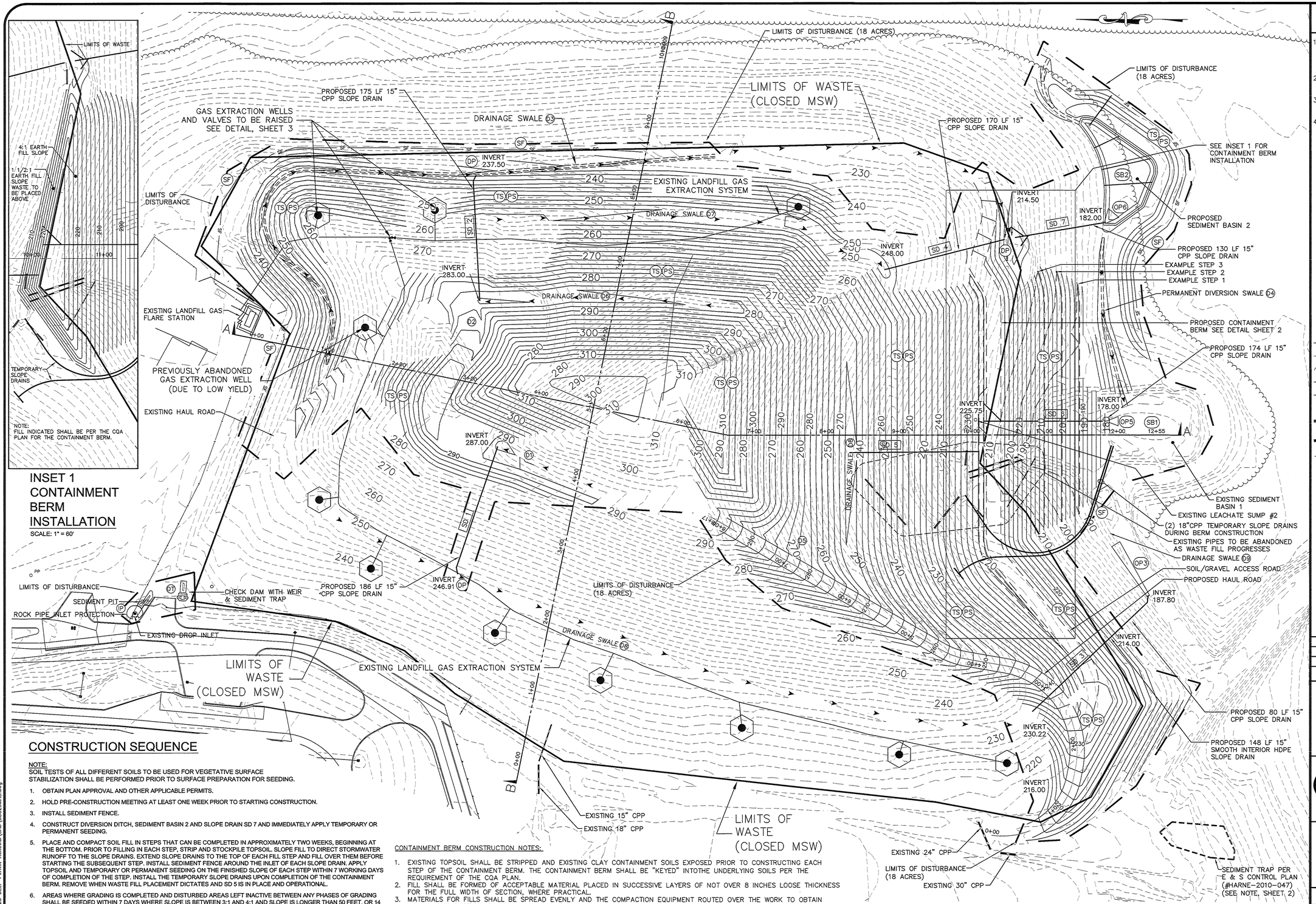
DATE: 7/25/13
CTC PROJ. # 03002E
DWG FILE: 030023MAS.dwg

NORTH CAROLINA PROFESSIONAL SEAL 028003 ENGINEER C. TYRUS CLAYTON, JR.

P.E.
7/26/2013 DATE

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

P:\0003 Harnett County\03003 DELF Permit Renewal\CAD\03003MAS.dwg Jul 26, 2013 12:50pm



INSET 1 CONTAINMENT BERM INSTALLATION

SCALE: 1" = 60'

CONSTRUCTION SEQUENCE

NOTE:
SOIL TESTS OF ALL DIFFERENT SOILS TO BE USED FOR VEGETATIVE SURFACE STABILIZATION SHALL BE PERFORMED PRIOR TO SURFACE PREPARATION FOR SEEDING.

1. OBTAIN PLAN APPROVAL AND OTHER APPLICABLE PERMITS.
2. HOLD PRE-CONSTRUCTION MEETING AT LEAST ONE WEEK PRIOR TO STARTING CONSTRUCTION.
3. INSTALL SEDIMENT FENCE.
4. CONSTRUCT DIVERSION DITCH, SEDIMENT BASIN 2 AND SLOPE DRAIN SD 7 AND IMMEDIATELY APPLY TEMPORARY OR PERMANENT SEEDING.
5. PLACE AND COMPACT SOIL FILL IN STEPS THAT CAN BE COMPLETED IN APPROXIMATELY TWO WEEKS, BEGINNING AT THE BOTTOM. PRIOR TO FILLING IN EACH STEP, STRIP AND STOCKPILE TOPSOIL. SLOPE FILL TO DIRECT STORMWATER RUNOFF TO THE SLOPE DRAINS. EXTEND SLOPE DRAINS TO THE TOP OF EACH FILL STEP AND FILL OVER THEM BEFORE STARTING THE SUBSEQUENT STEP. INSTALL SEDIMENT FENCE AROUND THE INLET OF EACH SLOPE DRAIN. APPLY TOPSOIL AND TEMPORARY OR PERMANENT SEEDING ON THE FINISHED SLOPE OF EACH STEP WITHIN 7 WORKING DAYS OF COMPLETION OF THE STEP. INSTALL THE TEMPORARY SLOPE DRAINS UPON COMPLETION OF THE CONTAINMENT BERM. REMOVE WHEN WASTE FILL PLACEMENT DICTATES AND SD 5 IS IN PLACE AND OPERATIONAL.
6. AREAS WHERE GRADING IS COMPLETED AND DISTURBED AREAS LEFT INACTIVE BETWEEN ANY PHASES OF GRADING SHALL BE SEEDED WITHIN 7 DAYS WHERE SLOPE IS BETWEEN 3:1 AND 4:1 AND SLOPE IS LONGER THAN 50 FEET, OR 14 DAYS ELSEWHERE. APPLY TEMPORARY OR PERMANENT SEEDING ACCORDING TO SEEDING SPECIFICATIONS.
7. PLACE WASTE FILL IN A CONTINUOUS OPERATION, COVERING PROMPTLY WITH SOIL.
8. CONSTRUCT HAUL ROAD AS FILL ADVANCES. APPLY TEMPORARY OR PERMANENT SEEDING TO HAUL ROAD SLOPES WITHIN 7 DAYS OF COMPLETION OF GRADING OF EACH 300 FOOT LENGTH.
9. COMPLETE SLOPE DRAINS AS FILL IS BROUGHT UP TO THE LEVEL OF THEIR INLETS. SEED THE SURROUNDING DISTURBED AREAS WITHIN 14 DAYS.
10. APPLY PERMANENT SEEDING TO AREAS SEEDED WITH TEMPORARY VEGETATION AT THE TIME OF THE YEAR GIVEN IN THE SEEDING SPECIFICATIONS.
11. MAINTAIN ALL EROSION AND SEDIMENT CONTROL PRACTICES UNTIL THE SITE IS STABILIZED MAINTENANCE REQUIREMENTS FOR EACH PRACTICE ARE GIVEN IN THE DETAIL FOR THE PRACTICE.

CONTAINMENT BERM CONSTRUCTION NOTES:

1. EXISTING TOPSOIL SHALL BE STRIPPED AND EXISTING CLAY CONTAINMENT SOILS EXPOSED PRIOR TO CONSTRUCTING EACH STEP OF THE CONTAINMENT BERM. THE CONTAINMENT BERM SHALL BE "KEYED" INTOTHE UNDERLYING SOILS PER THE REQUIREMENT OF THE CQA PLAN.
2. FILL SHALL BE FORMED OF ACCEPTABLE MATERIAL PLACED IN SUCCESSIVE LAYERS OF NOT OVER 8 INCHES LOOSE THICKNESS FOR THE FULL WIDTH OF SECTION, WHERE PRACTICAL.
3. MATERIALS FOR FILLS SHALL BE SPREAD EVENLY AND THE COMPACTION EQUIPMENT ROUTED OVER THE WORK TO OBTAIN UNIFORM COMPACTION. FILL SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. COMPACTION MOISTURE CONTROL SHALL BE MAINTAINED BETWEEN −1 AND +3 PERCENT OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D−698 OR AS DIRECTED BY THE ENGINEER. MATERIAL THAT IS TOO DRY FOR PROPER COMPACTION SHALL BE MOISTENED BY SUITABLE WATERING DEVICES, TURNED AND HARROWED TO DISTRIBUTE THE MOISTURE, AND THEN PROPERLY COMPACTED. WHEN MATERIAL IS TOO WET FOR PROPER COMPACTION, FILL SOILS SHALL BE DRIED PRIOR TO COMPACTION. THE SOILS SHALL BE DRIED BY AERATION DISKING, HARROWING, OR OTHER METHODS UNTIL THE MATERIALS CAN BE COMPACTED TO THE SPECIFIED DENSITY.
5. AS THE CONTAINMENT BERM IS CONSTRUCTED ABOVE THE TOE OF THE SLOPE ON THE NORTH SIDE, LEAVE A GAP 5 FEET WIDE AT THE BOTTOM WITH 3 TO 1 SIDE SLOPES THROUGH THE BERM FROM THE LOWEST POINT OF THE TOE OF THE SLOPE ON THE NORTH SIDE FOR SURFACE WATER DRAINAGE. FILL THE GAP AS A LAST STEP IN LIFTS ALTERNATING WITH LIFTS OF WASTE FILL SO THAT WATER DOES NOT POND BETWEEN WASTE AND THE BERM.
6. WASTE TO BE PLACED IN LIFTS NOT MORE THAN 15' IN HEIGHT WITH TOP SURFACE SLOPED AT APPROXIMATELY 5 PERCENT AWAY FROM THE LANDFILL UNIT.

GRAPHIC SCALE
60 30 0 60 120
(IN FEET)

PERMIT DRAWINGS NOT FOR CONSTRUCTION

General Notes

1. SOIL TESTS OF ALL DIFFERENT SOILS ON WHICH VEGETATIVE SURFACE STABILIZATION IS TO BE USED SHALL BE PERFORMED PRIOR TO SURFACE PREPARATION FOR SEEDING.
2. EXAMPLE STEPS ARE FOR VISUALIZATION PURPOSES ONLY. ACTUAL STEPS WILL DIFFER.
3. EXISTING PIPES INDICATED TO BE ABANDONED ARE TO BE COMPLETELY FILLED WITH CONCRETE.
4. SEE STABILIZATION TIME FRAME TABLE, SHEET 7

LEGEND

- PROPOSED CONTOUR
- EXISTING CONTOUR
- EXISTING TREE LINE
- GRADE BREAK
- CENTERLINE
- FLOW DIRECTION
- EXISTING STORM DRAINAGE PIPE
- PROPOSEED STORM DRAINAGE PIPE
- SF — SEDIMENT FENCE
- GAS EXTRACTION WELL
- SB2 — SEDIMENT BASIN
- IP — INLET PROTECTION
- OP6 — OUTLET PROTECTION
- DT — CHECK DAM W/ WEIR
- C1 — CULVERT
- SD 1 — SLOPE DRAIN
- DP — SLOPE DRAIN OUTLET PROTECTION – SEE SLOPE DRAIN DETAIL, SHEET 4
- TS — TEMPORARY SEEDING
- PS — PERMANENT SEEDING

No.	Revision/Issue	Date

NORTH CAROLINA PROFESSIONAL SEAL 028903 ENGINEER C. TYRUS CLAYTON, JR.

Signature

Date 7/26/2013

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DUNN-ERWIN LANDFILL C&D PIGGYBACK MODIFICATION PLAN

HARNETT COUNTY, NC

Project No:	03002E	File Name:	03023MAS.DWG
Designed By:	CTC Jr.	Drawn By:	WLF
Checked By:	CTC Jr.	Proj. Eng.:	CTC

Sheet Title: GRADING PLAN

Date: 7/25/13

Scale: 1" = 60'

Sheet 1 OF 7

P:\003 Harnett County\03023 DELF Permit Renewal\CAD\03023MAS.dwg

NOTE:
DRAINAGE SUBAREA D9 INCLUDED IN DRAINAGE AREA FOR SEDIMENT TRAP APPROVED IN E & S CONTROL PLAN #HARNE-2010-047.

GRAPHIC SCALE
60 30 0 60 120
(IN FEET)

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

General Notes

No.	Revision/Issue	Date

NORTH CAROLINA PROFESSIONAL SEAL 022803 ENGINEER C. TYRUS CLAYTON, JR.

Signature: C. Tyrus Clayton Jr.
Date: 7/26/2013

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DUNN-ERWIN LANDFILL C&D PIGGYBACK MODIFICATION PLAN

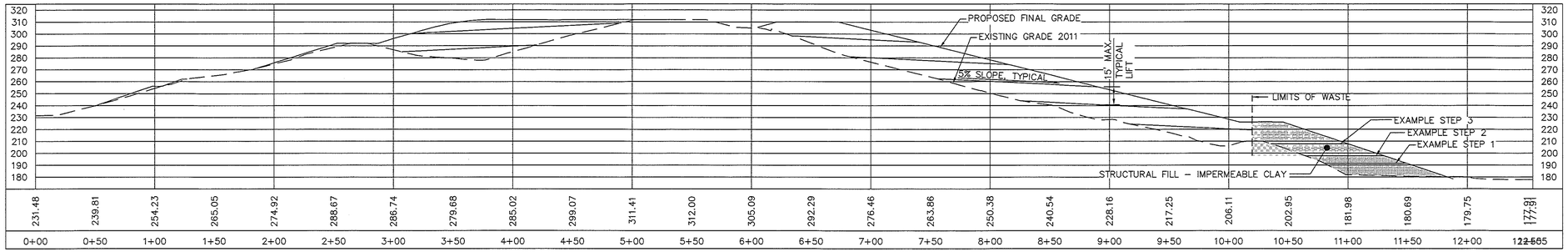
HARNETT COUNTY, NC

Project No:	03002E	File Name:	03023MAS.DWG
Designed By:	CTC Jr.	Drawn By:	WLF
Checked By:	CTC Jr.	Proj. Eng.:	CTC

Sheet Title: CLOSURE DRAINAGE PLAN

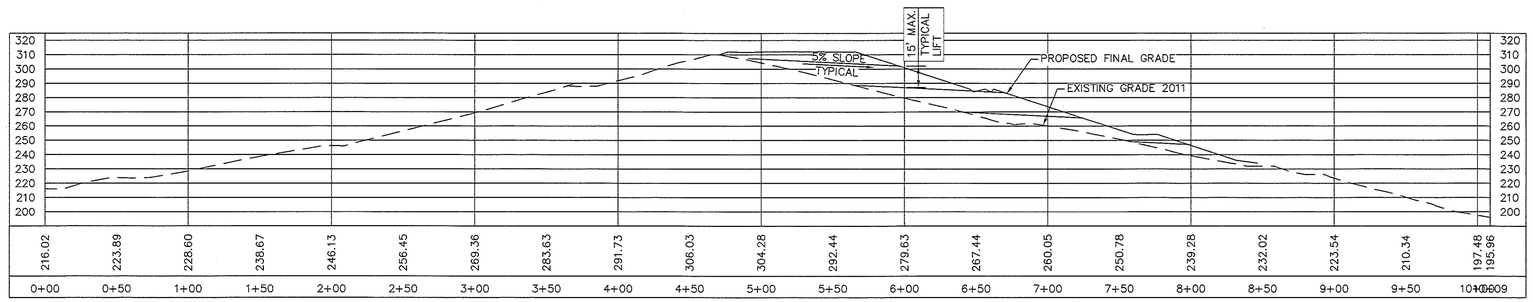
Date: 7/25/13	Sheet 2 OF 7
Scale: 1" = 60'	

P:\003 Harnett County\03023 DELF Permit Renewal\CAD\03023MAS.dwg



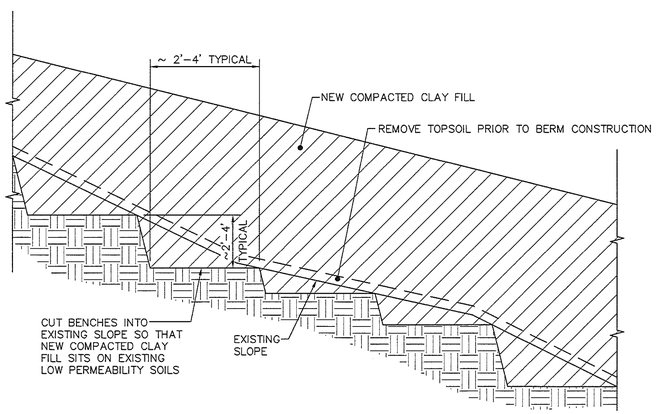
SECTION A-A

SCALE: 1" = 50'



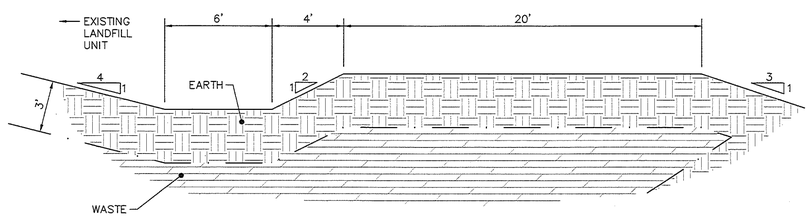
SECTION B-B

SCALE: 1" = 50'



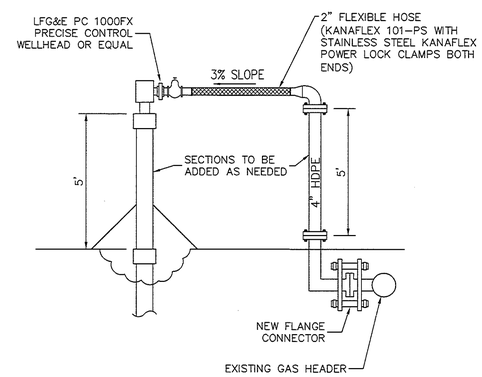
CONTAINMENT BERM CONSTRUCTION DETAIL

NOT TO SCALE



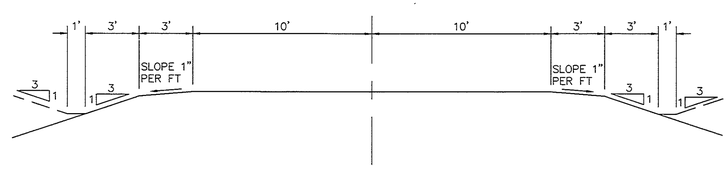
CONTAINMENT BERM TOP DETAIL

SCALE: 1/4" = 1'-0"



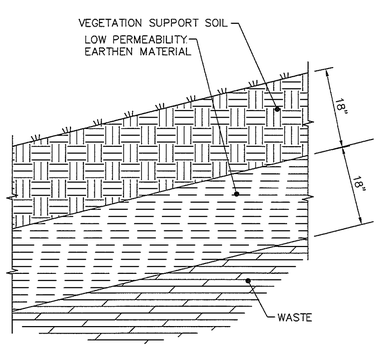
EXISTING GAS WELL EXTENSION DETAIL

NOT TO SCALE



PROPOSED HAUL ROAD DETAIL

SCALE: 1/4" = 1'-0"



TYPICAL CAP DETAIL

NOT TO SCALE

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

General Notes

1. EXAMPLE STEPS ARE FOR VISUALIZATION PURPOSES ONLY. ACTUAL STEPS WILL DIFFER.

No.	Revision/Issue	Date

NORTH CAROLINA PROFESSIONAL SEAL 028909 ENGINEER C. TYRUS CLAYTON, JR.

Signature

7/26/2013

Date

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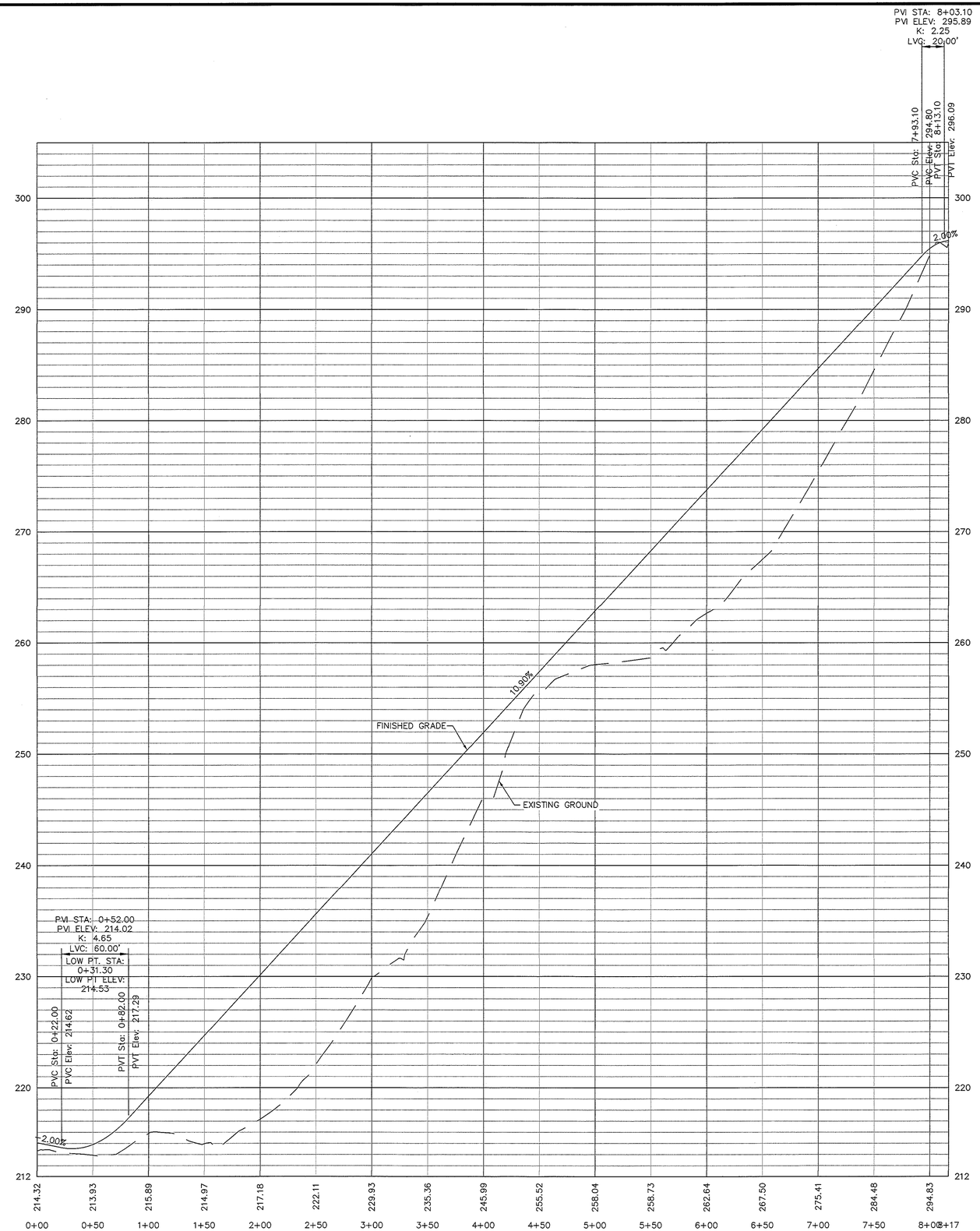
DUNN-ERWIN LANDFILL C&D PIGGYBACK MODIFICATION PLAN

HARNETT COUNTY, NC

Project No:	03002E	File Name:	03023MAS.DWG
Designed By:	CTC Jr.	Drawn By:	WLF
Checked By:	CTC Jr.	Proj. Eng.:	CTC
Sheet Title	CLOSURE SECTIONS & DETAILS		
Date	7/25/13	Sheet	3 OF 7
Scale	AS NOTED		

P:\003 Harnett County\03023 DELF Permit Renewal\CAD\03023MAS.dwg



HAUL ROAD PROFILE

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 5'

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

General Notes

No.	Revision/Issue	Date

NORTH CAROLINA PROFESSIONAL SEAL 026809 ENGINEER C. TYRUS CLAYTON, JR.

Signature: C. Tyrus Clayton Jr.
Date: 7/26/2013

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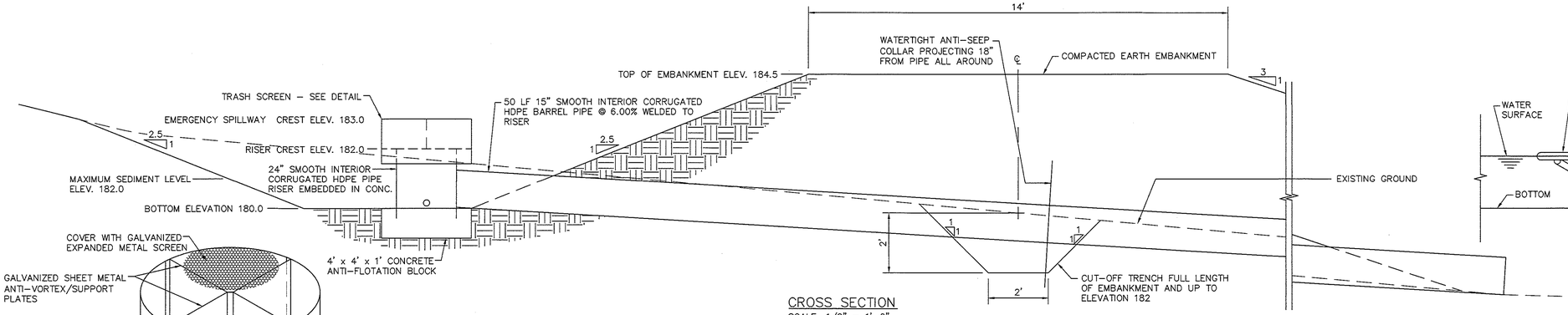
DUNN-ERWIN LANDFILL C&D
PIGGYBACK MODIFICATION
PLAN

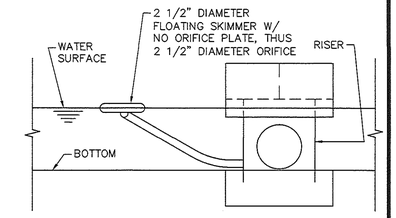
HARNETT COUNTY, NC

Project No:	03002E	File Name:	03023MAS.DWG
Designed By:	CTC Jr.	Drawn By:	WLF
Checked By:	CTC Jr.	Proj. Eng.:	CTC
Sheet Title	PROPOSED HAUL ROAD PROFILE		
Date	7/25/13	Sheet	4 OF 7
Scale	AS NOTED		

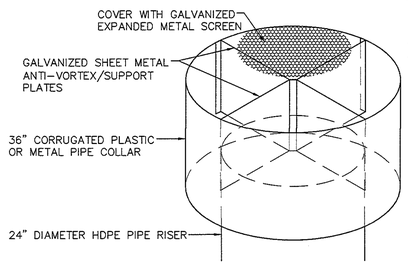
P:\003 Harnett County\03023 DELF Permit Renewal\CAD\03023MAS.dwg



CROSS SECTION
SCALE: 1/2" = 1'-0"



SECTION DETAIL AT SKIMMER
SCALE: 1/2" = 1'-0"



TRASH SCREEN DETAIL
NOT TO SCALE

SPECIFICATIONS

1. SITE PREPARATIONS - CLEAR, GRUB, AND STRIP TOPSOIL FROM AREAS UNDER THE EMBANKMENT TO REMOVE TREES, VEGETATION, ROOTS, AND OTHER OBJECTIONABLE MATERIAL. DELAY CLEARING THE POOL AREA UNTIL THE DAM IS COMPLETE AND THEN REMOVE BRUSH, TREES, AND OTHER OBJECTIONABLE MATERIALS TO FACILITATE SEDIMENT CLEANOUT. STOCKPILE ALL TOPSOIL OR SOIL CONTAINING ORGANIC MATTER FOR USE ON THE OUTER SHELL OF THE EMBANKMENT TO FACILITATE VEGETATIVE ESTABLISHMENT. PLACE TEMPORARY SEDIMENT CONTROL MEASURES BELOW THE BASIN AS NEEDED.

2. CUT-OFF TRENCH - EXCAVATE A CUT-OFF TRENCH ALONG THE CENTER LINE OF THE EARTH FILL EMBANKMENT. CUT THE TRENCH TO STABLE SOIL MATERIAL, BUT IN NO CASE MAKE IT LESS THAN 2 FEET DEEP. THE CUT-OFF TRENCH MUST EXTEND INTO BOTH ABUTMENTS TO AT LEAST THE ELEVATION OF THE RISER CREST, OR THE SPILLWAY CREST IF THERE IS NO RISER. MAKE THE MINIMUM BOTTOM WIDTH WIDE ENOUGH TO PERMIT OPERATION OF EXCAVATION AND COMPACTION EQUIPMENT, BUT IN NO CASE LESS THAN 2 FEET. MAKE SIDE SLOPES OF THE TRENCH NO STEEPER THAN 1:1. COMPACTION REQUIREMENTS ARE THE SAME AS THOSE FOR THE EMBANKMENT. KEEP THE TRENCH DRY DURING BACKFILLING AND COMPACTION OPERATIONS.

3. EMBANKMENT - TAKE FILL MATERIAL FROM THE APPROVED AREAS SHOWN ON THE PLANS. IT SHOULD BE CLEAN MINERAL SOIL, FREE OF ROOTS, WOODY VEGETATION, ROCKS, AND OTHER OBJECTIONABLE MATERIAL. SCARIFY AREAS ON WHICH FILL IS TO BE PLACED BEFORE PLACING FILL. THE FILL MATERIAL MUST CONTAIN SUFFICIENT MOISTURE SO IT CAN BE FORMED BY HAND INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL IT IS TOO WET FOR PROPER COMPACTION. PLACE FILL MATERIAL IN 6 TO 8 INCH CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL AREA AND COMPACT IT. COMPACTION MAY BE OBTAINED BY ROUTING THE CONSTRUCTION HAULING EQUIPMENT OVER THE FILL TO THAT THE ENTIRE SURFACE OF EACH LAYER IS TRAVERSED BY AT LEAST ON WHEEL OR TREAD TRACK OF HEAVY EQUIPMENT, OR A COMPACTOR MAY BE USED. CONSTRUCT THE EMBANKMENT TO AN ELEVATION 10 PERCENT HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLING.

4. CONDUIT SPILLWAYS - SECURELY ATTACH THE RISER TO THE BARREL OR BARREL STUB TO MAKE A WATERTIGHT STRUCTURAL CONNECTION. SECURE ALL CONNECTIONS BETWEEN BARREL SECTIONS BY APPROVED WATERTIGHT ASSEMBLIES. PLACE THE BARREL AND RISER ON A FIRM, SMOOTH FOUNDATION OF IMPERVIOUS SOIL. DO NO USE PERVIOUS MATERIAL SUCH AS SAND, GRAVEL, OR CRUSHED STONE AS BACKFILL AROUND THE PIPE OR ANTI-SEEP COLLARS. PLACE THE FILL MATERIAL AROUND THE PIPE SPILLWAY IN 4-INCH LAYERS, AND COMPACT IT UNDER AND AROUND THE PIPE TO AT LEAST THE SAME DENSITY AS THE ADJACENT EMBANKMENT. CARE MUST BE TAKEN NOT TO RAISE THE PIPE FROM FIRM CONTACT WITH ITS FOUNDATION WHEN COMPACTING UNDER THE PIPE HAUNCHES.

PLACE A MINIMUM OF 2 FEET OF COMPACTED BACKFILL OVER THE PIPE SPILLWAY BEFORE CROSSING IT WITH CONSTRUCTION EQUIPMENT. ANCHOR THE RISER IN PLACE BY CONCRETE OR OTHER SATISFACTORY MEANS TO PREVENT FLOTATION. IN NO CASE SHOULD THE PIPE CONDUIT BE INSTALLED BY CUTTING A TRENCH THROUGH THE DAM AFTER THE EMBANKMENT IS COMPLETE.

5. EMERGENCY SPILLWAY - INSTALL THE EMERGENCY SPILLWAY IN UNDISTURBED SOIL. THE ACHIEVEMENT OF PLANNED ELEVATIONS, GRADE, DESIGN WIDTH, AND ENTRANCE AND EXIT CHANNEL SLOPES ARE CRITICAL TO THE SUCCESSFUL OPERATION OF THE EMERGENCY SPILLWAY.

6. INLETS - DISCHARGE WATER INTO THE BASIN IN A MANNER TO PREVENT EROSION. USE DIVERSIONS WITH OUTLET PROTECTION TO DIVERT SEDIMENT-LADEN WATER TO THE UPPER END OF THE POOL TO IMPROVE BASIN TRAP EFFICIENCY.

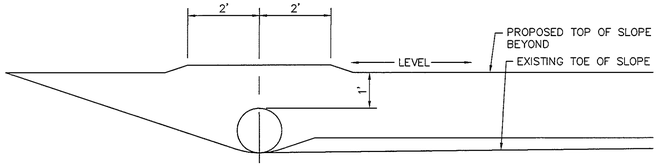
7. EROSION CONTROL - CONSTRUCT THE STRUCTURE SO THAT THE DISTURBED AREA IS MINIMIZED. DIVERT SURFACE WATER AWAY FROM BARE AREAS. COMPLETE THE EMBANKMENT BEFORE THE AREA IS CLEARED. STABILIZE THE EMERGENCY SPILLWAY EMBANKMENT AND ALL OTHER DISTURBED AREAS ABOVE THE CREST OF THE PRINCIPAL SPILLWAY IMMEDIATELY AFTER CONSTRUCTION.

MAINTENANCE

INSPECT TEMPORARY SEDIMENT BASINS AFTER EACH SIGNIFICANT (1/2 INCH OR GREATER) RAINFALL EVENT AND REPAIR IMMEDIATELY. REMOVE SEDIMENT AND RESTORE THE BASIN TO ITS ORIGINAL DIMENSIONS WHEN IT ACCUMULATES TO ONE-HALF THE DESIGN DEPTH. PLACE REMOVED SEDIMENT IN AREAS WITH SEDIMENT CONTROLS.

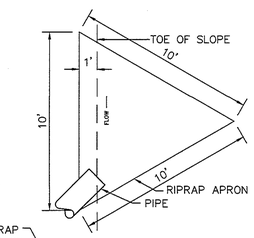
CHECK THE EMBANKMENT, SPILLWAYS, AND OUTLET FOR EROSION DAMAGE, AND INSPECT THE EMBANKMENT FOR PIPING AND SETTLEMENT. MAKE ALL NECESSARY REPAIRS IMMEDIATELY. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE RISER AND POOL AREA.

SEDIMENT BASIN DETAIL



CROSS SECTION
SCALE: 1/2" = 1'-0"

LONGITUDINAL SECTION
SCALE: 1/2" 1'-0"



PLAN DETAIL AT OUTLET
SCALE: 1/4" = 1'-0"

SPECIFICATIONS

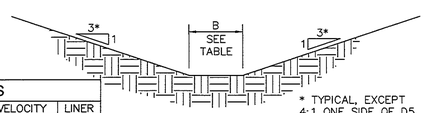
A COMMON FAILURE OF SLOPE DRAINS IS CAUSED BY WATER SATURATING THE SOIL AND SEEPING ALONG THE PIPE. THIS CREATES VOIDS FROM CONSOLIDATION AND PIPING AND CAUSES WASHOUTS. PROPER BACKFILLING AROUND AND UNDER THE PIPE "HAUNCHES" WITH STABLE SOIL MATERIAL AND HAND COMPACTING IN 6-INCH LIFTS TO ACHIEVE FIRM CONTACT BETWEEN THE PIPE AND THE SOIL AT ALL POINTS WILL ELIMINATE THIS TYPE OF FAILURE.

1. PLACE SLOPE DRAINS ON UNDISTURBED SOIL OR WELL COMPACTED FILL AT LOCATIONS AND ELEVATIONS SHOWN ON THE PLAN.
2. SLIGHTLY SLOPE THE SECTION OF PIPE UNDER THE DIKE TOWARD ITS OUTLET.
3. HAND TAMP THE SOIL UNDER AND AROUND THE ENTRANCE SECTION IN LIFTS NOT TO EXCEED 6 INCHES.
4. ENSURE THAT ALL SLOPE DRAIN CONNECTIONS ARE WATERTIGHT.
5. ENSURE THAT ALL FILL MATERIAL IS WELL COMPACTED.
6. ADEQUATELY PROTECT THE DRAIN OUTLET FROM EROSION.
7. MAKE THE SETTLED,COMPACTED DIKE RIDGE NO LESS THAN ONE FOOT ABOVE THE TOP OF THE PIPE AT EVERY POINT.
8. IMMEDIATELY STABILIZE ALL DISTURBED AREAS FOLLOWING CONSTRUCTION.

MAINTENANCE

INSPECT THE SLOPE DRAIN AND SUPPORTING DIVERSION AFTER EVERY RAINFALL, AND PROMPTLY MAKE NECESSARY REPAIRS. WHEN THE PROTECTED AREA HA BEEN PERMANENTLY STABILIZED, TEMPORARY MEASURES MAY BE REMOVED, MATERIALS DISPOSED OF PROPERLY, AND ALL DISTURBED AREAS STABILIZED APPROPRIATELY.

SLOPE DRAIN DETAIL



DIMENSIONS					
NO.	DEPTH	B	SLOPE	VELOCITY	LINER
D1	0.76'	0	3.0%	1.86 ft/sec	S75**
D2	0.42'	0	8.7%	1.24 ft/sec	S75**
D3	0.79'	0.5'	2.9%	2.38 ft/sec	S75**
D4	0.46'	3.0'	2.0%	1.14 ft/sec	NONE
D5	0.28'	1.0'	10.9%	1.86 ft/sec	S75**
D6	0.70'	0	1.0%	0.49 ft/sec	NONE
D7	0.78'	0	1.0%	0.72 ft/sec	NONE
D8	0.82'	0	2.5%	1.98 ft/sec	NONE
D9	0.69'	0.5'	2.9%	0.87 ft/sec	NONE

* TYPICAL, EXCEPT 4:1 ONE SIDE OF D5, 18:1 ONE SIDE OF D6 & D7

** NORTH AMERICAN GREEN CATALOG NO. – APPROVED SUBSTITUTE BY OTHER MANUFACTURER MAY BE USED

CONSTRUCTION

1. REMOVE AND PROPERLY DISPOSE OF ALL TREES, BRUSH, STUMPS OR OTHER OBJECTIONABLE MATERIAL. FILL AND COMPACT ALL DITCHES, SWALES OR GULLIES THAT WILL BE CROSSED TO NATURAL GROUND LEVEL OR ABOVE.
2. JUST BEFORE PLACEMENT OF FILL, THE BASE OF THE RIDGE SHOULD BE DISKED BY MACHINERY.
3. EXCAVATE, SHAPE AND STABILIZE THE DIVERSION TO LINE, GRADE AND CROSS SECTION, AS SHOWN ON THE DRAWINGS.
4. SEED AND MULCH IMMEDIATELY UPON COMPLETION.

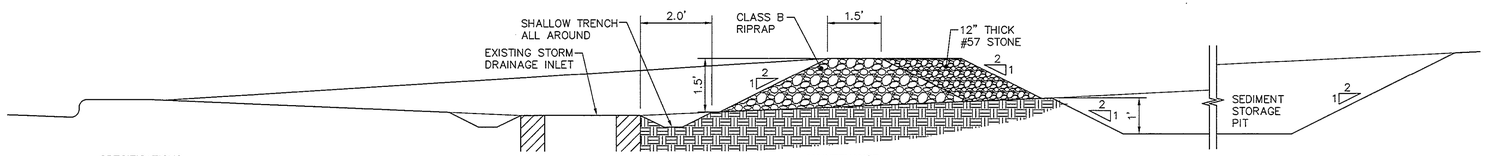
MAINTENANCE

1. INSPECT PERMANENT DIVERSIONS AFTER EVERY RAINFALL DURING THE CONSTRUCTION OPERATION. IMMEDIATELY REMOVE ANY OBSTRUCTIONS FROM THE FLOW AREA AND REPAIR THE DIVERSION RIDGE. CHECK OUTLETS AND MAKE TIMELY REPAIRS AS NEEDED. MAINTAIN THE VEGETATION IN A VIGOROUS, HEALTHY CONDITION AT ALL TIMES.

TYPICAL VEGETATED SWALE DETAIL

SCALE: 1/4" = 1'-0"

PERMIT DRAWINGS
NOT FOR CONSTRUCTION



SPECIFICATIONS

1. CLEAR THE AREA OF ALL DEBRIS THAT MIGHT HINDER EXCAVATION AND DISPOSAL OF SPOIL.
2. GRADE SHALLOW DEPRESSION UNIFORMLY TOWARDS THE INLET WITH SIDE SLOPES NO GREATER THAN 2:1. GRADE A 1-FOOT WIDE LEVEL AREA SET 4 INCHES BELOW THE AREA ADJACENT TO THE INLET.
3. INSTALL CLASS BE OR CLASS I RIPRAP IN A CIRCLE AROUND THE INLET. THE MINIMUM CREST WIDTH OF THE RIPRAP SHOULD BE18 INCHES, WITH A MINIMUM BOTTOM WIDTH OF 7.5 FEET. THE MINIMUM HEIGHT OF THE STONE IS 2 FEET.
4. THE OUTSIDE FACE OF THE RIPRAP IS THEN LINED WITH 12 INCHES OF NC DOT #5 OR #57 WASHED STONE.

MAINTENANCE

INSPECT ROCK DOUGHNUT INLET PROTECTION AT LEAST WEEKLY AND AFTER EVERY SIGNIFICANT (1/2 INCH OR GREATER) RAINFALL AND REPAIR IMMEDIATELY.

TO PROVIDE SATISFACTORY INLET PROTECTION EFFICIENCY, REMOVE SEDIMENT FROM THE SEDIMENT POOL AREA WHEN THE VOLUME IS DECREASED BY HALF. THIS WILL HELP PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN. STABILIZE EXCAVATED MATERIAL APPROPRIATELY.

TAKE CARE NOT TO DAMAGE OR UNDERCUT THE STRUCTURE DURING SEDIMENT REMOVAL. REMOVE DEBRIS FROM THE INLET AND REPLACE STONE AS NEEDED. IF THE INLET WAS COVERED WITH WIRE MESH THE MESH SHOULD BE CLEANED OF DEBRIS.

WHEN THE CONTRIBUTING DRAINAGE AREA HA BEEN PERMANENTLY STABILIZED, REMOVE ALL MATERIALS AND DISPOSE OF SEDIMENT PROPERLY. BRING THE DISTURBED AREA TO THE GRADE OF THE DROP INLET. SMOOTH AND COMPACT IT AS NEEDED.

APPROPRIATELY STABILIZE ALL BARE AREAS AROUND THE INLET WITH GROUND COVER.

INLET PROTECTION

SCALE: 1/2" = 1'-0"

General Notes

No.	Revision/Issue	Date

NORTH CAROLINA PROFESSIONAL SEAL 029809 ENGINEER C. TYRUS CLAYTON, JR.

Signature: C. Tyrus Clayton Jr.
Date: 7/26/2013

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DUNN-ERWIN LANDFILL C&D PIGGYBACK MODIFICATION PLAN

HARNETT COUNTY, NC

Project No:	03002E	File Name:	03023MAS.DWG
Designed By:	CTC Jr.	Drawn By:	WLF
Checked By:	CTC Jr.	Proj. Eng.:	CTC
Sheet Title	DETAILS		
Date	7/25/13	Sheet	5 OF 7
Scale	AS NOTED		

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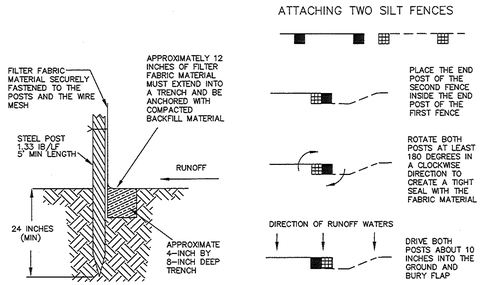
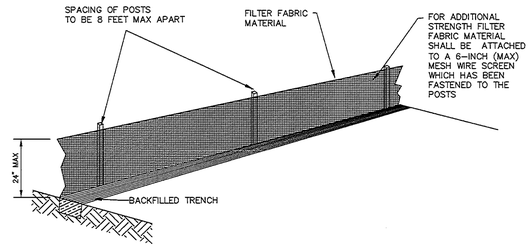




MATERIALS

1. USE A SYNTHETIC FILTER FABRIC OF AT LEAST 95% BY WEIGHT OF POLYOLEFINS OR POLYESTER, WHICH IS CERTIFIED BY THE MANUFACTURER OR SUPPLIER AS CONFORMING TO THE REQUIREMENTS IN ASTM D 6461, WHICH IS SHOWN IN PART IN TABLE 6.62B. SYNTHETIC FILTER FABRIC SHOULD CONTAIN ULTRAVIOLET RAY INHIBITORS AND STABILIZERS TO PROVIDE A MINIMUM OF 6 MONTHS OF EXPECTED USABLE CONSTRUCTION LIFE AT A TEMPERATURE RANGE OF 0 TO 120° F.
2. ENSURE THAT POSTS FOR SEDIMENT FENCES ARE 1.33 LB/LINEAR FT STEEL WITH A MINIMUM LENGTH OF 5 FEET. MAKE SURE THAT STEEL POSTS HAVE PROJECTIONS TO FACILITATE FASTENING THE FABRIC.
3. FOR REINFORCEMENT OF STANDARD STRENGTH FILTER FABRIC, USE WIRE FENCE WITH A MINIMUM 14 GAUGE AND A MAXIMUM MESH SPACING OF 6 INCHES.

CONSTRUCTION

1. CONSTRUCT THE SEDIMENT BARRIER OF STANDARD STRENGTH OR EXTRA STRENGTH SYNTHETIC FILTER FABRICS.
2. ENSURE THAT THE HEIGHT OF THE SEDIMENT FENCE DOES NOT EXCEED 24 INCHES ABOVE THE GROUND SURFACE. (HIGHER FENCES MAY IMPOUND VOLUMES OF WATER SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.)
3. CONSTRUCT THE FILTER FABRIC FROM A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID JOINTS. WHEN JOINTS ARE NECESSARY, SECURELY FASTEN THE FILTER CLOTH ONLY AT A SUPPORT POST WITH 4 FEET MINIMUM OVERLAP TO THE NEXT POST.
4. SUPPORT STANDARD STRENGTH FILTER FABRIC BY WIRE MESH FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS. EXTEND THE WIRE MESH SUPPORT TO THE BOTTOM OF THE TRENCH. FASTEN THE WIRE REINFORCEMENT, THEN FABRIC ON THE UPSLOPE SIDE OF THE FENCE POST. WIRE OR PLASTIC ZIP TIES SHOULD HAVE MINIMUM 50 POUND TENSILE STRENGTH.
5. WHEN A WIRE MESH SUPPORT FENCE IS USED, SPACE POSTS A MAXIMUM OF 8 FEET APART. SUPPORT POSTS SHOULD BE DRIVEN SECURELY INTO THE GROUND A MINIMUM OF 24 INCHES.
6. EXTRA STRENGTH FILTER FABRIC WITH 6 FEET POST SPACING DOES NOT REQUIRE WIRE MESH SUPPORT FENCE. SECURELY FASTEN THE FILTER FABRIC DIRECTLY TO POSTS. WIRE OR PLASTIC ZIP TIES SHOULD HAVE MINIMUM 50 POUND TENSILE STRENGTH.
7. EXCAVATE A TRENCH APPROXIMATELY 4 INCHES WIDE AND 8 INCHES DEEP ALONG THE PROPOSED LINE OF POSTS AND UPSLOPE FROM THE BARRIER (FIGURE 6.62A).
8. PLACE 12 INCHES OF THE FABRIC ALONG THE BOTTOM AND SIDE OF THE TRENCH.
9. BACKFILL THE TRENCH WITH COMPACTED SOIL PLACED OVER THE FILTER FABRIC. THOROUGH COMPACTION OF THE BACKFILL IS CRITICAL TO SILT FENCE PERFORMANCE.
10. DO NOT ATTACH FILTER FABRIC TO EXISTING TREES.

SEDIMENT FENCE INSTALLATION USING THE SLICING METHOD

INSTEAD OF EXCAVATING A TRENCH, PLACING FABRIC AND THEN BACKFILLING TRENCH, SEDIMENT FENCE MAY BE INSTALLED USING SPECIALLY DESIGNED EQUIPMENT THAT INSERTS THE FABRIC INTO A CUT SLICED IN THE GROUND WITH A DISC.

INSTALLATION SPECIFICATIONS

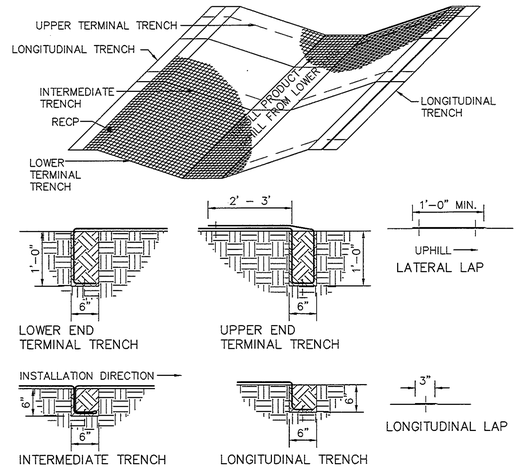
1. THE BASE OF BOTH END POSTS SHOULD BE AT LEAST ONE FOOT HIGHER THAN THE MIDDLE OF THE FENCE. CHECK WITH A LEVEL IF NECESSARY.
2. INSTALL POSTS 4 FEET APART IN CRITICAL AREAS AND 6 FEET APART ON STANDARD APPLICATIONS.
3. INSTALL POSTS 2 FEET DEEP ON THE DOWNSTREAM SIDE OF THE SILT FENCE, AND AS CLOSE AS POSSIBLE TO THE FABRIC, ENABLING POSTS TO SUPPORT THE FABRIC FROM UPSTREAM WATER PRESSURE.
4. INSTALL POSTS WITH THE NIPPLES FACING AWAY FROM THE SILT FABRIC.
5. ATTACH THE FABRIC TO EACH POST WITH THREE TIES, ALL SPACED WITHIN THE TOP 8 INCHES OF THE FABRIC. ATTACH EACH TIE DIAGONALLY 45 DEGREES THROUGH THE FABRIC, WITH EACH PUNCTURE AT LEAST 1 INCH VERTICALLY APART. ALSO, EACH TIE SHOULD BE POSITIONED TO HANG ON A POST NIPPLE WHEN TIGHTENED TO PREVENT SAGGING.
6. WRAP APPROXIMATELY 6 INCHES OF FABRIC AROUND THE END POSTS AND SECURE WITH 3 TIES.
7. NO MORE THAN 24 INCHES OF A 36 INCH FABRIC IS ALLOWED ABOVE GROUND LEVEL.
8. THE INSTALLATION SHOULD BE CHECKED AND CORRECTED FOR ANY DEVIATIONS BEFORE COMPACTION.
9. COMPACTION IS VITALLY IMPORTANT FOR EFFECTIVE RESULTS. COMPACT THE SOIL IMMEDIATELY NEXT TO THE SILT FENCE FABRIC WITH THE FRONT WHEEL OF THE TRACTOR, SKID STEER, OR ROLLER EXERTING AT LEAST 60 POUNDS PER SQUARE INCH. COMPACT THE UPSTREAM SIDE FIRST, AND THEN EACH SIDE TWICE FOR A TOTAL OF 4 TRIPS.

MAINTENANCE

1. INSPECT SEDIMENT FENCES AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL. MAKE ANY REQUIRED REPAIRS IMMEDIATELY.
2. SHOULD THE FABRIC OF A SEDIMENT FENCE COLLAPSE, TEAR, DECOMPOSE OR BECOME INEFFECTIVE, REPLACE IT PROMPTLY.
3. REMOVE SEDIMENT DEPOSITS AS NECESSARY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND TO REDUCE PRESSURE ON THE FENCE. TAKE CARE TO AVOID UNDERMINING THE FENCE DURING CLEANOUT.
4. REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AND BRING THE AREA TO GRADE AND STABILIZE IT AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.

(SF) SEDIMENT FENCE DETAIL

NOT TO SCALE



SPECIFICATIONS

1. GRADE THE SURFACE OF INSTALLATION AREAS SO THAT THE GROUND IS SMOOTH AND LOOSE. WHEN SEEDING PRIOR TO INSTALLATION, FOLLOW THE STEPS FOR SEED BED PREPARATION, SOIL AMENDMENTS AND SEEDING IN SEEDING SPECIFICATION. ALL GULLIES, RILLS AND OTHER DISTURBED AREAS MUST BE FINE GRADED PRIOR TO INSTALLATION. SPREAD SEED BEFORE RECP INSTALLATION. IMPORTANT; REMOVE ALL LARGE ROCKS, DIRT CLODS, STUMPS, ROOTS, GRASS CLUMPS AND OTHER OBSTRUCTIONS FROM THE SOIL SURFACE TO ALLOW FOR DIRECT CONTACT BETWEEN THE SOIL SURFACE AND THE RECP.
2. TERMINAL ANCHOR TRENCHES ARE REQUIRED AT RECP ENDS AND INTERMEDIATE TRENCHES MUST BE CONSTRUCTED ACROSS CHANNELS AT 25–FOOT INTERVALS. TERMINAL ANCHOR TRENCHES SHOULD BE A MINIMUM OF 12 INCHES IN DEPTH AND 6 INCHES IN WIDTH, WHILE INTERMEDIATE TRENCHES NEED BE ONLY 6 INCHES DEEP AND 6 INCHES WIDE.

INSTALLATION IN CHANNELS

3. EXCAVATE TERMINAL TRENCHES ACROSS THE CHANNEL AT THE UPPER AND LOWER ENDS OF THE LINED CHANNEL SECTIONS. AT 25–FOOT INTERVALS ALONG THE CHANNEL, ANCHOR THE RECP ACROSS THE CHANNEL EITHER IN 6 INCH BY 6 INCH TRENCHES OR BY INSTALLING TWO CLOSELY SPACED ROWS OF ANCHORS. EXCAVATE LONGITUDINAL TRENCHES 6 INCHES DEEP AND WIDE ALONG CHANNEL EDGES (ABOVE WATER LINE) IN WHICH TO BURY THE OUTSIDE RECP EDGES. PLACE THE FIRST RECP AT THE DOWNSTREAM END OF THE CHANNEL. PLACE THE END OF THE FIRST RECP IN THE TERMINAL TRENCH AND PIN IT AT 1 FOOT INTERVALS ALONG THE BOTTOM OF THE TRENCH.
NOTE: THE RECP SHOULD BE PLACED UPSIDE DOWN IN THE TRENCH WITH THE ROLL ON THE DOWNSTREAM SIDE OF THE TRENCH.
ONCE PINNED AND BACKFILLED, THE RECP IS DEPLOYED BY WRAPPING OVER THE TOP OF THE TRENCH AND UNROLLING UPSTREAM. IF THE CHANNEL IS WIDER THAN THE PROVIDED ROLLS, PLACE ENDS OF ADJACENT ROLLS IN THE TERMINAL TRENCH, OVERLAPPING THE ADJACENT ROLLS A MINIMUM OF 3 INCHES. PIN AT 1 FOOT INTERVALS, BACKFILL AND COMPACT. UNROLL THE RECP IN THE UPSTREAM DIRECTION UNTIL REACHING THE FIRST INTERMEDIATE TRENCH. FOLD THE RECP BACK OVER ITSELF, POSITIONING THE ROLL ON THE DOWNSTREAM SIDE OF THE TRENCH, AND ALLOW THE MAT TO CONFORM TO THE TRENCH.
THEN PIN THE RECP (TWO LAYERS) TO THE BOTTOM OF THE TRENCH, BACKFILL AND COMPACT. CONTINUE UP THE CHANNEL (WRAPPING OVER THE TOP OF THE INTERMEDIATE TRENCH) REPEATING THIS STEP AT OTHER INTERMEDIATE TRENCHES, UNTIL REACHING THE UPPER TERMINAL TRENCH. AT THE UPPER TERMINAL TRENCH, ALLOW THE RECP TO CONFORM TO THE TRENCH, SECURE WITH PINS OR STAPLES, BACKFILL, COMPACT AND THEN BRING THE MAT BACK OVER THE TOP OF THE TRENCH AND ONTO THE EXISTING MAT (2 TO 3 FEET OVERLAP IN THE DOWNSTREAM DIRECTION), AND PIN AT 1 FOOT INTERVALS ACROSS THE RECP. WHEN STARTING INSTALLATION OF A NEW ROLL, BEGIN IN A TRENCH OR SINGLE–LAP ENDS OF ROLLS A MINIMUM OF 1 FOOT WITH UPSTREAM RECP ON TOP TO PREVENT UPLIFTING. PLACE THE OUTSIDE EDGES OF THE RECP(S) IN LONGITUDINAL TRENCHES, PIN, BACKFILL, AND COMPACT.

ANCHORING DEVICES

4. 11 GAUGE, AT LEAST 6 INCHES LENGTH BY 1 INCH WIDTH STAPLES OR 12 INCH MINIMUM LENGTH WOODEN STAKES ARE RECOMMENDED FOR ANCHORING THE RECP TO THE GROUND.
DRIVE STAPLES OR PINS SO THAT THE TOP OF THE STAPLE OR PIN IS FLUSH WITH THE GROUND SURFACE. ANCHOR EACH RECP EVERY 3 FEET ALONG ITS CENTER. LONGITUDINAL OVERLAPS MUST BE SUFFICIENT TO ACCOMMODATE A ROW OF ANCHORS AND UNIFORM ALONG THE ENTIRE LENGTH OF OVERLAP AND ANCHORED EVERY 3 FEET ALONG THE OVERLAP LENGTH. ROLL ENDS MAY BE SPLICED BY OVERLAPPING 1 FOOT (IN THE DIRECTION OF WATER FLOW), WITH THE UPSTREAM/USLOPE MAT PLACED ON TOP OF THE DOWNNSTREAM/ DOWNSLOPE RECP. THIS OVERLAP SHOULD BE ANCHORED AT 1 FOOT SPACING ACROSS THE RECP. WHEN INSTALLING MULTIPLE WIDTH MATS HEAT SEAMED IN THE FACTORY, ALL FACTORY SEAM AND FIELD OVERLAPS SHOULD BE SIMILARLY ANCHORED.

MAINTENANCE

4. INSPECT ROLLED EROSION CONTROL PRODUCTS AT LEAST WEEKLY AND AFTER EACH SIGNIFICANT (1/2 INCH OR GREATER) RAINFALL EVENT. REPAIR IMMEDIATELY.
5. GOOD CONTACT WITH THE GROUND MUST BE MAINTAINED, AND EROSION MUST NOT OCCUR BENEATH THE RECP. ANY AREAS OF THE RECP THAT ARE DAMAGED OR NOT IN CLOSE CONTACT WITH THE GROUND SHALL BE REPAIRED AND STAPLED.
6. IF EROSION OCCURS DUE TO POORLY CONTROLLED DRAINAGE, THE PROBLEM SHALL BE FIXED AND THE ERODED AREA PROTECTED.
7. MONITOR AND REPAIR THE RECP AS NECESSARY UNTIL GROUND COVER IS ESTABLISHED.

ROLLED EROSION CONTROL PRODUCTS (RECP)

TEMPORARY & PERMANENT SEEDING (TS) (PS)

TEMPORARY SEEDING SCHEDULE

DATES	SPECIES	RATE (LB/ACRE)
JAN 1 - MAY 1	RYE (GRAIN)	120
	KOBE LESPEDEZA	50
MAY 1 - AUG 15	GERMAN MILLET	40
AUG 15 - DEC 31	RYE (GRAIN)	120

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 2000 LB/ACRE SMALL GRAIN STRAW AND TACK WITH ASPHALT OR CRIMP.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE. TOPDRESS RYE SEEDED IN FALL OR EARLY WINTER WITH 50 LB/ACRE OF NITROGEN IN MARCH. IF IT IS NECESSARY TO EXTEND TEMPORARY COVER OF RYE BEYOND JUNE 15, OVERSEED WITH 50 LB/ACRE KOBE LESPEDEZA IN LATE FEBRUARY OR EARLY MARCH. MOW RYE USED FOR TEMPORARY COVER PRIOR TO SEEDING PERMANENT COVER.

PERMANENT SEEDING SCHEDULE FOR GRASS-LINED CHANNELS

DATES	SPECIES	RATE (LB/ACRE)
BEST AUG 15 - OCT 31 POSSIBLE FEB 1 - APR 15	TALL FESCUE	200

NURSE PLANTS
PRIOR TO MAY 1 OR AFTER AUG 15, ADD 40 LB/ACRE RYE (GRAIN).

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 4,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 1000 LB/ACRE 10-10-10 FERTILIZER. OPERATE TILLAGE EQUIPMENT ACROSS THE WATERWAY.

MULCH
USE A ROLLED EROSION CONTROL PRODUCT TO COVER THE BOTTOM OF CHANNELS AND DITCHES AND STAPLE SECURELY. THE LINING SHOULD EXTEND ABOVE THE HIGHEST CALCULATED DEPTH OF FLOW.

MAINTENANCE
INSPECT AND REPAIR MULCH FREQUENTLY. REFERTILIZE IN LATE WINTER OF THE FOLLOWING YEAR. FOLLOW RECOMMENDATIONS OF SOIL TESTS OR USE 150 LB/ACRE OF 10-10-10. MOW REGULARLY TO A HEIGHT OF 2-4 INCHES.

PERMANENT SEEDING SCHEDULE FOR AREAS OTHER THAN CHANNELS

SPECIES	RATE (LB/ACRE) 3:1 AND STEEPER SLOPES	SLOPES FLATTER THAN 3:1
TALL FESCUE	100	80
SERICEA LESPEDEZA	30	20
KOBE LESPEDEZA	10	10

AFTER AUGUST 15 USE UNSCARIFIED SERICEA SEED.

NURSE PLANTS
PRIOR TO MAY 1 OR AFTER AUG 15, ADD 40 LB/ACRE RYE (GRAIN).

SEEDING DATES

	BEST	POSSIBLE
FALL:	AUG 25 - SEP 15	AUG 20 - OCT 25
LATE WINTER:	FEB 15 - MAR 21	FEB 1 - APR 15

FALL IS BEST FOR TALL FESCUE AND LATE WINTER FOR LESPEDEZAS. OVERSEEDING OF KOBE LESPEDEZA OVER FALL-SEEDED TALL FESCUE IS VERY EFFECTIVE.

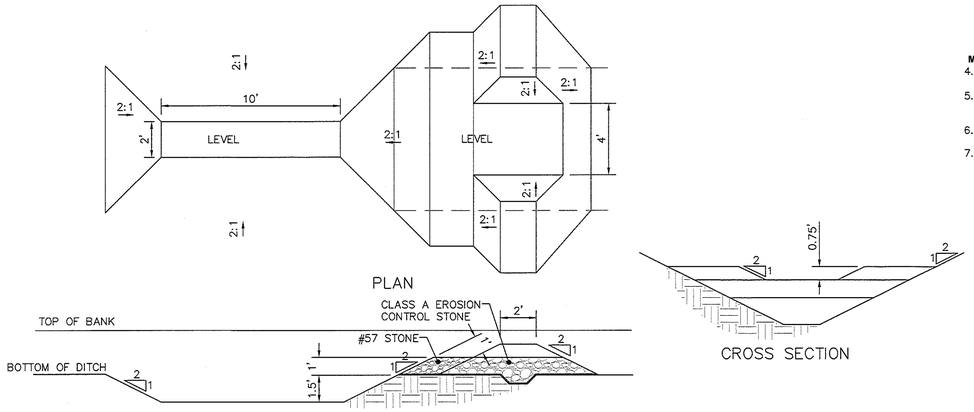
SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 4,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 1000 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 2,000 LB/ACRE GRAIN STRAW. ANCHOR BY TACKING WITH ASPHALT OR CRIMPING. ON SLOPE 3:1 OR STEEPER ANCHOR STRAW WITH NETTING.

MAINTENANCE
REFERTILIZE IN THE SECOND YEAR UNLESS GROWTH IS FULLY ADEQUATE. MAY BE MOWED ONCE OR TWICE A YEAR, BUT MOWING IS NOT NECESSARY. REFERTILIZE, RESEED AND MULCH DAMAGED AREAS IMMEDIATELY.

SPECIFICATIONS

1. PLOW COMPACTED AREAS 6 INCHES DEEP.
2. APPLY TOPSOIL IF AVAILABLE.
3. APPLY LIME AND FERTILIZER UNIFORMLY AND INCORPORATE INTO THE TOP 4-6 INCHES OF SOIL. IF A HYDRAULIC SEEDER IS USED, DO NOT MIX SEED AND FERTILIZER MORE THAN 30 MINUTES BEFORE APPLICATION.
4. UNLESS HYDROSEEDING IS USED, BREAK UP LARGE CLODS. LOOSEN THE SURFACE IMMEDIATELY BEFORE SEEDING BY RAKING, DISKING, HARROWING OR OTHER SUITABLE METHODS. REMOVE ALL STONES LARGER THAN 3 INCHES ON ANY SIDE, STICKS AND ROOT. COMPACT SOIL WITH A CULTIPACKER ROLLER. GROOVE OR FURROW SLOPES STEEPER THAN 3:1 ON THE CONTOUR BEFORE SEEDING.
5. EVENLY APPLY SEED USING A CYCLONE SEEDER (BROADCAST), DRILL, CULTIPACKER SEEDER OR HYDROSEEDER. SMALL GRAINS SHOULD BE PLANTED NO MORE THAN ONE INCH DEEP, GRASSES AND LEGUMES NO MORE THAN 1/2 INCH.
6. BROADCAST SEED MUST BE COVERED BY RAKING OR CHAIN DRAGGING AND THEN LIGHTLY FIRMED WITH A CULTIPACKER ROLLER. HYDROSEEDED MIXTURES SHOULD INCLUDE A WOOD FIBER (CELLULOSE) MULCH.
7. IN AREAS NOT HYDROSEEDED, MULCH WITH GRAIN STRAW AND TACK. SEE SEEDING SCHEDULES.



SPECIFICATIONS

1. PLACE STRUCTURAL STONE TO THE LINES AND DIMENSIONS SHOWN ON A FILTER FABRIC FOUNDATION.
2. PLACE #57 STONE ON THE UPSTREAM SIDE OF THE DAM THAT IS A MINIMUM OF 1 FOOT THICK.
3. EXCAVATE SEDIMENT STORAGE AREA TO THE DIMENSIONS SHOWN.

MAINTENANCE

INSPECT SEDIMENT TRAP AT LEAST WEEKLY AND AFTER EACH SIGNIFICANT (1/2 INCH OR GREATER) RAINFALL EVENT AND REPAIR IMMEDIATELY. CLEAN OUT SEDIMENT, STRAW, LIMBS, OR OTHER DEBRIS.

ANTICIPATE SUBMERGENCE AND DEPOSITION ABOVE THE CHECK DAM AND EROSION FROM HIGH FLOWS AROUND THE EDGES OF THE DAM. CORRECT ALL DAMAGE IMMEDIATELY.

REMOVE ACCUMULATED SEDIMENT WHEN PIT IS 1/2 FULL. ADD STONES TO DAM AS NEEDED TO MAINTAIN DESIGN HEIGHT AND CROSS SECTION.

(DT) CHECK DAM WITH WEIR & SEDIMENT TRAP

SCALE: 1/4" = 1'-0"

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

General Notes

No.	Revision/Issue	Date

NORTH CAROLINA PROFESSIONAL SEAL 025803 ENGINEER C. TYRUS CLAYTON, JR.

Signature

7/26/2013
Date

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DUNN-ERWIN LANDFILL C&D PIGGYBACK MODIFICATION PLAN

HARNETT COUNTY, NC

Project No:	03002E	File Name:	03023MAS.DWG
Designed By:	CTC Jr.	Drawn By:	WLF
Checked By:	CTC Jr.	Proj. Eng.:	CTC

Sheet Title: DETAILS

Date 7/25/13	Sheet 6 OF 7
Scale AS NOTED	

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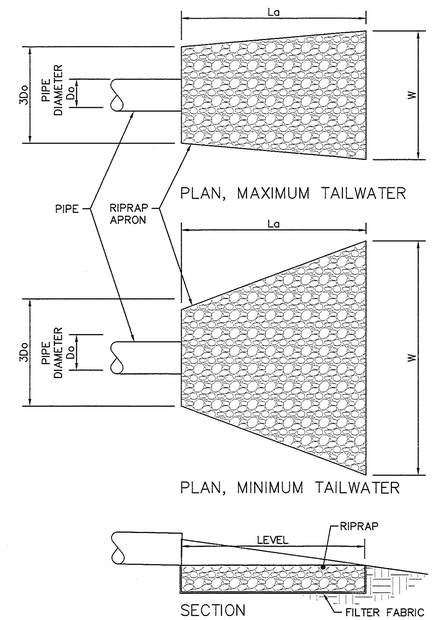

OUTLET PROTECTION DIMENSIONS						
NUMBER	TAILWATER CONDITION	Do	La	W	RIPRAP SIZE	APRON THICKNESS
OP3	MAXIMUM	15"	30'	13'	CLASS A	9"
OP5	MINIMUM	15"	13'	14'	CLASS A	9"
OP6	MINIMUM	15"	17'	18'	CLASS B	18"

NPDES Stormwater Discharge Permit for Construction Activities (NCGO1) NCDENR/Division of Water Quality

NEW STABILIZATION TIMEFRAMES
(Effective Aug. 3, 2011)

SITE AREA DESCRIPTION	STABILIZATION	TIMEFRAME EXCEPTIONS
Perimeter dikes, swales, ditches, slopes	7 days	None
High Quality Water (HQW) Zones	7 days	None
Slopes steeper than 3:1	7 days	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed.
Slopes 3:1 or flatter	14 days	7 days for slopes greater than 50' in length.
All other areas with slopes flatter than 4:1	14 days	None, except for perimeters and HQW Zones.

SPECIFICATIONS

1. ENSURE THAT THE SUBGRADE FOR THE FILTER AND RIPRAP FOLLOWS THE REQUIRED LINES AND GRADES SHOWN IN THE PLAN. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO THE DENSITY OF THE SURROUNDING UNDISTURBED MATERIAL. LOW AREAS IN THE SUBGRADE ON UNDISTURBED SOIL MAY ALSO BE FILLED BY INCREASING THE RIPRAP THICKNESS.
2. THE RIPRAP AND GRAVEL FILTER MUST CONFORM TO THE SPECIFIED GRADING LIMITS SHOWN ON THE PLANS.
3. FILTER CLOTH, WHEN USED, MUST MEET DESIGN REQUIREMENTS AND BE PROPERLY PROTECTED FROM PUNCHING OR TEARING DURING INSTALLATION. REPAIR ANY DAMAGE BY REMOVING THE RIPRAP AND PLACING ANOTHER PIECE OF FILTER CLOTH OVER THE DAMAGED AREA. ALL CONNECTING JOINTS SHOULD OVERLAP A MINIMUM OF 1 FT. IF THE DAMAGE IS EXTENSIVE, REPLACE THE ENTIRE FILTER CLOTH.
4. RIPRAP MAY BE PLACED BY EQUIPMENT, BUT TAKE CARE TO AVOID DAMAGING THE FILTER.
5. THE MINIMUM THICKNESS OF THE RIPRAP SHOULD BE 1.5 TIMES THE MAXIMUM STONE DIAMETER.
6. RIPRAP MAY BE FIELD STONE OR ROUGH QUARRY STONE. IT SHOULD BE HARD, ANGULAR, HIGHLY WEATHER-RESISTANT AND WELL GRADED.
7. CONSTRUCT THE APRON ON ZERO GRADE WITH NO OVERFALL AT THE END. MAKE THE TOP OF THE RIPRAP AT THE DOWNSTREAM END LEVEL WITH THE RECEIVING AREA OR SLIGHTLY BELOW IT.
8. ENSURE THAT THE APRON IS PROPERLY ALIGNED WITH THE RECEIVING STREAM AND PREFERABLY STRAIGHT THROUGHOUT ITS LENGTH. IF A CURVE IS NEEDED TO FIT SITE CONDITIONS, PLACE IT IN THE UPPER SECTION OF THE APRON.IMMEDIATELY AFTER CONSTRUCTION, STABILIZE ALL DISTURBED AREAS WITH VEGETATION.

MAINTENANCE

1. INSPECT RIP-RAP OUTLET STRUCTURES WEEKLY AND AFTER SIGNIFICANT (1/2 INCH OR GREATER) RAINFALL EVENTS TO SEE IF ANY EROSION AROUND OR BELOW THE RIP-RAP HAS TAKEN PLACE, OR IF STONES HAVE BEEN DISLODGED. PROMPTLY MAKE ALL NEEDED REPAIRS TO PREVENT FURTHER DAMAGE.

OP PIPE OUTLET PROTECTION

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

General Notes

No.	Revision/Issue	Date

NORTH CAROLINA PROFESSIONAL SEAL 028909 ENGINEER C. TYRUS CLAYTON, JR.

Signature

Date 7/26/2013

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DUNN-ERWIN LANDFILL C&D PIGGYBACK MODIFICATION PLAN

HARNETT COUNTY, NC

Project No:	03002E	File Name:	03023MAS.DWG
Designed By:	CTC Jr.	Drawn By:	WLF
Checked By:	CTC Jr.	Proj. Eng.:	CTC
Sheet Title	DETAILS		
Date	7/25/13	Sheet	7 OF 7
Scale	AS NOTED		

P:\003 Harnett County\03023 DELF Permit Renewal\CAD\03023MAS.dwg

APPENDIX V

Slope Stability Evaluation

Slope Stability Evaluation

Dunn-Erwin C&D Landfill Expansion
Harnett County, North Carolina

Prepared for:

Draper Aden Associates
Richmond, Virginia

May 2013

Prepared by:

NC LIC. NO. C-0628 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

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Slope Stability Evaluation

Dunn-Erwin C&D Landfill Expansion
Harnett County, North Carolina

Prepared For:
Draper Aden Associates
Richmond, Virginia

S+G Project No. DAAHC-13-1

NORTH CAROLINA PROFESSIONAL SEAL 021666 ENGINEER PIETER K. SCHEER
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Dunn-Erwin C&D Landfill Expansion
Harnett County, North Carolina

Slope Stability Evaluation

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1.0 OVERVIEW

This report describes a slope stability evaluation performed by Smith Gardner, Inc. (S+G) for the Dunn-Erwin construction and demolition debris (C&D) landfill located near the City of Dunn and the Town of Erwin in Harnett County, North Carolina. The C&D landfill, which is owned and operated by Harnett County, is a vertical expansion of a closed municipal solid waste (MSW) landfill. Currently a vertical expansion of the C&D landfill, designed by C.T. Clayton, Sr., P.E., Inc. (C.T. Clayton), is planned with significant waste to be added to the southern and eastern slopes as shown on **Figure 1**. The southern portion of this expansion will include the installation of a structural fill berm at the toe of slope. This evaluation includes analysis of the stability of a critical cross section of the overall waste mass and the structural fill berm.

Analyses were performed to determine the required material properties to achieve the required minimum factors of safety for both static and seismic conditions. Based on the available information regarding the subgrade soils and the soil to be used in construction of the structural fill berm, it is expected that these soils will exceed the minimum required shear strength values necessary to achieve the required factors of safety. The parties involved in the selection and placement of the soil for the structural fill berm will need to perform testing as necessary to verify that the berm is suitably compacted.

Note that the results of this evaluation are based in part on subsurface information (boring logs and groundwater elevations) provided to S+G by C.T. Clayton via Draper Aden Associates. Subsurface conditions may differ from those indicated in the boring logs and by the groundwater levels provided. Thus, S+G makes no warranties or guarantees of the continuity of conditions between borings and beneath/within the waste mass itself.

2.0 SEISMIC CONSIDERATIONS

In that the project site lies near a seismic impact zone (defined as $a_{max} > 0.10$ g according to USGS (Petersen et. al)), seismic (pseudo-static) slope stability analyses were performed.

2.1 Regulatory Requirements/Guidance

On October 9, 1993, RCRA Subtitle D regulations (40 CFR Part 258) governing landfills receiving municipal solid waste (MSW) went into effect. These regulations require that:

- Section 258.13: landfills cannot be sited within 200-feet of a fault that has had displacement in the Holocene Epoch (past 11,000 years) unless it can be demonstrated that a lesser set back is safe.

- Section 258.14: landfills must be designed for seismic conditions if they are within a seismic impact zone defined as having a peak bedrock acceleration exceeding 0.10 g based on a 10% probability of being exceeded in a 250 year time period (approximately equivalent to 2% probability of being exceeded in 50 years).

The EPA guidance for seismic design guidance for municipal solid waste landfills (EPA/600/R-95/051) states that, within the United States and east of the Rocky Mountains, only the Meers Fault in Oklahoma and the Reelfoot Fault in Tennessee (source of the 1811/1812 New Madrid earthquake sequence) (Krinitsky et. al) have had displacement evidenced at the ground surface. The project site thus satisfies the requirements of 258.13.

2.2 Seismic Coefficient

The peak bedrock acceleration at the project site is obtained from 2008 USGS information (Petersen et. al) (tabulated projected ground acceleration -- 2% probability of being exceeded in 50 years). This indicates that a peak bedrock acceleration of 0.095 g can be assigned to the site based on the site longitude (-78.65 degrees) and latitude (35.37 degrees). Conservatively, the full peak bedrock acceleration value was used in the evaluation of seismic conditions.

3.0 SLOPE STABILITY

The stability of circular failure surfaces were evaluated based on EPA guidance and standard industry practices. Block-type failure surfaces were not evaluated because: 1) there are no geosynthetic layers in the landfill; and 2) there appear to be no layers in the subgrade that would act as preferential slip surfaces.

3.1 Required Factors of Safety

The minimum acceptable factors of safety for long-term slope stability were selected to be 1.5 for static conditions and 1.0 for seismic conditions.

3.2 Circular Failure Surfaces

The stability of circular failure surfaces was evaluated using the computer program Slide (v. 6.0) by Roc Science. Circular (rotational within waste mass and/or subgrade) failure surfaces were analyzed using Spencer's Method.

Analyses were performed for the cross section shown in **Figures 1 & 2** and the output figures shown in **Appendix A**. This cross section was chosen based on inspection as representative of the greatest proposed addition of C&D waste upslope of a proposed structural fill berm. Water table elevations were estimated from seasonal high water level measurements provided by C.T. Clayton. The water table was assumed to coincide with the assumed bottom of waste.

3.2.1 Material Properties

Summaries of material properties used in the evaluation of failure surfaces are presented in **Tables 1 and 2.** A discussion of these values is as follows:

Subgrade:

The assumed material properties for the perimeter berms/subgrade were:

Unit Weight:	110 pcf (moist); 120 pcf (saturated)
Cohesion:	**See Tables 1 and 2**
Friction Angle (phi):	**See Tables 1 and 2**

Based on the boring logs and soil test data provided by C.T. Clayton, the landfill subgrade consists of a mixture of sand, silt, and clay (see **Appendix B**).

Structural Fill Berm Material:

The assumed material properties for the structural fill berm were:

Unit Weight:	100 pcf (moist); 110 pcf (saturated)
Cohesion:	**See Tables 1 and 2**
Friction Angle (phi):	**See Tables 1 and 2**

Based on the soil test data provided by C.T. Clayton, the material to be used in the construction of the structural fill berm is generally classified as a clayey sand (SC) (see **Appendix B**). Compacted SC soil can be expected to have shear strength values of at least those assumed in this evaluation (NAVFAC DM 7.02). It is recommended that soil testing be performed during construction of this berm to ensure consistency of the material and adequate compaction ($\geq$ 95% standard Proctor dry density (ASTM D698)).

Waste:

The assumed material properties for the waste were:

Unit Weight:	70 pcf (moist); 90 pcf (saturated)
Cohesion (c):	500 psf
Friction Angle (phi):	25 degrees

The assumed unit weight is typical of MSW landfills that do not recirculate leachate and is likely conservatively high for C&D waste that typically is not as densely compacted as MSW. The assumed shear strength envelope (cohesion and friction angle values) is believed to be conservative for C&D wastes and is

generally lower than summarized strength properties for MSW waste by Kavazanjian et al. (1995) and Eid et al. (2000).

3.2.2 Results

Table 3 provides a summary of the results of the stability analyses for circular failure surfaces. The results show the required material properties to achieve the required minimum factors of safety for both static and seismic conditions (1.5 for final static conditions; 1.0 for seismic conditions). Based on the available information regarding the subgrade soils and the soil to be used in construction of the structural fill berm, it is expected that these soils will exceed the minimum required shear strength values necessary to achieve the required factors of safety. The analyses are presented in **Appendix A**.

4.0 SURFICIAL STABILITY OF FINAL COVER SYSTEM

S+G understands that this landfill will receive a final cover system consisting of a compacted soil barrier (18" minimum thickness) overlain by vegetative support soil (18" minimum thickness). Although there are no geosynthetic materials planned which would necessitate an evaluation of veneer stability, the surficial stability of the final cover system is important to consider given the potential for erosion on these long steep slopes. The proposed final grades for the southern slope of the landfill form an approximately 340 foot long 4H:1V slope with no benches. Due to the length of this slope, there is a high likelihood that erosion rills will form, particularly in the lower half. Due to the relatively moderate slope and small area of the south slope, it is feasible to address the situation through careful selection of vegetation and regular maintenance. However, if this level of maintenance is not acceptable to the owner, then a bench/berm constructed of structural fill should be placed mid-slope (at approximately elevation 260 feet) with corrugated polyethylene drain pipes as necessary to carry runoff to the toe of slope non-erosively.

5.0 REFERENCES

Eid, H.T., Stark, T.D., Evans, W.D., and Sherry, P.E. (2000), "Municipal Solid Waste Slope Failure. I: Waste and Foundation Soil Properties," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 126, No. 5, pp. 397-407.

Petersen, M.D., Frankel, A.D., et al (2008), "Documentation for the 2008 Update of the United States National Seismic Hazard Maps," U.S. Geological Survey Open-File Report 2008-1128.

Kavazanjian, E., Bonaparte, R., and Schmertmann, G.R. (1995), "Evaluation of MSW Properties for Seismic Analysis," Proceedings of the Geoenvironment 2000 Specialty Conference, ASCE, Vol. 2, pp. 1126-1141, New Orleans, LA, 24-26 February 1995.

Krinitzsky, E.L., Gould, J.P., and P.H. Edinger (1993), Fundamentals of Earthquake-Resistant Construction, John Wiley & Sons, New York.

Naval Facilities Engineering Command (NAVFAC) (1986), Foundations and Earth Structures (Design Manual 7.02), NAVFAC, Alexandria, VA, p 7.2-39.

Richardson, G.N., Kavazanjian, E., and N. Matasovic (1995), RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA/600/R-95/051, U.S. Environmental Protection Agency, Washington, D.C.

Table 1 Material Properties Used in Analysis of Full Slope

Material	Unit Weight (pcf)	Shear Strength Properties[1]	
		Cohesion/ Adhesion (c) (psf)	Friction Angle (ϕ) (degrees)
Subgrade	110 (Moist) 120 (Saturated)	0-2,500	0-25
Structural Fill Berm Material	100 (Moist) 110 (Saturated)	1	27
Waste (MSW and C&D)	70 (Moist) 90 (Saturated)	500	25

Notes:

1. The subgrade shear strength was varied to determine the shear strength envelope that provides the required factor of safety.

Table 2 Material Properties Used in Analysis of Structural Fill Berm

Material	Unit Weight (pcf)	Shear Strength Properties[1]	
		Cohesion/ Adhesion (c) (psf)	Friction Angle (ϕ) (degrees)
Subgrade	110 (Moist) 120 (Saturated)	100	28
Structural Fill Berm Material	100 (Moist) 110 (Saturated)	1[2]-650	0-30
Waste (MSW and C&D)	70 (Moist) 90 (Saturated)	500	25

Notes:

1. The structural fill berm material shear strength was varied to determine the shear strength envelope that provides the required factor of safety.
2. A minimal amount of cohesion was used in the slope stability analyses to prevent an excessively small critical failure surface.

Table 3 Results Summary - Minimum Required Shear Strength

Cross Section Analyzed	Material Controlling the Failure Surface	Cohesion (c) (psf)[1]	Friction Angle (ϕ) (degrees)[1]	Factor of Safety - Static (FS $\geq$ 1.5)[2]
A-A (Full Slope)	Subgrade Soil	0	23	1.50[3]
		2,295	0	1.50
A-A (Structural Fill Berm)	Structural Fill Berm Material	2	27	1.54[3]
		632	0	1.50

Notes:

1. The shear strength values given for the soil materials are the minimum required to satisfy the required factors of safety. Combinations of cohesion/adhesion and friction angle that are different than these values that produce the same shear strength could also be used here (shear strength (τ) = normal load x tan (ϕ) + c). Refer to **Figures 3 & 4**.
2. Factor of safety was calculated by analysis of circular failure surfaces using Spencer's Method.
3. Seismic factor of safety for seismic coefficient (a) = 0.095g was determined to be 1.08 for full slope analysis and 1.16 for analysis of the structural fill berm (FS $\geq$ 1.0 in both cases).

REFERENCE:
"DUNN-ERWIN LANDFILL C&D UNIT CLOSURE PLAN FINAL PHASE, PRINTED 3/8/13." (PRELIMINARY DRAWING) PREPARED BY C.T. CLAYTON, SR., P.E., INC.
NO REFERENCE INCLUDED FOR TOPOGRAPHIC MAPPING.

PREPARED FOR:

LOCATION OF SLOPE STABILITY CROSS SECTION

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN:	APPROVED:	SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:	FILE NAME:
J.A.L.	P.K.S.	AS SHOWN	May 2013	DAAHC 13-1	1	DAAHC-A0001

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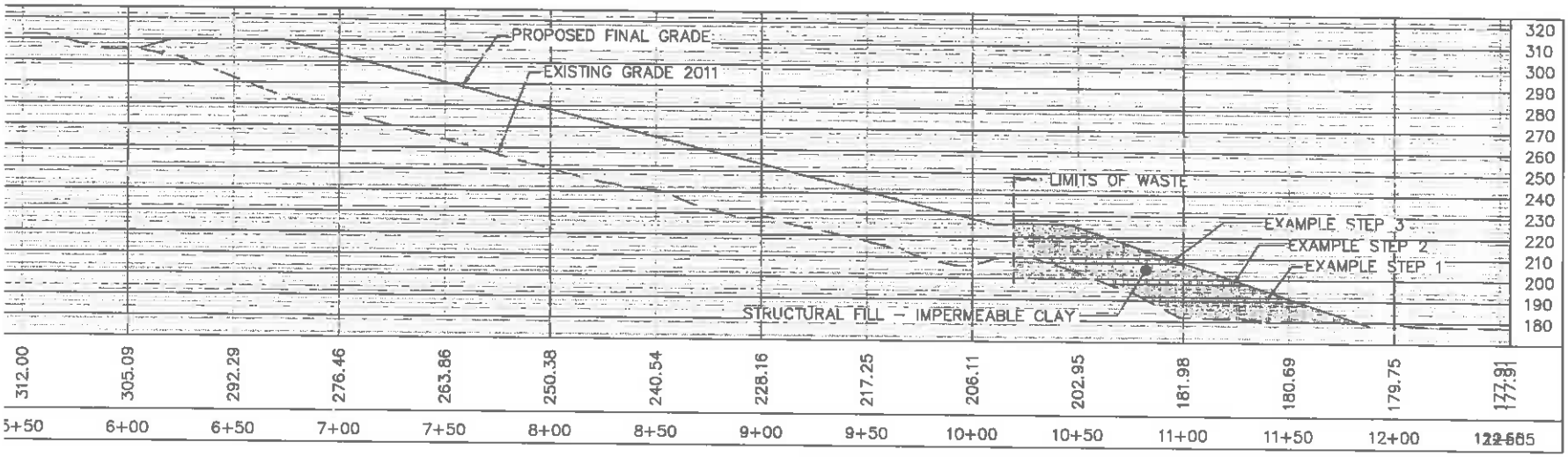

SECTION A-A

SCALE: 1" = 50'

REFERENCE:

"CLOSURE SECTIONS AND DETAILS," SHEET 3 OF 7 OF DUNN-ERWIN LANDFILL C&D PIGGYBACK CLOSURE PLAN, HARNETT COUNTY, NC (PERMIT DRAWINGS) PREPARED BY C.T. CLAYTON, SR., P.E., INC., DATED 3/23/12, REVISED 5/7/12.

PREPARED FOR:	DRAWN:	APPROVED:	SCALE:	DATE:	PREPARED BY:
SLOPE STABILITY CROSS SECTION	J.A.L.	P.K.S.	AS SHOWN	May 2013	NC LIC. NO. C-0828 (ENGINEERING) SMITH+GARDNER
	PROJECT NO.: DAAHC 13-1	FIGURE NO.: 2	FILENAME: DAAHC-A0002		14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

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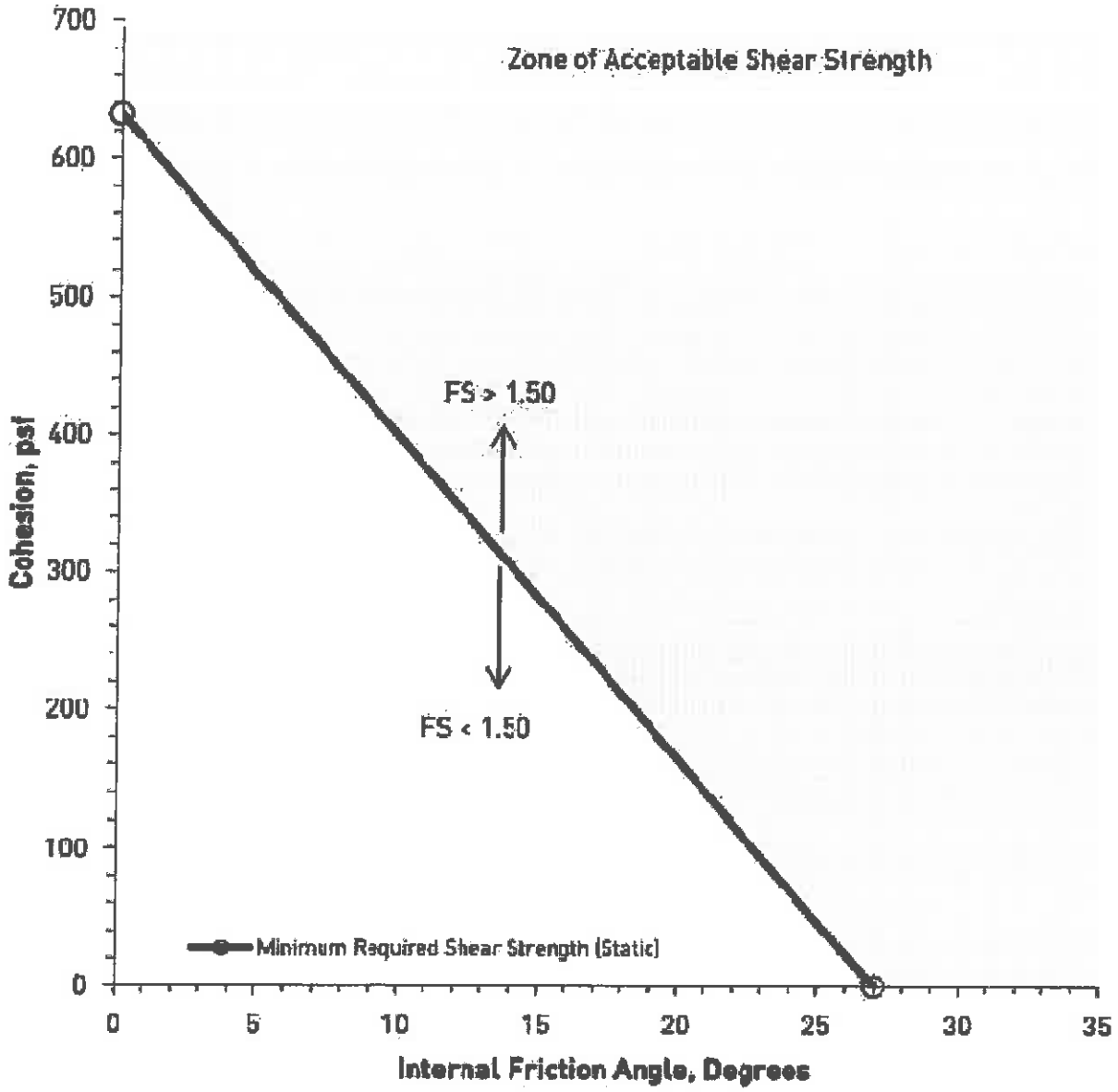

PREPARED FOR:

MINIMUM REQUIRED PEAK SHEAR STRENGTH
STRUCTURAL FILL BERM MATERIAL

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN:	APPROVED:	SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:	FILE NAME:
J.A.L.	P.K.S.	NOT TO SCALE	May 2013	DAAHC 13-1	3	DAAHC-A0004

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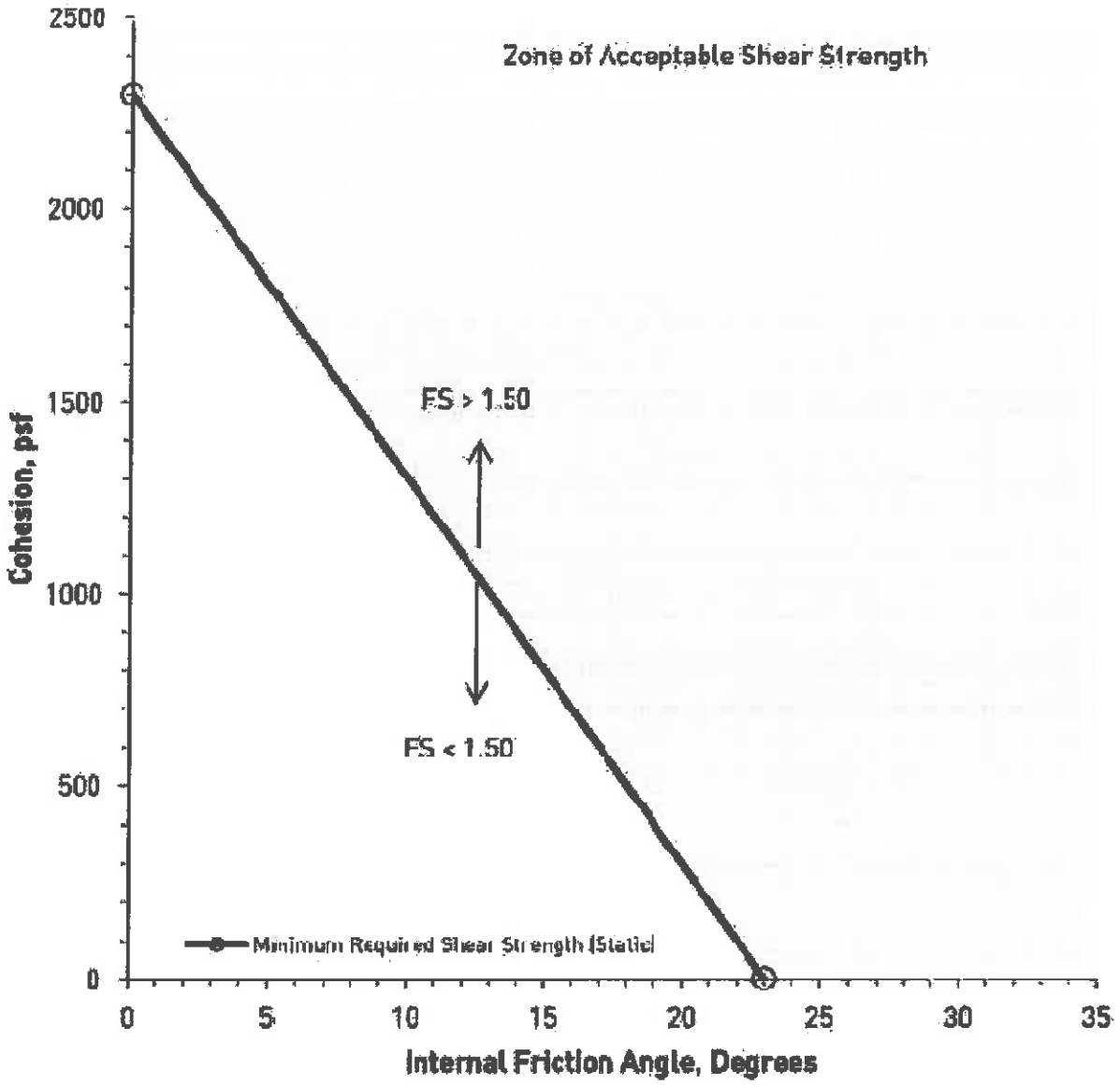

PREPARED FOR:

MINIMUM REQUIRED PEAK SHEAR STRENGTH
SUBGRADE SOIL

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN:	APPROVED:	SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:	FILE NAME:
J.A.L.	P.K.S.	NOT TO SCALE	May 2013	DAAHC 13-1	4	DAAHC-A0005

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Appendix A

Slope Stability Analyses

Slope Stability Evaluation
Dunn-Erwin Landfill
Harnett County, North Carolina

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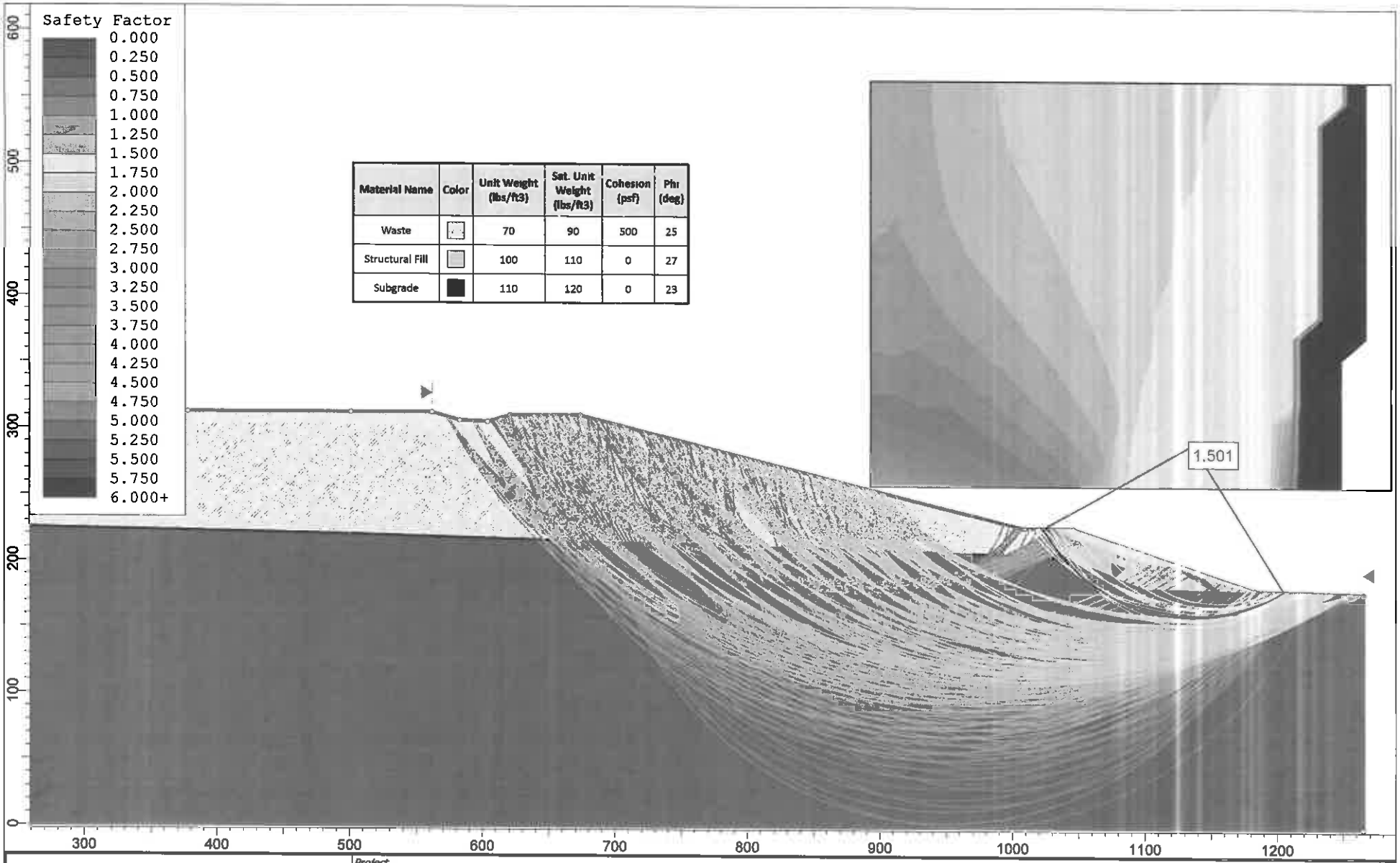
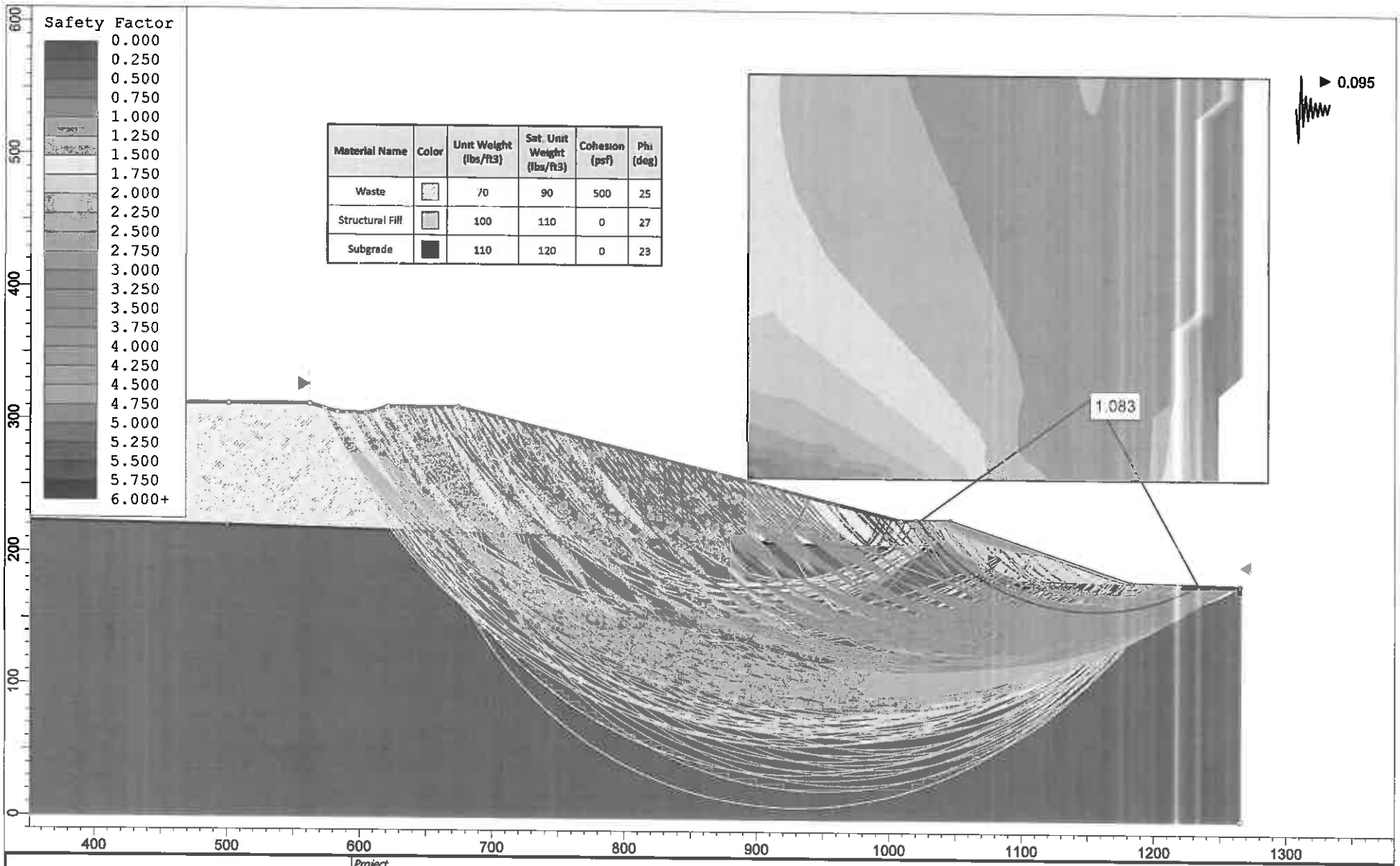


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Waste		70	90	500	25
Structural Fill		100	110	0	27
Subgrade		110	120	0	23

SMITH+GARDNER

SLIDEINTERPRET 6.022

Project	Dunn Erwin LF Sec. A-A		
Analysis Description	Full Slope-Subgrade-Static		
Drawn By	JRF	Company	Smith Gardner, Inc.
Date	5/8/2013, 9:26:09 AM	File Name	Subgrade -Static.slim

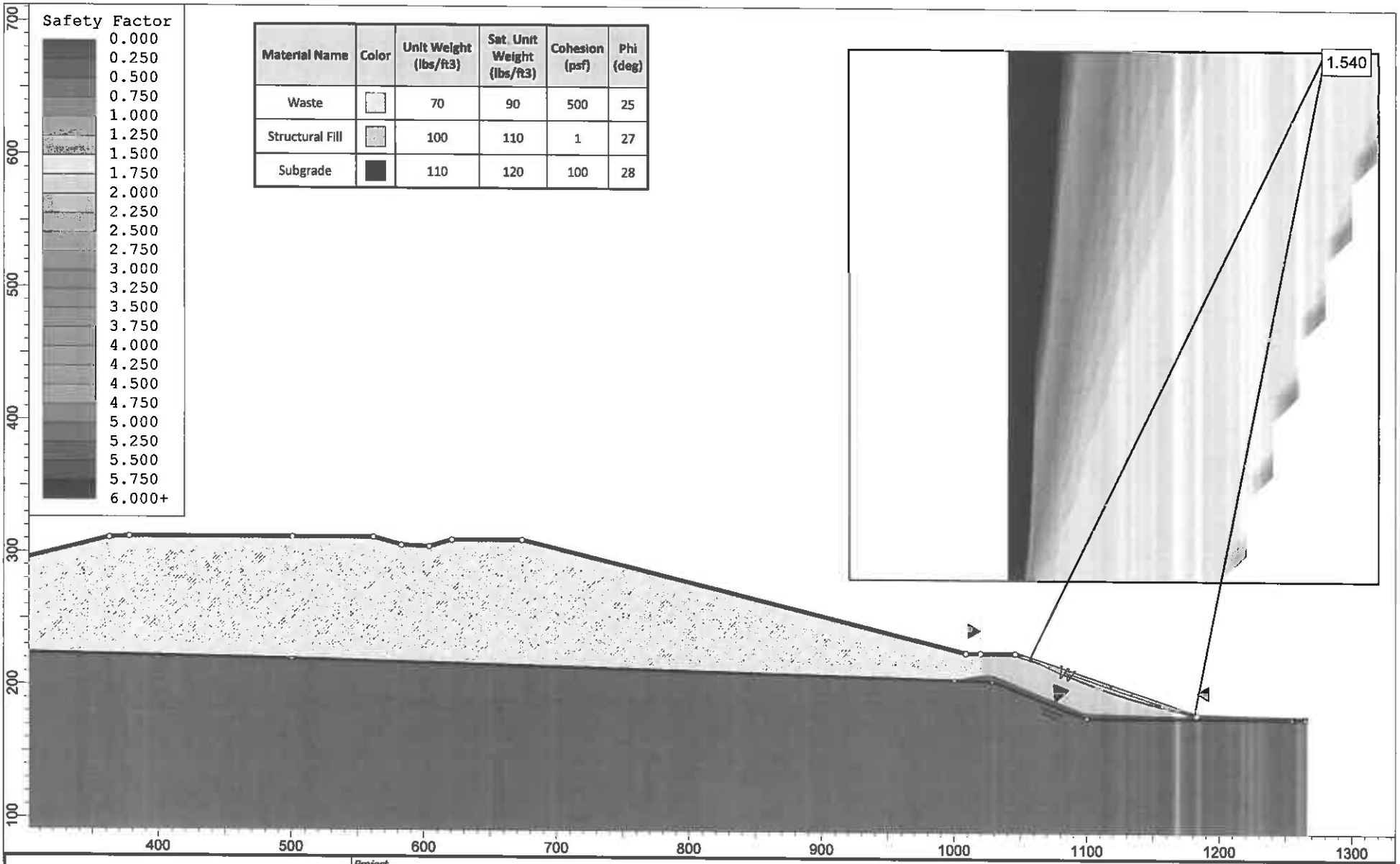


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Waste		70	90	500	25
Structural Fill		100	110	0	27
Subgrade		110	120	0	23

SMITH GARDNER

SLIDEINTERPRET 6.022

Project	Dunn Erwin LF Sec. A-A		
Analysis Description	Full Slope-Subgrade-Seismic		
Drawn By	JRF	Company	Smith Gardner, Inc.
Date	5/8/2013, 9:26:09 AM	File Name	Subgrade -Seismic.slim

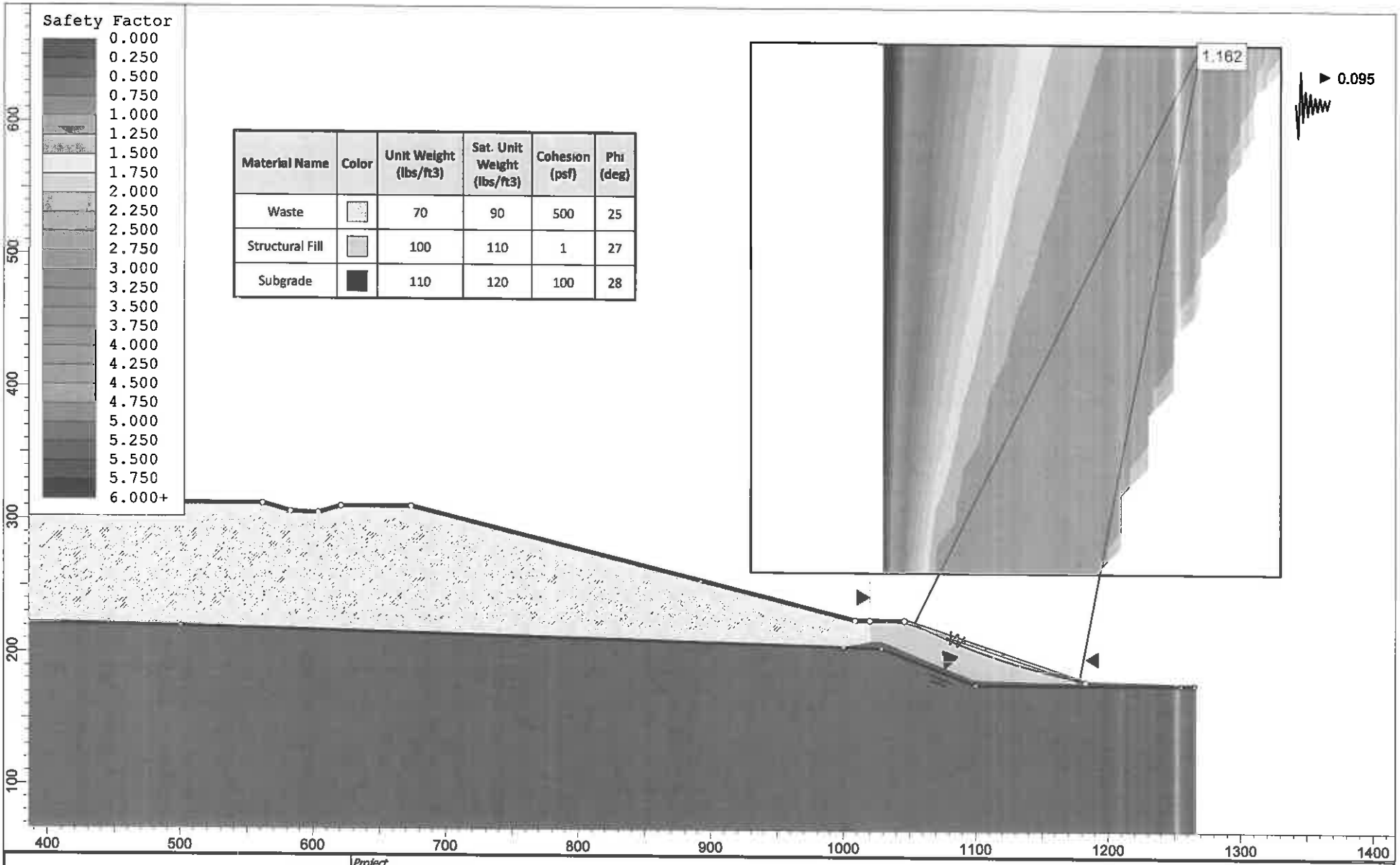


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Waste		70	90	500	25
Structural Fill		100	110	1	27
Subgrade		110	120	100	28

SMITH+GARDNER

SLIDEINTERPRET 6.022

Project	Harnett Co. LF Sec. A-A		
Analysis Description	Structural Fill Berm Analysis - Static		
Drawn By	JRF	Company	Smith Gardner, Inc.
Date	5/8/2013, 9:26:09 AM	File Name	Berm-Static.slim



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Waste		70	90	500	25
Structural Fill		100	110	1	27
Subgrade		110	120	100	28

SMITH+GARDNER

SLIDEINTERPRET 6.022

Project	Harnett Co. LF Sec. A-A
Analysis Description	Structural Fill Berm Analysis - Seismic
Drawn By	JRF
Company	Smith Gardner, Inc.
Date	5/8/2013, 9:26:09 AM
File Name	Berm-Seismic.slim

Slide Analysis Information

Dunn Erwin LF Sec. A-A

Project Summary

- File Name: Subgrade -Static.slim
- Slide Modeler Version: 6.022
- Project Title: Dunn Erwin LF Sec. A-A
- Analysis: Full Slope-Subgrade-Static
- Author: JRF
- Company: Smith Gardner, Inc.
- Date Created: 5/8/2013, 9:26:09 AM

General Settings

- Units of Measurement: Imperial Units
- Time Units: days
- Permeability Units: feet/second
- Failure Direction: Left to Right
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Spencer

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 62.4 lbs/ft3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Grid Search
- Radius Increment: 10
- Composite Surfaces: Disabled
- Reverse Curvature: Create Tension Crack
- Minimum Elevation: Not Defined
- Minimum Depth: Not Defined

Material Properties

Property	Waste	Structural Fill	Subgrade
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	70	100	110
Saturated Unit Weight [lbs/ft3]	90	110	120
Cohesion [psf]	500	0	0
Friction Angle [deg]	25	27	23
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: spencer

- FS: 1.501340
- Center: 1136.205, 289.759
- Radius: 129.840
- Left Slip Surface Endpoint: 1023.099, 226.000
- Right Slip Surface Endpoint: 1204.722, 179.470
- Resisting Moment=2.54863e+007 lb-ft
- Driving Moment=1.69757e+007 lb-ft
- Resisting Horizontal Force=178205 lb
- Driving Horizontal Force=118697 lb
- Total Slice Area=5237.3 ft2

Valid / Invalid Surfaces

Method: spencer

- Number of Valid Surfaces: 4403
- Number of Invalid Surfaces: 437

Error Codes:

- Error Code -102 reported for 12 surfaces
- Error Code -103 reported for 50 surfaces
- Error Code -106 reported for 70 surfaces
- Error Code -108 reported for 43 surfaces
- Error Code -111 reported for 12 surfaces
- Error Code -112 reported for 19 surfaces
- Error Code -1000 reported for 231 surfaces

Error Codes

The following errors were encountered during the computation:

- -102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
- -103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
- -106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- -108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
- -111 = safety factor equation did not converge
- -112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
- -1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

- **Global Minimum Query (spencer) - Safety Factor: 1.50134**

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	6.47124	3338.09	Structural Fill	0	27	95.8151	143.851	282.324	0	282.324
2	6.47124	9439.58	Structural Fill	0	27	295.764	444.042	871.481	0	871.481
3	7.33397	17014.9	Subgrade	0	23	435.557	653.919	1540.53	0	1540.53
4	7.33397	22699.5	Subgrade	0	23	577.556	867.108	2200.44	157.657	2042.78
5	7.33397	26258.9	Subgrade	0	23	653.021	980.407	2693.16	383.464	2309.69
6	7.33397	28912.3	Subgrade	0	23	719.83	1080.71	3099.23	553.233	2546
7	7.33397	30895.2	Subgrade	0	23	780.916	1172.42	3437.52	675.459	2762.06
8	7.33397	32292	Subgrade	0	23	836.133	1255.32	3713.48	756.125	2957.36
9	7.33397	33164	Subgrade	0	23	885.362	1329.23	3931.06	799.592	3131.47
10	7.33397	33557.4	Subgrade	0	23	928.457	1393.93	4093.01	809.113	3283.9
11	7.33397	33546	Subgrade	0	23	966.636	1451.25	4206.09	787.148	3418.94
12	7.33397	33416.1	Subgrade	0	23	970.466	1457	4305.64	873.156	3432.48

13	7.33397	32962.7	Subgrade	0	23	958.55	1439.11	4360.3	969.956	3390.34
14	7.33397	32125.6	Subgrade	0	23	938.695	1409.3	4359.64	1039.56	3320.08
15	7.33397	30914.9	Subgrade	0	23	910.387	1366.8	4302.63	1082.66	3219.97
16	7.33397	29336.6	Subgrade	0	23	872.993	1310.66	4187.42	1099.7	3087.72
17	7.33397	27392.9	Subgrade	0	23	825.696	1239.65	4011.25	1090.83	2920.42
18	7.33397	25082.6	Subgrade	0	23	767.448	1152.2	3770.39	1055.97	2714.42
19	7.33397	22400.9	Subgrade	0	23	696.904	1046.29	3459.67	994.78	2464.89
20	7.33397	19339.2	Subgrade	0	23	612.288	919.252	3072.26	906.645	2165.62
21	7.33397	15884.5	Subgrade	0	23	511.255	767.567	2598.92	790.646	1808.28
22	7.33397	12018.9	Subgrade	0	23	390.602	586.427	2027.05	645.511	1381.54
23	7.33397	8492.94	Subgrade	0	23	287.259	431.273	1485.55	469.534	1016.01
24	7.33397	5398.69	Subgrade	0	23	208.485	313.007	997.859	260.461	737.398
25	7.33397	1827.21	Subgrade	0	23	104.579	157.008	385.204	15.3152	369.889

Interslice Data

- **Global Minimum Query (spencer) - Safety Factor: 1.50134**

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	1023.1	226	0	0	0
2	1029.57	215.683	2290.65	531.426	13.0614
3	1036.04	207.143	7813.64	1812.75	13.0615
4	1043.38	198.98	17184.4	3986.75	13.0615
5	1050.71	192.042	28202.5	6542.91	13.0614
6	1058.04	186.082	39448.7	9152.01	13.0614
7	1065.38	180.94	50089.5	11620.7	13.0615
8	1072.71	176.504	59592.9	13825.4	13.0614
9	1080.04	172.694	67590.1	15680.7	13.0614
10	1087.38	169.45	73827.5	17127.8	13.0614
11	1094.71	166.728	78138.2	18127.9	13.0614
12	1102.05	164.493	80425.1	18658.4	13.0614
13	1109.38	162.721	80917.6	18772.7	13.0614
14	1116.71	161.391	79664.3	18481.9	13.0614
15	1124.05	160.49	76685.7	17790.9	13.0614
16	1131.38	160.009	72056.4	16716.9	13.0614
17	1138.72	159.944	65907.1	15290.3	13.0614
18	1146.05	160.294	58430.3	13555.7	13.0614
19	1153.38	161.061	49889.5	11574.2	13.0614
20	1160.72	162.255	40633.2	9426.81	13.0614
21	1168.05	163.886	31116.6	7218.98	13.0614
22	1175.39	165.973	21932.5	5088.29	13.0614
23	1182.72	168.538	13859	3215.26	13.0614
24	1190.05	171.613	7177.44	1665.15	13.0614
25	1197.39	175.239	2025.37	469.882	13.0614
26	1204.72	179.47	0	0	0

List Of Coordinates

Water Table

X	Y
0	230
500	220
1000	206
1029	205
1100	177.6
1255	177.6
1265	177.6

External Boundary

X	Y
1265	0
1265	178
1183	180
1046	226
1020	226

1009	226
674	310
621	310
604	305
583	306
562	312
501	312
378	312
363	311
287	292
279	292
262	292
252	292
183	270
128	262
123	262
106	256
98	256
52	240
30	232
0	231
0	0

Material Boundary

X	Y
52	240
106	256
128	262

Material Boundary

X	Y
183	270
262	292

Material Boundary

X	Y
604	305
998	206
1011	209
1021	210
1029	210
1098	182
1183	180

Material Boundary

X	Y
1020	226
1021	210

Material Boundary

X	Y
30	232
998	206

Slide Analysis Information

Harnett Co. LF Sec. A-A

Project Summary

- File Name: Berm-Static.slim
- Slide Modeler Version: 6.022
- Project Title: Harnett Co. LF Sec. A-A
- Analysis: Structural Fill Berm Analysis - Static
- Author: JRF
- Company: Smith Gardner, Inc.
- Date Created: 5/8/2013, 9:26:09 AM

General Settings

- Units of Measurement: Imperial Units
- Time Units: days
- Permeability Units: feet/second
- Failure Direction: Left to Right
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Spencer

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 62.4 lbs/ft3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Grid Search
- Radius Increment: 10
- Composite Surfaces: Disabled
- Reverse Curvature: Create Tension Crack
- Minimum Elevation: Not Defined
- Minimum Depth: Not Defined

Material Properties

Property	Waste	Structural Fill	Subgrade
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	70	100	110
Saturated Unit Weight [lbs/ft3]	90	110	120
Cohesion [psf]	500	1	100
Friction Angle [deg]	25	27	28
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: spencer

- FS: 1.539980
- Center: 1280.453, 681.248
- Radius: 510.412
- Left Slip Surface Endpoint: 1057.277, 222.214
- Right Slip Surface Endpoint: 1181.381, 180.544
- Resisting Moment=9.1498e+006 lb-ft
- Driving Moment=5.94152e+006 lb-ft
- Resisting Horizontal Force=16978.8 lb
- Driving Horizontal Force=11025.3 lb
- Total Slice Area=367.538 ft2

Valid / Invalid Surfaces

Method: spencer

- Number of Valid Surfaces: 2819
- Number of Invalid Surfaces: 2032

Error Codes:

- Error Code -104 reported for 26 surfaces
- Error Code -106 reported for 256 surfaces
- Error Code -108 reported for 34 surfaces
- Error Code -1000 reported for 1716 surfaces

Error Codes

The following errors were encountered during the computation:

- -104 = Same as -102. Surface / nonslope intersections also exist, but these points lie outside the arc defined by the two surface / slope intersections.
- -106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- -108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
- -1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

- **Global Minimum Query (spencer) - Safety Factor: 1.53998**

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	4.96416	177.143	Structural Fill	1	27	10.3971	16.0113	29.4614	0	29.4614
2	4.96416	515.209	Structural Fill	1	27	29.2586	45.0577	86.4682	0	86.4682
3	4.96416	821.072	Structural Fill	1	27	46.5885	71.7454	138.846	0	138.846
4	4.96416	1095.21	Structural Fill	1	27	62.3747	96.0558	186.557	0	186.557
5	4.96416	1338.06	Structural Fill	1	27	76.6049	117.97	229.566	0	229.566
6	4.96416	1550.06	Structural Fill	1	27	89.2661	137.468	267.834	0	267.834
7	4.96416	1731.63	Structural Fill	1	27	100.346	154.531	301.32	0	301.32
8	4.96416	1883.14	Structural Fill	1	27	109.83	169.136	329.986	0	329.986
9	4.96416	2004.98	Structural Fill	1	27	117.705	181.263	353.786	0	353.786
10	4.96416	2097.49	Structural Fill	1	27	123.956	190.889	372.678	0	372.678
11	4.96416	2161.02	Structural Fill	1	27	128.568	197.992	386.618	0	386.618
12	4.96416	2195.9	Structural Fill	1	27	131.526	202.547	395.559	0	395.559
13	4.96416	2202.42	Structural Fill	1	27	132.813	204.53	399.45	0	399.45

14	4.96416	2180.88	Structural Fill	1	27	132.415	203.916	398.244	0	398.244
15	4.96416	2131.57	Structural Fill	1	27	130.311	200.677	391.888	0	391.888
16	4.96416	2054.74	Structural Fill	1	27	126.487	194.787	380.329	0	380.329
17	4.96416	1950.66	Structural Fill	1	27	120.922	186.218	363.51	0	363.51
18	4.96416	1819.57	Structural Fill	1	27	113.598	174.939	341.375	0	341.375
19	4.96416	1661.7	Structural Fill	1	27	104.495	160.92	313.861	0	313.861
20	4.96416	1477.26	Structural Fill	1	27	93.5928	144.131	280.909	0	280.909
21	4.96416	1266.47	Structural Fill	1	27	80.8692	124.537	242.455	0	242.455
22	4.96416	1029.52	Structural Fill	1	27	66.3028	102.105	198.43	0	198.43
23	4.96416	766.602	Structural Fill	1	27	49.871	76.8003	148.766	0	148.766
24	4.96416	477.89	Structural Fill	1	27	31.5496	48.5857	93.3921	0	93.3921
25	4.96416	163.554	Structural Fill	1	27	11.3366	17.4582	32.3009	0	32.3009

Interslice Data

- **Global Minimum Query (spencer) - Safety Factor: 1.53998**

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	1057.28	222.214	0	0	0
2	1062.24	219.833	18.5239	6.15508	18.3805
3	1067.21	217.518	73.4768	24.4147	18.3805
4	1072.17	215.267	154.73	51.4135	18.3806
5	1077.13	213.08	253.175	84.1245	18.3805
6	1082.1	210.955	360.695	119.851	18.3805
7	1087.06	208.892	470.144	156.218	18.3805
8	1092.03	206.89	575.324	191.167	18.3805
9	1096.99	204.948	670.967	222.948	18.3805
10	1101.95	203.066	752.721	250.113	18.3805
11	1106.92	201.242	817.13	271.514	18.3805
12	1111.88	199.476	861.624	286.299	18.3805
13	1116.85	197.768	884.511	293.904	18.3805
14	1121.81	196.116	884.963	294.054	18.3805
15	1126.78	194.521	863.01	286.759	18.3805
16	1131.74	192.981	819.537	272.314	18.3805
17	1136.7	191.497	756.273	251.293	18.3805
18	1141.67	190.067	675.798	224.553	18.3805
19	1146.63	188.691	581.532	193.23	18.3805
20	1151.6	187.369	477.741	158.743	18.3805
21	1156.56	186.101	369.538	122.789	18.3805
22	1161.52	184.885	262.883	87.3502	18.3805
23	1166.49	183.722	164.592	54.6902	18.3805
24	1171.45	182.611	82.339	27.3594	18.3805
25	1176.42	181.551	24.6667	8.1962	18.3805
26	1181.38	180.544	0	0	0

List Of Coordinates

Water Table

X	Y
0	230
500	220
1000	206
1029	205
1100	177.6
1255	177.6
1265	177.6

External Boundary

X	Y
1265	0
1265	178
1183	180
1046	226
1020	226
1009	226
674	310
621	310
604	305
583	306
562	312
501	312
378	312
363	311
287	292
279	292
262	292
252	292
183	270
128	262
123	262
106	256
98	256
52	240
30	232
0	231
0	0

Material Boundary

X	Y
52	240
106	256
128	262

Material Boundary

X	Y
183	270
262	292

Material Boundary

X	Y
604	305
998	206
1021	210
1029	210
1098	182
1183	180

Material Boundary

X	Y
1020	226
1021	210

Material Boundary

X	Y
30	232
998	206

Appendix B

Boring and Soil Test Information

Slope Stability Evaluation
Dunn-Erwin Landfill
Harnett County, North Carolina

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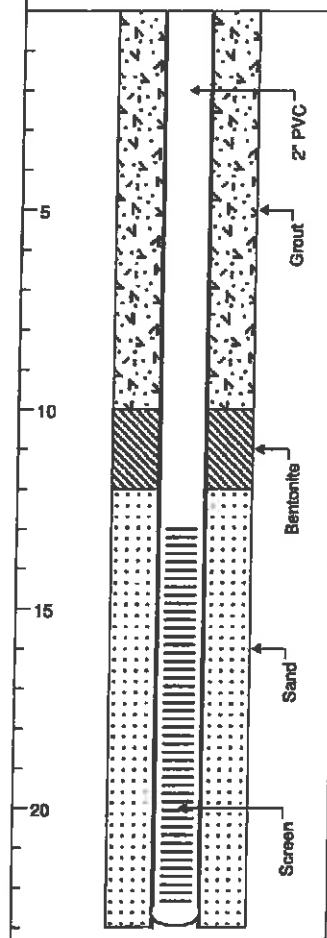
Project: DELF | BORING: MW-3R | Page: 1 of 1

Drilling Co.: J&L Drilling | Date Started: 6-28-05

Drilling Method: 8" HSA | Date Completed: 6-28-05

Location: SE of Active C&D | Logged By: CTC Jr

Surface Elev.: 179.44' | TOC Elev.: 181.52' | Project #: 3009

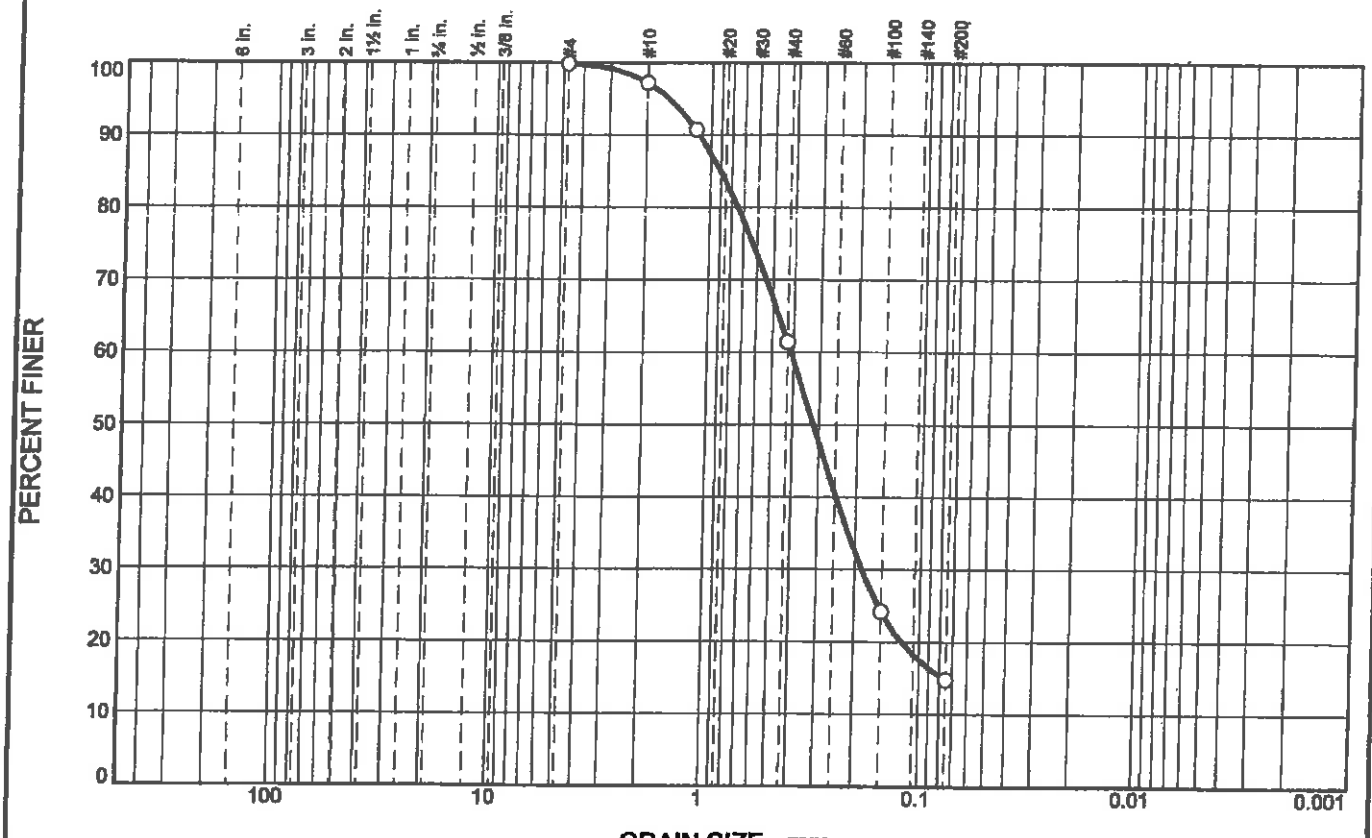


ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
-0.500	Topsoil			
-3.000	Red-Brown **Lean CLAY** with Silts and some Sand			Damp
-5.000	Red-Brown-Yellow-Grey mottled **Fat CLAY** with some coarse Sand	14		Dry to Damp
-5.500	Brown **SILT** with some coarse Sand			
-6.000	Red-Brown-Yellow mottled **Fat CLAY** with some Sand	35	ML	
-7.000	Grey **Clayey Sandy SILT**			
-9.000	Grey-Brown-Red mottled **Sandy CLAY** to **Clayey Medium SAND** (poorly graded)	35		
	Grey with some Red mottling **Silty CLAY** with Mica	32		
-12.500				Moist
-14.000	Grey **Silty SAND** with Mica	73	SM	
	Grey **Clayey SAND**	43		Moist to Wet
		26	SC	Wet
		60		
-22.000		43		
	Grey-Brown-Yellow mottled **Silty CLAY** with Mica	81	ML	Damp
-24.000	Boring Terminated at 24'. No water at time of drilling.			

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
3100 NC Hwy 27 E
Coats, NC 27521
Phone: 910-897-7070
Fax: 910-897-6767

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			2.6	35.8	46.6	14.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.8		
#10	97.2		
#16	90.7		
#40	61.4		
#100	24.2		
#200	14.8		

* (no specification provided)

Material Description

Tan Clayey SAND

Atterberg Limits (ASTM D 4318)

PL= 18 LL= 32 PI= 14

Classification

USCS= SC AASHTO= A-2-6(0)

Coefficients

D_{85}= 0.8995 D_{60}= 0.4098 D_{50}= 0.3182
D_{30}= 0.1853 D_{15}= 0.0771 D_{10}=
C_u= C_c=

Date Tested: **Tested By:**

Remarks

Sample No.: 0105A **Source of Sample:** September Samples **Date Sampled:**
Location: **Elev./Depth:** MW-3R @ 14-16'
Checked By: **Title:**

KAM Engineering Services, P.C.

Fayetteville, NC

Client: CT CLayton, Sr., P.E., Inc.
Project: DELF
Project No: 05-040 **Figure** 6

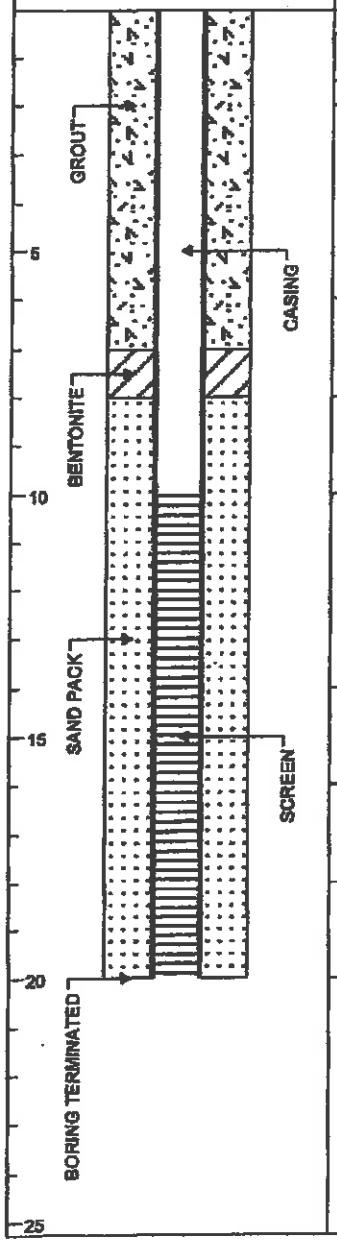
Project: Dunn-Erwin Landfill | BORING: MW-6B (Replacement for MW-6) | Page: 1 of 1

Drilling Co.: J&L Drilling Co. | Date Started: 6/28/10

Drilling Method: Truck mounted HSA | Date Completed: 6/28/10

Location: DELF | Logged By: RLS

Surface Elev.: 207.24 | TOC Elev.: 209.73 | Project #: 3002B



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
208.740	TOPSOIL Brown			
205.740	SAND Brown	19	SW	
205.240	Clayey SAND Red-Orange		SC	Moist
	Clayey SAND w/ Gravel Red	45		
		66	GC	
201.240				Moist
	Clayey SAND Red	41	SC	
199.240				
	Silty CLAY Yellow, Red, White Mottled	24	CL	Moist
197.240				
	SAND Red, Pink, Yellow, Orange	19		
		18	SW	Wet
193.240				
	Sandy SILT Yellow-Brown	6	SM	Wet
191.240				
	Sandy CLAY Yellow, Brown, Gray Mottled	15	SC	
189.240				Moist
	SILT Yellow, Orange, Gray Mottled	13	ML	
187.240				
		36		

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
46 W. Washington St.
Coats, NC 27521

Phone: 910-897-7070
Fax: 910-897-6767

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY	
QUAD. NO.	SERIAL NO.
Lat.	Long. RO
Minor Basin	
Basin Code	
Header Ent.	GW-1 Ent.

WELL CONSTRUCTION RECORD

LING CONTRACTOR: PATTERSON EXPLORATION SERVICES

DRILLER REGISTRATION NUMBER: 351

STATE WELL CONSTRUCTION PERMIT NUMBER:

MW-2

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: COATS County: HARNETT
   DUNN-ERWIN LANDFILL - S.R. 1724
   (Road, Community, or Subdivision and Lot No.)
2. OWNER HARNETT COUNTY
   ADDRESS P.O. BOX 759
   (Street or Route No.)
   LILLINGTON NC 27546
   City or Town State Zip Code
3. DATE DRILLED 9-23-94 USE OF WELL MONITORING
4. TOTAL DEPTH 30'
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 24.5' FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
   * Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): <1.0 METHOD OF TEST BAILING
10. WATER ZONES (depth): 22'-30'

DEPTH From	To	DRILLING LOG Formation Description
0'	3'	SANDY CLAY
3'	30'	GRAY SILTY CLAY

If additional space is needed use back of form

1 HLORINATION: Type _____ Amount _____

12. CASING:

Depth From	To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
0	15		2	SCH 40	PVC

13. GROUT:

Depth From	To	Ft.	Material	Method
0	13		NEAT CEMENT	
13	14		BENTONITE	

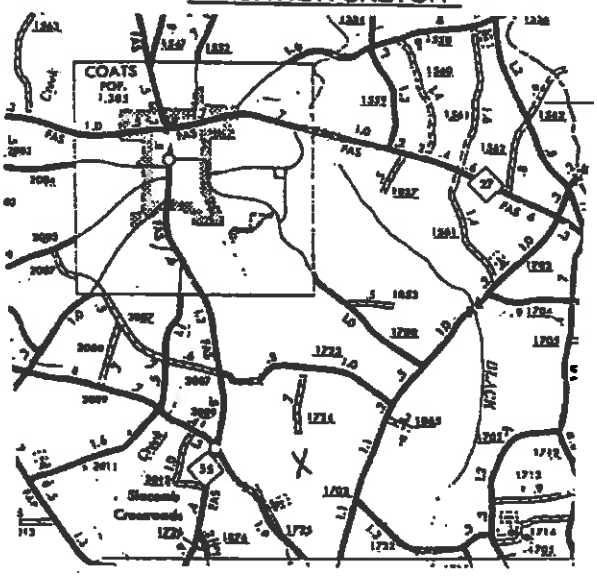
14. SCREEN:

Depth From	To	Ft.	Diameter	Slot Size	Material
15	30		2 in.	.010 in.	PVC
			in.	in.	
			in.	in.	

15. SAND/GRAVEL PACK:

Depth From	To	Ft.	Size	Material
14	30			SAND

LOCATION SKETCH



16. REMARKS:

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.

James C Izzell 9-29-94

SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Environmental Management and copy to well owner

GW-1 REV. 9/91

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY	
QUAD. NO.	SERIAL NO.
Lat.	Long. RO
Minor Basin	
Basin Code	
Header Ent.	GW-1 Ent.

WELL CONSTRUCTION RECORD

.LING CONTRACTOR: PATTERSON EXPLORATION SERVICES

DRILLER REGISTRATION NUMBER: 351

STATE WELL CONSTRUCTION PERMIT NUMBER:

MW-3

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: COATS County: HARNETT
DUNN-ERWIN LANDFILL - S.R. 1724
(Road, Community, or Subdivision and Lot No.)

2. OWNER HARNETT COUNTY
ADDRESS P.O. BOX 759
(Street or Route No.)
LILLINGTON NC 27546
City or Town State Zip Code

3. DATE DRILLED 9-23-94 USE OF WELL MONITORING
4. TOTAL DEPTH 20'
5. CUTTINGS COLLECTED YES ☐ NO ☒
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 6.5 FT.
(Use "+" If Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): < 1.0 METHOD OF TEST BAILING
10. WATER ZONES (depth): 12' - 20'

DEPTH From	To	DRILLING LOG Formation Description
0'	5'	BROWN SILTY CLAY
5'	20'	MOTTLED CLAY

If additional space is needed use back of form

HLORINATION: Type _____ Amount _____

12. CASING:

	Depth From	To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
	0	9		2"	SCH 40	PVC

13. GROUT:

	Depth From	To	Ft.	Material	Method
	0	7		NEAT CEMENT	
	7	8		BENTONITE	

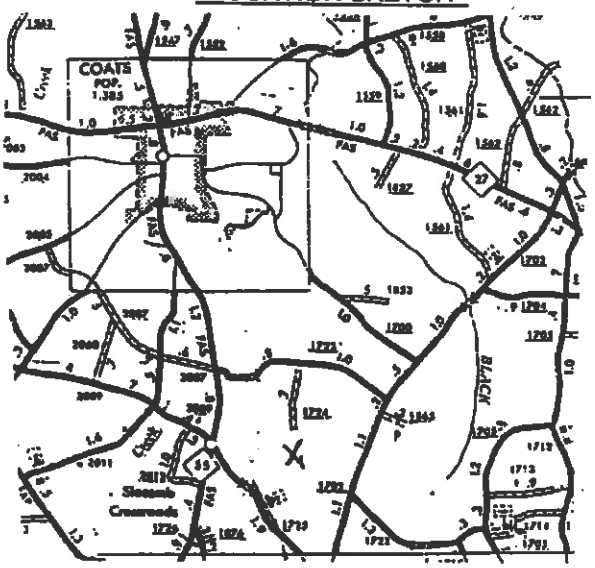
14. SCREEN:

	Depth From	To	Ft.	Diameter in.	Slot Size in.	Material
	9	19		2	.010	PVC

15. SAND/GRAVEL PACK:

	Depth From	To	Ft.	Size	Material
	8	20			SAND

LOCATION SKETCH



16. REMARKS:

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.

James Yazell 9-29-94
SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Environmental Management and copy to well owner.

GW-1 REV. 9/91

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY	
QUAD. NO.	SERIAL NO.
Lat.	Long. RO
Minor Basin	
Basin Code	
Header Ent.	GW-1 Ent.

WELL CONSTRUCTION RECORD

..LING CONTRACTOR: PATTERSON EXPLORATION SERVICES

DRILLER REGISTRATION NUMBER: 351

STATE WELL CONSTRUCTION PERMIT NUMBER:

MW-5

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: COATS County: HARNETT
DUNN-ERWIN LANDFILL - S.R. 1724
(Road, Community, or Subdivision and Lot No.)

2. OWNER HARNETT COUNTY
ADDRESS P.O. BOX 759
(Street or Route No.)
LILLINGTON NC 27546
City or Town State Zip Code

3. DATE DRILLED 9-23-94 USE OF WELL MONITORING
4. TOTAL DEPTH 35'
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 15.25 FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
*Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): <1.0 METHOD OF TEST BAILING
10. WATER ZONES (depth): 25'-35'

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0'	10'	CLAY / BACKFILL
10'	35'	GRAY SILTY CLAY

If additional space is needed use back of form

1 ..HLORINATION: Type _____ Amount _____

12. CASING:

From	To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
0'	19'		2"	SCH 40	PVC

13. GROUT:

From	To	Ft.	Material	Method
0	17		NEAT CEMENT	
17	18		BENTONITE	

14. SCREEN:

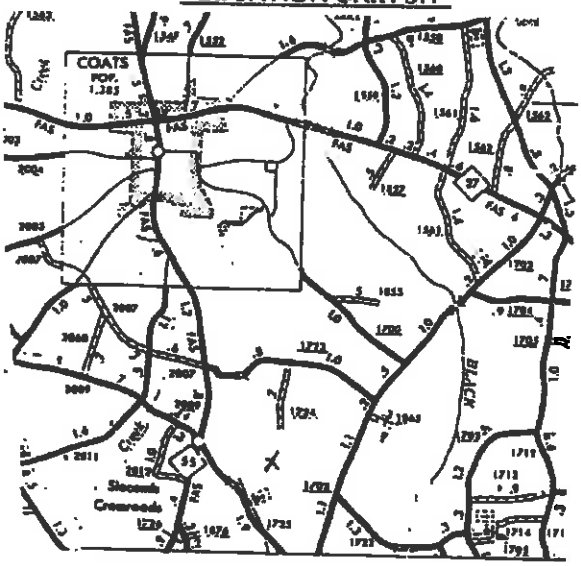
From	To	Ft.	Diameter	Slot Size	Material
19'	34'		2 in.	.010 in.	PVC
			in.	in.	
			in.	in.	

15. SAND/GRAVEL PACK:

From	To	Ft.	Size	Material
18'	35'			SAND

16. REMARKS:

LOCATION SKETCH



..O HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C ..ONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

James Ingall 9-29-94
SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Environmental Management and copy to well owner

GW-1 REV. 9/91

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY	
QUAD. NO.	SERIAL NO.
Lat.	Long. / RO
Minor Basin	
Basin Code	
Header Ent.	GW-1 Ent.

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: PATTERSON EXPLORATION SERVICES

DRILLER REGISTRATION NUMBER: 351

STATE WELL CONSTRUCTION PERMIT NUMBER:

1. WELL LOCATION: (Show sketch of the location below) MW-7
Nearest Town: COATS County: HARNETT
DUNN-ERWIN LANDFILL - S.R. 1724
(Road, Community, or Subdivision and Lot No.)

2. OWNER HARNETT COUNTY
ADDRESS P.O. BOX 759
(Street or Route No.)
LILLINGTON NC 27546
City or Town State Zip Code

3. DATE DRILLED 9-23-94 USE OF WELL MONITORING
4. TOTAL DEPTH 25
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 22 FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
*Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): <1.0 METHOD OF TEST BAILING
10. WATER ZONES (depth): 23' - 25'

DEPTH From	To	DRILLING LOG Formation Description
0'	18'	SANDY CLAY
18'	25'	SILTY CLAY

If additional space is needed use back of form

. CHLORINATION: Type _____ Amount _____

12. CASING:

	Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	14	2"	SCH 40	PVC

13. GROUT:

	Depth From	To	Material	Method
	0	~~8~~ 12	NEAT CEMENT	
	~~8~~ 12	13	BENTONITE	

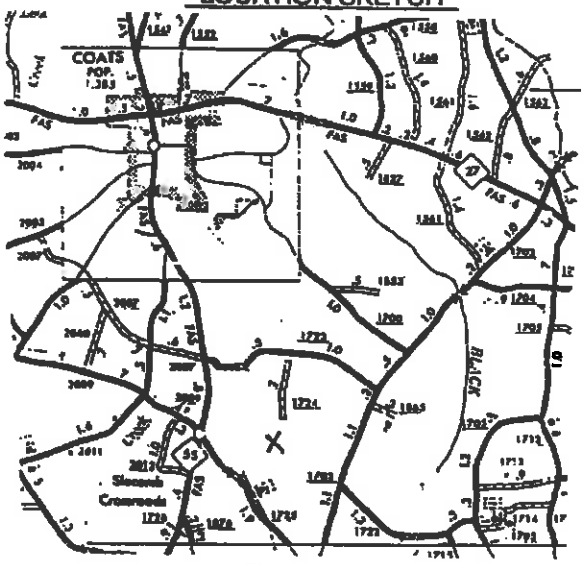
14. SCREEN:

	Depth From	To	Diameter	Slot Size	Material
	14	24	2 in.	.010 in.	PVC
			in.	in.	
			in.	in.	

15. SAND/GRAVEL PACK:

	Depth From	To	Size	Material
	13	25		SAND

LOCATION SKETCH



16. REMARKS:

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.

James Hall 9-29-94
SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Environmental Management and copy to owner

GW-1 REV. 9/91

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY	
QUAD. NO.	SERIAL NO.
Lat.	Long. RO
Minor Basin	
Basin Code	
Header Ent.	GW-1 Ent.

WELL CONSTRUCTION RECORD

ILLING CONTRACTOR: PATTERSON EXPLORATION SERVICES

DRILLER REGISTRATION NUMBER: 351

STATE WELL CONSTRUCTION PERMIT NUMBER:

MW-8

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: COATS County: HARNETT
DUNN-ERWIN LANDFILL - S.R. 1724
(Road, Community, or Subdivision and Lot No.)

2. OWNER HARNETT COUNTY
ADDRESS P.O. BOX 759
(Street or Route No.)
LILLINGTON NC 27546
City or Town State Zip Code

3. DATE DRILLED 9-23-94 USE OF WELL MONITORING
4. TOTAL DEPTH 25
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 17.5' FT.
(Use "+" If Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
*Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): <1.0 METHOD OF TEST BAILING
10. WATER ZONES (depth): 18'-25'

DEPTH From	To	DRILLING LOG Formation Description
0'	8'	SANDY CLAY
8'	10'	GRAVEL
10'	25'	SILTY CLAY

If additional space is needed use back of form

1. CHLORINATION: Type _____ Amount _____
12. CASING:

Depth From	To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
0	9		2"	SCH 40	PVC

13. GROUT:

Depth From	To	Ft.	Material	Method
0'	7'		NEAT CEMENT	
7'	8'		BENTONITE	

14. SCREEN:

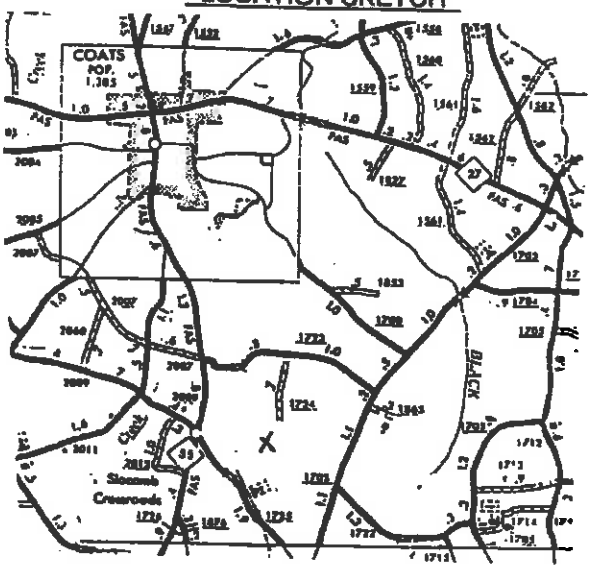
Depth From	To	Ft.	Diameter	Slot Size	Material
9	24'		2 in.	.010 in.	PVC
			in.	in.	
			in.	in.	

15. SAND/GRAVEL PACK:

Depth From	To	Ft.	Size	Material
8'	25'			SAND

16. REMARKS:

LOCATION SKETCH

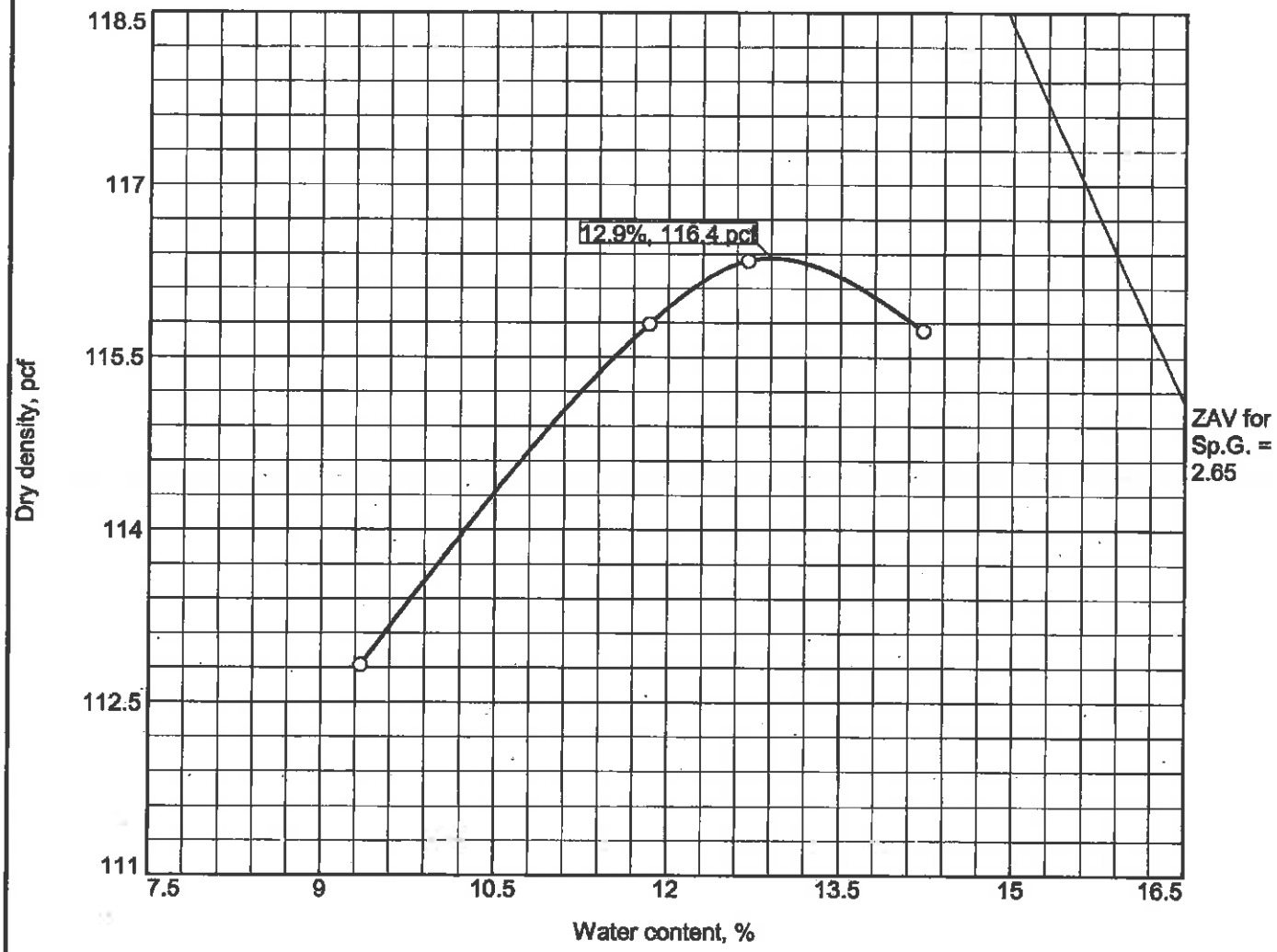


I HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

James Lazell. 9-29-94
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV. 9/91

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.00-0.00	SC-SP			2.65	NP	NP	0	15

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 116.4 pcf Optimum moisture = 12.9 %	Orange, Pink, Silty, Slightly Clayey, Poorly Graded SAND (Visual)

Project No. 2291 **Client:** Harnett County

Project: Dunn Erwin Landfill Corrective Action Plan

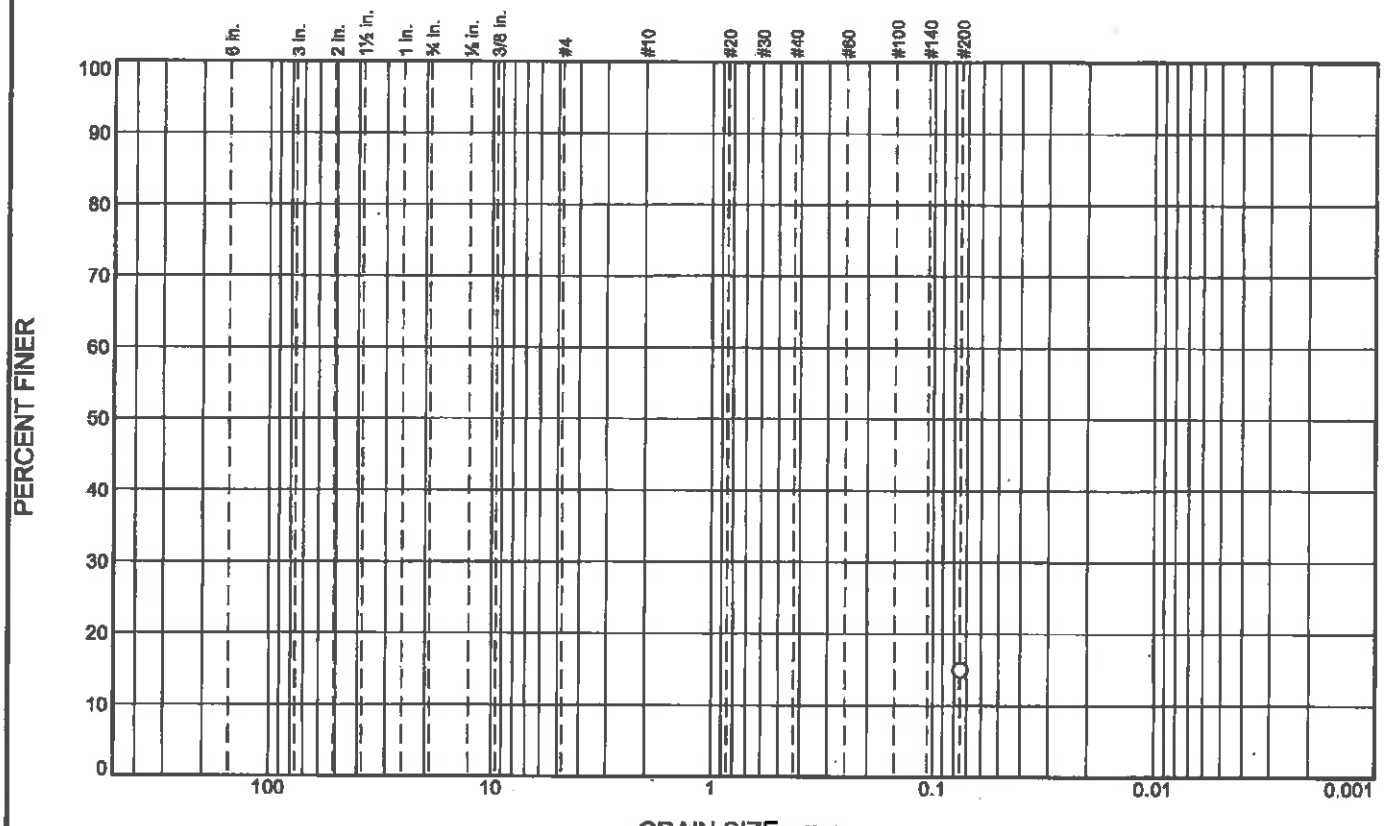
○ **Source of Sample:** ON SITE **Sample Number:** S-4

Remarks:
ASTM D-2488 Visual/Manual Method Used

ECS Carolinas, LLP
726 Ramsey St., Suite 3
Fayetteville, NC 28301
Phone: (910) 401-8263 Fax: (910) 323-0530

Figure

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
				15	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	15		

* (no specification provided)

Soil Description

Orange, Pink, Silty, Slightly Clayey, Poorly Graded SAND (Visual)

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SP AASHTO=

Remarks

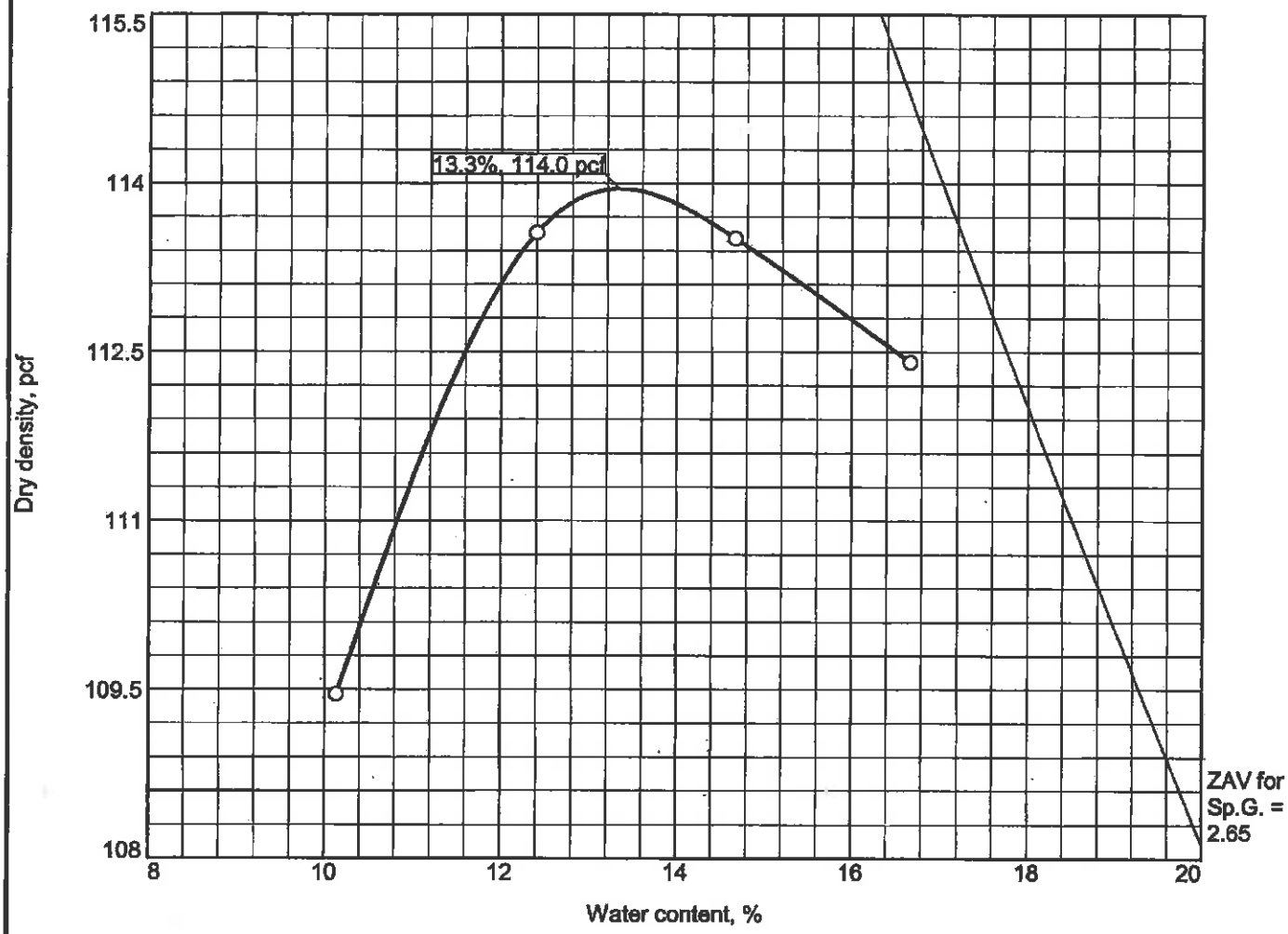
Source of Sample: ON SITE **Depth:** 0.00-0.00
Sample Number: S-4 **Date:** 05/15/2013

ECS Carolinas, LLP
726 Ramsey St., Suite 3
Fayetteville, NC 28301
Phone: (910) 401-3288 Fax: (910) 323-0539

Client: Harnett County
Project: Dunn Erwin Landfill Corrective Action Plan
Project No: 2291 **Figure**

Tested By: Aaron Cain

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.00-0.00	SC			2.65	39	17	0	16

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 114.0 pcf Optimum moisture = 13.3 %	Tan, Brown, Silty, Clayey, SAND (Visual)

Project No. 2291 **Client:** Harnett County
Project: Dunn Erwin Landfill Corrective Action Plan

○ **Source of Sample:** ON SITE **Sample Number:** S-5

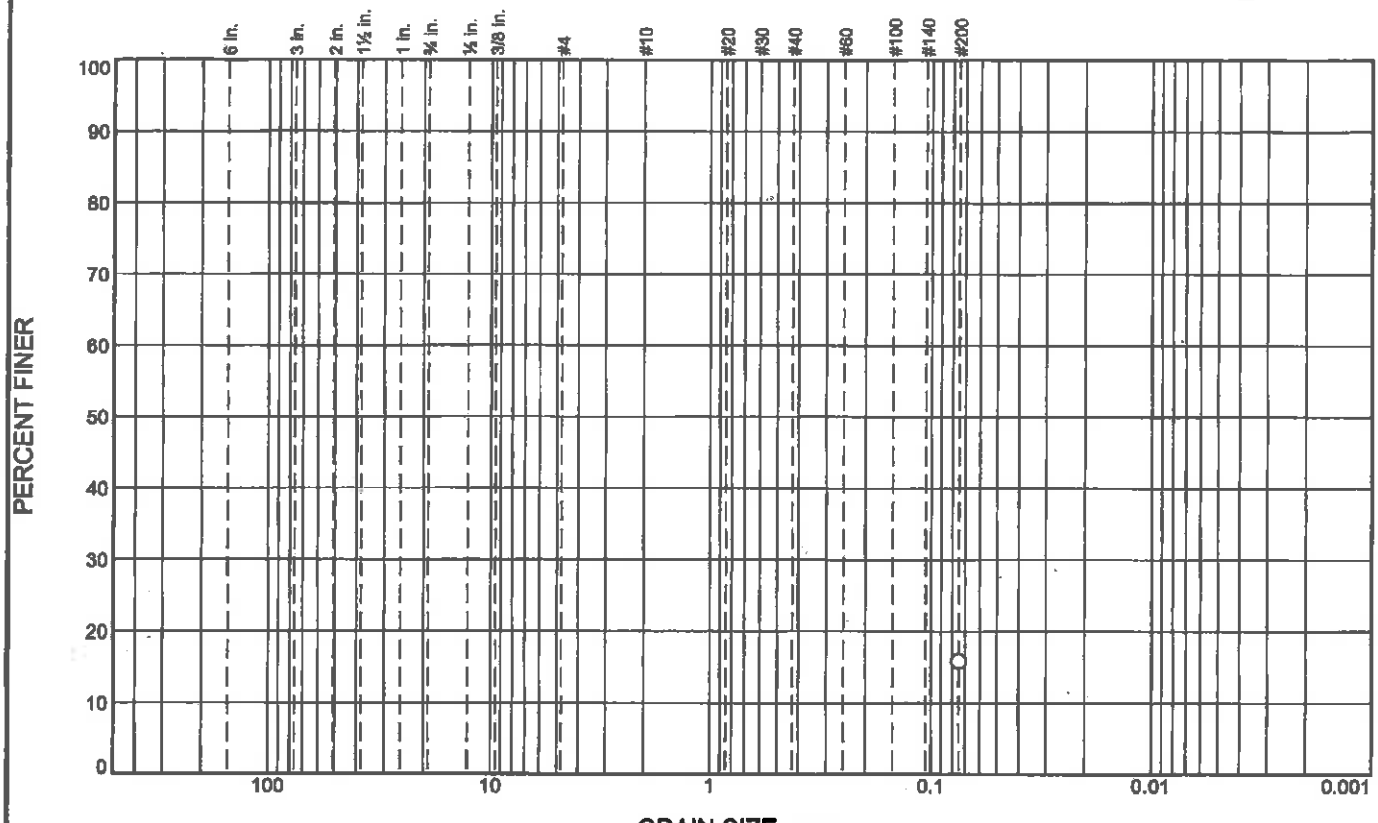
Remarks:
ASTM D-2488 Visual/Manual Method Used

ECS Carolinas, LLP
726 Ramsey St. Suite 5
Fayetteville, NC 28301
Phone: (910) 401-3203 Fax: (910) 323-0339

Figure

Tested By: Aaron Cain

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
				16	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	16		

* (no specification provided)

Soil Description

Tan, Brown, Silty, Clayey, SAND (Visual)

Atterberg Limits

PL= 22 LL= 39 PI= 17

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

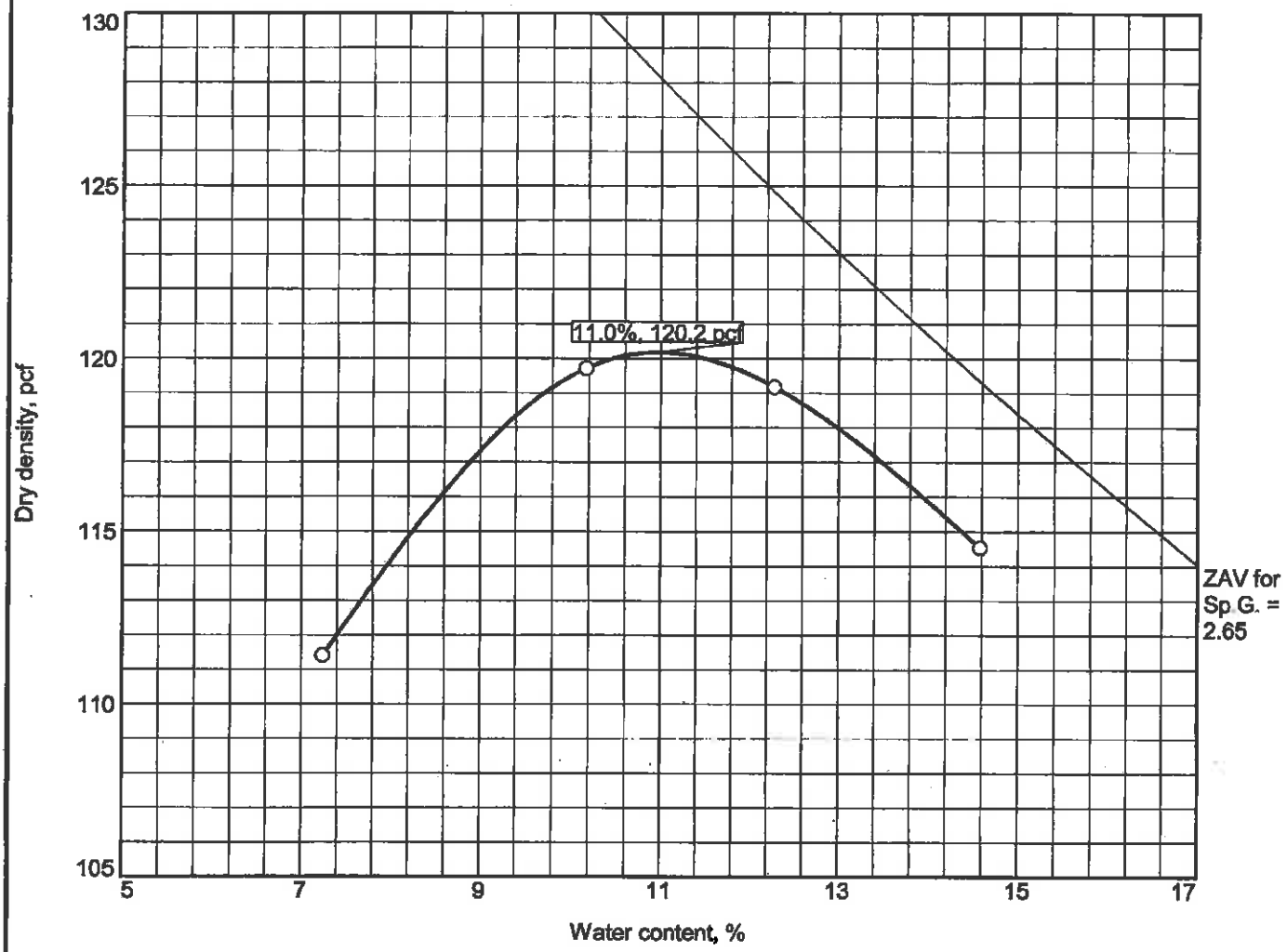
Source of Sample: ON SITE **Depth:** 0.00-0.00
Sample Number: S-5 **Date:**

ECS Carolinas, LLP
726 Ramsey St., Suite 3
Fayetteville, NC 28301
Phone: (910) 401-3288 Fax: (910) 323-0539

Client: Harnett County
Project: Dunn Erwin Landfill Corrective Action Plan
Project No: 2291 **Figure**

Tested By: Aaron Cain

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.00-0.00	SP-SC			2.65	NP	NP	0	18

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 120.2 pcf Optimum moisture = 11.0 %	Light Brown, Silty, Slightly Clayey, Poorly Graded SAND (Visual)

Project No. 2291 **Client:** Harnett County

Project: Dunn Erwin Landfill Corrective Action Plan

○ **Source of Sample:** ON SITE **Sample Number:** S-6

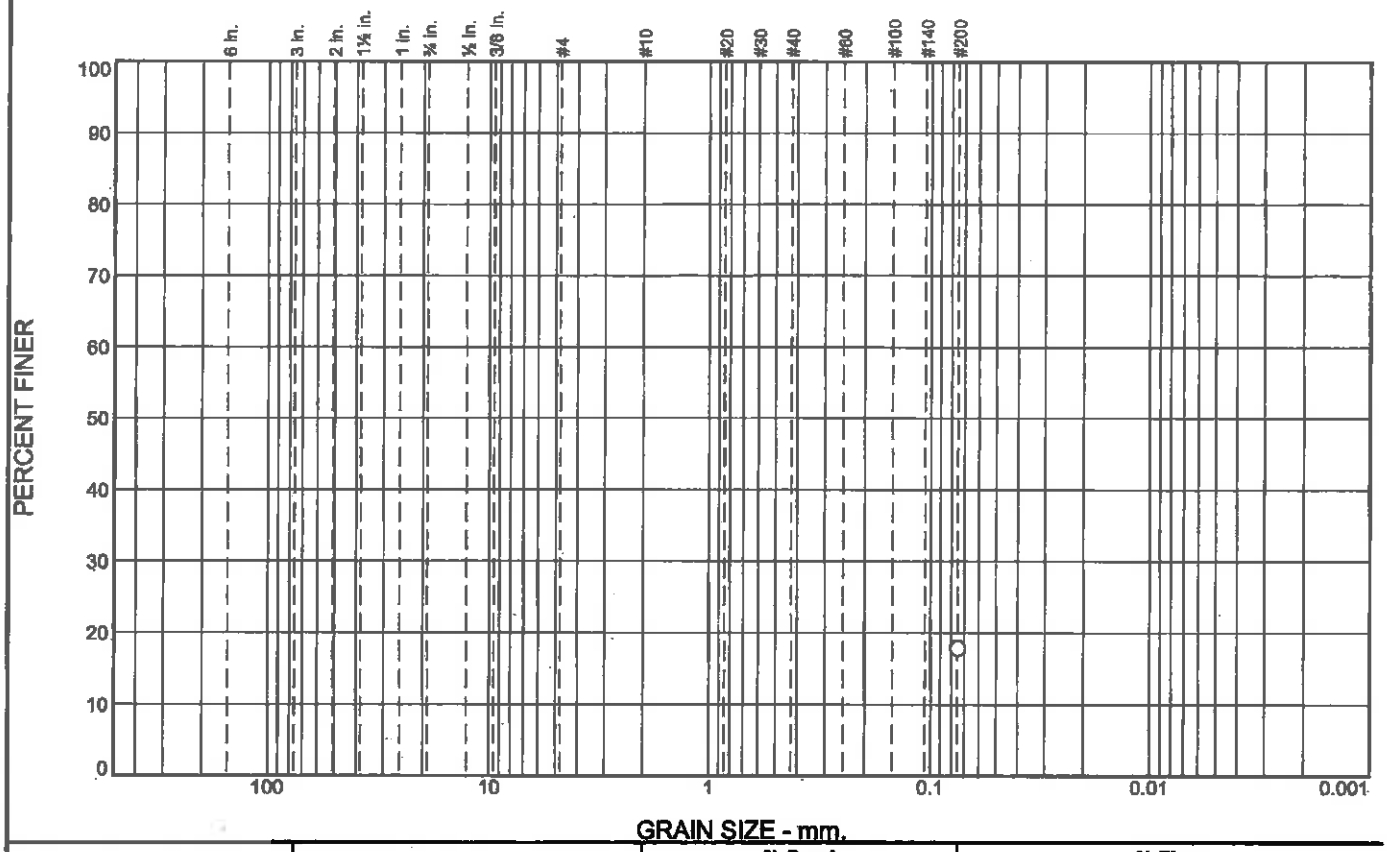
Remarks:
ASTM D-2488 Visual/Manual Method Usec

ECS Carolinas, LLP
726 Ramsey St., Suite 8
Fayetteville, NC 28301
Phone: (910) 401-3265 Fax: (910) 323-0539

Figure

Tested By: Aaron Cain

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
				18	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	18		

* (no specification provided)

Soil Description

Light Brown, Silty, Slightly Clayey, Poorly Graded SAND (Visual)

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SP-SC AASHTO=

Remarks

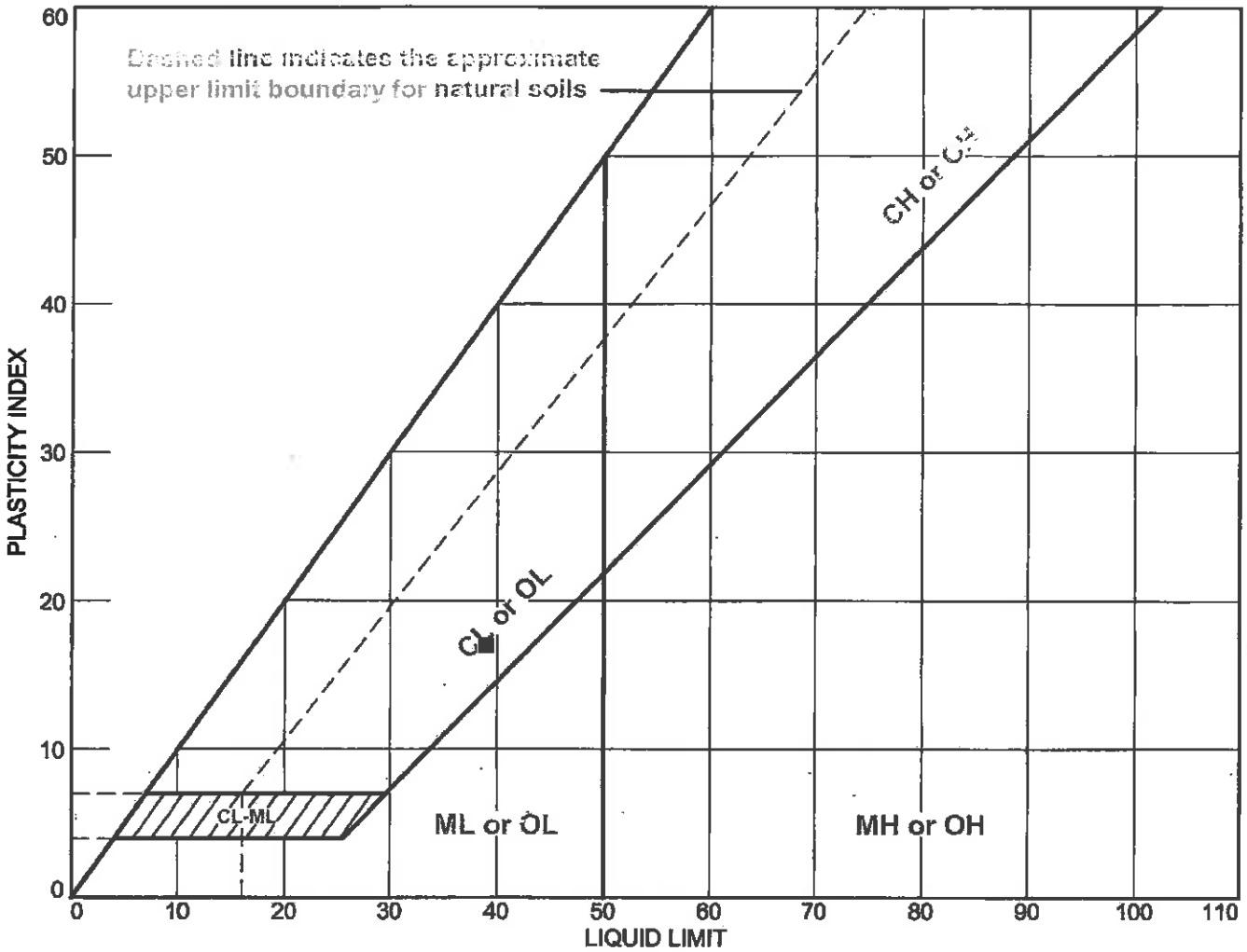
Source of Sample: ON SITE **Depth:** 0.00-0.00
Sample Number: S-6 **Date:** 05/14/2013

ECS Carolinas, LLP
726 Ramsey St., Suite 3
Fayetteville, NC 28301
Phone: (910) 401-3268 Fax: (910) 323-0539

Client: Harnett County
Project: Dunn Erwin Landfill Corrective Action Plan
Project No: 2291 **Figure**

Tested By: Aaron Cain

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	ON SITE	S-4	0.00-0.00		NP	NP	NP	SC-SP
■	ON SITE	S-5	0.00-0.00		22	39	17	SC
▲	ON SITE	S-6	0.00-0.00		NP	NP	NP	SP-SC

ECS Carolinas, LLP
726 Ramsey St., Suite 3
Fayetteville, NC 28301
Phone: (910) 401-3288 Fax: (910) 323-0539

Client: Harnett County
Project: Dunn Erwin Landfill Corrective Action Plan
Project No.: 2291 **Figure**

Tested By: Aaron Cain

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APPENDIX VI

CQA Plan

CONSTRUCTION QUALITY ASSURANCE PLAN

(CQA PLAN)

for the

DUNN ERWIN C&D LANDFILL –

Piggyback C&D Landfill Modification

(Operated under NC Solid Waste Permit No. 43-02)

Prepared for:

Harnett County

PERMIT DOCUMENT
NOT FOR CONSTRUCTION

Prepared by:

Clayton, Sr., P.E., Inc.

Civil & Environmental Engineering

46 W. Washington Street · Coats, NC 27521
Phone: 910-897-7070 · Fax: 910-897-6767
Offices located in Coats and New Bern, North Carolina
License No. C 2570 · www.ctclayton.com

NORTH CAROLINA PROFESSIONAL SEAL 026830 ENGINEER C. TYRUS CLAYTON, JR.

7/26/2013

CTC Project No. 03002E
July 2013

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SECTION 1.0 - GENERAL

1.1 INTRODUCTION

The Construction Quality Assurance (CQA) Plan is intended to fulfill Rule .0541, which requires that a CQA Plan be developed to ensure that the design materials meet the design specifications and the construction and certification requirements set forth in Rule .0540 for C&D landfills. This plan describes the observations and tests that will be used before, during, and upon completion of the cell modification to ensure that the construction materials and workmanship meet the design specifications and the requirements set forth in Rule .0539.

1.2 OVERVIEW OF MANUAL

Per .0541(b) (1) through (5) this CQA Plan addresses:

1. Responsibilities and authorities: The plan establishes responsibilities and authorities for the construction management organization. This includes a pre-construction meeting conducted prior to beginning of construction activities. The meeting shall include a discussion of the construction management organization, respective duties during construction, and periodic reporting requirements for tests results and construction activities. This information is presented in subsequent sections.

2. Inspection activities: A description of all field observations, tests, and equipment that will be used to ensure that the construction meets or exceeds all design criteria established in accordance with Rule .0543 (c) is presented in within.

3. Sampling strategies: A description of all sampling protocols, sample size, methods for determining sample locations and frequency of sampling is presented within.

4. Documentation: Reporting requirements for CQA activities are described in detail in Section 5 of the CQA plan.

5. Progress meetings: A plan will be prepared for holding periodic progress meetings. The proceedings of the meetings will be documented. Meeting information is included in Section 1of the CQA Plan.

1.3 QUALITY ASSURANCE AND QUALITY CONTROL

In the context of this CQA Plan, quality assurance and quality control are defined as follows:

- Quality Assurance: A program of tests and observations, executed by a party independent of the contractor, performed in order to confirm that completed work meets contractual and regulatory requirements and will perform satisfactory in service.

- Quality Control: Those actions performed by the contractor or an agent of the contractor which provide a means to monitor the quality of the work being performed.

1.4 CQA PARTIES

The parties discussed in this section are associated with the ownership, design, construction, and quality assurance of the landfill berm construction. The definitions, responsibilities, and qualifications of these parties are outlined in the following subsections.

1.4.1 CONTRACTOR

The Contractor is the company with which the Owner has entered into agreement to construct the project. The responsibilities and qualifications of the Contractor are as follows:

(in some cases the Owner may serve as the Contractor and does not change the responsibilities below)

- Responsibilities: The Contractor is ultimately responsible for meeting the requirements of the Contract Documents and the successful completion of the landfill berm construction. Some of the Contractor's specific responsibilities include (but are not limited to): providing qualified personnel to perform quality control, providing submttals for the various materials as required by the specifications, scheduling and coordinating the work with suppliers and subcontractors, providing a representative at all times during construction activity, provide surveying services, furnish progress and record drawings, attending progress meetings, and notifying the Engineer of design discrepancies.

- The Contractor shall be experienced in all aspects of the work required to successfully construct the project. The Contractor shall be registered in the State of North Carolina and shall provide references from previous projects.

- The Contractor shall appoint a Contractor's Representative (CR). The CR is a qualified individual assigned to represent the Contractor onsite during construction activities.

- The CR is responsible for: communication with the Engineer and Owner, coordinating and supervising his crew, subcontractors, and quality control personnel, ensuring that construction activities are conducted in accordance with the plans and specifications, immediately notifying the Engineer's Field Representative (EFR) of any discrepancies between the plans and specifications and the field conditions, attending all meetings held on the project, and keeping a daily log of all construction activities onsite.

- The CR shall be an individual who demonstrates the capability to direct all tasks required for landfill berm construction. The CR shall demonstrate experience similar to the nature of the project and be knowledgeable of all aspects of the work.

1.4.2 ENGINEER

The Engineer is the party with which the Owner has entered into agreement with to provide project design and construction oversight. The responsibilities and qualifications of the Engineer are as follows:

- Responsibilities: The Engineer is responsible for performing the engineering design and preparing the associated construction drawings and specifications. The Engineer is responsible for approving all design and specification changes, clarifying the design, reviewing and approving shop drawings, and other tasks as required during construction. The Engineer conducts the pre-construction meeting and progress meetings outlined in this plan. The Engineer will certify that the construction was completed in accordance with the requirements of Rule .0543 (c) (7), and acceptable engineering practices.

- The Engineer shall be a professional engineer registered by the State of North Carolina. The Engineer shall have a working knowledge of landfill design and construction and all applicable regulatory requirements.

- The Engineer shall appoint an Engineer's Field Representative (EFR). The EFR is a qualified individual assigned by the Engineer to observe and document activities requiring quality assurance.

- The EFR is responsible for observing and documenting activities related to the quality assurance of the construction of the landfill berm/ cap. The EFR is responsible for implementation of this CQA Plan and coordination of the Quality Assurance Laboratory (QAL).

  The specific duties of the EFR are as follows:

- Review all construction drawings and specifications.

  a. Review other site-specific documentation, including permits.

  b. Review all changes to design drawings and specifications as issued by the Engineer.

  c. Act as the Owner's representative.

  d. Attend all quality assurance related meetings, e.g., resolution, pre-construction, progress, trouble-shooting, etc.

  e. Review Contractor's Daily Reports, logs, and photographs.

  f. Reports to the Engineer, and log any relevant observations.

  g. Review the results of laboratory testing.

h. Report any unapproved deviations from the CQA Plan.

i. Prepare the final certification report.

- The EFR shall be experienced with the implementation and preparation of quality assurance documentation including: quality assurance forms, reports, certifications, and manuals; and shall have prior experience with soil berm installation.

1.4.3 QUALITY ASSURANCE LABORATORY

The Quality Assurance Laboratory (QAL) is a firm, independent from the Contractor and Owner, responsible for conducting tests on samples of materials for the landfill berm construction. The responsibilities, qualifications, and submittals of the QAL are as follows:

- Responsibilities: The QAL shall be responsible for conducting the appropriate laboratory tests as directed by the Engineer and in accordance with the test methods outlined in this CQA Plan

- Qualifications: The QAL shall have experience in soil testing and be familiar with American Society for Testing and Materials (ASTM).

- The QAL shall deliver all test results to the Engineer in written form. Written test results shall be in an easily readable format and include references to the standard test method used.

1.5 CQA MEETINGS

Communication is essential to achieve a high level of quality during construction and to assure the final product that meets all project requirements. This section discusses and establishes the main forms of communication which are the pre-construction meeting and the progress meetings.

1.5.1 PRE-CONSTRUCTION MEETING

A pre-construction meeting shall be held before construction activity begins. The meeting shall be conducted by the Engineer and attended by the Owner, EFR, Contractor, and CR. The Solid Waste Section will be notified of this meeting and may attend as SWS deems necessary.

> Per Rule .0541 (b) (1), the meeting will include a discussion of the construction management organization, the responsibilities and duties of each party during construction, and periodic reporting requirements for testing results and construction activities.

1.5.2 PROGRESS MEETING

Per Rule .0541 (b) (5) progress meetings shall be conducted by the Engineer and attended by the Owner, EFR, and CR. Progress meetings shall be held as deemed necessary, but at

a minimum frequency of one month. These meetings shall discuss current progress, planned activities to be accomplished prior to the next progress meeting, issues requiring resolution, and any new business or revisions to the work. The EFR shall log any problems, decisions, or questions arising at this meeting. If any matter remains unresolved at the end of this meeting, the EFR will be responsible for obtaining a resolution of the matter and for forwarding communication of the decision to the appropriate parties.

1.6 UNITS

In this CQA Plan, all properties and dimensions are expressed in U.S. units, with "equivalent" SI units in parentheses (). It should be noted that the conversion is typically only accurate within ten percent (10%). In case of conflict, the U.S. units shall be deemed to govern.

1.7 REFERENCES

The CQA Plan includes references to test procedures of the American Society for Testing Materials (ASTM).

SECTION 2.0 - SUBGRADE CQA

2.1 SUBGRADE PREPARATION

The Contractor shall be responsible for preparing the subgrade prior to placement of the containment berm and is responsible for constructing the subgrade with in accordance with the technical specifications.

Before beginning placement of the low permeability soil berm/cap:

1. The EFR shall document that a licensed land surveyor has verified that all grades and elevations are consistent with the SWS approved engineering plans.
2. The EFR shall document that the he/she has visually inspected the subgrade for project conformance.
3. The EFR shall conduct a proof-roll of the subgrade using equipment and procedures approved by the Engineer.
4. The EFR shall document that the subgrade has been tested for conformance to the construction specifications at the following minimum frequencies.

TABLE 1.0 - QA Testing Frequencies for Subgrade

Construction Testing		
Test	**ASTM Method**	**Quantity**
Field Density	D2922, D1556, D2167	1/40,000 FT^2/Lift
Field Moisture	D2216, D3017, D4643	1/40,000 FT^2/Lift

SECTION 3.0 - SOIL BERM CQA

3.1 LOW PERMEABILITY SOIL BERM

The materials, construction and certification requirements in this Section are intended to comply with Rule .0543 (c) (1) (A) and (B).

3.1.1 MATERIALS

1. Low permeability soil berm materials shall conform to the following properties:

   - Passing the 1-inch SieveASTM D422 100%
   - Passing the 200 Sieve ASTM D1140 45% minimum*
   - Liquid Limit ASTM D4318 30 minimum*
   - Plasticity Index ASTM D4318 7 minimum*
   - Soil Classification ASTM D2488 SC,CH,CL,CH,ML,MH
   - Hydraulic Conductivity ASTM D5084 1.0×10^{-5} cm/s max.
   - Organic Content ASTM D2974 5% maximum

   * The Engineer may modify these conformance test properties based on the results of initial conformance testing; provide modification of the results does not compromise the hydraulic conductivity or internal friction angle test results

2. A soil-bentonite mixture may be used for the low permeability soil berm provided it achieves the specified hydraulic conductivity as presented above. Both onsite and offsite soils may be used for soil-bentonite mix. Soil to be used for the soil-bentonite mix shall conform to the following properties:

   - Passing the 1-inch SieveASTM D422 100%
   - Soil Classification ASTM D2488 SC,SM.CL.CH.ML.MH
   - Soils with organic materials of any kind, particularly leaves and roots, shall not be used in the mixture.

3. The soil-bentonite mixture shall consist of an acceptable soil described above; containing a sealant consisting of free flowing, high swelling sodium-based Wyoming type bentonite. The bentonite sealant shall conform to all items of this specification with all supporting test data certified, submitted to, and approved by the Engineer, prior to bid as follows:

- The bentonite shall be covered by the Manufacturer's warranty against defects in the material and workmanship and shall have a useful life of 30 years under normal weathering and normal use conditions.

4. The low permeability soil berm or soil-bentonite mixture material used for construction shall be uniform in character, and after compaction, shall have an in-place saturated hydraulic conductivity of 1.0×10^{-5} cm/s or less.

5. The Contractor shall use adequate construction quality control (CQC) to verify the conformance of materials according to this section. The Contractor shall submit to the Engineer, within 15 days of the effective date of the agreement, representative samples from the soil source(s). In the case that the submitted samples fail to conform to the required criteria, the contractor may locate another source, and upon approval of that source by the Engineer, submit samples from the new source for conformance testing at the cost of the Contractor.

6. If the Contractor plans to use any blending of soils as low permeability soil berm material, the Contractor shall submit the blended soil for the Engineer's approval in accordance with the requirements.

3.1.2 CONFORMANCE TESTING

1. Initial conformance testing shall be the quality assurance laboratory (QAL) on samples from the soil source to assure compliance with the Specifications. The samples will be obtained from multiple test pits to be dug by the Contractor under the direction of the QAL. The following tests shall be performed on the samples.

TABLE 1.1 - QA Testing Frequencies and Criteria for Low Permeability Soil

Preconstruction Qualification		
Test	**ASTM Method**	**Quantity**
Moisture Content	D2216	1/1,000 YD^3
Grain Size	D422 or D1140	1/5,000 YD^3
Atterberg Limits	D4318	1/5,000 YD^3
Laboratory Compaction	D698 - Standard	1/5,000 YD^3
Permeability	D5084	1/5,000 YD^3
***Preconstruction test samples shall be taken from the borrow source and or low permeability soil stockpiled prior to construction.**		
Construction Testing		
Test	**ASTM Method**	**Quantity**
Field Density	D2922, D1556, D2167	1/10,000 FT^2/Lift
Field Moisture	D2216, D3017, D4643	1/10,000 FT^2/Lift
Permeability	D5084	1/20,000 FT^2/ 4 Lifts
Atterberg Limits	D4318	1/5,000 YD^3
Grain Size	D422 or D1140	1/5,000 YD^3
Testing Criteria		
Classification	CL, CH, ML, or MH	
Maximum Particle Size		1/2-inch diameter

2. If a nuclear gauge is used as the primary method for construction testing of the low permeability soil berm, the test data shall be verified by alternate methods at least once for every 25 tests performed

3. Any modifications made to these testing frequencies will require prior approval from the Division of Solid Waste.

4. For natural low permeability soil sources, the QAL shall determine an acceptable zone of moisture contents, dry unit weights and compaction for which hydraulic conductivities are less than or equal to 1.0×10^{-5} cm/s by performing the following testing and analysis procedures:

   - Using the samples extracted from the proposed source, perform Modified and Standard Proctor compaction tests to develop at least two moisture-density curves.

For each of the compaction tests use up to five specimens at incremental moisture contents to develop a compaction curve showing dry density for each molding water content.

- Permeate each compacted specimen to determine its hydraulic conductivity in accordance with ASTM D5084.
- On the graph of dry density vs. moisture content, identify the samples which have a hydraulic conductivities less than or equal to $1x10^{-5}$ cm/s.
- Draw an "acceptable zone" of water content and dry density around the passing samples.
- Based on pertinent factors such as constructability, shrink/swell potential, dessication cracks, and consolidation, the QAL shall modify the acceptable zone as required.

5. For soil-bentonite mixes, prior to constructing the test pad, the QAL shall determine an acceptable zone of moisture contents and dry unit weights in which the hydraulic conductivity is less than or equal to 1x10-5 cm/s by following the procedures described above (with the exception that samples will be extracted from the pug mill operation). The samples will be taken from a soil-bentonite mix once the bentonite percentage for production has been firmly established. The Contractor shall be responsible for performing preliminary hydraulic conductivity tests on initial mix ratios (based on manufacturer's recommendation and adjusted based on contractor's experience) in order to establish the percentage of bentonite to be used in production.

6. Results of the tests will be submitted to the Engineer within 24 hours of test completion. The Engineer reserves the right to reject material based on the results of the conformance tests.

3.2 CONSTRUCTION

3.2.1 Soil Berm Installation

1. The QCL shall supervise the soil berm installation. Work shall not be performed by the Contractor without the QCL onsite. The QCL shall perform field tests (ie. moisture content, densities, etc.) as required to ensure proper installation. The QAL shall perform tests as described in Section 3.1.2 to determine acceptance of the soil berm.

2. The placement moisture content shall be within the acceptable zone of moisture content as determined by the QAL during the conformance testing of the low permeability soil described in Section 3.1.1. The acceptable zone may be modified by the Engineer based on results and observations of the test pad.

3. **Prior to installing the soil berm, the QCL shall verify that the underlying soil containment system is exposed and the soil berm will be adequately "keyed" into this system.**

4. Water for Compaction –

   - The Contractor shall provide water as required to guarantee constructability and proper condition of the in-place and stockpiled material.

   - Prior to installing the soil berm, the Contractor shall inspect the subgrade to ensure that it has been sufficiently wetted to prevent excessive absorption of moisture from the installed material.

   - Should the material be stockpiled for any length of time the Contractor shall slope and compact the stockpile to prevent erosion and oversaturation.

   - Should the material become oversaturated, the Contractor shall spread and dry the material as needed to adjust the moisture to the proper level.

5. The materials shall be uniformly compacted to no less than the minimum dry density of the acceptable zone that corresponds to the placement moisture content. The acceptable zone shall be as specified by the QAL in accordance with the procedures outlined in Section 3.1.2. This minimum density shall be uniformly obtained throughout the entire thickness of 6 inches per lift to assure achievement of the specified compaction in the lower part of the cap. However, the initial lift may be placed at 8 inches to prevent mixing with the existing base/operational cover during compaction.

6. Soil berm material which has been contaminated with clusters of rock or gravel, sand lenses, organic debris or other deleterious material shall be removed and replaced with uncontaminated low permeability soil materials.

7. The Contractor shall use a pugmill to produce the soil-bentonite mix at the required moisture content to achieve an in-place material with a hydraulic conductivity less than or equal $1x10^{-5}$ cm/s. Based on the soil material to be used, the Engineer may direct the Contractor to screen the soils prior to placement in the pugmill. The pugmill must be approved by the Engineer prior to its arrival on site.

8. No low permeability soil berm material shall be placed, spread, or compacted while the existing operational cover or soil berm materials is frozen/thawed, saturated, desiccated, nor during unfavorable weather conditions or periods of precipitation. The cap surface must be made smooth and free from ruts or indentations at the end of any working day when significant precipitation is forecast and/or at the completion of the compaction operations in that area in order to prevent saturation of the soil berm material. Any regrading due to the above conditions or final preparation should be retested at those locations for berm thickness prior to placement of the next lift or erosion control layer. Thickness measurements should be performed as indicated in Section 3.3.

9. Work shall be limited to an area where a lift can be completed in one working day and shall continue in that area until three lifts have been placed. Completion of an area shall be defined as the construction of the soil containment berm that is homogenously

installed at a moisture content and density within the acceptable zone, free rocks larger than 1 inch diameter, and possessing a smooth rolled surface.

10. If a lift is not to receive a subsequent lift within 16 hours of its completion, the lift shall be sealed with a smooth wheel compactor at the end of each day's work to protect the material from desiccation. Should desiccation cracks develop, soil berm material shall be scarified, disked, rewetted, rehomogenized and recompacted in accordance with the specifications to the depth of any such cracks or as instructed by the Engineer. If desiccation extends below half of the lift thickness, the lift shall be removed and replaced.

11. During construction, the Contractor shall make all necessary provisions to deal with inclement weather conditions. The Contractor shall be fully responsible for control of storm water during installation of the berm system and for moisture control and protection of the low permeability soil berm.

12. After final grading and smooth rolling is completed, the compacted soil berm shall meet the grades shown on the plans. The surface is to be surveyed and compared to design elevations. Areas not meeting the requirements shall be augmented with additional low permeability soil material at the expense of the Contractor. Any additional testing or CQA services associated with corrective action for achieving the elevation requirements will be at the cost of the Contractor. The added material shall be worked into the in-place berm to ensure homogeneity and proper bonding. This shall be done by scarification of the surface prior to addition of the new material. As a minimum, the top 4 inches of the soil berm shall be wetted, kneaded, compacted and reworked with the additional material to obtain the required thickness.

3.2.2 Field Quality Control

1. The QAL shall conduct designated tests at frequencies outlined in Table 1.1.

2. All holes made as a result of depth measurements, hydraulic conductivity samples, density tests, grade stakes or other means shall be completely filled by the Contractor with bentonite or soil-bentonite mix, as instructed by the Engineer.

3. The Engineer shall have the authority to request additional hydraulic conductivity tests in areas that, in the Engineer's judgment, may be suspect or deficient. Hydraulic conductivity tests shall be conducted in accordance with ASTM D5084. For each sample tested, one back-up sample will be extracted in the proximity of the sample location. These samples will be held in a controlled environment at the QAL laboratory as a precautionary measure. If adequate demonstration is presented that a sample was not representative of the low permeability soil berm or that an error in testing occurred, the backup samples will be tested and the original test will be disregarded.

4. Any sample or area tested shall be rejected, removed and replaced if it does not meet the requirements of the technical specifications. Reconstructed areas shall have feathered, overlapping edges that tie into adjacent berm areas.

5. Grade stakes for soil berm construction shall be numbered by the Contractor and located on an inventory map. The inventory map shall be submitted to the Engineer. Upon completion of an area, the removed stakes will be compared to the inventory map to ensure that none were left in place.

6. The Contractor shall submit a survey plan with final elevation of top of low permeability soil berm for Engineer's approval.

3.2.3 Corrective Action

If soil has been desiccated to a depth less than or equal to the thickness of a single lift, the desiccated lift may be disked, moistened, and recompacted. However, disking may produce large, hard clods that will require pulverization. Also, it should be recognized that if the soil is wetted, time must be allowed for water to be absorbed into the clods and hydration to take place uniformly. For this reason it may be necessary to remove the desiccated soil from the construction area, process the lift in a separate processing area, and replace the soil accordingly.

SECTION 4.0 – CERTIFICATION DOCUMENTATION

1. Upon completion of the construction activities, a Construction Quality Assurance Certification Report will be submitted to the Solid Waste Section in accordance with Rule .0541. The report will summarize all quality assurance services performed during construction of the C&D landfill berm and will include, at a minimum the following:

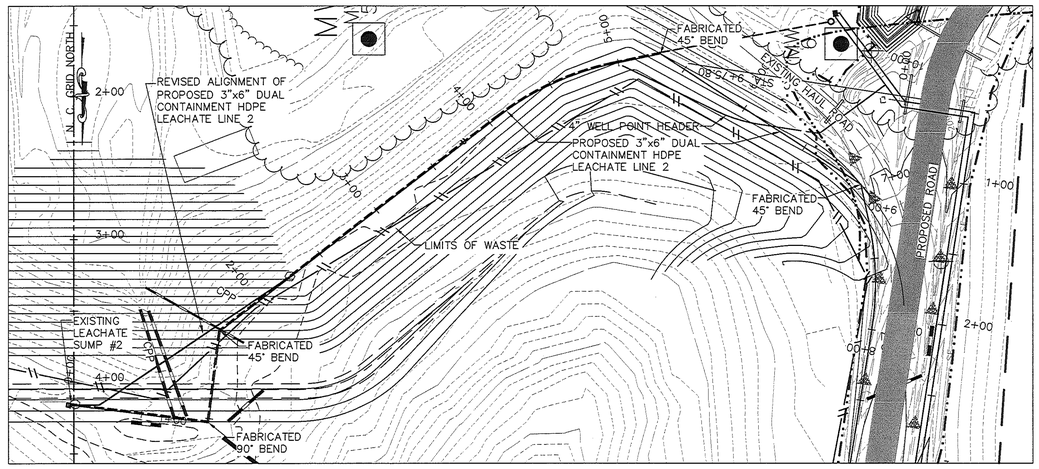
   - Field observation inspection reports;
   - The results of all construction quality assurance and construction quality control testing required by this Plan;
   - Documentation of any failed test results, descriptions of procedures used to correct the improperly installed material and results of all retesting performed;
   - Record survey drawings documenting the completed project and noting any deviation from the approved engineering plans; and
   - A comprehensive narrative including, but not limited to, daily reports from the project engineer and a series of color photographs of major project features.

2. The CQA Certification report shall bear the seal of a North Carolina Professional Engineer who was involved during the construction and a certification that construction was completed in accordance with:

- This CQA Plan;
- The conditions of the Permit to Construct;
- The requirements of Rules .0539 through .0542; and
- Good engineering practices.

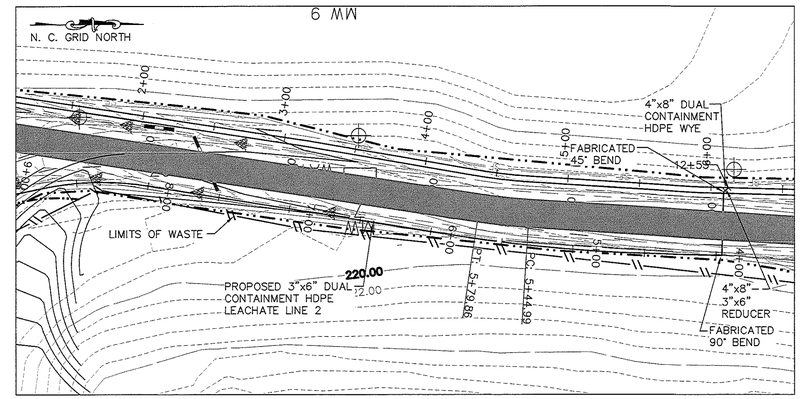
APPENDIX VI

Modified Leachate Management Drawings



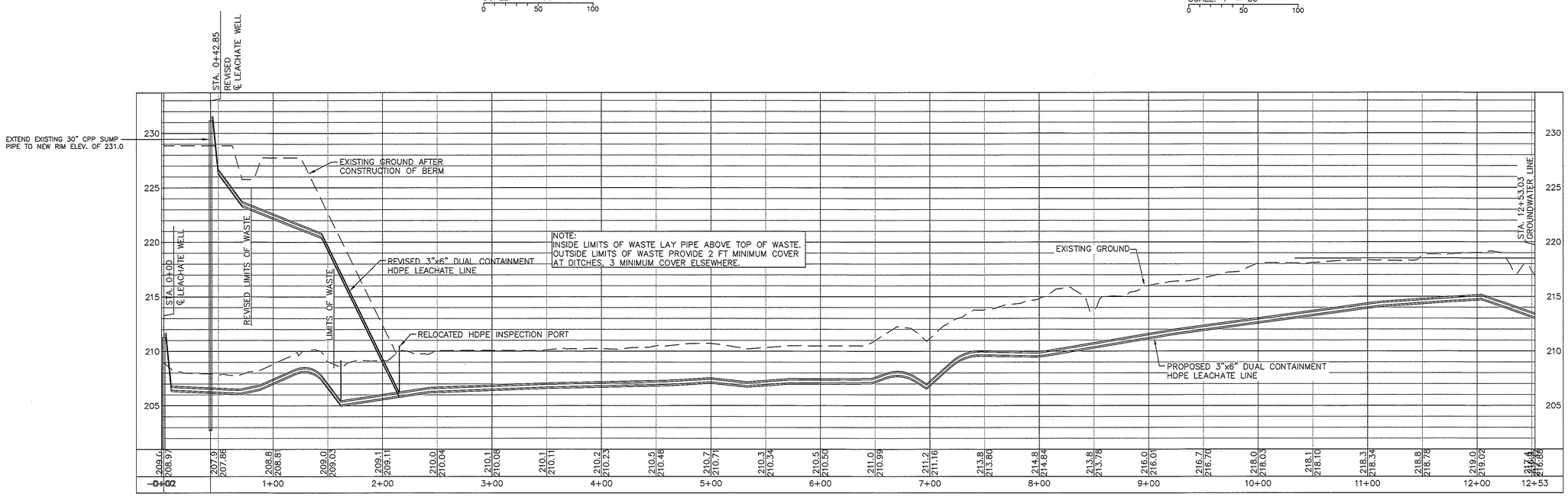
LEACHATE LINE 2 PLAN
STA. 0+00 - STA. 8+00

SCALE: 1" = 50'



LEACHATE LINE 2 PLAN
STA. 8+00 - STA. 12+53.03

SCALE: 1" = 50'



LEACHATE LINE 2 PROFILE

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 5'

General Notes

1. GRADING OF EXISTING ROAD AND INSTALLATION OF E & S CONTROL MEASURES FOR DIVISION 1.2 SHOWN WITHIN THESE PLANS IS TO HAVE BEEN COMPLETED BY THE OWNER PRIOR TO PROJECT COMMENCEMENT DATE. THERE MAY BE DEVIATIONS FROM GRADES DEPICTED. BIDDERS ARE RESPONSIBLE FOR INSPECTING THE PROJECT SITE PRIOR TO BIDDING TO BECOME FAMILIAR WITH SITE CONDITIONS.

FINAL DRAWINGS
RELEASED FOR BID
NOT FOR CONSTRUCTION

No.	Revision/Issue	Date
1	ADDED LANDFILL UNIT MODIFICATIONS	7/25/13

NORTH CAROLINA PROFESSIONAL SEAL 028909 ENGINEER C. TYRUS CLAYTON, JR.

Signature

Date 7/26/13

Clayton, Sr., P.E., Inc.
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HARNETT COUNTY
DUNN-ERWIN LANDFILL
PROJECT 1

HARNETT COUNTY, NORTH CAROLINA

Project No:	03002B	File Name:	03002B MAS.dwg
Designed By:	CTC Jr.	Drawn By:	WLF
Checked By:	CTC Jr.	Proj. Eng.:	CTC Jr.
Sheet Title	PLAN & PROFILE LEACHATE LINE 2		
Date	7/25/13	Sheet	1.2.5 OF 16
Scale	AS NOTED		

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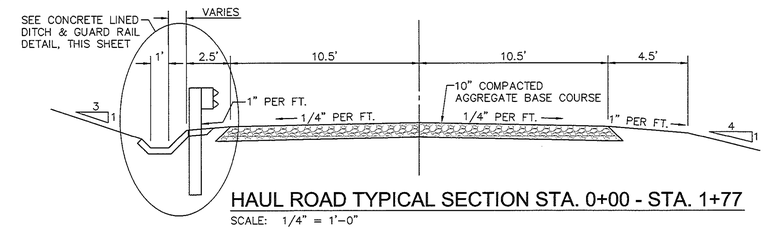
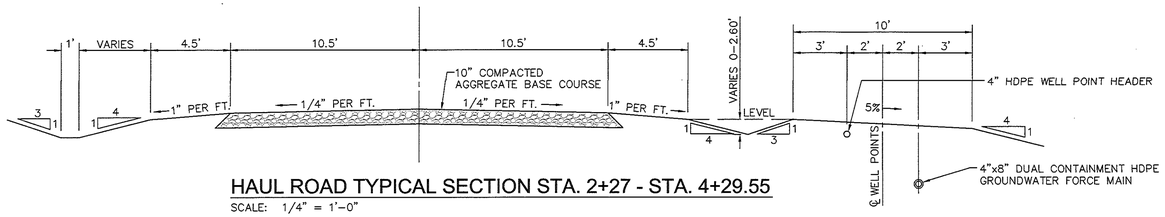


HAUL ROAD TYPICAL SECTION STA. 0+00 - STA. 1+77

SCALE: 1/4" = 1'-0"



HAUL ROAD TYPICAL SECTION STA. 2+27 - STA. 4+29.55

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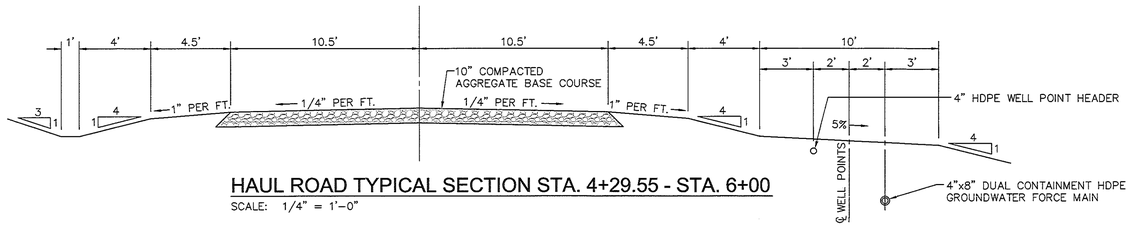
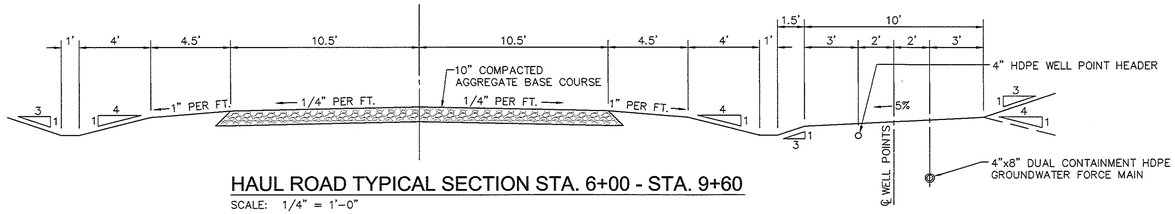


HAUL ROAD TYPICAL SECTION STA. 4+29.55 - STA. 6+00

SCALE: 1/4" = 1'-0"



HAUL ROAD TYPICAL SECTION STA. 6+00 - STA. 9+60

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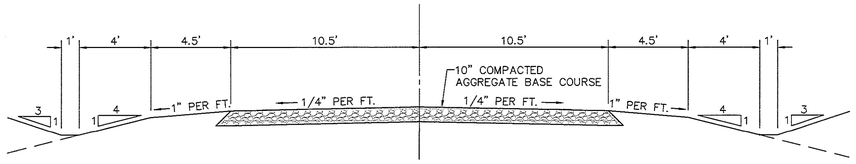
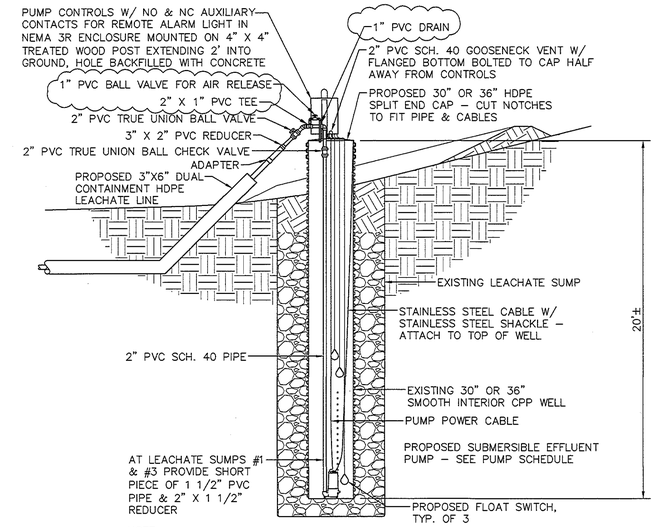


HAUL ROAD TYPICAL SECTION STA. 10+00 - STA. 15+89

SCALE: 1/4" = 1'-0"

SECTIONS ABOVE ARE SHOWN FOR PIPE LAYOUT PURPOSES. GRADING AND ROAD CONSTRUCTION ARE NOT IN THIS CONTRACT. CONTRACTOR SHALL PERFORM MINOR GRADING ASSOCIATED WITH PIPE AND WELL POINT INSTALLATION AS NECESSARY.



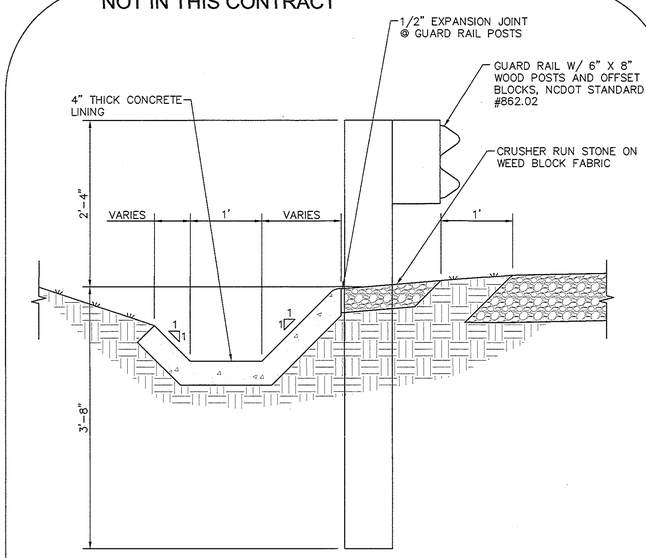
NOTE:
EXISTING EXTRACTION PIPING TO REMAIN IN PLACE.

PUMP SCHEDULE							
LOCATION	WELL DIAMETER	PUMP			MOTOR		
		MANUFACTURER	MODEL	DISCHARGE	HORSEPOWER	VOLTS	PHASE
SUMP #1	36"	MYERS	ME40	1 1/2" NPT	4/10	230	1
SUMP #2	30"	MYERS	ME75	2" NPT	3/4	230	1
SUMP #3	36"	MYERS	ME40	1 1/2" NPT	4/10	230	1

TYPICAL LEACHATE EXTRACTION PUMP DETAIL

SCALE: 1/4" = 1'-0"

NOT IN THIS CONTRACT



CONCRETE LINED DITCH & GUARD RAIL DETAIL

SCALE: 1" = 1'-0"

General Notes

FINAL DRAWINGS
RELEASED FOR BID
NOT FOR CONSTRUCTION

No.	Revision/Issue	Date
2	REVISED SHEET NUMBER	7/25/13
1	REVISED SHEET NUMBER	9/14/11

NORTH CAROLINA PROFESSIONAL SEAL 026626 ENGINEER C. TRUS CLAYTON, JR.

Signature

7/26/13
Date

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HARNETT COUNTY
DUNN-ERWIN LANDFILL
PROJECT 1

HARNETT COUNTY, NORTH CAROLINA

Project No: 03002B	File Name: 03002B Mas.dwg
Designed By: CTC Jr.	Drawn By: WLF
Checked By: CTC Jr.	Proj. Eng.: CTC Jr.
Sheet Title: TYPICAL SECTIONS & DETAILS	
Date: 5/13/11	Sheet 1.2.6 OF 8
Scale: AS NOTED	

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APPENDIX VII

Stormwater and E&S Control Calculations

RUNOFF CALCULATIONS

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

DA 1

to SD 1

Drainage Area, A: 51,975 ft^2
1.19 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 1.19
= 3.29 ft^3/sec

DA 2

to SD 2

Drainage Area, A: 43,726 ft^2
1.00 acre

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 1
= 2.77 ft^3/sec

DA 3

to SD 3

Drainage Area, A: 165,736 ft^2
3.8 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 3.8
= 10.52 ft^3/sec

DA 4

to Swale D7 & SD 4

Drainage Area, A: 72,265 ft^2
1.66 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 1.66
= 4.60 ft^3/sec

DA 5

to SD 5

Drainage Area, A: 60,163 ft^2
1.38 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 1.38
= 3.82 ft^3/sec

DA 6

to SD 6

Drainage Area, A: 101,456 ft^2
2.33 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 2.33
= 6.45 ft^3/sec

DA 7 to SD 7

Drainage Area, A: 133,076 ft^2
3.05 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 3.05
= 8.44 ft^3/sec

DA 8 to SD 8

Drainage Area, A: 128,529 ft^2
2.95 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 2.95
= 8.17 ft^3/sec

DA 9 to SB 2

Drainage Area, A: 13,964 ft^2
0.32 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 0.32
= 0.89 ft^3/sec

DA 10 to SD 9

Drainage Area, A: 70,808 ft^2
1.63 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 1.63
= 4.51 ft^3/sec

DA 1a to Ditch D1

Drainage Area, A: 42,979 ft^2
0.99 acres

Runoff Coefficient, C: 0.40

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.4 x 7.91 x 0.99
= 3.13 ft^3/sec

DA 2a to Ditch D2

Drainage Area, A: 8,939 ft^2
0.21 acres

Runoff Coefficient, C: 0.40

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.4 x 7.91 x 0.21
= 0.66 ft^3/sec

DA 2b

to Swale D6

Drainage Area, A: 34,824 ft^2
0.8 acres

Runoff Coefficient, C: 0.40

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.4 x 7.91 x 0.8
= 2.53 ft^3/sec

DA 5a

to Ditch D3

Drainage Area, A: 9,181 ft^2
0.21 acres

Runoff Coefficient, C: 0.40

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.4 x 7.91 x 0.21
= 0.66 ft^3/sec

DA 7a

to Drainage Swale D4

Drainage Area, A: 73,979 ft^2
1.7 acres

Runoff Coefficient, C: 0.40

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.4 x 7.91 x 1.7
= 5.38 ft^3/sec

DA 8a

to diversion swale D4

Drainage Area, A: 35,737 ft^2
0.82 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.35 x 7.91 x 0.82
= 2.27 ft^3/sec

DA 8b

to Drainage Swale D9

Drainage Area, A: 45,280 ft^2
1.04 acres

Runoff Coefficient, C: 0.40

Time of Concentration: 5 min
Return Frequency: 10 years
Rainfall intensity, I: 7.91 in/hr

Runoff, Q= C x I x A
= 0.4 x 7.91 x 1.04
= 3.29 ft^3/sec

Temp Slope Drain 1

to existing sed basin

Drainage Area, A: 286,900 ft^2
6.59 acres

Runoff Coefficient, C: 0.35

Time of Concentration: 10 min
Return Frequency: 10 years
Rainfall intensity, I: 6.29 in/hr

Runoff, Q= C x I x A
= 0.35 x 6.29 x 6.59
= 14.51 ft^3/sec

SEDIMENT BASIN SB 1 (EXISTING)

Project:	Dunn-Erwin Landfill C&D Unit Closure
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By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Drainage Areas 1, 3, 5 & 7

Runoff, 10 year: 32.44 ft^3/sec
Rainfall intensity, 10 year: 7.91
Rainfall intensity, 2 year: 6.16
Runoff, 2 year = 32.44 x 6.16 / 7.91
= 25.26 ft^3/sec

Disturbed Area: 7.98 acres

Volume required = 1800 ft^3 per acre disturbed area
= 1800 X 7.98
= 14,364 ft^3
Surface area required = 435 ft^2 per ft^3/sec Q_{10}
= 435 X 32.44
= 14,111 ft^2

Basin is irregular.
Surface elevation: 183
Bottom elevation: 180
Ponding depth: 3 ft
Surface area: 14,235 ft^2
Surface area required: 14,111
Conclusion: ADEQUATE

Bottom area: 8,521 ft^2
Ponding volume = (14235 + 8521) /2 x 3
= 34,134 ft^3
Volume required: 14,364
Conclusion: ADEQUATE

SEDIMENT BASIN SB 2 (RISER & BARREL)

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Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Drainage Areas 2, 4, 6 & 8 6.03 ac total
Runoff, 10 year: 16.70 ft^3/sec
Rainfall intensity, 10 year: 7.91
Rainfall intensity, 2 year: 6.16
Runoff, 2 year = 16.7 x 6.16 / 7.91
= 13.01 ft^3/sec

Disturbed Area: 4.60 acres

Volume required = 1800 ft^3 per acre disturbed area
= 1800 X 4.6
= 8,280 ft^3
Surface area required = 435 ft^2 per ft^3/sec Q_{10}
= 435 X 16.7
= 7,265 ft^2

Basin is irregular.
Surface elevation: 182
Bottom elevation: 180
Ponding depth: 2 ft
Surface area: 7,902 ft^2
Surface area required: 7,265
Conclusion: ADEQUATE

Bottom area: 5,061 ft^2
Ponding volume = (7902 + 5061) /2 x 2
= 12,963 ft^3
Volume required: 8,280
Conclusion: ADEQUATE

Spillway Design

Principal Spillway

Riser & barrel, smooth-interior corrugated HDPE

Bottom Elevation:	180.0	
Principal Spillway Crest Elevation	182.0	
Riser Diameter:	24	in
Riser Circumference:	6	ft
Riser Capacity @ 1 ft head:	19	ft^3/sec
Barrel Diameter:	15	in
Barrel Area, A:	1.227	ft^2
Wetted Perimeter:	3.927	ft
Hydraulic Radius, R:	0.31	ft
Roughness Coefficient, n:	0.012	
Barrel Slope, S:	0.060	ft/ft
Velocity, $V=1.49/nxR^{2/3}xS^{1/2}$:	13.95	ft/sec
Barrel Capcity:	17.12	ft^3/sec
Principal Spillway Capcity:	17.12	ft^3/sec
Prin. Spillway Capacity Required:	13.01	ft^3/sec
Conclusion:	ADEQUATE	

Emergency Spillway

Trapezoidal channel, grass & legume lining

Emergency Spillway Crest Elev.:	183.0	
Bottom Width:	3.0	ft
Side Slope Ratio:	3.0	ft h/ft v
Water Depth:	0.50	ft
Area, A:	2.25	ft^2
Wetted Perimeter:	6.16	ft
Hydraulic Radius, R:	0.365	ft
VR:	0.33	
Roughness Coeffilcient, n:	0.190	(6"-12" grass)
Slope, S:	0.050	ft/ft
Velocity, $V=1.49/nxR^{2/3}xS^{1/2}$:	0.89	ft/sec
Emergency Spillway Capacity=VxA:	2.01	ft^3/sec
Required Capacity:	-0.42	ft^3/sec
Conclusion:	ADEQUATE	
Top of Embankment Elevation:	184.5	

Baffle Spacing Calculation

Inlet Zone - 35%	2765.7	ft
First Chamber - 25%	1975.5	ft
Second Chamber - 25%	1975.5	ft
Outlet Zone - 15%	1185.3	ft

Riser Flotation Calculation

Riser Diameter:	2.00	ft
Riser Height:	2.0	ft
Riser Volume:	6.28	ft^3
Riser Displacement:	392.1	lb
Anti-flotation block dimensions:	3' x 3' x 1'	
Anti-flotation block volume:	9.0	ft^3
Anti-flotation block weight:	1125.0	lb

SLOPE DRAIN SD 1

Project:	Dunn-Erwin Landfill C&D Unit Closure
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Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 1

10-year runoff: 3.29 ft^3/sec

Pipe Capacity

Pipe material: Corrugated plastic

Roughness Coeffiicient, n: 0.024

Pipe diameter, d: 15 in

= 1.25 ft

Pipe radius, r = 1.25 / 2

= 0.625 ft

Area, A =

= 1.2 ft^2

Wetted perimeter, WP =

= 3.93 ft

Hydraulic Radius, R = A / WP

= 1.23 / 3.93 ft^2

= 0.31 ft

Pipe slope, S: 0.250 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 14.304 ft/sec

Flow, Q = A x V

= **17.59** ft^3/sec

Pipe Inlet Capacity

Coefficient of discharge, Cd: 0.6

Inlet area, A: 1.2 ft^2

Inlet radius, r: 0.625 ft

Water depth, wd: 2 ft

Driving head, h = wd - r

= 2 - 0.625

= 1.375 ft

Acceleration of gravity, g: 32.2 ft/sec2

Flow, Q_I = $CdA(2gH)^{1/2}$

= 0.6 x 1.23 x (2 x 32.2 x 1.375)^.5

= 6.94 ft^3/sec

Number of inlets required = Q / Q_I

= 3.29 / 6.94

= 0.5

Number of inlets provided: 1

SLOPE DRAIN SD 2

Project:	Dunn-Erwin Landfill C&D Unit Closure
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By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 2

10-year runoff: 2.77 ft^3/sec

Pipe Capacity

Pipe material: Corrugated plastic

Roughness Coeffiicient, n: 0.024

Pipe diameter, d: 15 in

= 1.25 ft

Pipe radius, r = 1.25 / 2

= 0.625 ft

Area, A =

= 1.2 ft^2

Wetted perimeter, WP =

= 3.93 ft

Hydraulic Radius, R = A / WP

= 1.23 / 3.93 ft^2

= 0.31 ft

Pipe slope, S: 0.250 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 14.304 ft/sec

Flow, Q = A x V ft

= **17.59** ft^3/sec

Pipe Inlet Capacity

Coefficient of discharge, Cd: 0.6

Inlet area, A: 1.2 ft^2

Inlet radius, r: 0.625 ft

Water depth, wd: 2 ft

Driving head, h = wd - r

= 2 - 0.625

= 1.375 ft

Acceleration of gravity, g: 32.2 ft/sec2

Flow, Q_I = $CdA(2gH)^{1/2}$

= 0.6 x 1.23 x (2 x 32.2 x 1.375)^.5

= 6.94 ft^3/sec

Number of inlets required = Q / Q_I

= 2.77 / 6.94

= 0.4

Number of inlets provided: 1

SLOPE DRAIN SD 3

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Areas 1 & 3

10-year runoff: 13.81 ft^3/sec

Pipe Capacity, Lower Section

Pipe material: Corrugated plastic

Roughness Coeffiicient, n: 0.024

Pipe diameter, d: 15 in

= 1.25 ft

Pipe radius, r = 1.25 / 2

= 0.625 ft

Area, A =

= 1.2 ft^2

Wetted perimeter, WP =

= 3.93 ft

Hydraulic Radius, R = A / WP

= 1.23 / 3.93 ft^2

= 0.31 ft

Pipe slope, S: 0.330 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 16.434 ft/sec

Flow, Q = A x V

= **20.21** ft^3/sec

Pipe Capacity, Upper Section

Pipe material: Smooth Interior Corrugated HDPE

Roughness Coeffiicient, n: 0.012

Pipe diameter, d: 15 in

= 1.25 ft

Pipe radius, r = 1.25 / 2

= 0.625 ft

Area, A =

= 1.2 ft^2

Wetted perimeter, WP =

= 3.93 ft

Hydraulic Radius, R = A / WP

= 1.23 / 3.93 ft^2

= 0.31 ft

Pipe slope, S: 0.109 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 18.890 ft/sec

Flow, Q = A x V

= **23.23** ft^3/sec

SLOPE DRAIN SD 4

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 4

10-year runoff: 4.60 ft^3/sec

Pipe Capacity

Pipe material: Corrugated plastic

Roughness Coeffiicient, n: 0.024

Pipe diameter, d: 15 in

= 1.25 ft

Pipe radius, r = 1.25 / 2

= 0.625 ft

Area, A =

= 1.2 ft^2

Wetted perimeter, WP =

= 3.93 ft

Hydraulic Radius, R = A / WP

= 1.23 / 3.93 ft^2

= 0.31 ft

Pipe slope, S: 0.250 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 14.304 ft/sec

Flow, Q = A x V

= **17.59** ft^3/sec

Pipe Inlet Capacity

Coefficient of discharge, Cd: 0.6

Inlet area, A: 1.2 ft^2

Inlet radius, r: 0.625 ft

Water depth, wd: 2.25 ft

Driving head, h = wd - r

= 2.25 - 0.625

= 1.625 ft

Acceleration of gravity, g: 32.2 ft/sec2

Flow, Q_I = $CdA(2gH)^{1/2}$

= 0.6 x 1.23 x (2 x 32.2 x 1.625)^.5

= 7.55 ft^3/sec

Number of inlets required = Q / Q_I

= 4.6 / 7.55

= 0.6

Number of inlets provided: 1

SLOPE DRAIN SD 5

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 5

10-year runoff: 3.82 ft^3/sec

Pipe Capacity

Pipe material: Corrugated plastic

Roughness Coeffiicient, n: 0.024

Pipe diameter, d: 15 in

= 1.25 ft

Pipe radius, r = 1.25 / 2

= 0.625 ft

Area, A = π x $(d/24)^2$

= 1.2 ft^2

Wetted perimeter, WP = π x d / 12

= 3.93 ft

Hydraulic Radius, R = A / WP

= 1.23 / 3.93 ft^2

= 0.31 ft

Pipe slope, S: 0.333 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 16.508 ft/sec

Flow, Q = A x V

= **20.31** ft^3/sec

Pipe Inlet Capacity

Coefficient of discharge, Cd: 0.6

Inlet area, A: 1.2 ft^2

Inlet radius, r: 0.625 ft

Water depth, wd: 2 ft

Driving head, h = wd - r

= 2 - 0.625

= 1.375 ft

Acceleration of gravity, g: 32.2 ft/sec2

Flow, Q_I = $CdA(2gH)^{1/2}$

= 0.6 x 1.23 x (2 x 32.2 x 1.375)^.5

= 6.94 ft^3/sec

Number of inlets required = Q / Q_I

= 3.82 / 6.94

= 0.6

Number of inlets provided: 1

SLOPE DRAIN SD 6

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Areas 2, 4 & 6

10-year runoff: 10.27 ft^3/sec

Pipe Capacity

Pipe material: Corrugated plastic

Roughness Coeffiicient, n: 0.024

Pipe diameter, d: 15 in

= 1.25 ft

Pipe radius, r = 1.25 / 2

= 0.625 ft

Area, A = π x $(d/24)^2$

= 1.2 ft^2

Wetted perimeter, WP = π x d / 12

= 3.93 ft

Hydraulic Radius, R = A / WP

= 1.23 / 3.93 ft^2

= 0.31 ft

Pipe slope, S: 0.256 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 14.474 ft/sec

Flow, Q = A x V

= **17.80** ft^3/sec

Pipe Inlet Capacity

Coefficient of discharge, Cd: 0.6

Inlet area, A: 1.2 ft^2

Inlet radius, r: 0.625 ft

Water depth, wd: 1.5 ft

Driving head, h = wd - r

= 1.5 - 0.625

= 0.875 ft

Acceleration of gravity, g: 32.2 ft/sec2

Flow, Q_I = $CdA(2gH)^{1/2}$

= 0.6 x 1.23 x (2 x 32.2 x 0.875)^.5

= 5.54 ft^3/sec

Number of inlets required = Q / Q_I

= 10.27 / 5.54

= 1.9

Number of inlets provided: 2

SLOPE DRAIN SD 7

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Areas 2, 4 & 6

10-year runoff: 15.81 ft^3/sec

Pipe Capacity

Pipe material: Corrugated plastic

Roughness Coeffiicient, n: 0.024

Pipe diameter, d: 15 in

= 1.25 ft

Pipe radius, r = 1.25 / 2

= 0.625 ft

Area, A = π x $(d/24)^2$

= 1.2 ft^2

Wetted perimeter, WP = π x d / 12

= 3.93 ft

Hydraulic Radius, R = A / WP

= 1.23 / 3.93 ft^2

= 0.31 ft

Pipe slope, S: 0.256 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 14.474 ft/sec

Flow, Q = A x V

= **17.80** ft^3/sec

Pipe Inlet Capacity

Coefficient of discharge, Cd: 0.6

Inlet area, A: 1.2 ft^2

Inlet radius, r: 0.625 ft

Water depth, wd: 2.25 ft

Driving head, h = wd - r

= 2.25 - 0.625

= 1.625 ft

Acceleration of gravity, g: 32.2 ft/sec2

Flow, Q_I = $CdA(2gH)^{1/2}$

= 0.6 x 1.23 x (2 x 32.2 x 1.625)^.5

= 7.55 ft^3/sec

Number of inlets required = Q / Q_I

= 15.81 / 7.55

= 2.1

Number of inlets provided: 3

Temporary SLOPE DRAIN

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CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Areas 2, 4 & 6

10-year runoff: 14.51 ft^3/sec

Pipe Capacity

Pipe material: Corrugated plastic

Roughness Coeffiicient, n: 0.024

Pipe diameter, d: 18 in

= 1.50 ft

Pipe radius, r = 1.5 / 2

= 0.75 ft

Area, A =

= 1.8 ft^2

Wetted perimeter, WP =

= 4.71 ft

Hydraulic Radius, R = A / WP

= 1.77 / 4.71 ft^2

= 0.38 ft

Pipe slope, S: 0.070 ft/ft

Velocity, V = 1.49 / n x $R^{2/3}$ x $S^{1/2}$

= 8.551 ft/sec

Flow, Q = A x V

= **15.14** ft^3/sec

Pipe Inlet Capacity

Coefficient of discharge, Cd: 0.6

Inlet area, A: 1.8 ft^2

Inlet radius, r: 0.75 ft

Water depth, wd: 1.6 ft

Driving head, h = wd - r

= 1.6 - 0.75

= 0.85 ft

Acceleration of gravity, g: 32.2 ft/sec2

Flow, Q_I = $CdA(2gH)^{1/2}$

= 0.6 x 1.77 x (2 x 32.2 x 0.85)^.5

= 7.86 ft^3/sec

Number of inlets required = Q / Q_I

= 14.507885 / 7.86

= 1.8

Number of inlets provided: 2

DITCH D1

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
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By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 1a

10-year runoff: **3.13** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	0.0 ft	0.0 ft
Side Slope Ratio:	3.0 ft h/ft v	3.0 ft h/ft v
Water Depth:	0.76 ft	0.95 ft
Area, A:	1.73 ft^2	2.71 ft^2
Wetted Perimeter:	4.81 ft	6.01 ft
Hydraulic Radius, R:	0.360 ft	0.451 ft
VR:	0.67	0.52
Roughness Coeffiicient, n:	0.070 (2"-6" grass)	0.130 (6"-10" grass)
Slope, S:	0.030 ft/ft	0.030 ft/ft
Velocity, $V=1.49/n x R^{2/3} x S^{1/2}$:	**1.86** ft/sec	1.16 ft/sec
Flow, Q:	3.22 ft^3/sec	**3.15** ft^3/sec

Permissible Velocity: 3.50 ft/sec

Conclusion: STABLE

Use temporary synthetic mat.

Flow Required: 3.13 ft^3/sec

Conclusion: ADEQUATE

DITCH D2

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 2a

10-year runoff: **0.66** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	0.0 ft	0.0 ft
Side Slope Ratio:	3.0 ft h/ft v	3.0 ft h/ft v
Water Depth:	0.42 ft	0.57 ft
Area, A:	0.53 ft^2	0.97 ft^2
Wetted Perimeter:	2.66 ft	3.60 ft
Hydraulic Radius, R:	0.199 ft	0.270 ft
VR:	0.25	0.19
Roughness Coeffiicient, n:	0.120 (2"-6" grass)	0.260 (6"-10" grass)
Slope, S:	0.087 ft/ft	0.087 ft/ft
Velocity, $V=1.49/n x R^{2/3} x S^{1/2}$:	**1.24** ft/sec	0.70 ft/sec
Flow, Q:	0.66 ft^3/sec	**0.69** ft^3/sec

Permissible Velocity: 3.00 ft/sec

Conclusion: STABLE

Use temporary synthetic mat

Flow Required: 0.66 ft^3/sec

Conclusion: ADEQUATE

DRAINAGE SWALE D3

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 6a

10-year runoff: **5.38** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	0.5 ft	0.5 ft
Side Slope Ratio Right:	3.0 ft h/ft v	3.0 ft h/ft v
Side Slope Ratio Left:	3.0 ft h/ft v	3.0
Water Depth:	0.79 ft	0.95 ft
Side Slope Width Right =	0.79 x 3	0.95 x 3
=	2.37	2.85
Side Slope Width Left =	2.37 x 3	0.95 x 3
=	2.37	2.85
Area, A =	0.5 x 0.79 + 0.79 x 2.37 / 2 + 0.79 x 2.37 / 2	0.5x0.95 + 0.95x2.85/2 + 0.95x2.85/2
=	2.27 ft^2	3.18 ft^2
Wetted Perimeter:	5.50 ft	6.51 ft
Hydraulic Radius, R:	0.413 ft	0.489 ft
VR:	0.98	0.84
Roughness Coefficient, n:	0.059 (2"-6" grass)	0.091 (6"-10" grass)
Slope, S:	0.029 ft/ft	0.029 ft/ft
Velocity, $V=1.49/nxR^{2/3}xS^{1/2}$:	**2.38** ft/sec	1.73 ft/sec
Flow, Q:	5.39 ft^3/sec	**5.49** ft^3/sec

Permissible Velocity: 3.00 ft/sec

Conclusion: STABLE

Use temporary synthetic mat

Flow Required: 5.38 ft^3/sec

Conclusion: ADEQUATE

DIVERSION SWALE D4

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 7a

10-year runoff: **2.27** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	3.0 ft	3.0 ft
Side Slope Ratio:	3.0 ft h/ft v	3.0 ft h/ft v
Water Depth:	0.46 ft	0.68 ft
Area, A:	2.01 ft^2	3.43 ft^2
Wetted Perimeter:	5.91 ft	7.30 ft
Hydraulic Radius, R:	0.341 ft	0.469 ft
VR:	0.39	0.31
Roughness Coeffiicient, n:	0.090 (2"-6" grass)	0.190 (6"-10" grass)
Slope, S:	0.020 ft/ft	0.020 ft/ft
Velocity, $V=1.49/n x R^{2/3} x S^{1/2}$:	**1.14** ft/sec	0.67 ft/sec
Flow, Q:	2.29 ft^3/sec	**2.29** ft^3/sec

Permissible Velocity: 3.50 ft/sec Flow Required: 2.27 ft^3/sec

Conclusion: STABLE Conclusion: ADEQUATE

No temporary lining required.

DITCH D5

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 5a

10-year runoff: **0.66** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	1.0 ft	1.0 ft
Side Slope Ratio Right:	3.0 ft h/ft v	3.0 ft h/ft v
Side Slope Ratio Left:	4.0 ft h/ft v	4.0 ft h/ft v
Water Depth:	0.28 ft	0.42 ft
Side Slope Width Right =	0.28 x 3	0.42 x 3
=	0.84	1.26
Side Slope Width Left =	0.84 x 4	0.42 x 4
=	1.12	1.68
Area, A =	1 x 0.28 + 0.28 x 0.84 / 2 + 0.28 x 1.12 / 2	1 x 0.42 + 0.42 x 1.26 / 2 + 0.42 x 1.68 / 2
=	0.55 ft^2	1.04 ft^2
Wetted Perimeter:	3.04 ft	4.06 ft
Hydraulic Radius, R:	0.182 ft	0.256 ft
VR:	0.22	0.19
Roughness Coefficient, n:	0.130 (2"-6" grass)	0.260 (6"-10" grass)
Slope, S:	0.109 ft/ft	0.109 ft/ft
Velocity, $V=1.49/nxR^{2/3}xS^{1/2}$:	**1.21** ft/sec	0.76 ft/sec
Flow, Q:	0.67 ft^3/sec	**0.79** ft^3/sec

Permissible Velocity: 3.00 ft/sec

Conclusion: STABLE

Use temporary synthetic mat

Flow Required: 0.66 ft^3/sec

Conclusion: ADEQUATE

DRAINAGE SWALE D6

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 2b

10-year runoff: **2.53** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	0.0 ft	0.0 ft
Side Slope Ratio Right:	18.0 ft h/ft v	18.0 ft h/ft v
Side Slope Ratio Left:	3.0 ft h/ft v	3.0 ft h/ft v
Water Depth:	0.70 ft	0.91 ft
Side Slope Width Right =	0.7 x 18	0.91 x 18
=	12.60	16.38
Side Slope Width Left =	12.6 x 3	0.91 x 3
=	2.10	2.73
Area, A =	0.7 x 12.6 / 2 + 0.7 x 2.1 / 2	0.91 x 16.38 / 2 + 0.91 x 2.73 / 2
=	5.15 ft^2	8.70 ft^2
Wetted Perimeter:	14.83 ft	19.28 ft
Hydraulic Radius, R:	0.347 ft	0.451 ft
VR:	0.17	0.13
Roughness Coefficient, n:	0.150 (2"-6" grass)	0.300 (6"-10" grass)
Slope, S:	0.010 ft/ft	0.010 ft/ft
Velocity, $V=1.49/nxR^{2/3}xS^{1/2}$:	**0.49** ft/sec	0.29 ft/sec
Flow, Q:	2.51 ft^3/sec	**2.53** ft^3/sec

Permissible Velocity: 3.00 ft/sec

Conclusion: STABLE

No temporary liner required

Flow Required: 2.53 ft^3/sec

Conclusion: ADEQUATE

DRAINAGE SWALE D7

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	March 23, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Area 4

10-year runoff: **4.60** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	0.0 ft	0.0 ft
Side Slope Ratio Right:	3.0 ft h/ft v	3.0 ft h/ft v
Side Slope Ratio Left:	18.0 ft h/ft v	18.0 ft h/ft v
Water Depth:	0.78 ft	1.08 ft
Side Slope Width Right =	0.78 x 3	1.08 x 3
=	2.34	3.24
Side Slope Width Left =	2.34 x 18	1.08 x 18
=	14.04	19.44
Area, A =	0.78 x 2.34 / 2 + 0.78 x 14.04 / 2	1.08 x 3.24 / 2 + 1.08 x 19.44 / 2
=	6.39 ft^2	12.25 ft^2
Wetted Perimeter:	16.53 ft	22.89 ft
Hydraulic Radius, R:	0.387 ft	0.535 ft
VR:	0.28	0.20
Roughness Coeffiicient, n:	0.110 (2"-6" grass)	0.260 (6"-10" grass)
Slope, S:	0.010 ft/ft	0.010 ft/ft
Velocity, $V=1.49/nxR^{2/3}xS^{1/2}$:	**0.72** ft/sec	0.38 ft/sec
Flow, Q:	4.58 ft^3/sec	**4.62** ft^3/sec

Permissible Velocity: 3.00 ft/sec

Conclusion: STABLE

No temporary liner required

Flow Required: 4.60 ft^3/sec

Conclusion: ADEQUATE

DRAINAGE SWALE D8

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	April 26, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Areas 1 & 3

10-year runoff: **13.81** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	0.0 ft	0.0 ft
Side Slope Ratio Right:	18.0 ft h/ft v	18.0 ft h/ft v
Side Slope Ratio Left:	3.0 ft h/ft v	3.0 ft h/ft v
Water Depth:	0.82 ft	1.03 ft
Side Slope Width Right =	0.82 x 18	1.03 x 18
=	14.76	18.54
Side Slope Width Left =	14.76 x 3	1.03 x 3
=	2.46	3.09
Area, A =	0.82 x 14.76 / 2 + 0.82 x 2.46 / 2	1.03 x 18.54 / 2 + 1.03 x 3.09 / 2
=	7.06 ft^2	11.14 ft^2
Wetted Perimeter:	17.38 ft	21.83 ft
Hydraulic Radius, R:	0.406 ft	0.510 ft
VR:	0.81	0.64
Roughness Coeffiicient, n:	0.065 (2"-6" grass)	0.120 (6"-10" grass)
Slope, S:	0.025 ft/ft	0.025 ft/ft
Velocity, $V=1.49/nxR^{2/3}xS^{1/2}$:	**1.98** ft/sec	1.25 ft/sec
Flow, Q:	14.00 ft^3/sec	**13.94** ft^3/sec

Permissible Velocity: 3.00 ft/sec

Conclusion: STABLE

No temporary liner required

Flow Required: 13.81 ft^3/sec

Conclusion: ADEQUATE

DRAINAGE SWALE D9

Project:	Dunn-Erwin Landfill C&D Unit Closure
Project #:	03002E
Date:	May 7, 2012
By:	WLF

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

Runoff

Drainage Areas 3 & 7b

10-year runoff: **17.10** ft^3/sec

Ditch Design

Lining: Grass-legume mixture, easily erodible soil

	Check stability	Check capacity
Bottom Width:	1.0 ft	1.0 ft
Side Slope Ratio Right:	3.0 ft h/ft v	3.0 ft h/ft v
Side Slope Ratio Left:	3.0 ft h/ft v	3.0 ft h/ft v
Water Depth:	1.03 ft	1.42 ft
Side Slope Width Right =	1.03 x 3	1.42 x 3
=	3.09	4.26
Side Slope Width Left =	3.09 x 3	1.42 x 3
=	3.09	4.26
Area, A =	1.03 x 3.09 / 2 + 1.03 x 3.09 / 2	1.42 x 4.26 / 2 + 1.42 x 4.26 / 2
=	4.21 ft^2	6.05 ft^2
Wetted Perimeter:	7.51 ft	9.98 ft
Hydraulic Radius, R:	0.561 ft	0.606 ft
VR:	2.30	1.75
Roughness Coeffiicient, n:	0.042 (2"-6" grass)	0.063 (6"-10" grass)
Slope, S:	0.029 ft/ft	0.029 ft/ft
Velocity, $V=1.49/nxR^{2/3}xS^{1/2}$:	**4.10** ft/sec	2.88 ft/sec
Flow, Q:	17.27 ft^3/sec	**17.42** ft^3/sec

Permissible Velocity: 3.00 ft/sec

Conclusion: ERROR

Flow Required: 17.10 ft^3/sec

Conclusion: ADEQUATE

Use temporary synthetic liner downstream of SD3