

Permit to Construct Application

Phase III Avery County C&D Landfill Ingalls, North Carolina NC Solid Waste Permit No. 06-03

Prepared For:



Avery County
175 Linville Street
Newland, North Carolina 28657

February 2009

PERMIT ISSUE

Prepared By:



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**SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE**



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February 17, 2009

Mr. Allen Gaither
Environmental Engineer II
NC DENR - Solid Waste Section
2090 U.S. Highway 70
Swannanoa, North Carolina 28778

**RE: Phase III Permit to Construct Application
Avery County C & D Landfill
NC Solid Waste Permit No. 06-03**

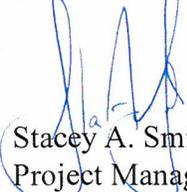
Dear Mr. Gaither:

On behalf of Avery County, Richardson Smith Gardner & Associates (RSG) is hereby submitting the Phase III Permit to Construct (PTC) application for expansion of the landfill. As the Division is aware, Avery County recently received approval (**copy attached**) of the Phase III area following a Revised Site Study¹ by RSG to expand the existing construction and demolition debris (C&D) landfill. Furthermore, this area proposes an impact to an existing stream feature between Phases I and II. This impact has been approved under a Nationwide Permit No. 39 and the approvals are included in the application.

We appreciate your attention and we are prepared to respond immediately to any questions or concerns regarding this application. Please feel free to contact me by phone at (919) 828-0577 ext. 127 or by email at stacey@rsgengineers.com.

Sincerely,

Richardson Smith Gardner & Associates, Inc.


Stacey A. Smith, P.E.
Project Manager

Att.

Cc: Mr. Henry "Buddy" Norris, Avery County Solid Waste Department
Mr. Bill Wagner, NCDENR (cover letter only)
File

H:\Projects\Avery County (NC)\Permit Application\Phase 3\Cover Letter 2-17-09.wpd

¹

Revised Site Study Application Avery County Landfill NC Solid Waste Permit No. 06-03 prepared by Richardson Smith Gardner & Associates, Inc. dated April 2008.



North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary

November 18, 2008

Mr. Buddy Norris
Avery County Solid Waste - Director
PO Box 640
Newland, North Carolina 28657

Subject: Notice of Incomplete Demonstration for Site Suitability and Technical Review Letter,
Hydrogeologic Investigation Report, Revised Site Study, C&DLF Expansion
Avery County, Permit #06-03. Doc ID No: 6258

Dear Mr. Norris:

The Division of Waste Management, Solid Waste Section (Section) completed the technical review of the document, *Revised Site Study, Avery County Landfill, Ingalls, North Carolina*, April 2008, prepared on your behalf by Richardson, Smith, Gardner and Associates. At this time, with the information provided in the Revised Site Study, the Section cannot make a determination on the suitability for landfill construction of most of the proposed expansion site.

The Hydrogeologic Investigation Report, dated April 2008, included in Appendix C, failed to adequately assess geologic and hydrogeologic characteristics of the proposed site pursuant to 15A NCAC13B .0538(a). Foremost, there is an insufficient number of borings within and around the proposed expansion area North of existing Phases 1 and 2 on the Eastern portion of the property and within and around the proposed expansion area on the Western portion of the property. Although part of Rule .0538(a)(3) specifies a minimum ratio of borings to acreage, another part specifies that the number and depths of borings will "depend on the hydrogeologic characteristics of the site." The Rule further stipulates that the numbers, locations, and depths of borings should be sufficient to provide adequate understanding of subsurface conditions and the groundwater flow regime of the uppermost aquifer. Avery County's mountainous terrain requires more data than what suffices in hilly and coastal terrain. No determination on site suitability can be made without sufficient numbers, locations, and depths of borings to characterize geologic and hydrogeologic conditions of the entire site proposed for expansion.

Groundwater conditions in and around existing Phases 1 and 2 had been acceptably characterized in a prior study. Proposed Phase 3 depicted on Drawing P1, Sheet 6 and Drawing X2, Sheet 5 in Appendix H is within these areas. Therefore, since all other required documents for the Site Study have been submitted, after approval of the Nationwide Permit application a Permit to Construct application for Phase 3 can proceed.

If you should have any questions regarding this matter, please contact me at (919) 508-8401.

Sincerely,

Zinith Barbee
Hydrogeologist

Cc: Stacey Smith – RSG Engineers
Allen Gaither – SWS/ARO
Bill Wagner – SWS/ARO

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PERMIT TO CONSTRUCT APPLICATION

Phase III Avery County C&D Landfill Avery County, North Carolina

Prepared for:



Avery County
175 Linville Street
Newland, North Carolina 28657

To The Attention of:
Mr. Buddy Norris
Avery County

RSG Project No. **Avery-08-4**

A handwritten signature in blue ink, appearing to read "Don Misenheimer", is written over a horizontal line.

Don Misenheimer
Staff Scientist

Stacey A. Smith, P.E.
Project Manager



February 2009



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**AVERY COUNTY
C&D LANDFILL - PHASE III**

PERMIT TO CONSTRUCT APPLICATION

TABLE OF CONTENTS

EXECUTIVE SUMMARY

ATTACHMENT A	PROPERTY DEED AND SURVEY DESCRIPTION
ATTACHMENT B	FACILITY AND ENGINEERING PLAN
ATTACHMENT C	TECHNICAL SPECIFICATIONS
ATTACHMENT D	CONSTRUCTION QUALITY ASSURANCE MANUAL
ATTACHMENT E	OPERATIONS PLAN
ATTACHMENT F	CLOSURE AND POST-CLOSURE PLAN
ATTACHMENT G	EROSION AND SEDIMENTATION CONTROL PLAN
ATTACHMENT H	PERMIT DRAWINGS
ATTACHMENT I	WATER QUALITY MONITORING PLAN
ATTACHMENT J	WETLAND AND STREAM IMPACTS

EXECUTIVE SUMMARY

GENERAL

The following is a Permit Application submitted on behalf of Avery County, North Carolina for the construction of Phase III of the construction and demolition debris (C&D) landfill at the County's facility located near Ingalls, NC (Permit 06-03). This facility is an expansion of the current C&D landfill (Phases I and II). This permit application has been prepared to satisfy the requirements of Rule 15A NCAC 13B .0500 of the North Carolina Solid Waste Management Rules.

Phase III will occupy approximately 2.1 acres of the approximate 78 total site acres. Phase III construction will be located north of an unnamed tributary situated between Phase I and Phase II of the existing landfill that drains southward to Brushy Creek. At the proposed gate rates as described in the Facility and Engineering Plan (**Attachment B**), Phase III is projected to have a life expectancy of five (5) years.

PROPERTY DESCRIPTION

The Phase III landfill construction is proposed on the existing site property of the current Avery County C&D landfill as described in Avery County Deed Book 26, Pages 0646-0648. The complete tract is approximately 78 acres which is accessed from Brushy Creek Road (SR1101) as shown in the Site Plan, provided in **Attachment H**. Legal description for this property is included in **Attachment A**

Existing Site Conditions

Existing ground surface elevations vary from elevation 3140 feet above mean sea level (ft-msl) within the northeast corner of the property to about 2870 ft-msl within the southeast portion of the site. Topographically, the site is generally sloping to the south at an average of 15 to 20 percent. The landfill site is located adjacent to Brushy Creek which is classified as a Class C Trout Water in this area. There is an unnamed tributary located between Phase 1 and Phase 2 of the existing landfill that drains southward to Brushy Creek. West of the disposal area, there is another unnamed tributary. Both of these are on-site groundwater discharge features. The property is not zoned as there is no county-wide zoning in Avery County.

Adjacent Areas

The C&D landfill is bounded on the south by Brushy Creek Road and to all other directions by private property. Access to the site is from Brushy Creek Road which connects with Highway 19E to the west. Both of these roads serve as primary routes of waste transportation.

REGULATORY REFERENCES

This submittal has been prepared in accordance with the requirements of the North Carolina Solid Waste Management Rules (15A NCAC 13B) and the North Carolina Sedimentation Control Rules (15A NCAC 4), which are enforced by the Division of Waste Management (DWM) and the Division of Land Quality, respectively, of the North Carolina Department of Environment and Natural Resources (NCDENR). Included in this submittal are the following documents (*with applicable rule(s) in italics*):

Facility and Engineering Plan (*13B.0537 and .0539*);
Technical Specifications (*13B.0539*);
Construction Quality Assurance (CQA) Manual (*13B.0541*);
Operations Manual (*13B.0542*);
Closure and Post-Closure Plan (*13B.0543*);
Erosion and Sedimentation Control Plan (*13B.0540 and 15A NCAC 4*);
Permit Drawings (*13B.0537, .0539, .0540, .0542, and 15A NCAC 4*);
Financial Assurance (*13B.0546*);
Water Quality Monitoring Plan (*.0544*).

APPLICATION REQUIREMENTS

The following sections corresponds with the permit application for a transfer facility as outlines in the North Carolina Solid Waste Facilities Rules. The site plan drawing was prepared by a professional engineer duly registered in the State of North Carolina.

Facility and Engineering Plan

The Facility and Engineering Plan presents plans for the development of the landfill facility and the detailed engineering design of the Phase III landfill, and, along with the Technical Specifications (**Attachment C**) and Permit Drawings (**Attachment H**), has been prepared to comply with the requirements of 15A NCAC 13B.0537 and .0539. A copy of the Facility and Engineering Plan is provided in **Attachment B**.

Construction Quality Assurance Manual

The Construction Quality Assurance (CQA) Manual has been prepared to provide the Owner, Engineer, and CQA Engineer the means to govern the construction quality and to satisfy landfill certification requirements under current North Carolina Solid Waste Management regulations. This document has been prepared to comply with the requirements of 15A NCAC 13B.0541. A copy of the Construction Quality Assurance Manual is provided in **Attachment D**.

Operations Manual

The Operations Manual outlines and describes protocols for facility operation and maintenance and was prepared to provide landfill personnel with a clear understanding of

how the Design Engineer assumed that the completed facility would be operated. Along with the Permit Drawings, the Operations Manual has been prepared to comply with the requirements of 15A NCAC 13B.0542. A copy of the Operations Manual is provided in **Attachment E**.

Closure and Post Closure Plan

The Closure and Post-Closure Plan was prepared to outline the requirements for closure and post-closure activities at the landfill and includes a cost analysis for each. Along with the Project Drawings, this document has been prepared to comply with the requirements of 15A NCAC 13B.0543. A copy of the Closure and Post Closure Plan is provided in **Attachment F**.

Erosion and Sedimentation Control Plan

An Erosion and Sedimentation Control Plan outlines the measures to be taken during facility construction to minimize erosion and sediment runoff due to land disturbance. The erosion and sediment control structures are designed, and will be maintained, to manage the 24-hour and 25 year storm events. This Plan, along with the Permit Drawings, have been prepared to comply with the requirements of 15A NCAC 13B.0540 and the Sediment Pollution Control Law 15A NCAC 4. The Erosion and Sedimentation Control Plan is referenced in **Attachment G**.

Design Hydrogeologic Report

The Avery County C&D landfill is located in the Blue Ridge Province of North Carolina, approximately 12 miles from the Brevard Fault zone. Local bedrock is comprised of the Aligator Back formation which is a finely laminated gneiss. Micaceous conglomerate, schist and phyllite are also found within this formation. Amphibolite was noted in central to northern portions of the site. The site has been investigated with a total of 16 monitoring wells and piezometers that range in depth from approximately 20 feet below grade to 88 feet below grade. Bedrock at the site was encountered at depths that ranged from 31 feet below grade to 88 feet below grade.

Unconsolidated sediments at the site consist of variably micaceous clayey silt to silty sand weathered from the underlying bedrock. The unconsolidated sediments are grouped into two lithological units. Unit 1A consists of sediments exhibiting a standard penetration test of less than 100 blows per foot, while Unit 1B consists of sediments exhibiting a standard penetration test of greater than 100 blows per foot.

Groundwater flow at the site is from north to south toward the discharge points of on-site streams and Brushy Creek (located across Brushy Creek Road). Depth to groundwater ranges from approximately 5.00 feet (measured from top of casing) to approximately 47 feet below top of casing elevations with an average gradient of 0.12 ft/ft and an average groundwater velocity of 1.57 ft/day. Lithological Unit 1A has an average hydraulic conductivity of 1.40 ft/day, while Unit 1B has an average hydraulic conductivity of 2.05

ft/day. The bedrock aquifer (Unit 2) has an average hydraulic conductivity of 4.65 ft/day.

Several nested pairs of monitoring wells/piezometers were installed at the site to evaluate vertical gradients at the site. In general, vertical gradients across the site were found to move in a downward direction with the exception of the pairs located near the discharge point of Brushy Creek (MW-1s/1d and MW-2s/2d). These pairs indicated upward gradients which are typically associated with groundwater discharge points.

A complete hydrogeological evaluation of the site is included in the Revised Site Study for Avery County submitted by Richardson Smith Gardner in April 2008 (Appendix C)¹. The referenced Hydrogeologic Investigation Report meets all requirements for both the Site Hydrogeologic Report and the Design Hydrogeologic Report.

Water Quality Monitoring Plan

The current Water Quality Monitoring Plan has been prepared to meet the field sampling and laboratory analysis requirements of ongoing monitoring at the site. The Water Quality Monitoring Plan details field and laboratory protocols that must be followed to meet the objectives of the semi-annual groundwater monitoring, and was prepared to satisfy the requirements of 15A NCAC 13B.0544. A copy of the Water Quality Monitoring Plan is provided in **Attachment I**.

WETLAND AND STREAM IMPACT

The U.S Army Corps of Engineers (USACE), North Carolina Wildlife Resources Commission (NCWRC), and NCDENR Division of Water Quality (DWQ) have approved the wetland and stream impact for this expansion. These documents are provided in **Attachment J**.

Subsequently, a Trout Stream Buffer Variance Request has been submitted to NCDENR Division of Land Resources. Documentation pertaining to this Request is provided in **Attachment J**.

FINANCIAL ASSURANCE

In accordance with 15A NCAC 13B.0546, financial assurance will be provided by Avery County in the form of a Financial Test submitted directly to the Department.

¹ David Garrett & Associates, Hydrogeologic Investigation Report Site Suitability Evaluation Update Avery County C&D Landfill, April 2008

IMPLEMENTATION SCHEDULE

Avery County plans to start C&D waste operations on the site immediately after approval of this application. However, Avery County understands that full operation of this facility may not be granted until the Waste Relocation and Mitigation Plan² is complete.

² Waste Relocation and Mitigation Plan. Avery County C&D Landfill. Richardson Smith Gardner and Associates, October 2008

Attachment A

Property Deed and
Survey Description

BK | PG
2660646

FILED #

95 JAN 20 PM 3:14

THE H. T. BAKER
REGISTER OF DEEDS
AVERY COUNTY, N.C.

AVERY
16

01-20-95



\$370.00

Real Estate
Excise Tax

Excise Tax 370.00

Recording Time, Book and Page

Tax Lot No. Parcel Identifier No.

Verified by County on the day of, 19.....

by

NO Recording fee due to being County Work - Nonce Cook

Mail after recording to William B. Cocks, Jr., P.O. Box 606, Newland, NC 28657

This instrument was prepared by William B. Cocks, Jr., Attorney at Law

of description for the Index

78.115 acres, Toe River Tsp.

NORTH CAROLINA GENERAL WARRANTY DEED

THIS DEED made this 20th day of January, 19 95, by and between

GRANTOR

GRANTEE

ALLAN ARBUTHNOT and wife, MARIE W. ARBUTHNOT

AVERY COUNTY, NORTH CAROLINA

Enter in appropriate block for each party: name, address, and, if appropriate, character of entity, e.g. corporation or partnership.

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.

KNOWESSETH, 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 the City of Toe River Township, Avery County, North Carolina and more particularly described as follows:

See attached Schedule A incorporated herein by reference.

~~Property Transfer Tax~~
Date 1-20-95 By CD

Taxes Paid Through
7994
By MSA Date 1/20/95

on or prior to March 31, 1995 and continue to use telephone
and power services through and including March 31, 1995.

2660647

The property hereinabove described was acquired by Grantor by instrument recorded in Book 194, Page 882

A map showing the above described property is recorded in Plat Book page.....

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:

- 1. Reservations set forth hereinabove.
- 2. Road right-of-way along Brushy Creek Road (NCSR 1101).

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

ATTEST:

.....
Secretary (Corporate Seal)

USE BLACK INK ONLY

Allan Arbuthnot (SEAL)

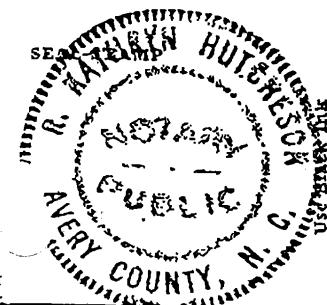
Allan Arbuthnot

Marie W. Arbuthnot (SEAL)

Marie W. Arbuthnot

..... (SEAL)

..... (SEAL)



NORTH CAROLINA, Avery County.

I, a Notary Public of the County and State aforesaid, certify that Allan Arbuthnot and wife, Marie W. Arbuthnot Grantor,

personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 20th day of January, 1995

My commission expires August 21, 1998 *R. Kathryn Hutcheson* 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 is Secretary of

Use Black

... a North Carolina corporation, and that by authority duly given and as the act of the corporation, the foregoing instrument was signed in its name by its President, sealed with its corporate seal and attested by ... as its Secretary. Witness my hand and official stamp or seal, this ... day of ..., 19...

My commission expires: ... Notary Public

The foregoing Certificate(s) of B. Kathryn Hutcherson - NP

is/are certified to be correct. This instrument and this certificate are duly registered at the date and time and in the Book and Page shown on the first page hereof.

Tamela T. Baker REGISTER OF DEEDS FOR Avery COUNTY
By Rhonda Hallifield Deputy Assistant - Register of Deeds

2660648

Schedule A

Warranty Deed from Allan Arbuthnot and wife, Marie W. Arbuthnot, to Avery County, North Carolina, dated January 20, 1995.

BEGINNING at a 38-inch chestnut oak at a fence corner in the Radcliff Estate line and running thence with the fence and the Radcliff Estate line the following courses and distances: South 64°35'40" West 573.94 feet to a fence post, South 12°06'40" East 375.32 feet to a 12-inch black gum, South 18°10'50" East 568.98 feet to a fence post, South 45°04'30" West 143.35 feet to a fence post, South 78°34'50" West 189.43 feet to an iron stake, and South 13°24'30" West 131.78 feet to a fence post on the north side of Brushy Creek Road (NCSR 1101); thence leaving the Radcliff Estate line and running with the north side of Brushy Creek Road the following courses and distances: South 64°33'40" West 104.40 feet, South 83°35'40" West 64.40 feet, South 89°00'10" West 169.77 feet, South 72°45'40" West 119.67 feet, South 63°53'20" West 71.48 feet, and South 39°08'00" West 72.72 feet to an iron found, corner of Roger Wise; thence leaving the north side of Brushy Creek Road and running with the Roger Wise line and a fence North 70°46'50" West 342.41 feet to an iron set, North 08°01'50" West 696.52 feet to an iron set, and North 85°50'30" West 345.15 feet to a 10-inch sourwood, corner of Uninin Corporation; thence leaving the Roger Wise line and running with the Uninin Corporation line and the fence North 23°22'50" West 334.16 feet to an 8-inch maple, North 08°35'50" East 242.08 feet to a triple maple, and North 02°56'30" West 1,024.41 feet to an iron set in the Radcliff Estate line; thence leaving the Uninin Corporation line and running with the Radcliff Estate line South 83°31'00" East 974.67 feet to a fence post and South 83°57'50" East 982.21 feet to an oak stump on the east side of a branch; thence with said branch and continuing with the Radcliff Estate line the following courses and distances: South 05°19'20" West 72.09 feet, South 23°17'00" East 214.78 feet, South 51°29'20" East 20.64 feet, South 12°55'30" West 84.42 feet, South 02°04'50" East 37.67 feet and South 07°31'30" East 183.99 feet to the point of beginning. Being two tracts containing 41.50 acres and 36.615 acres, respectively, containing in the aggregate 78.115 acres, as shown on a map of survey prepared by William E. Arrowood, RLS L-1510, dated August 12, 1988.

This conveyance is made subject to the following reservations:

1. Grantor shall have the right to remove the following, provided that the same are removed on or prior to January 20, 1996, to-wit: the two barns measuring 10 feet x 20 feet and 17 feet x 22 feet;
2. Grantor shall have the right to remove the following, provided that the same are removed on or prior to March 31, 1995, to-wit: all hemlock seedlings, boxwood shrubbery, and a total of 30 trees;

Attachment B

Facility and Engineering Plan

Facility and Engineering Plan

**Avery County C&D Landfill
Ingalls, North Carolina
NC Solid Waste Permit No. 06-03**

Prepared for:



**Avery County
Newland, North Carolina**

PERMIT ISSUE DOCUMENTS

February 2009



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**AVERY COUNTY
C&D LANDFILL EXPANSION**

FACILITY PLAN

TABLE OF CONTENTS

	<u>Page</u>
1.0 OVERVIEW	1
2.0 FACILITY SERVICES AND WASTE STREAM	1
2.1 Facility Services	1
2.2 Types of Waste	1
2.3 Disposal Rates and Estimated Variances	1
2.4 Service Area	1
2.5 Procedures for Waste Segregation	2
2.6 Equipment Requirements	2
3.0 LANDFILL CAPACITY	2
3.1 Total Operating Capacity and Life Expectancy	2
3.2 In-Place Ratio of Waste to Soil and Compaction Factor	2
4.0 AVAILABLE SOIL RESOURCES AND REQUIRED SOIL QUANTITIES	2
4.1 Earthwork Quantities	3
4.2 Periodic Cover	3
4.3 Low Permeability and Vegetative Soil Layer	3
4.4 Soil Summary	3
5.0 FACILITY DESIGN CRITERIA	3
5.1 Horizontal Separation Requirements	3
5.2 Vertical Separation Requirements	3
5.3 Survey Control	4
6.0 CONTAINMENT AND ENVIRONMENTAL CONTROL SYSTEMS	4
6.1 Landfill Subgrade and Perimeter Berms	4
6.2 Final Cover System	4
6.3 Erosion and Sedimentation Control	4
6.4 Landfill Gas Control	5
6.5 Access and Roadways	5
7.0 SLOPE STABILITY	5
8.0 UNDERDRAIN SYSTEM	5
9.0 STREAM RESTORATION PLAN	5

Table Of Contents (Continued)

FIGURES

Figure 1 Service Area

TABLES

Table 1 Summary of Landfill Capacity and Life Expectancy
Table 2 Soil Summary

APPENDICES

Appendix A Volume Calculations
Appendix B Slope Stability Analysis
Appendix C Underdrain System Analysis

**AVERY COUNTY
C&D LANDFILL FACILITY EXPANSION**

FACILITY AND ENGINEERING PLAN

1.0 OVERVIEW

This section presents a plan for the expansion of the Avery County construction and demolition (C&D) debris landfill (Solid Waste Permit No. 06-03) and as presented in the Facility Plan Drawings provided as **Attachment H** to this report.

2.0 FACILITY SERVICES AND WASTE STREAM

2.1 Facility Services

Currently, the following activities or services are provided at the Avery County C&D Landfill facility:

- Scales and scale house facilities
- Construction and Demolition Debris (C&D) Landfill (Permit No. 06-03)
- Mobile Home Deconstruction Area
- White Goods Management Area
- Municipal Solid Waste (MSW) Transfer Station (Permit No. 06-02T)

2.2 Types of Waste

The Avery County Landfill and Transfer facility accepts MSW, C&D, LCID waste, inert debris, asphalt, and white goods. The MSW wastes are routed to the on-site Transfer Station for disposal at the Bristol, Virginia Integrated Waste Management Facility. C&D wastes are routed to the on-site landfill and White Goods are managed on a designated concrete lined management area adjacent to the Transfer Station.

2.3 Disposal Rate

The Avery County Landfill facility currently receives about about 3,000 tons per year of C&D waste, which has been historically disposed of within the existing Phases 1 & 2 disposal areas. However, the landfill expansion anticipates a maximum disposal rate of 10,000 tons per year. This amounts to an average of about 40 tons per day based upon 260 days of operation per year. Actual daily amounts of C&D are expected to vary considerably.

2.4 Service Area

The landfill serves Avery County and its surrounding counties in NC and TN as shown in **Figure 1**.

2.5 Procedures for Waste Segregation

Wastes are segregated at the scales and routed to the appropriate area. Operators at the scalehouse are trained to classify and segregate the waste stream.

Employees at the landfill are trained in the safety procedures for the handling and detection of illegal waste. The screening of unacceptable waste is done through the random checking of incoming loads by a landfill employee at the scalehouse and at the tipping area. When unacceptable waste is detected at the scalehouse, the load is rejected and not permitted into the landfill. If hazardous waste is found at the tipping area, identification of the truck or persons is made (if possible) and documented, then the hazardous waste is identified and placed in a hazardous waste container and taken to a designated hazardous waste staging area for proper disposal. When this occurs, the event is reported to the appropriate authorities.

2.6 Equipment Requirements

Avery County will maintain on-site equipment required to perform the necessary landfill activities. Periodic maintenance of all landfilling equipment, and minor and major repair work will be performed at designated maintenance zones outside of the landfill.

3.0 LANDFILL CAPACITY

3.1 Total Operating Capacity and Life Expectancy

Drawing No. S4 (Final Grading Plan), identifies the final configuration for the phase III facility expansion of the C&D landfill. The top elevation of the final grades is at approximately 3020 feet. The exterior side slopes will be at a maximum of 3:H to 1:V slope.

The estimated total gross operating capacity, net capacity (accounts for periodic and final cover), disposal area, and life expectancy for the facility expansion is shown in **Table 1**.

3.2 In-Place Ratio of Waste to Soil and Compaction Factor

The capacities obtained above were based on a 10 percent periodic cover ratio and a compaction factor of 1,000 pounds per cubic yard (0.50 tons/cy). The assumed periodic cover ratio and compaction factor is typical for similar C&D landfills.

4.0 AVAILABLE SOIL RESOURCES AND REQUIRED SOIL QUANTITIES

The soils required to construct the proposed landfill will be removed from within the facility footprint and on-site borrow sources. The soils removed during excavation of the facility may be used for structural fill and general fill.

4.1 Earthwork Quantities

The anticipated quantity of soil to be excavated to achieve base grades and the anticipated quantity to be required as structural fill for foundation soils and berms is shown in **Table 2** as shown in **Drawing No. S2** (Base Grading Plan).

4.2 Periodic Cover

Assuming the previously mentioned periodic cover ratio of 10 percent, the estimated quantity of soil that will be required for use as periodic cover during C&D landfill operations is shown in **Table 2**.

4.3 Low Permeability and Vegetative Soil Layer

On the basis of the three (3) foot thick soil layer (18" low permeability layer and 18" vegetative soil layer) of the C&D landfill final cover, the estimated in-place volume required is shown in **Table 2**.

4.4 Soil Summary

The above soil quantities are summarized in **Table 2**. Note that, based on the proposed base grades and final cover grades shown on **Drawings No. S2 & S4** respectively, long-term the site is a soil surplus which will satisfy all sources of soil required for the project.

5.0 FACILITY DESIGN CRITERIA

The Avery County C&D Landfill is designed and operates in accordance with Sections .0540 and .0542 of the North Carolina Administrative Code, Title 15A, Chapter 13, Subchapter 13B including the following requirements.

5.1 Horizontal Separation Requirements

The horizontal separation requirement between the disposal boundary (edge of waste) and the property lines is a minimum of 200 feet, the minimum buffer between private residences and wells and the disposal boundary is 500 feet, and the minimum buffer between any surface water (stream, wetland, river, creek, etc.) and the disposal boundary is 50 feet.

5.2 Vertical Separation Requirements

The phase III subgrade has been designed to meet the minimum requirement of four (4) feet (post-settlement) above the seasonal high groundwater table and bedrock. The upper two feet of the proposed subgrade generally consist of SM and ML soils. The phase III development includes impact to a portion of non-functioning stream between the existing phase I & II which includes an underdrain system described in **Section 8.0**.

5.3 Survey Control

The facility has established survey control benchmarks by a Registered Land Surveyor in the North Carolina State Plane (NCSP) coordinate system.

6.0 CONTAINMENT AND ENVIRONMENTAL CONTROL SYSTEMS

Technical specifications and a project construction quality assurance (CQA) manual for the following materials can be found in **Attachments C & D** respectively.

6.1 Landfill Subgrade and Perimeter Berms

The subgrade elevations will be achieved by excavation or placement of compacted structural fill (embankment). During excavation, a determination of unsuitable soils (i.e. soils which are too soft, wet, or organic) will be made. Where unsuitable soils are found, the soils will be undercut and backfilled with structural fill.

In addition to providing the landfill foundation in fill areas, structural fill will be used for berm and roadway construction. Structural fill will consist of on-site soils removed during excavation except that no CH, OL, or OH soils will be allowed.

6.2 Final Cover System

As a minimum, the components of the final cover system (bottom up) will consist of a 12 inch foundation layer (intermediate cover), 18 inch low permeability layer, and a 18 inch thick vegetative soil layer meeting the requirements of 15A NCAC 13B.0543. Other alternative cover demonstrations may be approved by the NC DENR Division of Solid Waste Management. This additional information will be available prior to construction of the final cover system.

6.3 Erosion and Sedimentation Control

The Erosion and Sedimentation Control structures provided will be designed and maintained to manage the run-off generated by the 24-hour, 25-year storm event, and conform to the requirements of the Sedimentation Pollution Control Law (15A, NCAC, 4).

A detailed discussion of the site erosion and sedimentation control for the facility can be found in site Erosion and Sedimentation Control Plan (**Attachment G**).

6.4 Landfill Gas Control

The landfill gas (LFG) control system will consist of collection wells, vents, or below surface trenches placed within the waste to capture the gas and either passively vent or flare the gas via utility flares. Monitoring of landfill or other explosive gases will be conducted on a quarterly basis in accordance with 15A NCAC 13B .0544 (d).

6.5 Access and Roadways

Site operations will provide for all-weather access to active areas.

7.0 SLOPE STABILITY

The slope stability of the waste mass is addressed in **Appendix B**. The results of the slope stability analysis indicates that the proposed C&D landfill configuration is stable.

8.0 UNDERDRAIN SYSTEM

The development of Phase III includes impact to a non-functioning stream under the approval of nationwide permit No. 39 issued by the US Army Corps of Engineers and the NCDENR Division of Water Quality. A copy of these approvals are included in **Attachment J**. The underdrain system has been proposed to assist in drainage of any base seepage remaining from the impacted stream and to maintain vertical separation of groundwater from the waste. Refer to **Appendix C** for underdrain analysis.

9.0 STREAM RESTORATION PLAN

The stream impacts approved under nationwide permit No. 39 includes requirements for stream buffer enhancements down stream of the proposed landfill expansion as shown on **Drawing No. S4**.

**TABLE 1
SUMMARY OF LANDFILL CAPACITY AND LIFE EXPECTANCY**

Phase	Area (Ac.)	Operating Capacity (CY)		Life Expectancy ³
		Gross ¹	Net ²	
Phase 1*	2.95	10,800	10,800	0 Years
Phase 2*	2.06	11,500	11,500	0 Years
Phase 3 - Cell 1	0.84	49,000	43,600	1.9 Years
Phase 3 - Cell 2	0.36	47,000	44,700	1.9 Years
Phase 3 - Cell 3	0.90	33,000	27,200	1.2 Years
Total:	7.11	151,300	137,800	5 Years

* Phases 1 & 2 volumes are based on vertical expansion grades proposed in correspondence dated 10-23-08 and will be consumed in accordance with the waste relocation and mitigation plan dated October 2008 by RSG.

Notes:

1. Gross capacity for the expansion is based on final cover grades provided on **Drawing No. S4** and assumes subgrades as shown on **Drawing No. S2**. It is also noted that the capacity does not include volume included in the current permitted area (Phase 1 and 2), but reflects gains in "layover".
2. The net capacity is determined by deductions for final and intermediate cover soils from the gross capacity.
3. The existing life expectancy assumes two hundred sixty (260) operating days a year accepting forty (40) tons a day with a unit weight of 0.5 tons per cubic yard.
4. Refer to **Appendix A** for volume calculations.

**TABLE 2
SOIL SUMMARY**

Material	Quantity (CY)			
	Phase 1	Phase 2	Phase 3	Total
Excavation ³	0	0	21,500	21,500
Structural Fill ³	0	0	12,000	12,000
Periodic Cover ²	0	0	11,500	11,500
Intermediate Cover ⁴	4,800	3,300	3,400	11,500
Final Cover ^{1,4}	14,300	10,000	10,200	34,500
Total:	19,100	13,300	58,600	91,000

Notes:

1. The soil summary quantities include remaining final cover earthwork volumes required in the existing Phase 1 area and in the Phase 2 area.
2. Ten (10) percent of the net volume shown in **Table 1** is assumed for periodic cover estimate.
3. Earthwork volumes are estimated based on proposed subgrades as shown in **Drawing No. S2** and existing site topography on the site.
4. Assumed Cap Area is increased by 5.4% to correct for slope.
5. Refer to **Appendix A** for volume calculations.

Appendix A
Volume Calculations

DATE: 2/13/2009
BY: KBS
CHECK BY:

Avery County Landfill Phase 1

Waste Parameters:

Unit Weight (pcy) =	1,000
Unit Weight (tcy) =	0.5
Percentage of Periodic Cover =	0 INCLUDED IN DENSITY
Area of Waste Footprint (Ac.) =	3.0
Slope of Cap	3 to 1
Plan Cap Area =	3.0
Corrected Cap Area	3.2

Waste Loading Parameters:

Daily Tonnage =	40 Maximum Annual Tonnage at 10,000
Daily Waste Volume (cy) =	80
Days of Operation per Year =	260

Volume Calculations:

Volume From AutoCAD =	10,800 cy
-----------------------	-----------

Adjustment For Other Layers:

1 feet of Intermediate Cover =	0 cy	
3 feet (Avg.) of Final Cover =	0 cy	Assumes waste volume only.
Sum =	0 cy	

Volume of Waste and Periodic Cover (cy) = 10,800

Volume of Periodic Cover (cy) = 0

Volume of Waste (cy) = 10,800

Weight of Waste (tons) = 5,400

Landfill Life Expectancy (years) =

Landfill Life Expectancy (months) =

**Assumed zero due to
relocation of waste efforts.**

Avery County Landfill Phase 2

Waste Parameters:

Unit Weight (pcy) =	1,000
Unit Weight (tcy) =	0.5
Percentage of Periodic Cover =	0 INCLUDED IN DENSITY
Area of Waste Footprint (Ac.) =	2.1
Slope of Cap	3 to 1
Plan Cap Area =	2.1
Corrected Cap Area	2.2

Waste Loading Parameters:

Daily Tonnage =	40 Maximum Annual Tonnage at 10,000
Daily Waste Volume (cy) =	80
Days of Operation per Year =	260

Volume Calculations:

Volume From AutoCAD =	11,500 cy
-----------------------	-----------

Adjustment For Other Layers:

1 feet of Intermediate Cover =	0 cy	
3 feet (Avg.) of Final Cover =	0 cy	Assumes waste volume only.
Sum =	0 cy	

Volume of Waste and Periodic Cover (cy) = 11,500

Volume of Periodic Cover (cy) = 0

Volume of Waste (cy) = 11,500

Weight of Waste (tons) = 5,750

Landfill Life Expectancy (years) =

Assumed zero due to relocation of waste efforts.

Landfill Life Expectancy (months) =

**Avery County Landfill
 Phase 3 - Cell 1**

Waste Parameters:

Unit Weight (pcy) =	1,000
Unit Weight (tcy) =	0.5
Percentage of Periodic Cover =	10 INCLUDED IN DENSITY
Area of Waste Footprint (Ac.) =	2.6
Slope of Cap	3 to 1
Plan Cap Area =	2.6
Corrected Cap Area	2.7

Waste Loading Parameters:

Daily Tonnage =	40 Maximum Annual Tonnage at 10,000
Daily Waste Volume (cy) =	80
Days of Operation per Year =	260

Volume Calculations:

Volume From AutoCAD =	49,000 cy
-----------------------	-----------

Adjustment For Other Layers:

1 feet of Intermediate Cover =	1,355 cy	
3 feet (Avg.) of Final Cover =	<u>4,066 cy</u>	(Use Final Cover Area = 0.84 Ac)

Sum = 5,421 cy

Volume of Waste and Periodic Cover (cy) = 43,579

Volume of Periodic Cover (cy) = 4,358

Volume of Waste (cy) = 39,221

Weight of Waste (tons) = 19,611

Landfill Life Expectancy (years) =

Landfill Life Expectancy (months) =

**Avery County Landfill
 Phase 3 - Cell 2**

Waste Parameters:

Unit Weight (pcy) =	1,000
Unit Weight (tcy) =	0.5
Percentage of Periodic Cover =	10 INCLUDED IN DENSITY
Area of Waste Footprint (Ac.) =	1.1
Slope of Cap	3 to 1
Plan Cap Area =	1.1
Corrected Cap Area	1.2

Waste Loading Parameters:

Daily Tonnage =	40 Maximum Annual Tonnage at 10,000
Daily Waste Volume (cy) =	80
Days of Operation per Year =	260

Volume Calculations:

Volume From AutoCAD = 47,000 cy

Adjustment For Other Layers:

1 feet of Intermediate Cover =	581 cy	
3 feet (Avg.) of Final Cover =	<u>1,742 cy</u>	(Use Final Cover Area = 0.36 Ac)

Sum = 2,323 cy

Volume of Waste and Periodic Cover (cy) = 44,677

Volume of Periodic Cover (cy) = 4,468

Volume of Waste (cy) = 40,209

Weight of Waste (tons) = 20,105

Landfill Life Expectancy (years) = 1.9

Landfill Life Expectancy (months) = 23.2

**Avery County Landfill
 Phase 3 - Cell 3**

Waste Parameters:

Unit Weight (pcy) =	1,000
Unit Weight (tcy) =	0.5
Percentage of Periodic Cover =	10 INCLUDED IN DENSITY
Area of Waste Footprint (Ac.) =	1.6
Slope of Cap	3 to 1
Plan Cap Area =	1.6
Corrected Cap Area	1.7

Waste Loading Parameters:

Daily Tonnage =	40 Maximum Annual Tonnage at 10,000
Daily Waste Volume (cy) =	80
Days of Operation per Year =	260

Volume Calculations:

Volume From AutoCAD = 33,000 cy

Adjustment For Other Layers:

1 feet of Intermediate Cover =	1,452 cy	
3 feet (Avg.) of Final Cover =	<u>4,356 cy</u>	(Use Final Cover Area = 0.90 Ac)

Sum = 5,808 cy

Volume of Waste and Periodic Cover (cy) = 27,192

Volume of Periodic Cover (cy) = 2,719

Volume of Waste (cy) = 24,473

Weight of Waste (tons) = 12,236

Landfill Life Expectancy (years) =

Landfill Life Expectancy (months) =

Appendix B

Slope Stability Evaluation

**AVERY COUNTY
C&D LANDFILL**

SLOPE STABILITY EVALUATION

1.0 SLOPE STABILITY

The stability of potential circular failure surfaces was evaluated based on EPA guidance and standard industry practices.

1.1 Required Factors of Safety

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

2.2 Deep-Seated Failure Surfaces

The stability of deep-seated failure surfaces was evaluated using the computer program STABL5M, a computer program developed by Purdue University, with the STEDWIN (v. 2.80) Windows interface program. Circular (rotational within waste mass and/or subgrade) failure surfaces were analyzed. The modified Bishop Method was used to analyze circular failure surfaces.

Analyses were performed for the cross sections shown in **Figure 1** (Figure 1A - Base Grades; Figure 1B - Final Cover Grades). These cross sections were chosen based on inspection as representative of worst case conditions.

2.2.1 Material Properties

A summary of material properties used in the evaluation of deep-seated failure surfaces is presented in **Table 1**

TABLE 1: Material Properties Used in Slope Stability Analysis

Material	Total Unit Weight (pcf)	Saturated Unit Weight (pcf)	Shear Strength Properties ¹	
			Cohesion/ Adhesion (c) (psf)	Friction Angle (ϕ) (degrees)
C&D*	70	70	50	28
Fill**	105	120	200	24
Subgrade(MH)***	125	127	200	24
Rock	140	140	10000	20

Notes:

1. 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 $(\tau) = \text{normal load} \times \tan(\phi) + c$).
2. * The assumed unit weight is typical of landfills that do not recirculate leachate. The assumed shear strength envelope (cohesion and friction angle values) is very conservative compared to EPA guidance and summarized strength properties for MSW waste by Kavazanjian et. al. (1995) and Eid et. al. (2000).
3. ** The data is assumed based on recompacted on-site soil and therefore, the shear strength is assumed to be the same as for MH soil.
3. *** These properties are conservative as compared to typical soil strength properties based on triaxial test results presented in the report “**Revised Site Study**” dated on April 2008 by Richardson Smith Gardner & Associates, Inc.

2.2.2 Results

Table 2 provides a summary of the results of the stability analyses for deep-seated failure surfaces. The results demonstrate that minimum factors of safety for static conditions meet or exceed the minimum criteria (1.5 for final static conditions). These analyses are **attached**.

TABLE 2: Result Summary - Deep Seated Failure Surfaces

Cross Section Analyzed (Condition)	Failure Type	Method of Analysis	Factor of Safety ¹
			Static (FS ≥ 1.5 - Final)
Section - AA	Circular	Modified Bishop	2.24
Section - BB	Circular	Modified Bishop	1.48 ¹

Note: ¹ Section BB shows a temporary slope.

3.0 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.

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.

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.

U.S. Army Corps of Engineers (2003), Engineering and Design - Slope Stability, Engineer Manual, EM 1110-2-1902, Dept. of the Army, Washington, D.C.

Figure 4B

Final cover

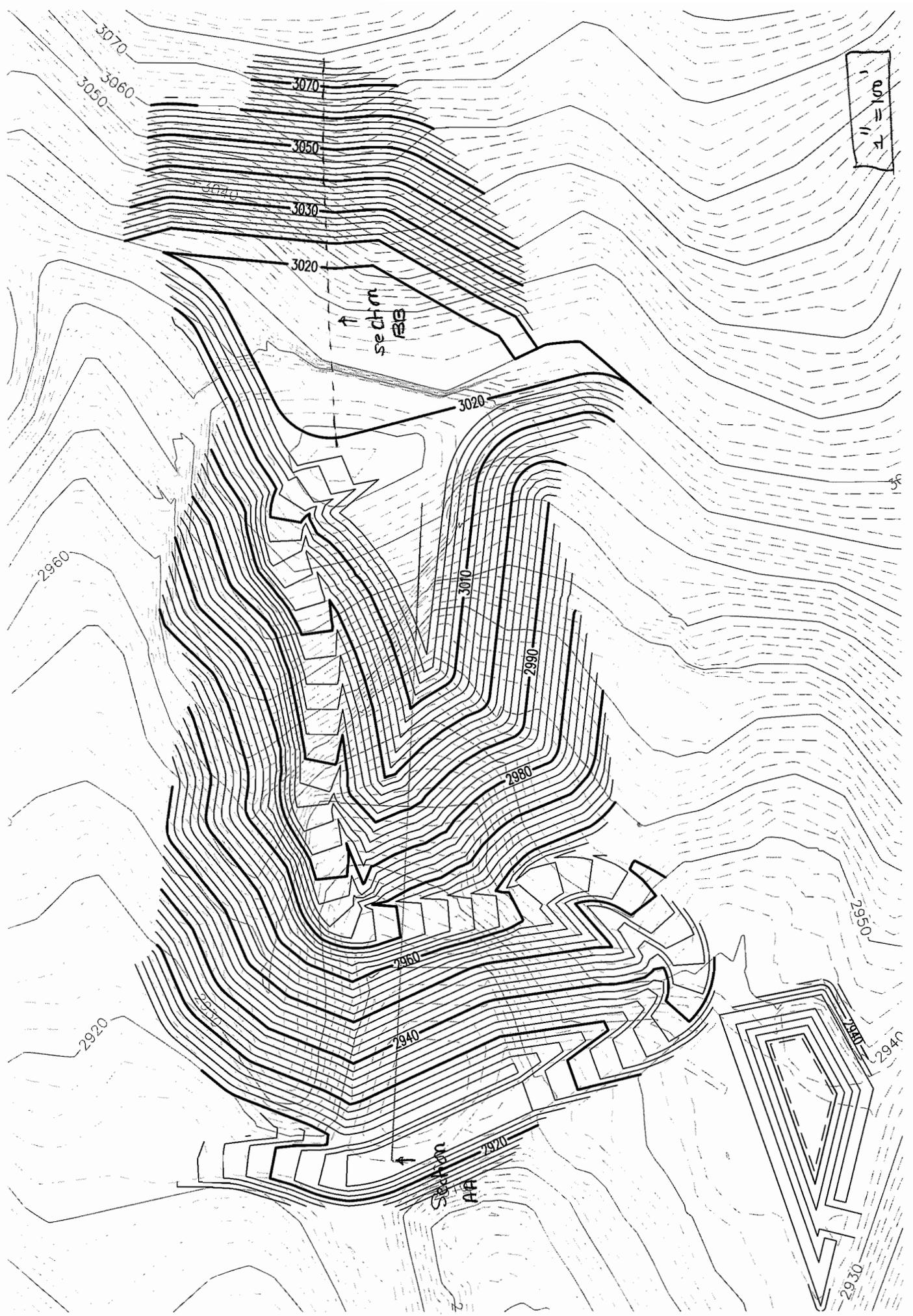
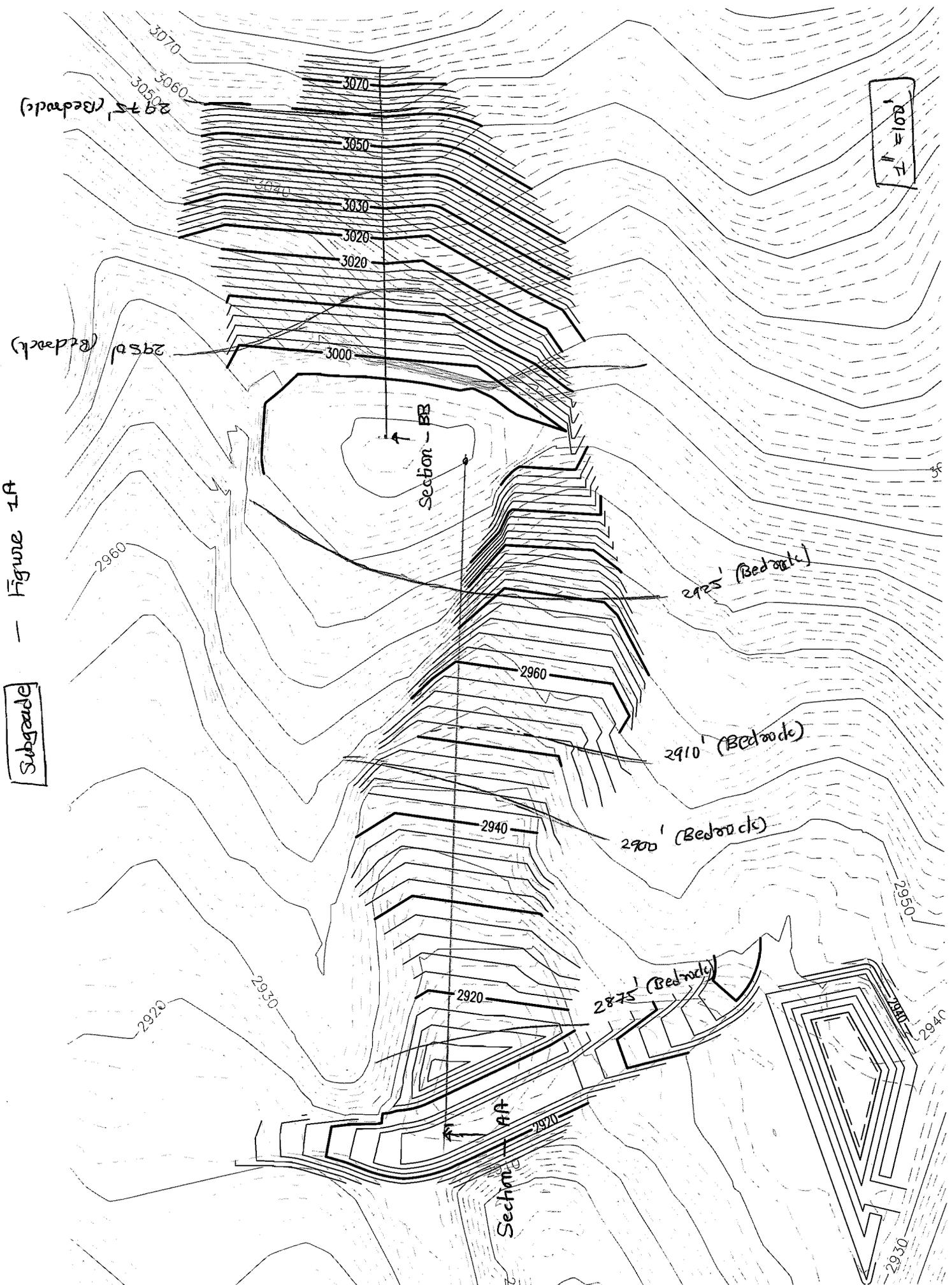


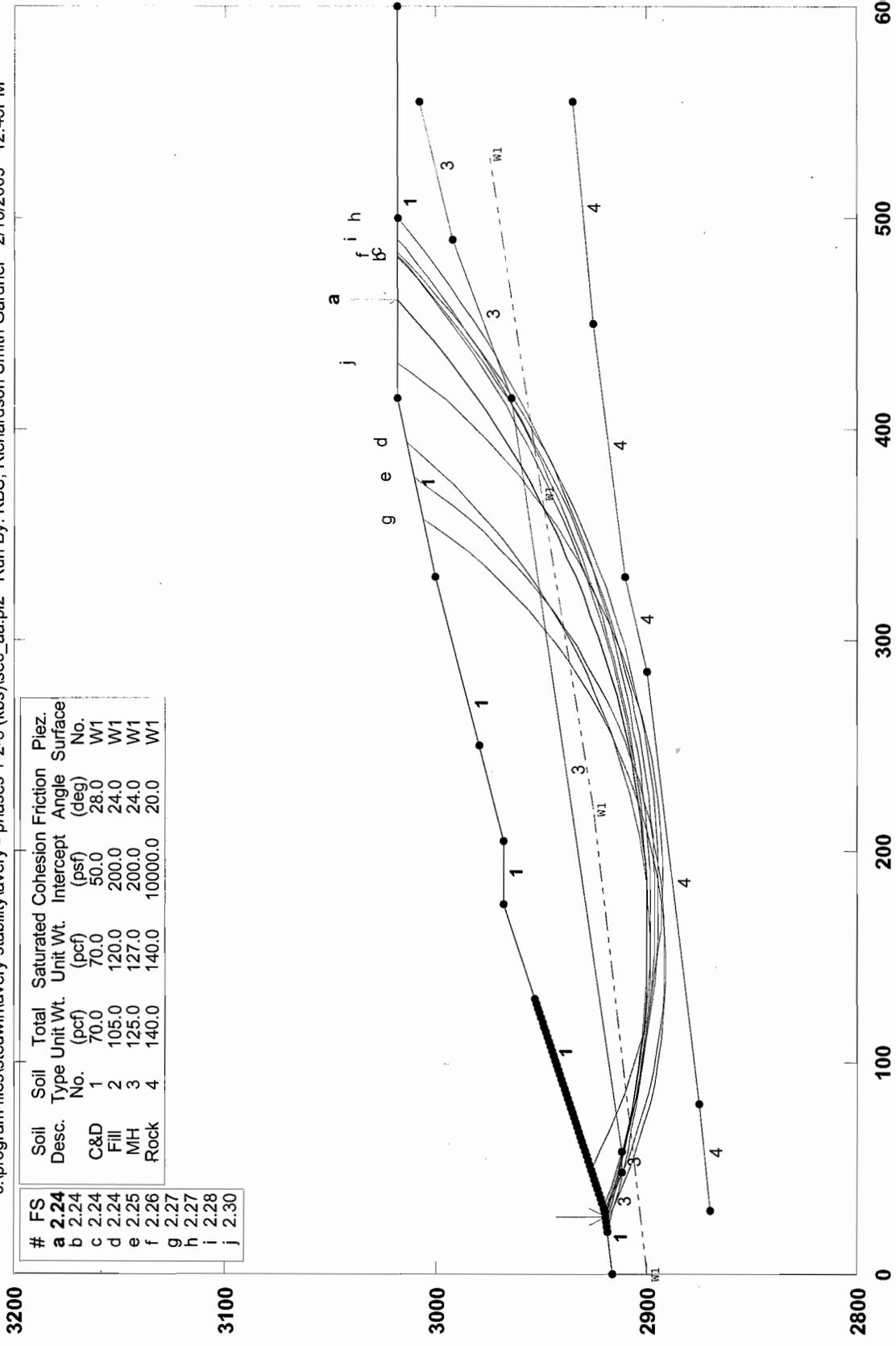
Figure 1A

Subgrade



Avery County C&D Landfill Section AA - Check for Circular Failure

c:\program files\stedwin\avery stability\avery - phases 1-2-3 (kbs)\sec_aa.pl2 Run By: KBS, Richardson Smith Gardner 2/16/2009 12:45PM

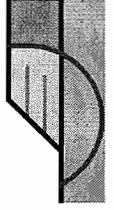


#	FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
a	2.24	C&D	1	70.0	70.0	50.0	28.0	W1
b	2.24	Fill	2	105.0	120.0	200.0	24.0	W1
c	2.24	MH	3	125.0	127.0	200.0	24.0	W1
d	2.25	Rock	4	140.0	140.0	10000.0	20.0	W1
e	2.26							
f	2.27							
g	2.27							
h	2.27							
i	2.28							
j	2.30							

STABL6H FSmin=2.24

Safety Factors Are Calculated By The Modified Bishop Method

STED



**** STABL6H ****

by
 Purdue University
 --Slope Stability Analysis--
 Simplified Janbu, Simplified Bishop
 or Spencer's Method of Slices

Run Date: 2/16/2009
 Time of Run: 12:45PM
 Run By: KBS, Richardson Smith Gardner
 Input Data Filename: C:sec_aa.in
 Output Filename: C:sec_aa.OUT
 Plotted Output Filename: C:sec_aa.PLT
 PROBLEM DESCRIPTION Avery County C&D Landfill
 Section AA - Check for Circular Failure

BOUNDARY COORDINATES

Note: User origin value specified.
 Add 0.00 to X-values and 2800.00 to Y-values listed.

6 Top Boundaries
 16 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	116.00	30.00	120.00	1
2	30.00	120.00	175.00	168.00	1
3	175.00	168.00	205.00	168.00	1
4	205.00	168.00	330.00	200.00	1
5	330.00	200.00	415.00	218.00	1
6	415.00	218.00	600.00	218.00	1
7	30.00	120.00	48.00	112.00	3
8	48.00	112.00	58.00	112.00	3
9	58.00	112.00	415.00	164.00	3
10	415.00	164.00	490.00	192.00	3
11	490.00	192.00	555.00	208.00	3
12	30.00	70.00	80.00	75.00	4
13	80.00	75.00	285.00	100.00	4
14	285.00	100.00	330.00	110.00	4
15	330.00	110.00	450.00	125.00	4
16	450.00	125.00	555.00	135.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	70.0	70.0	50.0	28.0	.00	.0	1
2	105.0	120.0	200.0	24.0	.00	.0	1
3	125.0	127.0	200.0	24.0	.00	.0	1
4	140.0	140.0	10000.0	20.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	100.00
2	220.00	125.00
3	370.00	150.00
4	530.00	175.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified. 500 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 50 Points Equally Spaced Along The Ground Surface Between X = 20.00 ft.

and X = 130.00 ft.

Each Surface Terminates Between X = 250.00 ft.

and X = 500.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 50.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.74	119.56
2	36.31	116.69
3	45.95	114.03
4	55.65	111.59
5	65.40	109.37
6	75.20	107.37
7	85.04	105.59
8	94.92	104.03
9	104.83	102.69
10	114.77	101.58
11	124.73	100.70
12	134.70	100.04
13	144.69	99.60
14	154.69	99.39
15	164.69	99.40
16	174.69	99.64
17	184.68	100.11
18	194.65	100.80
19	204.61	101.72
20	214.55	102.86
21	224.45	104.22
22	234.33	105.81
23	244.16	107.62
24	253.95	109.65
25	263.70	111.90
26	273.39	114.37
27	283.02	117.05
28	292.59	119.96
29	302.09	123.08
30	311.52	126.41
31	320.87	129.95
32	330.14	133.71
33	339.32	137.67
34	348.41	141.84
35	357.40	146.21
36	366.30	150.78
37	375.08	155.56
38	383.76	160.53
39	392.32	165.69
40	400.77	171.05
41	409.09	176.59
42	417.28	182.32
43	425.35	188.24
44	433.27	194.33
45	441.06	200.61
46	448.71	207.05
47	456.21	213.67
48	460.89	218.00

Circle Center At X = 159.0 ; Y = 542.8 and Radius, 443.4
 *** 2.236 ***

Failure Surface Specified By 50 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	28.98	119.86
2	38.48	116.74
3	48.05	113.84
4	57.68	111.14
5	67.37	108.67
6	77.11	106.40
7	86.90	104.36

8	96.73	102.54
9	106.60	100.93
10	116.50	99.55
11	126.44	98.38
12	136.39	97.44
13	146.37	96.72
14	156.35	96.23
15	166.35	95.95
16	176.35	95.90
17	186.35	96.07
18	196.34	96.47
19	206.32	97.09
20	216.29	97.93
21	226.23	98.99
22	236.15	100.27
23	246.03	101.78
24	255.88	103.50
25	265.69	105.44
26	275.46	107.61
27	285.17	109.99
28	294.83	112.58
29	304.42	115.39
30	313.95	118.41
31	323.42	121.65
32	332.80	125.09
33	342.11	128.75
34	351.34	132.61
35	360.47	136.67
36	369.52	140.94
37	378.46	145.41
38	387.31	150.08
39	396.05	154.94
40	404.67	159.99
41	413.19	165.24
42	421.58	170.68
43	429.85	176.30
44	437.99	182.11
45	446.00	188.09
46	453.88	194.25
47	461.62	200.59
48	469.21	207.10
49	476.66	213.77
50	481.17	218.00

Circle Center At X = 173.6 ; Y = 544.3 and Radius, 448.4

*** 2.242 ***

Failure Surface Specified By 50 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	31.22	120.41
2	40.66	117.11
3	50.18	114.02
4	59.76	111.16
5	69.40	108.52
6	79.11	106.10
7	88.86	103.90
8	98.67	101.93
9	108.51	100.18
10	118.40	98.66
11	128.31	97.37
12	138.26	96.31
13	148.22	95.47
14	158.20	94.87
15	168.20	94.49
16	178.19	94.35
17	188.19	94.43
18	198.19	94.74
19	208.17	95.28

20	218.14	96.06
21	228.09	97.06
22	238.02	98.28
23	247.91	99.74
24	257.77	101.42
25	267.59	103.33
26	277.36	105.47
27	287.07	107.83
28	296.73	110.41
29	306.33	113.21
30	315.87	116.23
31	325.33	119.47
32	334.71	122.93
33	344.01	126.60
34	353.23	130.48
35	362.35	134.58
36	371.38	138.88
37	380.30	143.39
38	389.12	148.10
39	397.83	153.02
40	406.43	158.13
41	414.90	163.44
42	423.25	168.94
43	431.47	174.64
44	439.56	180.52
45	447.51	186.58
46	455.32	192.83
47	462.98	199.25
48	470.50	205.85
49	477.86	212.62
50	483.45	218.00

Circle Center At X = 179.6 ; Y = 529.6 and Radius, 435.3

*** 2.242 ***

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	31.22	120.41
2	40.58	116.87
3	50.04	113.63
4	59.60	110.69
5	69.24	108.05
6	78.97	105.72
7	88.76	103.69
8	98.61	101.97
9	108.51	100.56
10	118.45	99.46
11	128.42	98.68
12	138.41	98.21
13	148.41	98.06
14	158.41	98.22
15	168.39	98.69
16	178.36	99.48
17	188.30	100.58
18	198.20	101.99
19	208.05	103.71
20	217.85	105.74
21	227.57	108.08
22	237.21	110.72
23	246.77	113.67
24	256.23	116.91
25	265.58	120.45
26	274.82	124.28
27	283.93	128.40
28	292.91	132.80
29	301.74	137.49
30	310.43	142.45
31	318.95	147.68

32	327.30	153.17
33	335.48	158.93
34	343.48	164.94
35	351.28	171.20
36	358.87	177.70
37	366.27	184.43
38	373.44	191.40
39	380.40	198.58
40	387.12	205.98
41	393.48	213.44

Circle Center At X = 148.3 ; Y = 416.1 and Radius, 318.1
 *** 2.243 ***

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	28.98	119.86
2	38.02	115.58
3	47.20	111.63
4	56.53	108.01
5	65.97	104.74
6	75.54	101.81
7	85.20	99.24
8	94.95	97.02
9	104.77	95.15
10	114.66	93.64
11	124.59	92.50
12	134.56	91.71
13	144.55	91.29
14	154.55	91.24
15	164.55	91.55
16	174.53	92.22
17	184.47	93.26
18	194.37	94.66
19	204.22	96.41
20	213.99	98.53
21	223.68	101.00
22	233.28	103.82
23	242.76	106.99
24	252.12	110.50
25	261.35	114.35
26	270.44	118.53
27	279.36	123.05
28	288.11	127.88
29	296.69	133.03
30	305.06	138.49
31	313.24	144.25
32	321.20	150.30
33	328.93	156.64
34	336.43	163.26
35	343.68	170.15
36	350.67	177.29
37	357.40	184.69
38	363.86	192.33
39	370.04	200.19
40	375.92	208.28
41	377.05	209.96

Circle Center At X = 151.1 ; Y = 365.7 and Radius, 274.5
 *** 2.250 ***

Failure Surface Specified By 50 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	24.49	119.27
2	34.11	116.55
3	43.79	114.03
4	53.52	111.71
5	63.29	109.59
6	73.10	107.66

7	82.96	105.94
8	92.84	104.42
9	102.75	103.10
10	112.69	101.98
11	122.65	101.06
12	132.62	100.35
13	142.61	99.84
14	152.60	99.54
15	162.60	99.43
16	172.60	99.53
17	182.60	99.84
18	192.58	100.35
19	202.56	101.06
20	212.52	101.97
21	222.45	103.09
22	232.37	104.41
23	242.25	105.93
24	252.10	107.65
25	261.92	109.57
26	271.69	111.69
27	281.42	114.01
28	291.09	116.53
29	300.72	119.24
30	310.29	122.15
31	319.79	125.26
32	329.23	128.55
33	338.60	132.04
34	347.90	135.72
35	357.13	139.59
36	366.27	143.64
37	375.32	147.88
38	384.29	152.30
39	393.17	156.90
40	401.95	161.69
41	410.63	166.65
42	419.21	171.79
43	427.69	177.10
44	436.05	182.58
45	444.30	188.23
46	452.43	194.05
47	460.45	200.03
48	468.33	206.18
49	476.10	212.48
50	482.62	218.00

Circle Center At X = 162.6 ; Y = 590.5 and Radius, 491.1
 *** 2.264 ***

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	24.49	119.27
2	33.48	114.89
3	42.63	110.86
4	51.94	107.19
5	61.37	103.88
6	70.93	100.94
7	80.60	98.37
8	90.35	96.18
9	100.19	94.36
10	110.08	92.93
11	120.03	91.88
12	130.01	91.21
13	140.00	90.93
14	150.00	91.04
15	159.99	91.53
16	169.95	92.41
17	179.87	93.67
18	189.73	95.31

19	199.53	97.34
20	209.23	99.74
21	218.84	102.51
22	228.33	105.66
23	237.70	109.16
24	246.92	113.03
25	255.99	117.25
26	264.88	121.82
27	273.60	126.73
28	282.11	131.97
29	290.42	137.53
30	298.51	143.41
31	306.36	149.61
32	313.97	156.09
33	321.32	162.87
34	328.41	169.93
35	335.21	177.26
36	341.73	184.84
37	347.95	192.67
38	353.87	200.73
39	357.28	205.78

Circle Center At X = 142.3 ; Y = 349.7 and Radius, 258.8
 *** 2.265 ***

Failure Surface Specified By 52 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	20.00	118.67
2	29.63	115.99
3	39.32	113.49
4	49.05	111.17
5	58.82	109.05
6	68.63	107.11
7	78.47	105.35
8	88.35	103.78
9	98.25	102.41
10	108.18	101.22
11	118.13	100.21
12	128.10	99.40
13	138.08	98.78
14	148.07	98.35
15	158.07	98.11
16	168.07	98.06
17	178.07	98.20
18	188.06	98.53
19	198.05	99.05
20	208.02	99.75
21	217.98	100.65
22	227.92	101.74
23	237.84	103.02
24	247.73	104.48
25	257.59	106.14
26	267.42	107.98
27	277.22	110.01
28	286.97	112.22
29	296.68	114.62
30	306.34	117.20
31	315.95	119.97
32	325.50	122.91
33	335.00	126.04
34	344.44	129.35
35	353.81	132.84
36	363.11	136.51
37	372.34	140.35
38	381.50	144.37
39	390.58	148.56
40	399.58	152.92
41	408.49	157.45

42	417.32	162.16
43	426.05	167.03
44	434.69	172.06
45	443.24	177.26
46	451.68	182.62
47	460.02	188.14
48	468.25	193.81
49	476.37	199.65
50	484.38	205.63
51	492.28	211.77
52	499.99	218.00

Circle Center At X = 165.8 ; Y = 623.7 and Radius, 525.6
 *** 2.274 ***

Failure Surface Specified By 51 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	24.49	119.27
2	34.13	116.59
3	43.81	114.11
4	53.55	111.81
5	63.32	109.72
6	73.14	107.81
7	82.99	106.10
8	92.88	104.59
9	102.79	103.27
10	112.73	102.15
11	122.68	101.22
12	132.66	100.49
13	142.64	99.96
14	152.64	99.63
15	162.64	99.50
16	172.64	99.56
17	182.63	99.82
18	192.62	100.28
19	202.60	100.94
20	212.57	101.79
21	222.51	102.85
22	232.43	104.09
23	242.33	105.54
24	252.19	107.18
25	262.02	109.02
26	271.81	111.04
27	281.56	113.27
28	291.27	115.68
29	300.92	118.29
30	310.52	121.09
31	320.06	124.08
32	329.55	127.25
33	338.96	130.62
34	348.31	134.16
35	357.59	137.90
36	366.79	141.81
37	375.91	145.91
38	384.95	150.19
39	393.91	154.64
40	402.77	159.28
41	411.54	164.08
42	420.21	169.06
43	428.78	174.21
44	437.25	179.53
45	445.61	185.02
46	453.86	190.67
47	462.00	196.48
48	470.02	202.45
49	477.92	208.58
50	485.70	214.86
51	489.43	218.00

Circle Center At X = 164.4 ; Y = 604.5 and Radius, 505.0
 *** 2.275 ***

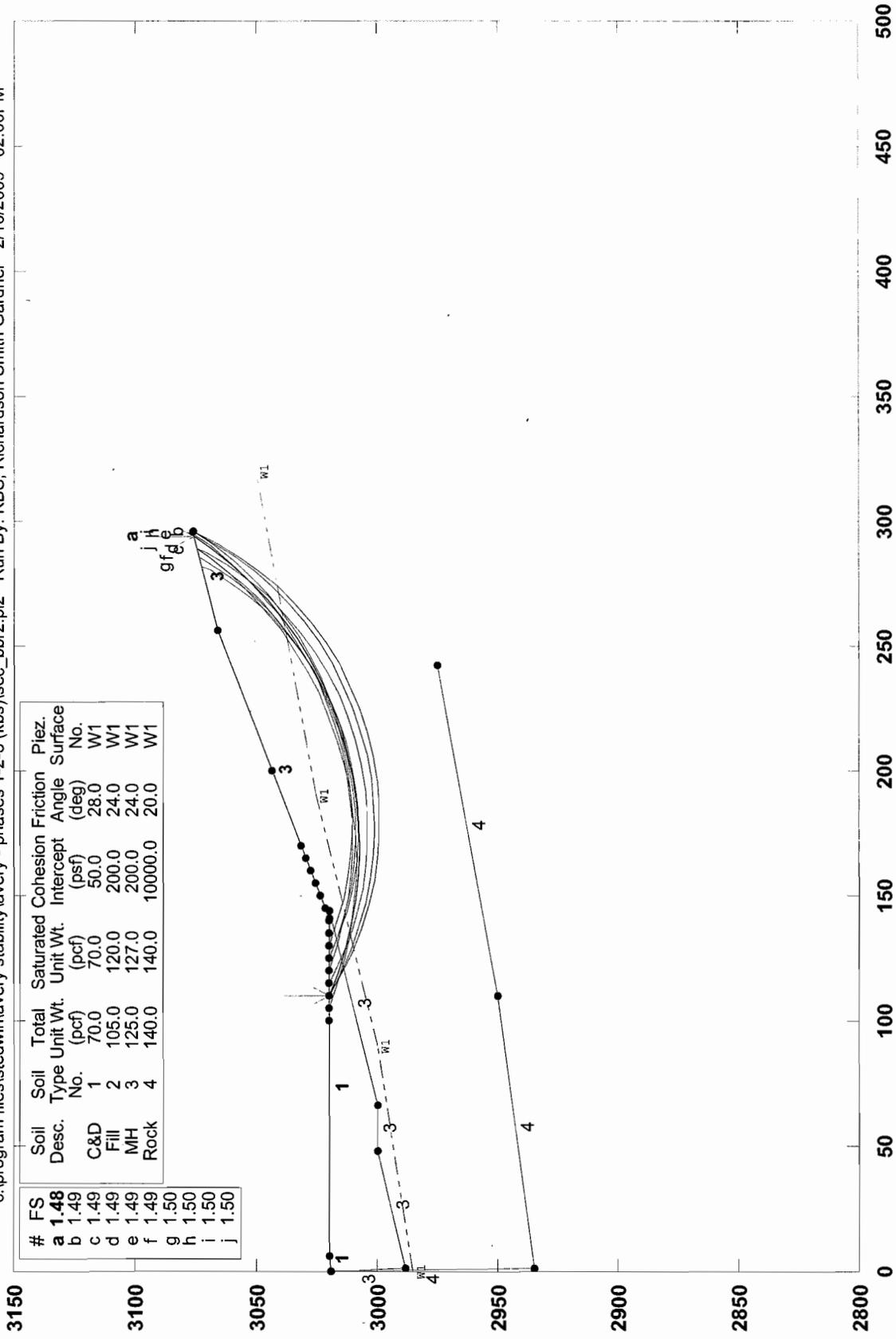
Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	49.18	126.35
2	58.13	121.88
3	67.21	117.70
4	76.44	113.83
5	85.78	110.27
6	95.24	107.03
7	104.80	104.10
8	114.46	101.50
9	124.19	99.22
10	134.00	97.26
11	143.87	95.63
12	153.78	94.34
13	163.74	93.37
14	173.72	92.74
15	183.71	92.44
16	193.71	92.47
17	203.70	92.84
18	213.68	93.54
19	223.63	94.58
20	233.53	95.95
21	243.39	97.64
22	253.18	99.67
23	262.90	102.02
24	272.54	104.69
25	282.08	107.68
26	291.51	110.99
27	300.83	114.62
28	310.03	118.55
29	319.09	122.79
30	328.00	127.33
31	336.75	132.16
32	345.34	137.28
33	353.75	142.69
34	361.98	148.37
35	370.01	154.33
36	377.84	160.55
37	385.46	167.02
38	392.86	173.75
39	400.03	180.73
40	406.96	187.93
41	413.65	195.37
42	420.08	203.02
43	426.26	210.89
44	431.47	218.00

Circle Center At X = 187.7 ; Y = 391.9 and Radius, 299.5
 *** 2.295 ***

Avery County C&D Landfill Section BB - Flattened to 2.5:1

c:\program files\stedwin\avery stability\avery - phases 1-2-3 (kbs)\sec_bbr2.pl2 Run By: KBS, Richardson Smith Gardner 2/16/2009 02:00PM



STABL6H FSmin=1.48
Safety Factors Are Calculated By The Modified Bishop Method

STED



**** STABL6H ****

by
 Purdue University
 --Slope Stability Analysis--
 Simplified Janbu, Simplified Bishop
 or Spencer's Method of Slices

Run Date: 2/16/2009
 Time of Run: 02:00PM
 Run By: KBS, Richardson Smith Gardner
 Input Data Filename: c:sec_bbr2.in
 Output Filename: c:sec_bbr2.OUT
 Plotted Output Filename: c:sec_bbr2.PLT
 PROBLEM DESCRIPTION Avery County C&D Landfill
 Section BB - Flattened to 2.5:1

BOUNDARY COORDINATES

Note: User origin value specified.
 Add 0.00 to X-values and 2800.00 to Y-values listed.

4 Top Boundaries
 11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	219.00	6.00	220.00	1
2	6.00	220.00	141.00	220.00	1
3	141.00	220.00	256.00	266.00	3
4	256.00	266.00	296.00	276.00	3
5	.00	219.00	1.00	188.00	3
6	1.00	188.00	48.00	200.00	3
7	48.00	200.00	66.00	200.00	3
8	66.00	200.00	144.00	220.00	3
9	.00	219.00	1.00	135.00	4
10	1.00	135.00	110.00	150.00	4
11	110.00	150.00	242.00	175.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	70.0	70.0	50.0	28.0	.00	.0	1
2	105.0	120.0	200.0	24.0	.00	.0	1
3	125.0	127.0	200.0	24.0	.00	.0	1
4	140.0	140.0	10000.0	20.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	185.00
2	90.00	200.00
3	190.00	225.00
4	320.00	250.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
 300 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 15 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
 and X = 170.00 ft.

Each Surface Terminates Between X = 200.00 ft.
 and X = 296.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 50.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *
 Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	110.00	220.00
2	119.27	216.24
3	128.77	213.12
4	138.46	210.66
5	148.30	208.86
6	158.23	207.74
7	168.22	207.29
8	178.22	207.53
9	188.18	208.45
10	198.05	210.04
11	207.79	212.30
12	217.36	215.22
13	226.70	218.79
14	235.78	222.98
15	244.55	227.78
16	252.97	233.17
17	261.01	239.12
18	268.63	245.60
19	275.78	252.59
20	282.44	260.04
21	288.58	267.94
22	293.61	275.40

Circle Center At X = 169.8 ; Y = 354.0 and Radius, 146.7

*** 1.483 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	110.00	220.00
2	118.74	215.14
3	127.82	210.96
4	137.20	207.49
5	146.82	204.75
6	156.62	202.76
7	166.54	201.52
8	176.53	201.05
9	186.53	201.34
10	196.47	202.41
11	206.30	204.23
12	215.97	206.80
13	225.41	210.10
14	234.56	214.12
15	243.39	218.83
16	251.82	224.20
17	259.82	230.20
18	267.33	236.80
19	274.32	243.95
20	280.74	251.62
21	286.55	259.76
22	291.71	268.32
23	295.52	275.88

Circle Center At X = 177.7 ; Y = 331.3 and Radius, 130.3

*** 1.486 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	110.00	220.00
2	119.24	216.18
3	128.73	213.02
4	138.42	210.54
5	148.26	208.76
6	158.20	207.67
7	168.19	207.29
8	178.19	207.62
9	188.13	208.65
10	197.98	210.39

11	207.68	212.82
12	217.19	215.92
13	226.45	219.70
14	235.42	224.11
15	244.06	229.15
16	252.31	234.79
17	260.15	241.00
18	267.53	247.75
19	274.42	255.00
20	280.77	262.73
21	286.56	270.88
22	288.54	274.14

Circle Center At X = 168.6 ; Y = 348.6 and Radius, 141.3
 *** 1.486 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.00	220.00
2	123.88	215.41
3	133.10	211.54
4	142.61	208.42
5	152.33	206.07
6	162.20	204.51
7	172.17	203.74
8	182.17	203.77
9	192.14	204.61
10	202.00	206.23
11	211.71	208.65
12	221.19	211.83
13	230.39	215.76
14	239.24	220.41
15	247.69	225.76
16	255.68	231.76
17	263.17	238.39
18	270.11	245.59
19	276.44	253.33
20	282.14	261.55
21	287.16	270.20
22	289.11	274.28

Circle Center At X = 176.8 ; Y = 328.5 and Radius, 124.9
 *** 1.487 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	120.00	220.00
2	129.45	216.71
3	139.09	214.08
4	148.90	212.11
5	158.81	210.82
6	168.79	210.20
7	178.79	210.27
8	188.77	211.02
9	198.66	212.45
10	208.44	214.55
11	218.05	217.32
12	227.45	220.73
13	236.59	224.78
14	245.44	229.44
15	253.95	234.70
16	262.08	240.52
17	269.79	246.89
18	277.05	253.76
19	283.82	261.12
20	290.08	268.92
21	294.79	275.70

Circle Center At X = 172.8 ; Y = 356.6 and Radius, 146.4
 *** 1.491 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	125.00	220.00
2	134.26	216.21
3	143.79	213.18
4	153.53	210.93
5	163.42	209.48
6	173.40	208.82
7	183.40	208.98
8	193.35	209.94
9	203.20	211.69
10	212.87	214.24
11	222.30	217.56
12	231.44	221.63
13	240.21	226.42
14	248.58	231.90
15	256.47	238.05
16	263.84	244.80
17	270.64	252.13
18	276.83	259.99
19	282.37	268.32
20	285.12	273.28

Circle Center At X = 176.5 ; Y = 332.7 and Radius, 123.9

*** 1.494 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	125.00	220.00
2	134.13	215.93
3	143.58	212.65
4	153.28	210.20
5	163.14	208.57
6	173.11	207.80
7	183.11	207.87
8	193.07	208.80
9	202.91	210.58
10	212.57	213.18
11	221.96	216.61
12	231.03	220.82
13	239.71	225.78
14	247.93	231.47
15	255.64	237.84
16	262.78	244.85
17	269.29	252.43
18	275.14	260.55
19	280.27	269.13
20	281.90	272.47

Circle Center At X = 177.2 ; Y = 324.9 and Radius, 117.2

*** 1.497 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	110.00	220.00
2	118.53	214.77
3	127.44	210.24
4	136.69	206.44
5	146.21	203.38
6	155.95	201.09
7	165.83	199.59
8	175.81	198.88
9	185.81	198.96
10	195.77	199.85
11	205.63	201.52
12	215.32	203.98
13	224.79	207.19
14	233.97	211.16

15	242.80	215.84
16	251.24	221.21
17	259.22	227.24
18	266.69	233.88
19	273.61	241.10
20	279.94	248.85
21	285.62	257.08
22	290.63	265.73
23	294.94	274.75
24	295.35	275.84

Circle Center At X = 179.7 ; Y = 324.2 and Radius, 125.4
 *** 1.498 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.00	220.00
2	139.42	216.64
3	149.06	213.99
4	158.87	212.06
5	168.80	210.86
6	178.79	210.39
7	188.79	210.67
8	198.74	211.69
9	208.58	213.43
10	218.27	215.90
11	227.75	219.08
12	236.97	222.96
13	245.88	227.50
14	254.43	232.69
15	262.57	238.50
16	270.26	244.89
17	277.45	251.84
18	284.11	259.30
19	290.20	267.23
20	295.69	275.59
21	295.91	275.98

Circle Center At X = 180.1 ; Y = 345.5 and Radius, 135.1
 *** 1.500 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.00	220.00
2	114.37	216.51
3	123.95	213.64
4	133.70	211.39
5	143.57	209.79
6	153.52	208.83
7	163.51	208.52
8	173.51	208.86
9	183.46	209.85
10	193.33	211.48
11	203.06	213.75
12	212.63	216.66
13	222.00	220.17
14	231.11	224.29
15	239.93	228.99
16	248.43	234.26
17	256.58	240.07
18	264.32	246.39
19	271.64	253.21
20	278.50	260.48
21	284.87	268.19
22	289.31	274.33

Circle Center At X = 163.3 ; Y = 362.2 and Radius, 153.7
 *** 1.500 ***

Appendix C

Underdrain System Analysis

PROJECT AVERY COUNTY CID LANDFILL

SHEET 1 OF

JOB NO. AVERY-03-4

DATE 2-16-09

SUBJECT UNDERDRAIN ANALYSIS

COMPUTED BY SAS

CHECKED BY

OBJECTIVE

DESIGN UNDERDRAIN BELOW PHASE III EXPANSION TO
PULL RESIDUAL STREAM FLOW AND MAINTAIN GROUNDWATER
SEPERATION.

GIVEN

→ GROUNDWATER FLOW OCCURS WITH UNIT IS IN THE
SAPROLITE LAYER AVERAGE $K \approx 7.24 \times 10^{-4}$ cm/sec

→ OLD STREAM BED IS $\approx 600'$ @ $\approx 20'$ WIDTH @ ~ 0.25 AC

CALCULATIONS

- BASED ON WATER BALANCE $\approx 30\%$ OF PRECIPITATION
IS AVAILABLE AS INFILTRATION

i. ASSUME 2 YR-5 MIN STORM AS DESIGN BASIS $i = 5.04$ "/hr

& EQUIVALENT C (FOR INFILTRATION) ≈ 0.30

9 AREA = 0.25 AC

$$Q_{\text{INFILTR}} = (0.30)(5.04)(0.25) \approx 0.38 \text{ cfs}$$

- BASED ON CONSERVATIVE ASSUMPTION THAT ALL INFILTRATION
REACHES TRENCH $q_{\text{TRENCH}} \approx Q_{\text{INFILTRATION}}$

$$q_{\text{TRENCH}} = K i A \Rightarrow K_{\text{STONE (NO. 57)}} = 1.90 \text{ FT/} \frac{\text{MIN}}{\text{MIN}} = 316 \cdot 10^{-2} \text{ FT/SEC}$$
$$i \approx 10\% \text{ (@ LEAST SLOPE)} = 0.10 \text{ FT/FT}$$

i. DETERMINE q @ 4' DEEP @ 25' WIDTH



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PROJECT AVERY COUNTY C&D LANDFILL

SHEET 2 OF 2

JOB NO. AVER-08-4

DATE 2-16-09

SUBJECT UNDERDRAIN ANALYSIS

COMPUTED BY SAB

CHECKED BY _____

$$Q_{TRENCH} = \frac{3.16 (10^{-2}) \text{ FT}}{500} \left(\frac{0.10 \text{ FT}}{\text{FT}} \right) (4') (25') = 0.32 \text{ CFS}$$

$$Q \approx q_{TRENCH} @ 5' = 0.40 \text{ CFS}$$

∴ USE 5' DEEP TRENCH @ 25' WIDTH.

NOTE: $K_{STONE} \gg K_{UNIT}$, ∴ TRENCH

WILL SUFFICIENTLY PULL BASE SEEPAGE QUICKLY AWAY WITH GOOD FACTOR OF SAFETY.



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 Raleigh, NC 27603 Fax: 919-828-3899

SHEET: /
 JOB #: Avery 07-1
 DATE: 7/17/08
 BY: KBS
 CHKD BY:

**Avery County C&D Landfill
 Analysis of Design Storms**

LOCATION: Avery County, NC

SOURCE: NOAA , North Carolina
http://hdsc.nws.noaa.gov/hdsc/pfds/orb/nc_pfds.html

DEPTH-DURATION-FREQUENCY TABLE

DURATION	RETURN PERIOD					
	2-YR (in)	5-YR (in)	10-YR (in)	25-YR (in)	50-YR (in)	100-YR (in)
5 min	0.42	0.53	0.61	0.70	0.77	0.84
10 min	0.67	0.85	0.97	1.11	1.22	1.33
15 min	0.85	1.08	1.23	1.41	1.55	1.68
30 min	1.17	1.53	1.78	2.09	2.33	2.57
60 min	1.47	1.97	2.31	2.78	3.16	3.54
2 hr	1.68	2.30	2.77	3.43	3.98	4.58
3 hr	1.81	2.47	2.97	3.70	4.32	5.00
6 hr	2.29	3.07	3.67	4.55	5.30	6.14
12 hr	2.95	3.92	4.63	5.63	6.44	7.32
24 hr	3.66	4.96	5.91	7.23	8.30	9.45

INTENSITY-DURATION-FREQUENCY TABLE

DURATION	RETURN PERIOD					
	2-YR (in/hr)	5-YR (in/hr)	10-YR (in/hr)	25-YR (in/hr)	50-YR (in/hr)	100-YR (in/hr)
5 min	5.04	6.36	7.32	8.40	9.24	10.08
10 min	4.02	5.10	5.82	6.66	7.32	7.98
15 min	3.40	4.32	4.92	5.64	6.20	6.72
30 min	2.34	3.06	3.56	4.18	4.66	5.14
60 min	1.47	1.97	2.31	2.78	3.16	3.54
2 hr	0.84	1.15	1.39	1.72	1.99	2.29
3 hr	0.60	0.82	0.99	1.23	1.44	1.67
6 hr	0.38	0.51	0.61	0.76	0.88	1.02
12 hr	0.25	0.33	0.39	0.47	0.54	0.61
24 hr	0.15	0.21	0.25	0.30	0.35	0.39



DATE: 16-Feb-09

BY: SAS

Water Balance
Western North Carolina

Month	PET(1) (in/month)	Runoff(2) (in/month)	Precipitation (3) 1951-1980 (in/month)	Infiltration(4) (in/month)	Recharge Area (acres)
January	0.9	0.41	3.89	2.58	0.25
February	1.7	0.41	3.92	1.81	0.25
March	2.1	0.51	5.06	2.45	0.25
April	3.3	0.45	4.36	0.61	0.25
May	3.7	0.45	4.35	0.20	0.25
June	4.3	0.46	4.38	0.00	0.25
July	4.1	0.49	4.81	0.22	0.25
August	3.8	0.47	4.56	0.29	0.25
September	3	0.44	4.2	0.76	0.25
October	2	0.38	3.55	1.17	0.25
November	1.1	0.39	3.63	2.14	0.25
December	0.7	0.38	3.55	2.47	0.25
Yearly Totals	30.7	5.24	50.26	14.70	0.25

→ ~ 30%

Source:

1. NCSU Agricultural Extension Service, Publication AG-375, "Weather and Climate in North Carolina" - Asheville, NC.
2. Runoff is calculated according to the Victor Mocus Equation based on a composite SCS Curve Number of 79 (HSG = B) for conditions prior to landfill construction. This assumption is considered conservative as the landfill and liner system will result in very little infiltration and almost 100% runoff.
3. NCSU Agricultural Extension Service, Publication AG-375, "Weather and Climate in North Carolina"
4. Infiltration determined as the difference between precipitation and losses due to runoff and potential evapotranspiration (PET)

defined on the basis of material density (see **Section 1.6**). The field hydraulic conductivity values relative to each **hydrogeologic unit** vary as follows:

Hydro. Unit	Unit Description	Conductivity (cm/sec)			Conductivity (ft/day)		
		Max.	Min.	Avg.	Max.	Min.	Avg.
1A	Saprolite <100 bpf	7.67E-4 PZ-13i	3.42E-4 PZ-12	4.92E-4	2.17 PZ-13i	0.968 PZ-12	1.40
1B	Saprolite >100 bpf	1.60E-3 PZ-9	8.19E-6 MW-3d	7.24E-4	4.53 PZ-9	0.002 MW-3d	2.05
2	Bedrock	2.66E-3 MW-1d	5.64E-4 B-6	1.61E-3	7.53 MW-1d	1.60 B-6	4.65

These data show a slight increasing trend with depth, most likely due to higher clay content in the upper soils, more sand-like conditions and fracturing at depth, indicated by the low RQD values. Due to the layering, distinct horizons of consistent conductivity values are not apparent – note the variability within Unit 1B. The boundaries between units are transitional, that is, the units are interconnected and could be considered as one contiguous porous aquifer. It should be noted that slug tests measure hydraulic properties within a relatively narrow zone of influence around the piezometer, and there is the possibility of sample bias.

1.4.5 Dispersivity Characteristics – Predicting the movement of contaminants in ground water is of interest in developing an effective monitoring program. Contaminant transport modeling, which is dependent on the properties of the both the aquifer and the contaminant of interest, is typically described in the literature by the advection-dispersion equation, where **advection** is chemical movement via groundwater flow due to the groundwater hydraulic (i.e. head) gradient, and **dispersion** is defined as, “The spreading and mixing of chemical constituents in groundwater caused by diffusion and mixing (due to microscopic variations in velocities within and between pores).”¹⁰

As water moves through a porous medium, soil grains present obstacles that result in friction between the fluid and solids, resulting in localized variations in ground water velocity. Solutes and non-soluble fluids that might be released from a waste unit, i.e., contaminants of concern, may be introduced as steady state flow over a long period or as a relatively short-term pulse. Without dispersion, all of the contaminant would travel in a straight line at the ambient groundwater velocity. With dispersion, some chemical fluids travels faster and some slower than the mean velocity – this is due in part to inherent aquifer properties and in part to chemical properties of the solute.

¹⁰ <http://www.fosterwelldrilling.com/glossary.htm>

Table 3
Hydrogeologic Properties of Lithologic Units

Piezometer Number	Hydrological Unit	Hydrogeological Description ⁽¹⁾	Average RQD for Screen Interval	Effective Porosity ^(2,3)	Total Porosity ^(2,3)	Hydraulic Conductivity (k)		
						ft/min	ft/day	cm/sec
MW-1d	2	Fractured mica gneiss	62.5%	10%	20%	5.23E-03	7.53E+00	2.66E-03
MW-2d	2	Fractured mica gneiss	17.0%	10%	20%	1.11E-03	1.60E+00	5.64E-04
MW-3d	1B	Silty Sand (micaceous)	NA	19%	40%	1.61E-05	2.32E-02	8.19E-06
MW-4d	1B	Sandy Silt (micaceous)	NA	15%	35%	4.53E-04	6.53E-01	2.30E-04
PZ-9	1B	Silty Sand (micaceous)	NA	19%	40%	3.14E-03	4.53E+00	1.60E-03
PZ-10	1B	Sandy Silt (micaceous)	NA	16%	35%	2.93E-03	4.22E+00	1.49E-03
PZ-11d	1B	Sandy Silt (micaceous)	NA	18%	40%	3.09E-05	4.45E-02	1.57E-05
MW-13d	1B	Sandy Silt (micaceous)	NA	15%	35%	1.97E-03	2.84E+00	1.00E-03
PZ-11s	1A/1B	Sandy Silt (micaceous)	NA	20%	45%	8.43E-04	1.21E+00	4.28E-04
PZ-12	1A/1B	Sandy Silt (micaceous)	NA	18%	40%	6.72E-04	9.68E-01	3.42E-04
MW-4s	1A	Sandy Silt (micaceous)	NA	22%	45%	8.72E-04	1.26E+00	4.43E-04
PZ-13i	1A	Sandy Silt (micaceous)	NA	20%	40%	1.51E-03	2.17E+00	7.67E-04
PZ-13s	1A	Silt (micaceous)	NA	20%	40%	9.47E-04	1.36E+00	4.81E-04

Notes

Slug test data acquisition and data reduction performed by David Garrett & Associates

Top of Unit 1 is water table

- (1) Unit 1A - silty/sandy near-surface soil, low to moderate plasticity (SPT <50 bpf).
Unit 1B - Dense saprolite-silty sand (generally with SPT values in excess of 100 bpf)
- (2) Unit 2 - Consolidated, fractured rock (variably weathered)
Total and Effective porosity values for soils assigned based on laboratory testing (see Table 2) (soils in contact with well screen interval taken into consideration)
- (3) Total and Effective porosity values for bedrock assigned based on published literature, adjusted for avg. rock core RQD values, ref. Sinhal and Gupta, 1999 (furnished courtesy of NC DENR SWS)
(NOTE: Total Porosity for Clayey SAND sample at G-2A, 13.3' - 13.8' used to represent silty and clayey sand, but values were adjusted up to exceed the slightly higher calculated effective porosity values)

Attachment C

Technical Specifications

Technical Specifications

Avery County C&D Landfill Ingalls, North Carolina

Prepared for:



Avery County
Newland, North Carolina

Permit Issue Documents

February 2008



PRINTED ON 100% RECYCLED PAPER

Avery County C&D Landfill

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

<u>Section No.</u>	<u>Specification</u>
02110	Site Preparation
02222	Excavation
02223	Embankment
02240	Geotextiles
02250	Soil Liner (Final Cover)
02258	Vegetative Soil Layer
02270	Erosion and Sedimentation Control
02271	Rip Rap
02275	Rolled Erosion Control Products
02500	Roadway Work
02608	Precast Concrete Structures
02614	HDPE Pipe
02710	Drainage Aggregate (Underdrain)
02720	Storm Water Systems
02776	Geosynthetic Clay Liner (GCL)
02930	Revegetation

SECTION 02110

SITE PREPARATION

Site Preparation: Site Preparation includes clearing, grubbing, and stripping operations which precede the proposed construction.

A. DESCRIPTION

1. General:

- a. The Contractor shall furnish all labor, material, and equipment to complete Site Preparation in accordance with the Contract Drawings and these Specifications.
- b. Principal items of work include:
 1. Notifying all authorities owning utility lines running to or on the property. Protect and maintain all utility lines to remain and cap those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.
 2. Clearing the site within the clearing limits, including removal of grass, brush, shrubs, trees, loose debris, and other encumbrances except for trees to remain.
 3. Boxing and protecting all areas to be preserved.
 4. Removing all topsoil from designated areas and stockpiling on site where directed by the Engineer for future use.
 5. Disposing from the site all debris resulting from work under this Section.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Embankment	02223

B. MATERIALS Not Used.

C. SUBMITTALS Not Used.

D. CONSTRUCTION

1. Clearing of the Site:

a. Clearing limits, as shown on the Contract Drawings, shall be established by the Contractor's Surveyor. Once established, the clearing limits shall be inspected and approved by the Engineer prior to clearing the affected areas.

b. Before removal of topsoil, and start of excavation and grading operations, the areas within the clearing limits shown on the Contract Drawings shall be cleared and grubbed.

c. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, fencing, and other perishable and objectionable material.

Should it become necessary to remove a tree, bush, brush, or other plants outside the clearing limits, the Contractor shall do so only after permission has been granted by the Engineer.

d. Excavation resulting from the removal of trees, roots, and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted per the requirements contained in Section 02223, Embankment, of these Specifications.

e. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional cost to the Owner, if such, in his opinion, they are too close to the work to be maintained or have become damaged due to the Contractor's operations.

2. Stripping and Stockpiling Existing Topsoil:

a. Existing topsoil and sod on the site within areas designated on the Contract Drawings shall be stripped to whatever depth it may occur, and stored in locations directed by the Engineer.

b. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling.

- c. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.

3. Grubbing:

- a. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks, and other perishable materials to a depth of at least 6 inches below ground surfaces.
- b. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

4. Disposal of Cleared and Grubbed Material:

All trees, stumps, roots, and bushes shall be disposed of by burning (Only if allowed by the Owner and local zoning) or shall be removed from the site and disposed of by the Contractor. The Contractor shall receive written authorization from the Owner prior to burning. Any material other than plant growth shall not be burned. On-site and off-site disposal areas are subject to approval by the Engineer. Ashes and residue from burning operations shall be removed from the site and disposed of by the Contractor. The Contractor shall also obtain all of the required permits for his burning operations, as applicable.

END OF SECTION

SECTION 02222

EXCAVATION

Excavation: Excavation includes excavating, sealing, hauling, scraping, undercutting, removal of accumulated surface water or ground water, stockpiling, and all necessary and incidental items as required for bringing the landfill and related structures to the specified lines and grades.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment required to complete Excavation of the project area in accordance with the Contract Drawings and these Specifications, except as noted below:

- a. Clearing and grubbing and removal of topsoil is addressed in Section 02110, Site Preparation, of these Specifications.
- b. Removal of rock is addressed in Section 02229, Rock Removal, of these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Site Preparation	02110
Embankment	02223
Erosion and Sedimentation Control	02270
Roadway Work	02500
CQA Manual	Attached

3. Quality Assurance:

Quality Assurance during Excavation will be provided by the Owner as described in the accompanying Project CQA Manual.

4. Definitions:

- a. Excavation: shall consist of the removal and satisfactory disposal and/or stockpiling of materials located within the limits of construction including

widening cuts and shaping of slopes necessary for the preparation of roadbeds, landfill slope areas, cutting of any ditches, channels, waterways, entrances, and other work incidental thereto.

- b. Borrow: shall consist of approved on-site material required for the construction of embankments/fills or for other portions of the work.
- c. Select Borrow: shall consist of approved off-site material required for the construction of embankments/fills, roadway subgrade, backfilling, or for other portions of the work as shown on Contract Drawings or in these Specifications. The Contractor shall make his own arrangements for obtaining select borrow and pay all costs involved.
- d. Unsuitable Material: is any in-place or excavated material which contains undesirable materials, or is in a state which is not appropriate; in the opinion of the CQA Engineer, for the intended use or support of planned structures, embankment, or excavation. This may include but not be limited to organic material, waste/refuse, soft, or wet material not meeting required specifications, etc.
- e. Unsuitable Materials Excavation (Overexcavation): shall consist of the removal and satisfactory disposal of all unsuitable material located within the limits of construction. Where excavation to the finished grade section shown results in a subgrade or slopes of unsuitable material, the Contractor shall overexcavate such material to below the grade shown on the Contract Drawings or as directed by the Engineer and CQA Engineer.

B. MATERIALS

Excavation shall include the removal of all soil, weathered rock, boulders, conduits, pipe, and all other obstacles encountered and shown on the Contract Drawings or specified herein.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer before approval is given to proceed:

1. Plans of open cut excavations showing side slopes and limits of the excavation at grade.
2. List of disposal site(s) for waste and unsuitable materials.
3. Descriptive information on Excavation equipment to be used.

D. CONSTRUCTION

1. The Contractor shall conduct Excavation activities in such a manner that erosion of disturbed areas and off site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.
2. The Contractor shall excavate to the lines and grades shown on the Contract Drawings and stockpile all suitable excavated materials. As the excavation is made, the materials will be examined and identified to the CQA Engineer.

The Contractor will perform all surveys necessary to establish and verify lines and grades for all Excavation, including pipe excavations, soil overexcavation, and anchor trenches.

3. Stockpiling:

The Contractor shall stockpile the materials in appropriate stockpiles as approved by the CQA Engineer. The Contractor shall use equipment and methods as necessary to maintain the moisture content of soils stockpiled (excluding topsoil) at or near their optimum moisture content.

Stockpiles shall be properly sloped and the surfaces sealed by the Contractor at the end of each working day, or during the day in the event of heavy rain, to the satisfaction of the Engineer.

4. The Contractor shall protect all existing facilities and structures including, but not limited to, existing utilities, monitoring wells, signs, grade stakes, etc. during the grading and stockpiling operations.
5. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such sheeting, timbering, pumping, and drainage as may be required.
6. The Contractor shall be responsible for control of surface and subsurface water, when necessary.
7. Excavation slopes shall be flat enough to avoid sloughs and slides that will cause disturbance of the subgrade or damage of adjacent areas. Slides and overbreaks which occur due to negligence, carelessness, or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as directed by the Engineer at no additional cost to the Owner.
8. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded. All protruding roots and other vegetation shall be removed from slopes.

9. The bottom of all excavations for structures and pipes shall be examined by the CQA Engineer for bearing value and the presence of unsuitable material. If, in the opinion of the CQA Engineer, additional Excavation is required due to the low bearing value of the subgrade material, or if the in-place materials are soft, yielding, pumping and wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted structural fill, or material directed by the CQA Engineer. No payment will be made for subgrade disturbance caused by inadequate Dewatering or improper construction methods.
10. Any areas excavated below design subgrade elevations by the Contractor, unless directed by the CQA Engineer, shall be brought back to design elevations at no cost to the Owner. The Contractor shall place and compact such material in accordance with Section 02223, Embankment, of these Specifications.
11. The Contractor shall dispose of excess or unsuitable excavation materials on-site at location(s) approved by the Owner.
12. The Contractor shall properly level-off bottoms of all excavations. Proof-rolling shall be conducted with appropriate equipment.
13. Upon reaching subgrade elevations shown in excavation areas, the Contractor shall scarify subgrade soils to a minimum depth of 6" and obtain the CQA Engineer's approval of quality. If unsuitable materials are encountered at the subgrade elevation, perform additional excavations as approved by the CQA Engineer to remove unsuitable materials.
14. Overexcavation and Backfill:

Where subgrade materials are determined to be unsuitable, such materials shall be removed by the Contractor to the lengths, widths and depths approved by the CQA Engineer and backfilled with suitable material in accordance with Section 02223, Embankment, of these Specifications unless further excavation or earthwork is required. No additional payment will be made for such excavation and backfill 1 foot or less than the finished subgrade. Unsuitable material excavation greater than 1 foot beneath the finished subgrade shall be made on a unit price basis for excavation and backfill, only as approved by the Engineer and CQA Engineer prior to the work. Unit price for overexcavation and backfill greater than 1 foot in depth shall include disposal of unsuitable materials.
15. All cuts shall be brought to the grade and cross section shown on the Contract Drawings, or established by the Engineer, prior to final inspection.
16. The Contractor shall protect finished lines and grades of completed excavation against excessive erosion, damage from trafficking, or other causes and shall repair any damage at no additional cost to the Owner.

17. Trench Excavation:

- a. All pipe Excavation and trenching shall be done in strict accordance with these Specifications, all applicable parts of the OSHA Regulations, 29 CFR 1926, Subpart P, and other applicable regulations. In the event of any conflicts in this information, safe working conditions as established by the appropriate OSHA guidelines shall govern.
- b. The minimum trench widths shall be as indicated on the Contract Drawings. Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Contract Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing.
- c. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.
- d. Hand excavation shall be employed wherever, in the opinion of the Engineer, it is necessary for the protection of existing utilities, poles, trees, pavements, obstructions, or structures.
- e. No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the Engineer and, in general, such length shall be limited to approximately one hundred (100) feet.
- f. Pipe Bedding: All pipe bedding shall be as shown on the Contract Drawings, unless otherwise specified herein.

18. Sheeting and Bracing:

- a. The Contractor shall furnish, place, and maintain such sheeting and bracing which may be required to support sides of Excavation or to protect pipes and structures from possible damage and to provide safe working conditions in accordance with current OSHA requirements. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports put in at the sole expense of the Contractor. The Contractor shall be responsible for the adequacy of all sheeting and bracing used and for all damage resulting from sheeting and bracing failure or from placing, maintaining, and removing it.
- b. The Contractor shall exercise caution in the installation and removal of sheeting to insure that excessive or unusual loadings are not transmitted to

any new or existing structure. The Contractor shall promptly repair at his expense any and all damage that can be reasonably attributed to sheeting installation or removal.

- c. All sheeting and bracing shall be removed upon completion of the work.
19. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed at the Contractor's sole expense.

END OF SECTION

SECTION 02223

EMBANKMENT

Embankment: Embankment is the on-site compacted fill that provides the foundation and the berms for the containment area, the subgrade for some access roadways and structures, and backfill around structures and piping.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Embankment including borrowing, hauling, screening, discing, drying, compaction, control of surface and subsurface water, final grading, sealing, and all necessary and incidental items as detailed or required to complete the Embankment, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Erosion and Sedimentation Control	02270
Roadway Work	02500
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³).
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4. Quality Assurance:

Quality Assurance during placement of Embankment will be provided by the Owner as described in the accompanying Project CQA Manual.

5. Definitions:

- a. Embankment: Shall include construction of all site earthwork including roadways, subgrade, perimeter berm embankments, including preparation of the areas upon which materials are to be placed. Embankment may also be referred to as structural and/or controlled fill. All Embankment materials may be either (off-site) Select Borrow or (on-site) Borrow unless otherwise noted on Contract Drawings or specified by the Engineer.
- b. Prepared Subgrade: The ground surface after clearing, grubbing, stripping, excavation, scarification, and/or compaction, and/or proof rolling to the satisfaction of the CQA Engineer.
- c. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Well-graded is used to define a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

- d. Unclassified Fill: The nature of materials to be used is not identified or described herein but must be approved by the Engineer prior to use.

B. MATERIALS

1. Embankment materials shall consist of clean well-graded natural soil classified as SW, SM, SM-SC, SC, ML, CL-ML, or CL (ASTM D 2488) containing no topsoil or other deleterious material. Other material classifications may be approved by the Engineer.
2. Stones or rock fragments shall not exceed one half the maximum lift thickness as compacted in any dimension. Isolated rocks shall be a maximum of 24-inches in any dimension.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer before approval is given to proceed:

1. Descriptive information on compaction equipment to be used for construction of Embankment.
2. Descriptive information on the location and source of any off-site borrow material to be used for Embankment, where applicable. Information shall include Standard Proctor curves (ASTM D698) for each borrow material.

D. CONSTRUCTION

1. The Contractor shall conduct Embankment activities in such a manner that erosion of disturbed areas and off-site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.
2. All placement and compaction of Embankment shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.
3. Embankment shall be placed and compacted to the lines and grades shown on the Contract Drawings. Placement of Embankment outside the construction limits shall occur only as directed and approved by the Engineer.

The Contractor will perform all surveys necessary to establish and verify lines and grades for all Embankment.

4. The Contractor shall protect all existing facilities including, but not limited to, utilities and monitoring wells.

5. Subgrade Preparation:
 - a. The CQA Engineer shall inspect the exposed subgrade prior to placement of Embankment to assure that all rocks, topsoil, vegetation, roots, debris, or other deleterious materials have been removed.
 - b. Prior to placement of Embankment, the exposed subgrade shall be proofrolled using a static smooth-drum roller, loaded tandem axle dump truck, or other suitable equipment in the presence of the CQA Engineer. Any soft or unsuitable materials revealed before or during the in-place compaction shall be removed as directed by the CQA Engineer and replaced with suitable Embankment.
6. Surfaces on which Embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the Embankment with the existing surface.
7. The Contractor shall be responsible for preparing the materials for the Embankment, including but not limited to, in-place drying or wetting of the soil necessary to achieve the compaction criteria of these Specifications.
8. The Contractor shall be responsible for control of surface and subsurface water, when necessary.
9. Embankment materials shall be placed in a manner permitting drainage and in continuous, approximately horizontal layers.
10. Compaction Requirements:
 - a. The Contractor shall compact Embankment in accordance with the requirements shown in Table 1 of this section. If Embankment does not meet the specified requirements, the Contractor shall rework the material, as may be necessary and continue compaction to achieve these requirements, or remove and replace the material to achieve the specified requirements, at Contractor's expense.
 - b. Each lift shall be compacted prior to placement of succeeding lifts. In confined areas, mechanical equipment, suitable for small areas and capable of achieving the density requirements, shall be required.
 - c. Lift compaction shall be performed with an appropriately heavy, properly ballasted, penetrating-foot or smooth-drum vibratory compactor depending on soil type. Compaction equipment shall be subject to approval by the CQA Engineer.

11. Embankment that becomes excessively eroded, soft, or otherwise unsuitable shall be removed or repaired by the Contractor as directed by the CQA Engineer, at no cost to the Owner.
12. The exposed surface of Embankment shall be rolled with a smooth-drum roller at the end of each work day to protect from adverse weather conditions.
13. Where Embankment is to be placed and compacted on slopes that are steeper than 3:1, the subgrade shall be benched to a minimum depth of 6 inches and the Embankment shall be placed in horizontal lifts.
14. Backfilling for Structures and Piping:
 - a. All structures, including manholes and pipes shall be backfilled with Embankment as shown in the Contract Drawings and as described in these Specifications.
 - b. Where sheeting is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when sheeting is removed. If significant volumes of soil cannot be prevented from clinging to the extracted sheets, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below subgrade that sheeting will be driven in similar soil conditions or employ other appropriate means to prevent loss of support.
 - c. When backfilling around structures, do not backfill until concrete has sufficiently cured (as determined by the CQA Engineer) and is properly supported. Place backfill in a manner to avoid displacement or damage of structures.

TABLE 1: REQUIRED EMBANKMENT PROPERTIES

ITEM	Required % Standard Proctor (ASTM D698) ²	Required Moisture Content ³	Maximum Lift Thickness (Compacted) (inches)
Embankment	95	As Required for Compaction	8
Embankment Beneath Structures and Roads ¹	98		8
Backfill Around Structures	95		8
Backfill in Pipe Trenches	95		6
Unclassified Fill	N/A	N/A	N/A

Notes:

1. Embankment beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope. Embankment beneath roads shall be considered to include all embankment placed within 2 vertical feet of the final wearing surface and shall also include shoulders.
2. Determine field density using ASTM D 6938, ASTM D 1556, ASTM D 2167, or ASTM D 2937.
3. Determine field moisture content using ASTM D 6938, ASTM D 2216, ASTM D 4643, or ASTM D 4959.
4. The Engineer may allow exceptions to the above criteria for areas outside of the containment area which are not subject to significant long-term loads.

END OF SECTION

SECTION 02240

GEOTEXTILES

Geotextiles: For the proposed construction, a Type GT-S (Separator/Filter) Geotextile is specified. The Type GT-S Geotextile will be placed between soil subgrade and aggregate in access roads, and in some erosion control and drainage applications.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Geotextiles including all necessary and incidental items as detailed or required for the Contractor to complete the installation in accordance with the Contract Drawings and these Specifications, except as noted below:

- a. Geotextiles used as a Silt Fence is covered under Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Erosion and Sedimentation Control	02270
Roadway Work	02500
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) and the American Association of State Highway and Transportation Officials (AASHTO) are hereby made a part of these specifications.

ASTM D 3786 Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.

ASTM D 4355 Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).

ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
ASTM D 5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
AASHTO M 288	Standard Specification for Geotextiles.

4. Quality Assurance:

Quality Assurance during installation of Geotextiles will be provided by the Owner as described in the accompanying Project CQA Manual.

B. MATERIALS

1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

Labels on each roll of Geotextile shall identify the length, width, lot and roll numbers, and name of Manufacturer.

2. The Type GT-S Geotextile shall be a nonwoven spunbonded or nonwoven needlepunched synthetic fabric consisting of polyester or polypropylene manufactured in a manner approved by the Engineer. Woven fabrics may be used in certain applications if approved in advance by the Engineer.

3. All Geotextiles shall conform to the properties listed in Table 1 of this section.

C. SUBMITTALS

Prior to the installation of Geotextiles, the Contractor shall submit the following to the CQA Engineer:

1. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each type of Geotextile attesting that the Geotextiles meet the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of each Geotextile to be used. The samples shall be labeled with the product name and be accompanied by the Manufacturer's specifications.
2. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.
3. Seaming Procedures:

Submit proposed seaming procedures including proposed method and equipment.
4. Quality Control Certificates: For Geotextiles delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided which represent every roll of each type of Geotextile supplied. Each certificate shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall be as shown in Table 2 of this section.
5. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

D. CONSTRUCTION

1. Shipping, Handling, and Storage:

All Geotextiles shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.
2. Failing CQA Material Control Tests:

Geotextiles that are rejected upon testing shall be removed from the project site and replaced at Contractor's cost. Sampling and CQA testing of Geotextiles supplied as replacement for rejected material shall be performed by the CQA Engineer at Contractor's cost.

3. Installation:

- a. The surface receiving the Geotextiles shall be prepared to a relatively smooth condition, free of obstructions, standing water, excessive depressions, debris, and very soft, excessively wet, and/or loose pockets of soil. This surface shall be approved by the CQA Engineer prior to Geotextile placement.
- b. Geotextiles shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, Geotextiles shall be rejected by the CQA Engineer if they have defects, rips, holes, flaws, evidence of deterioration, or other damage.
- c. The Geotextiles shall be placed smooth and free of excessive wrinkles.
- d. On slopes, Geotextiles shall be anchored at the top and unrolled down the slope. In the presence of wind, all Geotextiles shall be weighted with sandbags or other material as approved by the CQA Engineer. Geotextiles uplifted by wind may be reused upon approval by the CQA Engineer.

4. Seams:

- a. All Geotextile seams shall be continuously sewn or heat bonded with methods approved by the Engineer. Overlapping of seams may also be allowed if approved in advance by the Engineer. All seams must be approved by the CQA Engineer.
- b. On slopes of 6H:1V or steeper, all seams shall be oriented parallel to (in the direction of) the slope unless otherwise approved by the Engineer.
- c. Seams to be sewn shall be sewn using a Type 401 stitch. One or two rows of stitching may be used. Each row of stitching shall consist of 4 to 7 stitches per inch. The minimum distance from the geotextile edge to the stitch line nearest to that edge (seam allowance) shall be 1.5 inches if a Type SSa (prayer or flat) seam is used. The minimum seam allowance for all other seam types shall be 1.0 inches.
- d. Seams to be heat bonded shall be bonded using hot plate, hot knife, ultrasonic, or other approved devices.

5. Repair Procedures:

- a. Any Geotextile that is torn, punctured, or otherwise damaged shall be repaired or replaced, as directed by the CQA Engineer, by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of the same type of Geotextile placed over the failed areas and shall overlap

the existing Geotextile a minimum of 18 inches from any point of the rupture. Patches shall be spot sewn or heat bonded so as not to shift during cover placement.

- b. Slopes Flatter Than 6H:1V: Damaged areas of a size exceeding 10 percent of the roll width shall be removed and replaced across the entire roll width with new material. Damaged areas of a size less than 10 percent of the roll width may be patched.
- c. Slopes of 6H:1V or Steeper: Geotextile panels which require repair shall be removed and replaced with new material. Replacement material shall be sewn as previously described in this specification.

6. Cover Placement:

Placement of cover over Geotextiles shall be performed in a manner as to ensure that the Geotextiles or underlying materials are not damaged. Cover material shall be placed such that excess tensile stress is not mobilized in the Geotextile.

TABLE 1: REQUIRED GEOTEXTILE PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE ¹	
			TYPE GT-S	TYPE GT-C
Geotextile Construction (NW = Nonwoven) (W = Woven)	-----	-----	NW ² or W ³	NW ² Needle-punched
Mass per Unit Area (Unit Weight)	ASTM D 5261	oz/yd ²	N/A	12
Ultraviolet Resistance (500 hrs)	ASTM D 4355	%	70	70
Strength Class ⁴	AASHTO M 288	Class	2	1
Tensile Properties:	ASTM D 4632			
Grab Strength		lbs	160 (NW) 250 (W)	205
Grab Elongation		%	≥ 50 (NW) < 50 (W)	≥ 50
Puncture Resistance	ASTM D 4833	lbs	55 (NW) 90 (W)	80
Trapezoidal Tear Strength	ASTM D 4533	lbs	55 (NW) 90 (W)	80
Burst Strength	ASTM D 3786	psi	200 (NW) 400 (W)	255
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	70+	N/A
Permittivity	ASTM D 4491	sec ⁻¹	1.0	N/A

Notes:

1. Minimum Average Roll Value (MARV).
2. Nonwoven geotextiles that have been heat calendered are not acceptable, unless approved by the Engineer in advance.
3. Woven geotextiles shall be approved in advance by the Engineer. Woven geotextiles formed exclusively with slit film fibers are not acceptable.
4. AASHTO M 288 criteria includes the above listed requirements for: Tensile Properties, Puncture Resistance, Trapezoidal Tear Strength, and Burst Strength.

TABLE 2: REQUIRED MANUFACTURER QUALITY CONTROL TESTS

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
Mass per Unit Area (Unit Weight)	ASTM D 5261	200,000 ft ²
Ultraviolet Resistance (500 hrs)	ASTM D 4355	Periodic
Tensile Properties	ASTM D 4632	200,000 ft ²
Burst Strength (Diaphragm Methods)	ASTM D 3786	200,000 ft ²
Apparent Opening Size (AOS)	ASTM D 4751	Periodic
Permittivity	ASTM D 4491	Periodic
Puncture Resistance	ASTM D 4833	200,000 ft ²
Trapezoidal Tear Strength	ASTM D 4533	200,000 ft ²

END OF SECTION

SECTION 02250

SOIL LINER (FINAL COVER)

Soil Liner: The Soil Liner serves as a hydraulic containment barrier in the final cover system.

A. DESCRIPTION

1. General:

- a. The Contractor shall furnish all labor, material, and equipment to complete installation of the Soil Liner including borrowing, hauling, screening, mixing, stockpiling, discing, compacting, drying or wetting, removal of surface water, removal of all previously placed material affected by adverse weather conditions or construction disturbance, final grading and sealing, and all necessary and incidental items as detailed or required to complete the Soil Liner, all in accordance with the Contract Drawings and these Specifications.
- b. The Contractor shall provide suitable soil from an on-site or off-site borrow site that meets all requirements outlined in these Specifications for Soil Liner.

Off-site borrow sources shall be approved in advance by the Engineer. The Contractor shall be responsible for all submittals required for Engineer approval of off-site borrow sources.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Vegetative Soil Layer	02258

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

ASTM D 422 Standard Test Method for Particle Size Analysis of Soils.

ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³).
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.
ASTM D 5084	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4. Quality Assurance:

Quality Assurance during placement of Soil Liner will be provided by the Owner.

B. MATERIALS

All material for Soil Liner shall conform to the requirements shown in Table 1 of this section.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Before approval is given to proceed with test fill construction, the Contractor shall submit descriptive information on compaction equipment to be used for construction of the Soil Liner.
2. Off-Site Borrow Sources (If Applicable):
 - a. For each off-site borrow source for Soil Liner soils, the Contractor shall provide the following information at least four weeks prior to placement of the Soil Liner:

- (1) The name, location, and owner of proposed borrow site, including a topographic map and location map of the site.
- (2) A certification submitted by an independent Registered Professional Engineer that the proposed borrow site contains a minimum of double the in-place volume of Soil Liner required to complete the work.
- (3) A certification submitted by an independent Registered Professional Engineer that the proposed borrow soils meet the requirements for Soil Liner outlined in these Specifications. Certification shall include the following minimum testing and test frequency:

<u>Test</u>	<u>Min. Number of Tests</u>
Atterberg Limits (ASTM D 4318)	10
Grain Size (with Hydrometer) (ASTM D 422)	10
Standard Proctor (ASTM D 698)	5
Natural Moisture Content (ASTM D 2216)	10
Hydraulic Conductivity (Lab Remolded) (ASTM D 5084)	5

Testing samples for certification shall be obtained from well distributed locations within the proposed borrow area. All test data shall be submitted with the soil certification.

- b. The Contractor shall be responsible for maintaining quality of the Soil Liner borrow source throughout construction and shall ensure that the borrow soil meets the project criteria outlined in these Specifications. The

Contractor shall cooperate with the CQA Engineer so that the CQA Engineer has unlimited access to the borrow area during construction for the purposes of sampling and testing borrow soil.

- c. If the borrow source does not meet the requirements outlined in these Specifications, the Contractor shall be responsible for providing an alternative borrow source at no cost to the Owner.

D. CONSTRUCTION

1. General:

- a. All placement and compaction of Soil Liner shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.
- b. The Contractor shall place and compact the Soil Liner to the lines and grades shown on the Contract Drawings with the exception that a 0.15 foot overbuild at the Contractor's expense is allowed. Thickness requirements are minimum values. The Contractor will perform all surveys necessary to establish and verify lines and grades for all Soil Liner.

2. Borrow Soils:

- a. The Contractor may haul borrow soil to an on-site stockpile area. Unless otherwise allowed by the Engineer, borrow soil cannot be hauled directly to the containment area for placement and compaction unless each load is monitored and approved by the CQA Engineer prior to loading at the borrow site.
- b. Any borrow soil not meeting the requirements for Soil Liner shall be rejected and removed from the project site by the Contractor at no cost to the Owner.

3. Test Fill Construction:

The Contractor shall construct a test fill prior to construction of Soil Liner. The test fill shall be at least 20 feet wide by 50 feet long and shall be compacted in lifts to the full design thickness. The Contractor shall use materials and equipment for test fill construction that the Contractor intends to use during construction.

No Soil Liner construction may be performed until the test fill construction is confirmed to be adequate in accordance with the Project CQA Manual.

The Contractor shall amend construction techniques or equipment in order to meet all criteria outlined for Soil Liner in these Specifications at no cost to the Owner.

4. Subgrade Preparation:

- a. The CQA Engineer shall inspect the exposed subgrade prior to placement of Soil Liner to assure that all rocks, topsoil, vegetation, roots, debris, or other deleterious materials have been removed.
- b. Prior to placement of Soil Liner, the exposed subgrade shall be proofrolled using a static smooth-drum roller, loaded tandem axle dump truck, or other suitable equipment in the presence of the CQA Engineer. Any soft or unsuitable subgrade materials revealed before or during the in-place compaction shall be removed as directed by the CQA Engineer and replaced with Soil Liner.

5. Placement and Compaction:

- a. All Soil Liner shall be placed in loose lifts no greater than the height of the feet on compaction equipment to be used. The loose Soil Liner shall be free from clods or rocks which exceed the sizes in Table 1. Where excessive sized clods do occur, the Contractor shall break up the clods using methods approved by the CQA Engineer.
- b. Lift compaction shall be performed with an appropriately heavy, properly ballasted, penetrating-foot compactor. Compaction equipment shall be the same as used in the test fill, unless otherwise approved by the Engineer.

Each lift shall be compacted prior to placement of succeeding lifts. The maximum lift thickness shall be as shown in Table 2. In confined areas, mechanical equipment, suitable for small areas and capable of achieving the density requirements, shall be required.

- c. The exposed surface of Soil Liner shall be protected from adverse weather conditions or desiccation of the soil. This is commonly done by rolling the surface of the Soil Liner with a smooth-drum roller at the end of each work day. Alternative means of protecting the Soil Liner may be employed by the Contractor.
- d. The in-place Soil Liner shall conform to the requirements shown in Table 2 of this section. If Soil Liner does not meet the specified requirements, the Contractor shall rework the material, as may be necessary and continue compaction to achieve these requirements, or remove and replace the material to achieve the specified requirements, at Contractor's expense.

- e. Any Soil Liner surface which is smooth, has a moisture content outside of the specified moisture content range, as defined by ASTM D 698, or exhibits evidence of desiccation cracking ½ inch deep or greater, shall be scarified to a depth of 1 to 3 inches and brought to a proper moisture content prior to placement of a subsequent lift. This includes any Soil Liner surface that was previously seal rolled for protection.
- f. No Soil Liner shall be placed or compacted when soil temperatures are so low as to produce ice lenses in the Soil Liner borrow soil.
- g. Soil Liner placed on side slopes shall be placed and compacted in lifts which are parallel to the slope. Lift criteria shall be as described herein.
- h. Locations of control stakes, in-place density tests, thickness checks, or other samples in the Soil Liner shall be patched with compacted Soil Liner or sodium bentonite compacted and hydrated in the holes.

6. Surveying:

After completion of a segment of Soil Liner, but before installation of subsequent layers, the Soil Liner shall be surveyed (by test pit or hand auger) on a 100 foot grid to ensure the minimum specified thickness of Soil Liner has been achieved.

TABLE 1: SOIL LINER MATERIAL REQUIREMENTS

PROPERTY	TEST METHOD	VALUE
Visual Classification	ASTM D 2488	Clean natural fine-grained soil free from organics, debris, or other detrimental material. Soil type as required to achieve the hydraulic conductivity criteria.
Clod Size	-----	Maximum = ¾ inch (or less if required to achieve hydraulic conductivity criteria)
Gradation	ASTM D 422	Max. = 1½ inches
Atterberg Limits	ASTM D 4318	As required based on soil type.
Hydraulic Conductivity (Lab Remolded) (Compacted Soil Barrier)	ASTM D 5084 ³	≤ 1 x 10 ⁻⁵ cm/s at a density of ≥ 95% maximum standard dry density and a moisture content ≥ optimum moisture content ⁴

TABLE 2: IN-PLACE SOIL LINER REQUIREMENTS

PROPERTY	TEST METHOD	VALUE
Density	ASTM D 6938 ¹	≥ 95% maximum standard dry density ⁴
Moisture Content	ASTM D 6938 ²	≥ optimum moisture content ⁴
Maximum Lift Thickness (Compacted): (Compacted Soil Barrier)	----	9 inches
Hydraulic Conductivity (Shelby Tube): (Compacted Soil Barrier)	ASTM D 5084 ³	≤ 1 x 10 ⁻⁵ cm/s
Completed Thickness: (Compacted Soil Barrier)	Survey	18 inches minimum

Notes:

1. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937.
2. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959.
3. Maximum effective confining pressure and maximum hydraulic gradient as follows.
Backpressure as recommended by ASTM D 5084. Modifications of the maximum hydraulic gradient may be allowed by the Engineer depending on actual hydraulic conductivity values.

Material	Maximum Effective Confining Pressure (psi)	Maximum Hydraulic Gradient
Compacted Soil Barrier (k ≤ 1 x 10 ⁻⁵ cm/s)	5	15

4. Or as otherwise determined by remolded samples to achieve hydraulic conductivity criteria.

END OF SECTION

SECTION 02258

VEGETATIVE SOIL LAYER

Vegetative Soil Layer (VSL): The Vegetative Soil Layer (VSL) is placed in the final cover system in order to support permanent vegetative cover. This section includes the topsoil to be placed as the upper 6 inches of the VSL.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of the VSL (including topsoil) for the landfill cover, including borrowing, hauling, spreading, and final grading and all necessary and incidental items as detailed or required to complete the VSL, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
HDPE Pipe	02614
Revegetation	02930
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

ASTM D 422	Standard Test Method for Particle Size Analysis of Soils.
ASTM D 2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
ASTM D 5084	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

4. Quality Assurance:

Quality Assurance during placement of Vegetative Soil Layer will be provided by the Owner as described in the accompanying Project CQA Manual.

B. MATERIALS

Soil that meets all of the following requirements shall be classified as select soil fill for use in construction of the VSL.

1. Soil shall be classified according to the Unified Soil Classification System (USCS) as SM, SC, CL-ML, or CL(ASTM D 2487) Alternatives to these requirements must be approved in advance by the Engineer.
2. Select soil fill materials shall be reasonably free of gypsum, ferrous, and/or calcareous concretions and nodules, refuse, roots, or other deleterious substances.
3. Continuous and repeated visual inspection of the materials being used will be performed by the Contractor to ensure proper soils are being used. In addition, the CQA Engineer shall make frequent inspections of the placement operations and materials, and will consult with the Engineer.
4. The VSL shall be uniform, smooth, and free of debris, rock, plant materials, and other foreign material larger than 3 inches in diameter. The material should contain no sharp edges. This material must be capable of supporting growth of vegetative cover.
5. Topsoil: The upper 6 inches of VSL shall be natural or blended soil material capable of supporting the growth of vegetative cover. Topsoil shall contain a minimum of 2% by weight of organics evenly blended into the material in order to support the growth of vegetative cover. Also, the topsoil shall contain 10% by weight gravel size particles (1½ inch maximum particle size) to aid in the prevention of excess wind erosion.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Before approval is given to proceed, the Contractor shall submit descriptive information on placement equipment to be used in construction of the VSL.
2. Survey Results:

After completion of a segment of VSL, survey results shall be submitted for review prior to VSL acceptance.

D. CONSTRUCTION

1. All placement and compaction of VSL shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.
2. VSL shall be placed as specified below:
 - a. VSL shall be placed and compacted to the lines and grades shown on the Contract Drawings with the exception that a 0.15 foot overbuild at Contractor's expense is allowed. The Contractor will perform all surveys necessary to establish and verify lines and grades for all VSL.
 - b. VSL shall be compacted by tracking the final lift with tracked equipment.
3. After the specified thickness has been achieved and verified, the Contractor shall proceed immediately with seeding.
4. Surveying:

After completion of a segment of VSL, the VSL shall be surveyed on 100 foot centers and at slope breaks (including all tops and toes of slope, points of grade change, etc.) to ensure:

- a. The specified thickness has been achieved. A hand auger or similar method may be used to check for thickness at each location.
- b. The top of the VSL slopes at grades specified on the Contract Drawings; and
- c. VSL placed more than 0.15 feet beyond the limits of the lines and grades as shown on the Contract Drawings will not be accepted and must be removed at the Contractor's sole expense if required by the Engineer.

This work shall be performed at the Contractor's cost by a registered surveyor.

END OF SECTION

SECTION 02270

EROSION AND SEDIMENTATION CONTROL

Erosion and Sedimentation Control: Erosion and Sedimentation Control is a system of construction and engineered measures (devices, structures, practices, etc.) which act to minimize surface water induced erosion of disturbed areas and the resulting off-site sedimentation.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of and maintain Erosion and Sedimentation Control measures and related work in accordance with the Contract Drawings and these Specifications.

All Erosion and Sedimentation Control work shall be in accordance with the latest edition of the North Carolina Erosion and Sediment Control Planning and Design Manual as well as applicable regulations.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Geotextiles	02240
Rip Rap	02271
Rolled Erosion Control Products	02275
Precast Concrete Structures	02608
HDPE Pipe	02614
Storm Water Systems	02720
Revegetation	02930
Concrete Work	03310

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

ASTM D 3786	Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
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ASTM D 4355	Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

B. MATERIALS

1. Permanent Sediment or Detention Basins:

Permanent sediment or detention basins shall be constructed as shown on the Contract Drawings.

2. Permanent Drainage Channels, Diversions, Swales, and Ditches:

Permanent drainage channels, diversions, swales, and ditches shall be constructed as shown on the Contract Drawings.

3. Silt Fence:

Silt fences shall be constructed as shown on the Contract Drawings and as needed, based on the Contractor's discretion and Engineer's approval. The silt fence is a permeable barrier erected within and downgradient of small disturbed areas to capture sediment from sheet flow. It is made of filter fabric buried at the bottom, stretched, and supported by posts and wire mesh backing. Silt fence shall conform to the following properties:

- a. Posts: Posts shall be 3 feet long "U" or "T"-type steel posts.
- b. Filter Fabric: Filter fabric shall be a woven geotextile made specifically for sediment control. Filter fabric shall conform to the properties listed in Table 1 of this section.

4. Geotextiles:

Geotextiles shall conform to the requirements of Section 02240, Geotextiles, of these Specifications.

5. Down Pipes:

Down pipes shall be constructed as shown on the Contract Drawings.

6. Rip Rap:

Rip Rap shall conform to the requirements of Section 02271, Rip Rap, of these Specifications.

7. Rolled Erosion Control Products (RECPs):

Rolled Erosion Control Products (RECPs) shall conform to the requirements of Section 02275, Rolled Erosion Control Products, of these Specifications.

8. Other Work:

In addition to the Erosion and Sedimentation Control measures shown on the Contract Drawings, the Contractor shall provide adequate means to prevent any sediment from entering any storm drains, drop inlets, ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed upstream of any trench or other excavation to prevent sedimentation of off-site areas. In areas where a natural buffer area exists between the work area and the closest stream or water course, this area shall not be disturbed. All paved areas shall be scraped and swept as necessary to prevent the accumulation of dirt and debris. Work associated with this provision shall be considered incidental to the project and no separate payment will be made.

9. Temporary and Permanent Ground Cover:

The Contractor shall provide temporary or permanent ground cover (or other acceptable measure(s)) adequate to restrain erosion on erodible slopes or other areas within twenty-one (21) calendar days following completion of any phase of grading.

C. SUBMITTALS

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all Erosion and Sedimentation Control materials manufactured for the project have been produced in accordance with these Specifications.
2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. CONSTRUCTION

1. Establishment of Erosion and Sedimentation Control Measures:

- a. All Erosion and Sedimentation Control measures will be constructed according to the Contract Drawings and these Specifications.
- b. Due to the nature of the work required by this Contract, it is anticipated that the location and nature of the Erosion and Sedimentation Control measures may need to be adjusted on several occasions to reflect the current phase of construction.
- c. Erosion and Sedimentation Control measures shall be established prior to the work in a given area. Where such practice is not feasible, the Erosion and Sedimentation Control measure(s) shall be established immediately following completion of the clearing operation.
- d. The construction schedule adopted by the Contractor will impact the placement and need for specific measures required for the control of erosion. The Contractor shall develop and implement such additional techniques as may be required to minimize erosion and prevent or correct the discharge of sediment outside the limits of construction (unless controlled by other on-site measure(s)).
- e. The location and extent of Erosion and Sedimentation Control measures shall be revised at each phase of construction that results in a change in either the quantity or direction of surface runoff from construction areas. All deviations from the control provisions shown on the Contract Drawings shall have the prior approval of the Engineer.

2. Inspection and Maintenance of Erosion and Sedimentation Control Measures:

- a. The Contractor shall furnish the labor, material, and equipment required for the inspection and maintenance of all Erosion and Sedimentation Control measures. Maintenance shall be scheduled as required for a particular measure to maintain the removal efficiency and intent of the measure.
- b. All Erosion and Sedimentation Control measures shall be inspected at least once every seven calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period and appropriate maintenance conducted. A rain gauge shall be maintained on the site and a record of the rainfall amounts and dates shall be kept properly.
- c. Maintenance shall include, but not be limited to:

- (1) The removal and satisfactory disposal of trapped or deposited sediments from basins, traps, barriers, filters, and/or drainage features/devices;
 - (2) Replacement of filter fabrics used for silt fences upon loss of efficiency; and
 - (3) Replacement of any other components which are damaged or cannot serve the intended use.
- d. The Contractor shall accept and maintain any existing sediments that are included in existing sediment traps or basins that accept or will accept stormwater flow and or sediment accumulation from all areas within the Contractor's limits of construction.
 - e. Sediments removed from Erosion and Sedimentation Control measures shall be disposed of in locations that will not result in off-site sedimentation as approved by the Engineer.
 - f. All Erosion and Sedimentation Control measures shall be maintained to the satisfaction of the Engineer until the site has been stabilized.

3. Graded Slopes and Fills:

The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetated cover or other adequate measures.

4. Finish Grading:

All disturbed areas outside of the containment area shall be uniformly graded to the lines, grades, and elevations shown on the Contract Drawings. Finished surfaces shall be reasonably smooth, compacted, and free from irregular surface changes. Unless otherwise specified, the degree of finish shall be that ordinarily obtainable from either blade or scraper operations. Areas shall be finished to a smoothness suitable for application of topsoil.

5. Revegetation:

Revegetation shall conform to the requirements of Section 02930, Revegetation, of these Specifications.

6. Cleanup:

- a. The Contractor shall remove from the site all subsoil excavated from his work and all other debris including, but not limited to, branches, paper, and rubbish in all landscape areas, and remove temporary barricades as the work proceeds.
- b. All areas shall be kept in a neat, orderly condition at all times. Prior to final acceptance, the Contractor shall clean up the entire landscaped area to the satisfaction of the Engineer.

TABLE 1: REQUIRED SILT FENCE FILTER FABRIC PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE¹
Grab Tensile Strength ²	ASTM D 4632	lbs	100 x 100
Grab Elongation	ASTM D 4632	%	20 (Max.)
Trapezoidal Tear Strength ²	ASTM D 4533	lbs	65 x 65
Burst Strength	ASTM D 3786	psi	300
Puncture Resistance	ASTM D 4833	lbs	65
Ultraviolet Resistance (500 hrs)	ASTM D 4355	%	80
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	30+
Permittivity	ASTM D 4491	sec ⁻¹	0.05

Notes:

1. Minimum Average Roll Value (MARV).
2. Values for machine and cross machine direction (MD x XD), respectively.

END OF SECTION

SECTION 02271

RIP RAP

Rip Rap: This section includes all rip rap aprons.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Rip Rap for protection of earthen slopes against erosion as indicated, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Geotextiles	02240
Erosion and Sedimentation Control	02270

3. Reference Standards:

The latest revision of the following standards of the North Carolina Department of Transportation (NCDOT) are hereby made a part of these Specifications.

NCDOT Standard Specifications for Roads and Structures.

B. MATERIALS

1. Rip Rap: Rip Rap shall be of the size indicated on the Contract Drawings and shall conform to NCDOT Section 1042, Rip Rap Materials.

2. Geotextiles: Geotextiles shall conform to the requirements outlined in Section 02240, Geotextiles, of these Specifications.

C. SUBMITTALS

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results prior to installation, that all Rip Rap has been produced in accordance with these Specifications.
2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. CONSTRUCTION

1. Surface Preparation:

- a. Trim and dress all areas to conform to the Contract Drawings as indicated with tolerance of 2 inches from theoretical slope lines and grades.
- b. Bring areas that are below allowable minimum tolerance limit to grade by filling with compacted Embankment material similar to adjacent material.
- c. Geotextiles shall be placed as shown on the Contract Drawings and in accordance with Section 02240, Geotextiles, of these Specifications.
- d. Do not place any stone material on the prepared surface prior to inspection and approval to proceed from the Engineer.

2. Placing Rip Rap:

Rip Rap shall be placed in accordance with NCDOT Section 868, Rip Rap.

END OF SECTION

SECTION 02275

ROLLED EROSION CONTROL PRODUCTS

Rolled Erosion Control Products: Rolled Erosion Control Products (RECPs) include turf reinforcement mats (TRM) placed on side slope swales.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of all RECPs in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Erosion and Sedimentation Control	02270
Revegetation	02930

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

ASTM D 4355	Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
ASTM D 6475	Standard Test Method for Measuring Mass per Unit Area of Erosion Control Blankets.
ASTM D 6524	Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats.
ASTM D 6525	Standard Test Method for Measuring Nominal Thickness of Permanent Erosion Control Products.
ASTM D 6566	Standard Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats.

B. MATERIALS**1. General:**

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

Labels on each RECP shall identify the length, width, product name, and name of Manufacturer.

2. Turf Reinforcement Mat (TRM) (Type 1):

TRM (Type 1) shall consist of a dense web of crimped and interlocking polypropylene fibers positioned between two biaxially oriented nets and mechanically bound together by parallel stitching with polypropylene thread. TRM (Type 1) shall be designed to accelerate seedling emergence, exhibit high resiliency, and possess strength and elongation properties to limit stretching in a saturated condition. TRM (Type 1) shall be stabilized against chemical and UV degradation which are normally found in a natural soil environment and shall have no biodegradable components. TRM (Type 1) shall also conform to the properties listed in Table 1 of this section. TRM (Type 1) shall be LANDLOK TRM 435, as manufactured by Propex Fabrics, or approved equal.

3. Anchors: Anchors for RECPs shall consist of machine made staples of No. 8 gauge new steel wire formed into a “U” shape. The size when formed shall be not less than 8 inches in length with a throat of not less than 1 inch in width. Longer anchors may be required for loose soils. Other anchors, such as metal pins or plastic pegs, may also be used if approved in advance by the Engineer.**C. SUBMITTALS**

The Contractor shall submit the following to the Engineer:

1. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each RECP attesting that each RECP meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of each RECP to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.

2. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.
3. Installation Guidelines/Instructions: The Manufacturer's guidelines/instructions for installation shall be submitted for review.
4. Furnish copies of delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

D. CONSTRUCTION

1. Shipping, Handling, and Storage:

All RECPs shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Installation - General:

- a. Placing of RECPs shall be done immediately following seeding. Seeding shall be performed in accordance with Section 02930, Revegetation, of these Specifications.
- b. RECPs shall be placed to the lines and grades shown on the Contract Drawings. The earth surface shall be smooth and free from stones, clods, or debris which will prevent the contact of the RECP with the soil. Care shall be taken to preserve the required line, grade, and cross section of the area.
- c. RECPs shall be unrolled in the direction of the flow of water and shall be applied without stretching so that it will lie smoothly but loosely on the soil surface.
- d. At the time of installation, RECPs shall be rejected, if they have defects, rips, holes, flaws, evidence of deterioration, or other damage.
- e. The Engineer may require adjustments in the installation requirements to fit individual conditions.

3. Installation - Slopes:

RECPs installed on slopes shall be oriented in vertical strips and anchored. Subsequent rolls shall be installed outward to the edge(s) of the original roll and be lapped to allow installation of a common row of anchors. RECP ends shall be shingled. Refer to the Contract Drawings and/or the Manufacturer's installation guidelines/instructions for installation details.

4. Maintenance:

Maintenance of RECPs shall be in accordance with Section 02270, Erosion and Sedimentation Control, of these Specifications.

TABLE 1: REQUIRED ROLLED EROSION CONTROL PRODUCT PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE¹
Turf Reinforcement Mat (TRM) (Type 1)			
Mass per Unit Area	ASTM D 6566	oz/yd ²	8
Thickness	ASTM D 6525	inches	0.35
Tensile Strength ¹	ASTM D 6818	lbs/ft	225 x 175
Tensile Elongation	ASTM D 6818	%	50 (max.)
Resiliency	ASTM D 6524	%	80
UV Resistance (1,000 Hours)	ASTM D 4355	%	80
Maximum Permissible Shear Stress (Long-Term Vegetated)	Large Scale	lb/ft ²	5

Notes:

1. Values for machine and cross machine direction (MD x XD), respectively.

END OF SECTION

SECTION 02500

ROADWAY WORK

Roadway Work: Roadway Work refers to the construction of paved and gravel road surfaces.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment required to complete construction of all Roadway Work including gravel roads and asphalt concrete pavement in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Embankment	02223
Geotextiles	02240
Concrete Work	03300

3. Reference Standards:

The latest revision of the following standards of the North Carolina Department of Transportation (NCDOT) are hereby made a part of these Specifications:

NCDOT Standard Specifications for Roads and Structures.

B. MATERIALS

1. Geotextiles:

Geotextiles shall conform to the requirements outlined in Section 02240, Geotextiles, of these Specifications.

2. Aggregate Base Course (ABC):

All work, including materials, associated with ABC shall be in accordance with NCDOT Section 520, Aggregate Base Course, except that Articles 520-7

(Contractor Furnished Laboratory), 520-12 (Method of Measurement), and 520-13 (Basis of Payment) shall be deleted. Type "A" or "B" aggregate will be acceptable for this project.

3. Aggregate Stabilization:

All work, including materials, associated with aggregate stabilization shall be in accordance with NCDOT Section 510, Aggregate Stabilization, except that Articles 510-6 (Method of Measurement), and 510-7 (Basis of Payment) shall be deleted.

C. SUBMITTALS

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all materials for Roadway Work have been produced in accordance with these Specifications.
2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. CONSTRUCTION

1. General:

All Roadway Work including the replacement of portions of the existing roads shall be to the limits, grades, thicknesses, and types as shown on the Contract Drawings. Patches for pipe crossings and areas damaged during the construction work shall be asphalt or gravel, depending upon the material encountered, unless otherwise indicated.

2. Earthwork:

The earthwork for all Roadway Work shall be completed in accordance with Section 02222, Excavation, and Section 02223, Embankment, of these Specifications and as shown on the Contract Drawings.

3. Geotextiles:

Geotextiles shall be placed as shown on the Contract Drawings and in accordance with Section 02240, Geotextiles, of these Specifications. If overlapped seams are used, overlaps shall be a minimum of 12 inches.

4. Aggregate Stabilization:

Subgrade not overlain by a geotextile, where shown on the Contract Drawings, shall be aggregate stabilized by the addition and mixing of coarse aggregate with the top 3 inches of subgrade in accordance with NCDOT Section 510. Aggregate stabilization shall be applied to the subgrade at a rate of 300 lbs/yd². Following the application of stabilizer aggregate, the subgrade shall be shaped and compacted in accordance with NCDOT Section 510.

5. Aggregate Base Course:

ABC shall be constructed in accordance with NCDOT Section 520.

6. Underground Utility Lines:

Where an underground utility line is beneath the Roadway Work, backfilling shall be carried out with special care, and the final consolidation shall be accomplished by a vibratory roller. Construction of Roadway Work over the trench shall be deferred as long as practicable.

END OF SECTION

SECTION 02608

PRECAST CONCRETE STRUCTURES

Precast Concrete Structures: Precast Concrete Structures are used in the storm water.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Precast Concrete Structures in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Embankment	02223
Erosion and Sedimentation Control	02270
HDPE Pipe	02614
Storm Water Systems	02720
Concrete Work	03310
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

ASTM A 615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM C 443	Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
ASTM C 478	Standard Specification for Precast Reinforced Concrete Manhole Sections.
ASTM C 497	Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.

ASTM C 990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

ASTM C 1433 Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.

4. Quality Control:

The Contractor shall perform leak testing of Precast Concrete Structures as described in this section.

5. Quality Assurance:

Quality Assurance during placement of Precast Concrete Structures will be provided by the Owner as described in the accompanying Project CQA Manual.

B. MATERIALS

1. Precast Concrete Boxes: All precast concrete boxes shall be constructed from non-shrink, 4,000 psi compressive strength concrete in conformance with ASTM C 1433 and as detailed on the Contract Drawings.

2. Joints: All joints shall be sealed with preformed plastic gaskets in conformance with ASTM C 990 or rubber gaskets in conformance with ASTM C 443.

3. Steps: All steps shall be constructed of 0.5 inch reinforcing rod completely encased in corrosion-resistant rubber or plastic. The upper surfaces of each step shall have a traction tread of self cleaning rubber cleats and guide lugs on both sides to prevent slippage.

4. Frames and Covers: Frames and covers shall consist of cast iron frames and covers (Vulcan Foundry, or equal) equipped with steel handles and shall be of the opening size as indicated on the Contract Drawings. Markings on the covers shall indicate the intended use of the structure and shall be acceptable to the Owner.

5. Markings: All Precast Concrete Structures shall include markings clearly identifying the date of manufacture, the name of the manufacturer, and any other pertinent information.

C. SUBMITTALS

The Contractor shall submit the following to the Engineer:

1. The Contractor shall submit shop drawings for Precast Concrete Structures for approval at least 4 weeks prior to construction. Shop drawings shall show complete design, installation, and construction information in such detail as to enable the Engineer to determine the adequacy of the proposed units for the intended purpose. Details of steel reinforcement size and placement shall be included. The shop drawings shall include a schedule which will list the size and type of precast structure at each location where the precast structures are to be used.
2. Submit a certification and summary of all required test results, prior to installation, that all Precast Concrete Structures have been produced in accordance with these Specifications.

D. CONSTRUCTION

1. The Precast Concrete Structures shall be installed at the locations and to the elevations indicated on the Contract Drawings. The Contractor shall give the CQA Engineer sufficient notice so he may observe the field location and installation activities.
2. The Precast Concrete Structures will be bedded and backfilled as indicated on the Contract Drawings.
3. Precast Concrete Structures which are damaged or become damaged will be rejected or shall be repaired in a manner approved by the Engineer at the Contractor's sole expense.

END OF SECTION

SECTION 02614

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

High Density Polyethylene (HDPE) Pipe: HDPE Pipe is used in the storm water.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of HDPE Pipe in accordance with the Contract Drawings and these Specifications. The Contractor shall also clean and test pipelines where required.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Embankment	02223
Precast Concrete Structures	02608
Concrete Work	03310
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

ASTM D 638	Standard Test Method for Tensile Properties of Plastics.
ASTM D 790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
ASTM D 1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
ASTM D 1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique.
ASTM D 1603	Standard Test Method for Carbon Black in Olefin Plastics.

ASTM D 2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
ASTM D 3035	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
ASTM D 3261	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
ASTM D 3350	Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.
ASTM F 412	Standard Terminology Relating to Plastic Piping Systems.
ASTM F 714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
ASTM F 1417	Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
ASTM F 1473	Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins.
ASTM F 2164	Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.

4. Quality Control:

The Contractor shall perform pressure testing of HDPE Pipe as described in this section.

5. Quality Assurance:

Quality Assurance during placement of HDPE Pipe will be provided by the Owner as described in the accompanying Project CQA Manual.

B. MATERIALS

1. All HDPE Pipe shall be manufactured from new materials meeting the physical requirements shown in Table 1 of this section.
2. All HDPE Pipe shall have smooth interior walls and the DR (dimension ratio) and diameter of the pipe shall be as shown on the Contract Drawings.

3. All HDPE Pipe having an outside diameter 3.5 inches and larger shall meet the requirements of ASTM F 714. All HDPE Pipe having an outside diameter less than 3.5 inches shall meet the requirements of ASTM D 3035.
4. Visible defects, such as cracks, creases, crazing, non-uniformly pigmented areas, or undispersed raw materials shall not be acceptable and will result in rejection of the pipe by the CQA Engineer.
5. Pipe Perforations: The perforations of the perforated HDPE Pipe shall be as shown on the Contract Drawings.
6. All HDPE Pipe fittings shall be in accordance with ASTM D 3261 and shall be manufactured by the Manufacturer of the HDPE Pipe supplied for the project and shall be pressure rated to match the system piping. The fittings shall be manufactured from the same materials as the pipe itself. The butt fusion outlets of fittings shall be machined to the same DR as the system piping to which they are to be fused.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all HDPE Pipe manufactured for the project has been produced in accordance with these Specifications.
2. Submit a copy of the HDPE Pipe Manufacturer's recommendations for shipping, handling, and storage of pipe.
3. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.
4. Survey Results:

After placement of HDPE Pipe, survey results shall be submitted for review prior to acceptance.

D. CONSTRUCTION

1. Shipping , Handling, and Storage:

All HDPE Pipe shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. HDPE Pipe Installation:

- a. The Contractor shall install HDPE Pipe to the lines and grades shown on the Contract Drawings. Line and grade of piping shall be maintained with laser or approved equivalent. The Contractor shall give the CQA Engineer sufficient notice so that the he may observe field location and installation activities.
- b. Excavation for leachate transmission lines shall be backfilled as directed by the Engineer as shown on the Contract Drawings. Sand backfill or approved soil backfill compacted to at least 95 percent of the Standard Proctor dry density (ASTM D 698) shall be used.

Sharp stones or other potentially damaging material shall be removed from the base of the trench prior to placement of the piping. A leveling course, as required, shall consist of sand or other approved material.

- c. Pipe Connections: Joining of HDPE Pipe shall be as follows:
 - (1) General pipe sections shall be butt-fusion welded according to the Manufacturer's recommendations and shall be performed by a Manufacturer's authorized, trained fusion technician.
 - (2) Pipe ends to be butt-fusion welded shall be clean and dry at the time of welding. No welding shall occur during precipitation or excessive moisture.
 - (3) The Contractor shall grind burrs or other potentially damaging areas in the welds prior to placement of the pipe.
 - (4) Specified bolted pipe connections shall be made as specified on the Contract Drawings using stainless steel hardware and neoprene gaskets.
 - (5) Polyethylene stub ends and flanges must be at the ambient temperature of the surrounding soil at the time they are bolted tight to prevent relaxation of the flange bolts and loosening of the joint due to thermal contraction of the polyethylene.
 - (6) Properly executed electrofusion fittings may be used.
- d. Perforated HDPE Pipe shall be placed during construction as shown on the Contract Drawings.

3. Cleaning:

- a. All HDPE Pipe shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind and shall be kept clear of such accumulation until final acceptance of the work.

4. Pressure Testing:

- a. All solid piping where factory or field joints have been performed require pressure testing except as noted below.
 - (1) Any unjointed section of pipe showing visual signs of damage or that is of questionable quality may be required to be pressure tested as directed by the CQA Engineer.
 - (2) Cleanout risers within the containment areas do not require pressure testing.
- c. Pressure testing shall be conducted by the Contractor in a manner approved by the Engineer. Such testing shall be observed by the CQA Engineer.

5. Surveying:

The Contractor shall survey all HDPE Pipe on 100 foot centers and at bends to ensure the proper location and grade of the piping.

TABLE 1: REQUIRED HDPE PIPE PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE¹
Material Designation	ASTM D 412	-----	PE 3408
Cell Classification	ASTM D 3350	-----	345464 C
Density	ASTM D 1505	g/cm ³	0.955
Melt Flow Index	ASTM D 1238	g/10 min	0.1
Flexural Modulus	ASTM D 790	psi	130,000
Tensile Strength @ Yield	ASTM D 638	psi	3,200
SCG (PENT)	ASTM F 1473	hrs.	> 100
Hydrostatic Design Basis at 73° F	ASTM D 2837	psi	1,600
UV Stabilizer	ASTM D 1603	% Carbon Black	2 - 3%

Notes:

1. Nominal Values.

END OF SECTION

SECTION 02710

DRAINAGE AGGREGATE (UNDERDRAIN)

Drainage Aggregate: Drainage Aggregate includes coarse aggregate which is used in the underdrain.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete the installation of Drainage Aggregate in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Geotextiles	02240
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) and the North Carolina Department of Transportation (NCDOT) are hereby made a part of these specifications.

ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D 2434	Standard Test Method for Permeability of Granular Soils (Constant Head).
ASTM D 3042	Standard Test Method for Insoluble Residue in Carbonate Aggregates.
NCDOT	Standard Specifications for Roads and Structures.

4. Quality Assurance:

Quality Assurance during placement of Drainage Aggregate will be provided by the Owner as described in the accompanying Project CQA Manual.

B. MATERIALS

1. Coarse Aggregate:

- a. Coarse aggregate (NCDOT No. 57 or alternate gradation if approved by the Engineer) from a non-carbonate source ($\leq 15\%$ carbonate content by ASTM D 3042) shall be placed around as an underdrain below the landfill where shown on the Contract Drawings and shall be approved by the CQA Engineer at least four weeks prior to construction.
- b. Coarse aggregate shall be sound, durable, and free from seams, cracks, or other structural defects. The material shall be free of shale, clay, friable materials, and debris. Coarse aggregate consisting of long, thin, and/or angular particles may be rejected at the sole discretion of the Engineer.
- c. Coarse aggregate shall meet the following gradation criteria.

<u>Sieve Size</u>	<u>Percent Passing</u>
1½ Inch	100
1 Inch	95-100
½ Inch	25-60
No. 4	0-10
No. 8	0-5
No. 200	0-2

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Before approval is given to proceed, the Contractor shall submit descriptive information on equipment to be used for placement of the Drainage Aggregate.
2. The Contractor shall submit at least two bulk samples each of coarse aggregate from each material source for approval at least four weeks prior to beginning construction of the leachate collection system. Along with the bulk samples, the

Contractor shall also submit a certification from each material source that the materials proposed meet the specified gradation requirements.

3. Survey Results:

After completion of a segment of Drainage Aggregate, survey results shall be submitted for review prior to Drainage Aggregate acceptance.

D. CONSTRUCTION

1. Failing CQA Material Control Tests:

Drainage Aggregate that is rejected upon testing shall be removed from the project site and replaced at Contractor's cost. Sampling and CQA testing of Drainage Aggregate supplied as replacement for rejected material shall be performed by the CQA Engineer at the Contractor's cost.

2. Not Used.

3. All placement of Drainage Aggregate shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.

4. The Contractor shall exercise care in maintaining a true line and grade for all placement and spreading of Drainage Aggregate.

5. Drainage Aggregate shall be placed to the lines and grades as shown on the Contract Drawings except that a 0.15 foot overbuild at the Contractor's expense is allowed. Drainage Aggregate placed beyond these limits shall be removed at the Contractor's sole expense if required by the Engineer.

6. Surveying:

After completion of a segment of Drainage Aggregate, the Drainage Aggregate shall be surveyed on 100 foot centers and at slope breaks (including all tops and toes of slope, points of grade change, etc.) to ensure:

- a. The specified thickness has been achieved.
- b. The top of the Drainage Aggregate slopes at grades specified on the Contract Drawings; and
- c. Drainage Aggregate placed more than 0.15 feet beyond the limits of the lines and grades as shown on the Contract Drawings will not be accepted and must be removed at the Contractor's sole expense if required by the Engineer.

This work shall be performed at the Contractor's cost by a registered surveyor.

END OF SECTION

SECTION 02720

STORM WATER SYSTEMS

Storm Water Systems: Storm Water Systems shall include all piping, pipe fittings, headwalls, flared end sections, drop inlets, and other appurtenances designated to convey stormwater.

A. DESCRIPTION

1. General:

The contractor shall furnish all labor, material, and equipment to complete installation of Storm Water Systems in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Embankment	02223
Erosion and Sedimentation Control	02270
Rip Rap	02271
Precast Concrete Structures	02608
HDPE Pipe	02614
Concrete Work	03310

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM), the American Association of State Highway and Transportation Officials (AASHTO), and the North Carolina Department of Transportation (NCDOT) are hereby made a part of these specifications.

ASTM C 76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
ASTM C 150	Standard Specification for Portland Cement.
ASTM D 1248	Standard Specification for Polyethylene Plastics Molding and Extrusion Materials For Wire and Cable.

ASTM D 2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
ASTM D 3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
AASHTO M 36	Specification for Corrugated Steel Pipe.
AASHTO M 252	Specification for Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter.
AASHTO M 294	Specification for Corrugated Polyethylene Pipe, 12 to 36 Inch Diameter.
NCDOT	Standard Specifications for Roads and Structures and Roadway Standard Drawings.

B. MATERIALS

1. Reinforced Concrete Pipe (RCP):

- a. All reinforced concrete pipe shall be manufactured in accordance with ASTM C 76, Wall Type B or C, and shall be of the class that equals or exceeds the pipe class as shown on the Contract Drawings. All pipe shall be aged at the manufacturing plant for at least fourteen (14) days before delivery to the job site.
- b. Minimum pipe laying lengths shall be four (4) feet.
- c. Joints for reinforced concrete pipe shall have tongue and groove or bell and spigot ends with leak-resistant mastic joint sealant. Joint sealant shall be ConSeal type, or approved equal.

2. Corrugated Polyethylene (CPE) Pipe:

CPE pipe and fittings shall be of the sizes and type shown on the Contract Drawings and shall conform to every aspect of AASHTO M 252 (3 to 10 inch diameters) or AASHTO M 294 (12 to 36 inch diameters). All Type S CPE pipe shall have watertight joints.

3. Flared End Sections:

Flared end sections shall be reinforced and shall be fabricated from the same materials meeting the same requirements as the pipe to which they are connected. All reinforced concrete and corrugated metal flared end sections shall meet the

requirements of the NCDOT. Corrugated polyethylene flared end sections shall be as recommended by the pipe manufacturer.

4. Headwalls:

Headwalls shall be as described in the Contract Drawings.

5. Precast Concrete Structures:

Precast Concrete Structures shall be constructed as shown in the Contract Drawings and in accordance with Section 02608, Precast Concrete Structures, of these Specifications.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all Storm Water Systems have been produced in accordance with these Specifications.
2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. CONSTRUCTION

1. All piping shall be installed by skilled workmen and in accordance with the best standards for piping installation. Proper tools and appliances for the safe and convenient handling and installation of the pipe and fittings shall be used.
2. All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be defective. If any defective piece should be discovered after having been installed, it shall be removed and replaced at the Contractor's expense.
3. Excavation and backfilling of pipe trenches shall be as described in Section 02222, Excavation and Section 02223, Embankment, respectively, of these Specifications.
4. Following proper preparation of the trench subgrade, pipe and fittings shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from gaining entrance into the pipe and fittings. Proper facilities shall be provided for lowering sections of pipe into trenches. No materials shall be dropped or dumped into the trench.

5. Water shall be kept out of the trench until jointing and backfilling are completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no water, earth, or other substance will enter the pipes, fittings, or valves. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored as required.
6. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade.
7. The full length of each section of pipe shall rest solidly upon the bed of the trench, with recesses excavated to accommodate bells, couplings, joints, and fittings. Before joints are made, each pipe shall be well bedded on a solid foundation. No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid by the Contractor at his own expense.
8. The laying of reinforced concrete pipe shall conform to the current recommendations of the American Concrete Pipe Association for Installation Type 1 or 2.

END OF SECTION

SECTION 02776

GEOSYNTHETIC CLAY LINER (GCL)

Geosynthetic Clay Liner (GCL): The GCL is used as a secondary hydraulic barrier in certain applications.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of GCL in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Soil Liner	02250
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

ASTM D 5887	Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.
ASTM D 5890	Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.
ASTM D 5891	Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.
ASTM D 5993	Standard Test Method for Measuring Mass per Unit of Geosynthetic Clay Liners.

ASTM D 6243	Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method.
ASTM D 6496	Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners.
ASTM D 6768	Standard Test Method for Tensile Strength of Geosynthetic Clay Liners.

4. Not Used.

5. Quality Assurance:

Quality Assurance during installation of GCL will be provided by the Owner as described in the accompanying Project CQA Manual.

6. Manufacturer Qualifications:

The GCL shall be furnished by a Manufacturer that has previously produced a minimum of 10,000,000 square feet of the material for use in similar projects.

7. Installer Qualifications:

The GCL Installer shall have installed a minimum of 500,000 square feet of GCL in the past two (2) years in similar landfill installations.

8. Warranties:

- a. General: Should a defect occur, which is covered under warranty, the Warrantor shall bear all costs for repair and/or relocation and replacement of the GCL.
- b. Workmanship: The Contractor shall furnish the Owner a warranty from the GCL Installer which warrants their workmanship to be free of defects on a prorata basis for five (5) years after the final acceptance of the Work. This warranty shall include but not be limited to overlapped seams, anchor trenches, attachments to appurtenances, and penetration seals, as applicable.
- c. Manufacturer's Warranty: The Contractor shall furnish the Owner a warranty from the GCL Manufacturer for the materials used. The material warranty shall be for defects or failures related to manufacture on a prorata basis for five (5) years after date of shipment.

B. MATERIALS

1. General:

The GCL shall consist of bentonite encased, top and bottom, with 6 oz./square yard non-woven geotextiles needle-punched together for reinforcement. GCL with a lighter non-woven geotextile on one side may be considered by the Engineer as long as all other criteria are met. Needle-punched GCL shall be essentially free of broken needles and fragments of needles that would negatively effect the performance of the final product. The materials supplied under these Specifications shall be first quality products designed and manufactured specifically for the purposes of this work.

The GCL shall be supplied in rolls which have a minimum width of 14 feet. The roll length shall be maximized to provide the largest manageable sheet for the fewest overlaps. Labels on the roll shall identify the length, width, lot and roll numbers, name of Manufacturer, proper direction of unrolling, and minimum recommended overlap.

2. Needle Detection and Removal Procedures:

The GCL Manufacturer shall use continuous needle detection and removal devices (e.g. metal detectors and magnets) in the manufacture of needle-punched GCL.

3. Physical Properties:

Physical properties of GCL shall be as shown in Table 1 of this section.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Pre-Installation Requirements:

Prior to GCL installation, the Contractor shall submit the following:

- a. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for the GCL attesting that the GCL meets the physical and manufacturing requirements stated in these Specifications including needle detection and removal procedures. The Contractor shall also submit a sample of the GCL to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.

b. Qualifications:

- (1) Submit list of equipment and personnel proposed for the Project. Include equipment type and quantities. Include personnel experience on similar projects.
- (2) Submit resume and references of Installation Supervisor to be assigned to the Project, including data and duration of employment and pertinent experience information.

c. Shipping, Handling, and Storage Instructions: The Manufacturer's recommendations for shipping, handling, and storage shall be submitted for review.

d. Delivery Date: Submit notification of the scheduled delivery date for the materials.

e. Installation Procedures and Drawings:

Submit installation procedures and (shop) drawings for carrying out the work. Procedures addressed by the Contractor shall include but not be limited to material installation, repair, and protection to be provided in the event of rain. Submit drawings showing typical details including pipe penetrations (if applicable). Following review, these procedures and drawings will be used for installation of the GCL. Any deviations from these procedures and drawings must be approved by the Engineer and CQA Engineer.

f. Quality Control Certificates: For GCL delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided which represent every roll of GCL. Each certificate shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall be as shown in Table 2 of this section. Each certificate shall also include a certification that each roll of GCL has been continually checked by the Manufacturer for needles and that any needles detected have been removed.

g. Contractor Quality Control Test Results: The Contractor shall provide the results of required testing.

h. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

2. Post-Installation Requirements:

Upon completion of GCL installation the Contractor shall submit the following:

- a. A certificate stating that the GCL has been installed in accordance with the Drawings, Specifications, and the Manufacturer's recommendations.
- b. Completed Manufacturer's and Workmanship Warranties.

Finalization of payment for GCL installation shall not be made until the above submittals have been reviewed by the CQA Engineer.

D. CONSTRUCTION

1. Shipping , Handling, and Storage:

The GCL shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Failing CQA Material Control Tests:

GCL that is rejected upon testing shall be removed from the project site and replaced at Contractor's cost. Sampling and CQA testing of GCL supplied as replacement for rejected material shall be performed by the CQA Engineer at Contractor's cost.

3. Installation of GCL:

- a. The surface receiving the GCL shall be prepared to a relatively smooth condition, free of obstructions, standing water, excessive depressions, debris, and very soft, excessively wet, and/or loose pockets of soil. This surface shall be approved by the CQA Engineer prior to GCL placement.
- b. GCL shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, GCL shall be rejected by the CQA Engineer if it has defects, rips, holes, flaws, evidence of deterioration, or other damage.
- c. The GCL shall not be placed during precipitation. Any material that becomes hydrated shall be removed and replaced at Contractor expense.
- d. The GCL shall be placed smooth and free of excessive wrinkles.
- e. Where horizontal seams are required on sloped surfaces, the panels shall be placed such that the "upstream" panel forms the upper panel and overlaps the "downstream" panel in order to minimize infiltration potential. All seams constructed on slopes of 6H:1V or steeper shall be

vertical seams, except where slope lengths exceed standard roll lengths and elsewhere as approved in advance by the Engineer.

- f. All vertical panels placed on slopes of 6H:1V or steeper shall extend a minimum of 5 feet beyond the grade break with a slope flatter than 6H:1V.
- g. The GCL shall be laid with a 6 inch minimum overlap seam along roll edges and a 12 inch minimum overlap seam along roll ends. Granular sodium bentonite shall be added between all overlapped seams at a rate of approximately 0.25 lbs/linear foot. As an alternative to the addition of bentonite along roll edges, GCL with slits cut in one of the geotextiles may be used if approved in advance by the Engineer.
- h. GCL shall be temporarily secured in a manner approved by the CQA Engineer prior to placement of overlying materials.
- i. Any GCL that is torn, punctured, or otherwise damaged shall be repaired or replaced as directed by the CQA Engineer, by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of GCL placed over the damaged areas and shall overlap the existing GCL a minimum of 12 inches from any point of the damage.
- j. GCL shall be protected from hydration due to rainfall (i.e. temporary tarps, scrap geomembrane, etc.) within 24 hours of GCL placement, or sooner if rain is imminent.
- k. Penetrations: All penetrations of GCL shall be made in accordance with the Contract Drawings and/or as directed by the Engineer.

4. Not Used.

5. Cover Placement:

Placement of materials over GCL shall be performed in a manner as to ensure that GCL and the underlying geosynthetics are not damaged; minimal slippage of GCL on the underlying geosynthetics occurs; no excess tensile stresses occur in the GCL; and that no portion of the GCL develops excessive wrinkles or crimp. Wrinkles that exceed approximately 6 inches in height and cannot be eliminated by amended placement and covering methods or GCL that becomes crimped shall be cut and repaired by the Geosynthetics Installer in a method approved by the Engineer.

TABLE 1: REQUIRED GCL PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE
Clay:			
Bentonite Swell Index	ASTM D 5890	ml/2g	24
Bentonite Fluid Loss	ASTM D 5891	ml	≤ 18
GCL:			
Bentonite Content	ASTM D 5993	psf	0.75 (@ 0% moisture)
Tensile Strength	ASTM D 6768	lbs/in	30
Peel Strength	ASTM D 6496	lbs/in	7.5 Avg. Peak 5.3 Min. Avg.
Hydraulic Conductivity	ASTM D 5887	cm/sec	≤ 5 x 10 ⁻⁹
Internal Shear Strength ¹ (Hydrated) (Peak)	ASTM D 6243	psf	500
Interface Shear Strength (Hydrated) (Peak) ²	ASTM D 6243	psf	100 psf (Load = 200 psf) 1,000 psf (2,500 psf) 2,000 psf (5,000 psf) 4,000 psf (10,000 psf)

Notes:

1. Peak value measured at a normal load of 200 psf after a minimum 24 hour hydration period.
2. GCL shall have adequate adhesion against adjacent materials under low normal loads to achieve the successful installation of overlying components without slippage.

TABLE 2: REQUIRED MANUFACTURER QUALITY CONTROL TESTS

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
Clay:		
Bentonite Swell Index	ASTM D 5890	50 tons
Bentonite Fluid Loss	ASTM D 5891	50 tons
GCL:		
Bentonite Content	ASTM D 5993	5,000 yd ²
Tensile Strength	ASTM D 6768	25,000 yd ²
Peel Strength ¹	ASTM D 6496	5,000 yd ²
Hydraulic Conductivity	ASTM D 5887	30,000 yd ²
Internal Shear Strength ² (Hydrated)	ASTM D 6243	Periodic

Notes:

1. Conduct peel strength tests in accordance with the criteria given in Table 1.
2. Conduct shear strength tests in accordance with the criteria given in Table 1.

END OF SECTION

SECTION 02930

REVEGETATION

Revegetation: Revegetation includes permanent Revegetation of all site areas disturbed by the Contractor whether inside the Contract Limits or not.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Revegetation in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Embankment	02223
Vegetative Soil Layer	02258
Erosion and Sedimentation Control	02270
Rolled Erosion Control Products	02275

3. Warranty:

The Contractor shall be responsible for the satisfactory establishment and growth of a permanent stand of vegetation for a period of one year following the final seeding as judged by the Engineer. During this period, the Contractor shall be responsible for the maintenance items described in Paragraph D.4 (Maintenance) of this Specification.

4. The Contractor shall be a licensed landscape contractor in the state of North Carolina as defined in Chapter 89D of the General Statutes of North Carolina. The certificate number shall be provided.

B. MATERIALS

1. Limestone: Unless otherwise defined by specific soil tests, supply agricultural grade ground limestone conforming to the current "Rules, Regulations, and Standards of the Fertilizer Board of Control."

2. Fertilizer: Unless otherwise defined by specific soil tests, supply commercial fertilizer of 10-10-10 analysis, meeting applicable requirements of State and Federal law. Do not use cyanamic compounds of hydrated lime. Deliver fertilizer in original containers labeled with content analysis.
3. Grass Seed: Supply fresh, clean, new-crop seed as specified in Table 1 of this section. Do not use seed which is wet, moldy, or otherwise damaged. Deliver seed in standard sealed containers labeled with producer's name and seed analysis, and in accord with US Department of Agriculture Rules and Regulations under Federal Seed Act.
4. Mulch: Supply clean, seed-free, threshed straw of oats, wheat, barley, rye, beans, or other locally available mulch material.
 - a. Do not use mulch containing a quantity of matured, noxious weed seeds or other species that will be detrimental to seeding, or provide a menace to surrounding land.
 - b. Do not use mulch material which is fresh or excessively brittle, or which is decomposed and will smother or retard growth of grass.
5. Binder: Supply emulsified asphalt or synthetic binder.
6. Water: Supply potable, free of substances harmful to growth.

C. SUBMITTALS

The Contractor shall submit the following to the Engineer:

1. Results of soil tests performed and proposed modifications, if any, to the specified requirements.
2. Certificates for each grass seed mixture, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed. Certify that each container of seed delivered is fully labeled in accordance with Federal Seed Act and equals or exceeds specification requirements.
3. Copies of invoices for fertilizer, showing grade furnished and total quantity applied.

D. CONSTRUCTION

1. Graded slopes and fills within the trout buffer zone will, within 10 calendar days of completion of any phase of grading, be planted or otherwise provided with temporary or permanent vegetation. Other disturbed areas will, within 21

calendar days of completion of any phase of grading, be planted or otherwise provided with temporary or permanent vegetation.

2. The Contractor shall establish a smooth, healthy, uniform, close stand of grass from the specified seed. Prior to Revegetation, the Contractor shall adequately test the soils to be revegetated to ensure the adequacy of the specified requirements. Any modifications to these requirements deemed necessary after the review of soil test results, shall be at the Contractor's sole expense. The Engineer will perform the observations to determine when successful Revegetation is achieved.

3. Soil Preparation:

- a. Limit preparation to areas which will be planted soon after preparation.
- b. Loosen surface to minimum depth of four (4) inches.
- c. Remove stones, sticks, roots, rubbish and other extraneous matter over three (3) inches in any dimension.
- d. Spread lime uniformly over designated areas at the rate specified in Table 1 of this section.
- e. After application of lime, prior to applying fertilizer, loosen areas to be seeded with double disc or other suitable device if soil has become hard or compacted. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
- f. Distribute fertilizer uniformly over areas to be seeded at the rate specified in Table 1 of this section.
 - (1) Use suitable distributor.
 - (2) Incorporate fertilizer into soil to depth of a least two (2) inches.
 - (3) Remove stones or other substances which will interfere with turf development or subsequent mowing.
- g. Grade seeded areas to smooth, even surface with loose, uniformly fine texture.
 - (1) Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
 - (2) Fine grade just prior to planting.

4. Seeding:

- a. Use approved mechanical power driven drills or seeders, mechanical hand seeders, or other approved equipment.
- b. Distribute seed evenly over entire area at the rate specified in Table 1 of this section.
- c. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds, excessive moisture, or other factors.
- d. Resume work only when favorable condition develops, or as directed by the Engineer.
- e. Lightly rake seed into soil followed by light rolling or cultipacking.
- f. Immediately protect seeded areas against erosion by mulching or placing Rolled Erosion Control Products in accordance with Section 02275 of these Specifications, where applicable.
 - (1) Spread mulch in a continuous blanket at the rate specified in Table 1 of this section.
 - (2) Immediately following spreading mulch, secure with evenly distributed binder at the rate specified in Table 1 of this section.

5. Maintenance:

The Contractor shall be responsible for maintaining all seeded areas through the end of his warranty period. The Contractor shall provide, at his expense, protection of all seeded areas against damage at all times until acceptance of the work. Maintenance shall include, but not be limited to, the following items:

- a. Regrade and revegetate all eroded areas until adequately stabilized by grass.
- b. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
- c. Replant bare areas using same materials specified.

TABLE 1: SEEDING SCHEDULE

MATERIAL	SEED TYPE	APPLICATION RATE¹
Lime	-----	4,000 lbs/acre
Fertilizer	10-10-10 Analysis	1,000 lbs/acre
Seed Permanent:	Creeping Red Fescue, Bluegrass and Tall Fescue Crown Vetch Korean Lespedeza Seasonal Nurse Crop ²	40 lbs/acre 10 lbs/acre 10 lbs/acre See Note 2
Temporary:	Seasonal Nurse Crop ²	See Note 2
Mulch	-----	4,000 - 5,000 lbs/acre
Binder	Asphalt Emulsion	300 gallons/acre

Notes:

1. Application rates and/or chemical analysis shall be confirmed or established by a soil test(s).
2. Use seasonal nurse crop in accordance with seeding dates as stated below:

May 1 - August 15	10 lbs/acre German Millet or 15 lbs/acre Sudangrass
August 16 - April 30	25 lbs/acre Rye (grain).

END OF SECTION

Attachment D

Construction Quality Assurance

Construction Quality Assurance Manual

**Avery County C&D Landfill
Ingalls, North Carolina
NC Solid Waste Permit No. 06-03**

Prepared for:



Avery County
175 Linville Street
Newland, North Carolina

January 2009

PERMIT ISSUE DOCUMENTS

Prepared by:



PRINTED ON 100% RECYCLED PAPER

**AVERY COUNTY
C&D LANDFILL**

CONSTRUCTION QUALITY ASSURANCE MANUAL

TABLE OF CONTENTS

	<u>Page</u>
1.0 GENERAL	
1.1 Introduction	1.0-1
1.2 Definitions Relating to Construction Quality	1.0-1
1.2.1 Construction Quality Assurance (CQA)	1.0-1
1.2.2 Construction Quality Control (CQC)	1.0-1
1.2.3 CQA Certification Document	1.0-1
1.2.4 Discrepancies Between Documents	1.0-2
1.3 Parties to Construction Quality Assurance	1.0-2
1.3.1 Description of the Parties	1.0-2
1.3.1.1 Owner	1.0-2
1.3.1.2 Engineer	1.0-2
1.3.1.3 Contractor	1.0-2
1.3.1.4 CQA Engineer	1.0-2
1.3.1.5 Soils CQA Laboratory	1.0-3
1.3.2 Qualifications of the Parties	1.0-3
1.3.2.1 Contractor	1.0-3
1.3.2.2 CQA Engineer	1.0-3
1.3.2.3 Soils CQA Laboratory	1.0-3
1.4 Scope of Construction Quality Assurance Manual	1.0-4
1.5 Units	1.0-4
1.6 References	1.0-4
1.7 CQA Meetings	1.0-4
1.7.1 Soil Liner CQA Meeting	1.0-4
1.7.2 CQA Progress Meetings	1.0-4
1.7.3 Problem or Work Deficiency Meetings	1.0-5
1.8 Control Versus Record Testing	1.0-5
1.8.1 Control Testing	1.0-5
1.8.2 Record Testing	1.0-5
2.0 CQA DOCUMENTATION	
2.1 Documentation	2.0-1
2.2 Daily CQA Report	2.0-1
2.3 CQA Progress Reports	2.0-2
2.4 CQA Photographic Reporting	2.0-2
2.5 Deficiencies	2.0-3
2.6 Design And/Or Project Technical Specification Changes	2.0-3
2.7 Final CQA Report	2.0-3

Table of Contents (Continued)

	<u>Page</u>
2.8 Storage of Records	2.0-4
3.0 EARTHWORK CQA	
3.1 Introduction	3.0-1
3.2 Embankment Material Approval	3.0-1
3.2.1 Control Tests	3.0-1
3.3 Subgrade Approval	3.0-1
3.4 Earthwork Construction	3.0-1
3.4.1 Construction Monitoring	3.0-1
3.4.2 Control Tests	3.0-2
3.4.3 Record Tests	3.0-2
3.4.3.1 Record Test Failure	3.0-2
3.4.4 Judgmental Testing	3.0-2
3.5 Deficiencies	3.0-2
4.0 SOIL LINER CQA	
4.1 Introduction	4.0-1
4.2 Soil Liner Material Approval	4.0-1
4.2.1 Control Tests	4.0-1
4.3 Subgrade Approval	4.0-1
4.4 Test Fill Construction	4.0-1
4.4.1 Control Tests	4.0-2
4.4.2 Record Tests	4.0-2
4.4.3 Test Fill Completion	4.0-2
4.5 Soil Liner Construction	4.0-2
4.5.1 Construction Monitoring	4.0-2
4.5.2 Control Tests	4.0-3
4.5.3 Record Tests	4.0-3
4.5.3.1 Record Test Failure	4.0-3
4.5.4 Judgmental Testing	4.0-4
4.5.5 Perforations in Soil Liner	4.0-4
4.6 Deficiencies	4.0-4
5.0 FINAL COVER SYSTEM CQA	
5.1 Introduction	5.0-1
5.2 Final Cover System Material Approval	5.0-1
5.2.1 Corrugated Polyethylene (CPE) Pipe	5.0-1
5.2.2 Landfill Gas (LFG) System Components	5.0-1
5.2.3 Soil Liner	5.0-1
5.2.4 Vegetative Soil Layer	5.0-1

Table of Contents (Continued)

	<u>Page</u>
5.3 Final Cover System Installation	5.0-1
5.4 Deficiencies	5.0-2

APPENDICES

Appendix A	Reference List of Test Methods
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SECTION 1.0 GENERAL

1.1 INTRODUCTION

This Construction Quality Assurance (CQA) Manual has been prepared to provide the Owner, (Design) Engineer, and CQA Engineer the means to govern the construction quality and to satisfy landfill certification requirements under current solid waste management regulations.

More specifically, this CQA Manual addresses the construction of the landfill base grades and the final cover system.

The CQA Manual is divided into the following sections:

- Section 1.0 General
- Section 2.0 CQA Documentation
- Section 3.0 Earthwork CQA
- Section 4.0 Soil Liner CQA
- Section 5.0 Final Cover System CQA

1.2 DEFINITIONS RELATING TO CONSTRUCTION QUALITY

1.2.1 Construction Quality Assurance (CQA)

In the context of this Manual, Construction Quality Assurance is defined as a planned and systematic program employed by the Owner to assure conformity of the earthwork, liner, and final cover systems installation with the project drawings and the project specifications. CQA is provided by the CQA Engineer as a representative of the Owner and is independent from the Contractor, and all manufacturers. The CQA program is designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

1.2.2 Construction Quality Control (CQC)

Construction Quality Control refers to actions taken by manufacturers, fabricators, installers, and/or the Contractor to ensure that the materials and the workmanship meet the requirements of the project drawings and the project specifications. The manufacturer's specifications and quality control (QC) requirements are included in this CQA Manual by reference only. A complete updated version of each geosynthetic component manufacturer's QC Plan shall be incorporated as part of the Contractor's CQC Plan.

1.2.3 CQA Certification Document

At the completion of construction, a certification document will be prepared by the CQA Engineer and submitted to State Solid Waste Regulators. The certification report will

include all QC testing performed by the Geosynthetics Manufacturers, all CQC testing performed by the Geosynthetic Installers, and all CQA testing performed by the CQA Engineer.

1.2.4 Discrepancies Between Documents

The Contractor is instructed to bring discrepancies to the attention of the CQA Engineer who shall then notify the Engineer for resolution. The Engineer has the sole authority to determine resolution of discrepancies existing within the Contract Documents (this may also require the approval of State Solid Waste Regulators). Unless otherwise determined by the Engineer, the more stringent requirement shall be the controlling resolution.

1.3 PARTIES TO CONSTRUCTION QUALITY ASSURANCE

1.3.1 Description of the Parties

The parties to Construction Quality Assurance and Quality Control include the Owner, Engineer, Contractor, Geosynthetics Manufacturer, Geosynthetics Installer, CQA Engineer, Geosynthetics CQA Laboratory, and Soils CQA Laboratory.

1.3.1.1 Owner

The Owner is Avery County, who owns and/or is responsible for the facility.

1.3.1.2 Engineer

The Engineer is responsible for the engineering design, drawings, and project specifications for the landfill. The Engineer is an official representative of the Owner. The Engineer serves as communications coordinator for the project, initiating the meetings outlined in **Section 1.7**. The Engineer will also be responsible for proper resolution of all quality issues that arise during construction. The Engineer is Richardson Smith Gardner & Associates, Inc.

1.3.1.3 Contractor

The Contractor is responsible for the construction of the landfill. The Contractor is responsible for the overall CQC on the project and coordination of submittals to the CQA Engineer. Additional responsibilities of the Contractor are defined by the project specifications.

1.3.1.4 CQA Engineer

The CQA Engineer is a representative of the Owner, is independent from the Contractor, and is responsible for observing, testing, and documenting activities related to the CQA of the earthworks at the site, and the installation of the soil liner,

and final cover systems. The CQA Engineer may make field observations and review submittals for the Engineer and is responsible for notifying the Owner and Engineer of all quality issues that arise during construction. The CQA Engineer is also responsible for issuing a facility certification report, sealed by a Professional Engineer registered in The State of North Carolina. Note that if the Certifying Engineer is with the same firm as the Design Engineer, they must be different individuals.

1.3.1.5 Soils CQA Laboratory

The Soils CQA Laboratory is a party, independent from the Owner, that is responsible for conducting geotechnical tests on conformance samples of soils and aggregates used in structural fills and the liner, and final cover systems. The services of the Soils CQA Laboratory are coordinated by the CQA Engineer and are paid for by the Owner.

1.3.2 Qualifications of the Parties

The following qualifications are required of all parties involved with the manufacture, fabrication, installation, transportation, and CQA of all materials for the landfill. Where applicable, these qualifications must be submitted by the Contractor to the Owner and Engineer for review and approval.

1.3.2.1 Contractor

Qualifications of the Contractor are specific to the construction contract and independent of this CQA Manual.

1.3.2.2 CQA Engineer

The CQA Engineer will act as the Owner's Quality Assurance Representative. The CQA Engineer will perform CQA testing to satisfy the requirements of this CQA Manual and will prepare the CQA certification document. The CQA Engineer will have experience in the CQA aspects of the construction and testing of structural fills and final cover systems, and be familiar with ASTM and other related industry standards. The activities of the CQA Engineer will be performed under the supervision of a Registered Professional Engineer.

1.3.2.3 Soils CQA Laboratory

The Soils CQA Laboratory will have experience in testing structural fills, soil liners, and aggregates, and be familiar with ASTM and other applicable test standards. The Soils CQA Laboratory will be capable of providing test results within 24 hours or a reasonable time after receipt of samples depending on the test(s) to be

conducted, as agreed to at the outset of the project by affected parties, and will maintain that standard throughout the installation.

1.4 SCOPE OF CONSTRUCTION QUALITY ASSURANCE MANUAL

The scope of this CQA Manual includes the CQA of the soils and geosynthetic components of the liner, and final cover systems for the subject facility. The CQA for the selection, evaluation, and placement of the soils is included in the scope.

1.5 UNITS

In this CQA Manual, all properties and dimensions are expressed in U.S. units.

1.6 REFERENCES

The CQA Manual includes references to the most recent version of the test procedures of the American Society of Testing and Materials (ASTM). **Appendix A** contains a list of these procedures.

1.7 CQA MEETINGS

To facilitate the specified degree of quality during installation, clear, open channels of communication are essential. To that end, meetings are critical.

1.7.1 Soil Liner CQA Meeting

Prior to the start of the soil liner system construction a CQA Meeting will be held. This meeting will include all parties then involved, including the Engineer, the CQA Engineer, and the Contractor.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems which might cause difficulties and delays in construction, and, above all, review the CQA Manual to all of the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted by all.

This meeting should include all of the activities referenced in the project specifications.

The meeting will be documented by the Engineer and minutes will be transmitted to all parties. The Soil Liner CQA Meeting and the Geosynthetics CQA Meeting may be held as one meeting or separate meetings, depending on the direction of the Engineer.

1.7.2 CQA Progress Meetings

Progress meetings will be held between the Engineer, the CQA Engineer, the Contractor, the Geosynthetic Installation Superintendent(s), and representatives from any other

involved parties at the frequency dictated in the project specifications or, at a minimum, once per month during active construction. These meetings will discuss current progress, planned activities for the next week, and any new business or revisions to the work. The CQA Engineer will log any problems, decisions, or questions arising at this meeting in his daily or periodic reports. Any matter requiring action which is raised in this meeting will be reported to the appropriate parties. These meetings will be documented by the Engineer and minutes will be transmitted to affected parties.

1.7.3 Problem or Work Deficiency Meetings

A special meeting will be held when and if a problem or deficiency is present or likely to occur. At a minimum, the meeting will be attended by the Engineer, the CQA Engineer, the Contractor, and representatives from any other involved parties. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- define and discuss the problem or deficiency;
- review alternative solutions; and
- implement an action plan to resolve the problem or deficiency.

The meeting will be documented by the Engineer and minutes will be transmitted to affected parties.

1.8 CONTROL VERSUS RECORD TESTING

1.8.1 Control Testing

In the context of this CQA Manual, Control Tests are those tests performed on a material prior to its actual use in construction to demonstrate that it can meet the requirements of the project plans and specifications. Control Test data may be used by the Engineer as the basis for approving alternative material sources.

1.8.2 Record Testing

Record Tests are those tests performed during the actual placement of a material to demonstrate that its in-place properties meet or exceed the requirements of the project drawings and specifications.

SECTION 2.0 CQA DOCUMENTATION

2.1 DOCUMENTATION

An effective CQA plan depends largely on recognition of construction activities that should be monitored and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The CQA Engineer will document that quality assurance requirements have been addressed and satisfied.

The CQA Engineer will provide the Owner and Engineer with his daily and weekly progress reports including signed descriptive remarks, data sheets, and logs to verify that required CQA activities have been carried out. These reports will also identify potential quality assurance problems. The CQA Engineer will also maintain at the job site a complete file of project drawings, reports, project specifications, a CQA Manual, checklists, test procedures, daily logs, and other pertinent documents.

2.2 DAILY CQA REPORT

The CQA Engineer's reporting procedures will include preparation of a daily report which, at a minimum, will include the following information, where applicable:

- a unique identifying sheet number for cross referencing and document control;
- date, project name, location, and other identification;
- data on weather conditions;
- a reduced-scale Site Plan showing all proposed work areas and test locations;
- descriptions and locations of ongoing construction;
- descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- locations where tests and samples were taken;
- a summary of test results;
- calibrations or recalibrations of test equipment, and actions taken as a result of recalibration;
- off-site materials received, including quality verification documentation;

- decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality;
- summaries of pertinent discussions with the Contractor and/or Geosynthetic Installers; and
- the CQA Engineer's signature.

The daily report must be completed at the end of each CQA Engineer's shift, prior to leaving the site. This information will be submitted weekly to and reviewed by the Owner and Engineer.

2.3 CQA PROGRESS REPORTS

The CQA Engineer will prepare a summary progress report each week, or at time intervals established at the pre-construction meeting. As a minimum, this report will include the following information, where applicable:

- a unique identifying sheet number for cross-referencing and document control;
- the date, project name, location, and other information;
- a summary of work activities during the progress reporting period;
- a summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period;
- summary of all test results, failures and retests, and
- signature of the CQA Engineer.

The CQA Engineer's progress reports must summarize the major events that occurred during that week. Critical problems that occur shall be communicated verbally to the Engineer immediately as well as being included in the weekly reports. The CQA Engineer's weekly report must be submitted to the Owner and Engineer no later than the Monday following the week reported.

2.4 CQA PHOTOGRAPHIC REPORTING

Photographs will be taken by the CQA Engineer at regular intervals during the construction process and in all areas deemed critical by the CQA Engineer.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. These records will be presented to the Engineer upon completion of the project.

In lieu of photographic documentation, videotaping may be used to record work progress,

problems, and mitigation activities. The Engineer may require that a portion of the documentation be recorded by photographic means in conjunction with videotaping.

2.5 DEFICIENCIES

The Owner and Engineer will be made aware of any significant recurring nonconformance with the project specifications. The Engineer will then determine the cause of the non-conformance and recommend appropriate changes in procedures or specification. When this type of evaluation is made, the results will be documented, and any revision to procedures or project specifications will be approved by the Owner and Engineer.

2.6 DESIGN AND/OR PROJECT TECHNICAL SPECIFICATION CHANGES

Design and/or project specification changes may be required during construction. In such cases, the CQA Engineer will notify the Engineer. The Engineer will then notify the appropriate agency, if necessary.

Design and/or project specification changes will be made only with the written agreement of the Engineer, and will take the form of an addendum to the project specifications. All design changes will include a detail (if necessary) and state which detail it replaces in the plans.

2.7 FINAL CQA REPORT

At the completion of each major construction activity at the landfill unit, the CQA Engineer will certify all required forms, observation logs, field and laboratory testing data sheets including sample location plans, etc. The CQA Engineer will also provide a final report which will certify that the work has been performed in compliance with the plans and project technical specifications, and that the supporting documents provide the necessary information.

The CQA Engineer will also provide summaries of all the data listed above with the report. The Record Drawings will include scale drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, etc.). All surveying and base maps required for development of the Record Drawings will be done by the Contractor's Construction Surveyor. These documents will be certified by the Contractor and delivered to the CQA Engineer and included as part of the final CQA (Certification) report.

It may be necessary to prepare interim certifications, as allowed by the regulatory agency to expedite completion and review.

At a minimum, the items shown in **Table 2.1** will be included in the Final CQA Report. Note that some items may not be applicable to all projects.

2.8 STORAGE OF RECORDS

All handwritten data sheet originals, especially those containing signatures, will be stored by the CQA Engineer in a safe repository on site. Other reports may be stored by any standard method which will allow for easy access. All written documents will become property of the Owner.

TABLE 2.1: FINAL CQA REPORT GENERAL OUTLINE

1.0	Introduction
2.0	Project Description
3.0	CQA Program
	3.1 Scope of Services
	3.2 Personnel
4.0	Earthwork CQA
5.0	Soil Liner CQA
6.0	Final Cover System CQA
7.0	Summary and Conclusions
8.0	Project Certification

Appendices

Appendix A	Design Clarifications and Modifications
Appendix B	Piezometer Abandonment (if applicable)
Appendix C	Photographic Documentation
Appendix D	CQA Reporting
	D1. CQA Reports
	D2. CQA Meeting Minutes
Appendix E	Earthwork CQA Data
	E1. CQA Test Results - Control Tests
	E2. CQA Test Results - Record Tests
Appendix F	Soil Liner CQA Data
	F1. CQA Test Results - Control Tests
	F2. CQA Test Results - Record Tests
Appendix G	Record Drawings
	G1 Final Cover System As-Built

SECTION 3.0 EARTHWORK CQA

3.1 INTRODUCTION

This section of the CQA Manual addresses earthwork (excavation and embankment) and outlines the soils CQA program to be implemented with regard to material approval, subgrade approval, field control and record tests, and resolution of problems.

3.2 EMBANKMENT MATERIAL APPROVAL

All material to be used as compacted embankment shall be approved in advance by the CQA Engineer. Approval is based upon successful completion of CQA control testing outlined below. Such testing can be performed either during excavation and stockpiling or from existing stockpiles prior to use.

3.2.1 Control Tests

The procedure for CQA testing during excavation and stockpiling (including existing stockpiles) is outlined below.

Each load of soil will be examined either at the borrow source or the stockpile area. Any unsuitable material will be rejected or routed to separate stockpiles consistent with its end use. Appropriate entries will be made in the daily log.

During stockpiling operations, control tests, as shown on **Table 3.1**, will be performed by the CQA Engineer prior to placement of any compacted embankment.

3.3 SUBGRADE APPROVAL

The CQA Engineer will verify that the compacted embankment subgrade is constructed in accordance with the project specifications.

3.4 EARTHWORK CONSTRUCTION

3.4.1 Construction Monitoring

- A. Earthwork shall be performed as described in the project specifications.
- B. Only soil previously approved by the CQA Engineer (see **Section 3.2**) shall be used in construction of the compacted embankment. Unsuitable material will be removed prior to acceptance by the CQA Engineer.
- C. All required field density and moisture content tests shall be completed before the overlying lift of soil is placed. The surface preparation (e.g. wetting, drying,

scarification, etc.) shall be completed before the CQA Engineer will allow placement of subsequent lifts.

- D. The CQA Engineer will monitor protection of the earthwork during and after construction.

3.4.2 Control Tests

The control tests, as shown on **Table 3.2**, will be performed by the CQA Engineer prior to placement of compacted embankment.

3.4.3 Record Tests

The record tests, as shown on **Table 3.2**, will be performed by the CQA Engineer during placement of compacted embankment.

3.4.3.1 Record Test Failure

Recompaction of the failed area shall be performed and retested until the area meets or exceeds requirements outlined in the specifications.

3.4.4 Judgmental Testing

During construction, the frequency of control and/or record testing may be increased at the discretion of the CQA Engineer when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- the rollers slip during rolling operation;
- the lift thickness is greater than specified;
- the fill material is at an improper moisture content;
- fewer than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- the rollers may not have used optimum ballast;
- the fill materials differ substantially from those specified; or
- the degree of compaction is doubtful.

3.5 DEFICIENCIES

The CQA Engineer will immediately determine the extent and nature of all defects and deficiencies and report them to the Owner and Engineer. All defects and deficiencies will be documented by the CQA Engineer. The Contractor shall correct defects and deficiencies to the satisfaction of the CQA Engineer. The CQA Engineer will observe all retests on repaired defects.

TABLE 3.1: CQA TESTING PROGRAM FOR EMBANKMENT MATERIAL APPROVAL

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
CONTROL TESTS:		
Visual Classification	ASTM D 2488	Each Soil
Moisture-Density Relationship	ASTM D 698	5,000 CY per Each Soil

TABLE 3.2: CQA TESTING PROGRAM FOR COMPACTED EMBANKMENT

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
CONTROL TESTS: (See Table 3.1)		
RECORD TESTS:		
Lift Thickness	-----	Each Lift
In-Place Density	ASTM D 6938 ¹	20,000 ft ² per lift & 1 per 500 LF/lift of Berms (< 200 ft. base width)
Moisture Content	ASTM D 6938 ²	20,000 ft ² per lift & 1 per 500 LF/lift of Berms (< 200 ft. base width)

Notes:

1. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937. For every 10 nuclear density tests perform at least 1 density test by ASTM D 1556, ASTM D 2167, or ASTM D 2937 as a verification of the accuracy of the nuclear testing device.
2. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959. For every 10 nuclear moisture tests perform at least 1 moisture test by ASTM D 2216, ASTM D 4643, or ASTM D 4959 as a verification of the accuracy of the nuclear testing device.

SECTION 4.0 SOIL LINER CQA

4.1 INTRODUCTION

This information addresses the soil liner component of the final cover system and outlines the soils construction quality assurance (CQA) program to be implemented with regard to material approval, subgrade approval, test fill construction, field and laboratory control and record tests, and resolution of problems.

4.2 SOIL LINER MATERIAL APPROVAL

All material to be used as soil liner shall be approved in advance by the CQA Engineer. Approval is based upon successful completion of CQA control testing outlined below. Such testing can be performed either during excavation and stockpiling or from existing stockpiles prior to use.

4.2.1 Control Tests

The procedure for CQA testing during excavation and stockpiling (including existing stockpiles) is outlined below.

Each load of soil will be examined either at the borrow source or the stockpile area. Any unsuitable material will be rejected or routed to separate stockpiles consistent with its end use. Appropriate entries will be made in the daily log.

During stockpiling operations, control tests, as shown on **Table 1**, will be performed by the CQA Engineer prior to placement of any soil liner material.

4.3 SUBGRADE APPROVAL

The CQA Engineer will verify that the soil liner subgrade is constructed in accordance with the project specifications.

4.4 TEST FILL CONSTRUCTION

A test fill meeting the requirements of the project specifications will be constructed using the same construction methods, equipment, and material to be used for the soil liner component. The test fill construction will be conducted prior to or coincide with the beginning of construction of the soil liner component.

Construction equipment and methods will be reviewed by the CQA Engineer prior to test fill placement.

4.4.1 Control Tests

The control tests, as shown on **Table 2**, will be performed by the CQA Engineer prior to placement of soil liner material in the test fill.

4.4.2 Record Tests

The record tests, as shown on **Table 2**, will be performed by the CQA Engineer during placement of soil liner material in the test fill.

4.4.3 Test Fill Completion

The test fill program is completed when the Contractor has shown that the soil liner constructed using the same construction methods, equipment, and material to be used in construction of the soil liner will satisfy project specifications. No soil liner can be placed until the test fill program is completed.

4.5 SOIL LINER CONSTRUCTION

4.5.1 Construction Monitoring

- A. Soil liner shall be placed as described in the applicable section(s) of the project specifications using the construction methods, equipment, and material demonstrated in the test fill construction.
- B. Only soil previously approved by the CQA Engineer (see **Section 2.0**) shall be used in construction of the soil liner. Unsuitable material will be removed prior to acceptance by the CQA Engineer.
- C. All required field density and moisture content tests shall be completed before the overlying lift of soil is placed. The surface preparation (e.g. wetting, drying, scarification, etc.) shall be completed before the CQA Engineer will allow placement of subsequent lifts.
- D. The CQA Engineer will monitor protection of the soil liner during and after construction.
- E. The liner surface shall be sprinkled with water as needed to prevent desiccation. Should desiccation occur, the last lift shall be reconstructed in accordance with the project specifications. Standing water should not be present on the soil liner.
- F. Frost heave or other damage due to freezing shall require lift reconstruction in accordance with the project specifications.
- G. The CQA Engineer will inspect the soil liner and certify that it is in accordance with

the project specifications and approved plans prior to the Contractor beginning installation of overlying geosynthetics.

- H. The finished soil liner shall be free of all rock protrusions. All cracks and voids shall be filled and the surface made uniform. This shall be accomplished by final dressing of the soil liner with smooth-drum rollers and hand raking. No rubber tired vehicles are permitted on the final dressed surface unless authorized by the CQA Engineer.

4.5.2 Control Tests

The control tests, as shown on **Table 3**, will be performed by the CQA Engineer prior to placement of soil liner material.

4.5.3 Record Tests

The record tests, as shown on **Table 3** and as described below, will be performed by the CQA Engineer during placement of soil liner material.

- A. Each lift will be checked visually for soil clods, rocks, debris, plant materials and other foreign material. Any such material which does not meet specified requirements shall be identified and removed prior to and during the compaction process.
- B. The thickness of the loose lift will be measured at random locations after spreading and leveling is completed. Loose lift thickness should not exceed the depth of penetration of the compaction feet.
- C. Moisture content will be monitored by the CQA Engineer prior to compaction. If the soil is drier than the specified minimum moisture content, water will be added and the lift will be disced to distribute the moisture evenly.

Results of testing will be certified within 7 days of soil liner placement.

4.5.3.1 Record Test Failure

The following procedures shall be used in the event of density or hydraulic conductivity test failure:

- A. Failed Density Test: Recomposition of the failed area shall be performed and retested until the area meets or exceeds requirements outlined in the specifications.
- B. Failed Hydraulic Conductivity Test: The area of failure shall be localized and reconstructed in accordance with the project specifications. This area

will be retested as outlined within the plan by the CQA Engineer. Optionally, at least five replicate samples shall be obtained and tested by the Contractor in the immediate vicinity of the failed test. If all five samples pass, then the initial failing test will be discounted. However, should the replicate samples confirm the failure of the soil liner to meet specifications, the area of failure shall be localized, reconstructed, and retested as described above.

4.5.4 Judgmental Testing

During construction, the frequency of control and/or record testing may be increased at the discretion of the CQA Engineer when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- the rollers slip during rolling operation;
- the lift thickness is greater than specified;
- the fill material is at an improper moisture content;
- fewer than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- the rollers may not have used optimum ballast;
- the fill materials differ substantially from those specified; or
- the degree of compaction is doubtful.

4.5.5 Perforations In Soil Liner

All holes shall be patched with compacted soil liner or sodium bentonite compacted and hydrated in the holes.

4.6 DEFICIENCIES

The CQA Engineer will immediately determine the extent and nature of all defects and deficiencies and report them to the Owner and Engineer. All defects and deficiencies will be documented by the CQA Engineer. The Contractor shall correct defects and deficiencies to the satisfaction of the CQA Engineer. The CQA Engineer will observe all retests on repaired defects.

TABLE 4.1: CQA TESTING PROGRAM FOR SOIL LINER MATERIAL APPROVAL

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
CONTROL TESTS:		
Visual Classification	ASTM D 2488	Each Soil
Moisture Content	ASTM D 2216	2,000 CY per Each Soil
Grain Size Analysis	ASTM D 422	2,000 CY per Each Soil
Atterberg Limits	ASTM D 4318	2,000 CY per Each Soil
Moisture-Density Relationship	ASTM D 698	5,000 CY per Each Soil
Hydraulic Conductivity - Lab Remolded	ASTM D 5084 ³	10,000 CY per Each Soil

TABLE 4.2: CQA TESTING PROGRAM FOR SOIL LINER TEST FILL

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
CONTROL TESTS: (See Table 1)		
Moisture-Density Relationship	ASTM D 698 ⁴	1 per lift
Hydraulic Conductivity - Lab Remolded	ASTM D 5084 ^{3,4}	1 per lift
RECORD TESTS:		
Lift Thickness	-----	Each Lift
Atterberg Limits	ASTM D 4318	1 per lift
Grain Size Analysis	ASTM D 422	1 per lift
In-Place Density	ASTM D 2922 ¹	3 per lift
Moisture Content	ASTM D 6938 ²	3 per lift
Hydraulic Conductivity - Undisturbed (Shelby Tube)	ASTM D 6938 ³	1 per lift

TABLE 4.3: CQA TESTING PROGRAM FOR SOIL LINER

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
CONTROL TESTS: (See Table 1)		
RECORD TESTS:		
Lift Thickness	-----	Each Lift
In-Place Density	ASTM D 6938 ¹	10,000 ft ² per lift
Moisture Content	ASTM D 6938 ²	10,000 ft ² per lift
Hydraulic Conductivity - Undisturbed (Shelby Tube)	ASTM D 5084 ³	80,000 ft ² per lift

Notes:

1. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937. For every 10 nuclear density tests perform at least 1 density test by ASTM D 1556, ASTM D 2167, or ASTM D 2937 as a verification of the accuracy of the nuclear testing device.
2. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959. For every 10 nuclear moisture tests perform at least 1 moisture test by ASTM D 2216, ASTM D 4643, or ASTM D 4959 as a verification of the accuracy of the nuclear testing device.
3. Maximum effective confining pressure and hydraulic gradient as required by the project specifications. Backpressure as recommended by ASTM D 5084.
4. These tests performed on the test fill may count toward the minimum frequencies established in **Table 1**.

SECTION 5.0 FINAL COVER SYSTEM CQA

5.1 INTRODUCTION

This section of the CQA Manual addresses the landfill gas (LFG) system, drainage aggregate and piping, and the vegetative soil layer of the final cover system. By reference to **Section 4.0** of this CQA Manual, this section also addresses the soil liner that is included in the final cover system. This section outlines the CQA program to be implemented with regard to material approval, construction monitoring, and resolution of problems.

5.2 FINAL COVER SYSTEM MATERIAL APPROVAL

The CQA Engineer shall verify that the following are provided and installed in accordance with the project drawings, specifications, and this CQA Manual.

5.2.1 Corrugated Polyethylene (CPE) Pipe

- A. Receipt of Contractor's submittals on CPE pipe.
- B. Review of submittals for CPE pipe for conformity to the project specifications.

5.2.2 LFG System Components

- A. Receipt of Contractor's submittals on LFG system components.
- B. Review of submittals for LFG system components for conformity to the project specifications.

5.2.3 Soil Liner

The CQA program for soil liner is presented in **Section 4.0** of this CQA Manual.

5.2.4 Vegetative Soil Layer

- A. Review the proposed source of vegetative soil layer for conformance with the project specifications.
- B. Conduct material control tests in accordance with **Table 5.1**.

5.3 FINAL COVER SYSTEM INSTALLATION

The CQA Engineer will monitor and document the construction of all final cover system components for compliance with the project specifications. Monitoring the construction work for the components of the final cover system includes the following:

- verify location and depth of LFG wells;
- verify location of all piping;
- monitoring the placement of the final cover system components.

5.4 DEFICIENCIES

The CQA Engineer will immediately determine the extent and nature of all defects and deficiencies and report them to the Owner and Engineer. All defects and deficiencies will be documented by the CQA Engineer. The Contractor shall correct defects and deficiencies to the satisfaction of the CQA Engineer. The CQA Engineer will observe all retests on repaired defects.

TABLE 5.1: CQA TESTING PROGRAM FOR FINAL COVER SYSTEM

COMPONENT	PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
CONTROL TESTS:			
Vegetative Soil Layer:	Visual Classification	ASTM D 2488	Each Load
	Grain Size Analysis	ASTM D 422	5,000 CY
	Atterberg Limits	ASTM D 4318	5,000 CY

Appendix A

Reference List of Test Methods

**AVERY COUNTY
C&D LANDFILL**

CQA MANUAL

APPENDIX A: REFERENCE LIST OF TEST METHODS

American Society American Society of Testing and Materials (ASTM):

ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D 413	Standard Test Methods for Rubber Property - Adhesion to Flexible Substrate.
ASTM D 422	Standard Test Method for Particle Size Analysis of Soils.
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³).
ASTM D 792	Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
ASTM D 1004	Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
ASTM D 1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique.
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 1603	Standard Test Method for Carbon Black in Olefin Plastics.
ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2434	Standard Test Method for Permeability of Granular Soils (Constant Head).
ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 3042	Standard Test Method for Insoluble Residue in Carbonate Aggregates.
ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D 4716	Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.
ASTM D 5084	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
ASTM D 5199	Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
ASTM D 5596	Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
ASTM D 5641	Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
ASTM D 5820	Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

ASTM D 5887	Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.
ASTM D 5993	Standard Test Method for Measuring Mass per Unit of Geosynthetic Clay Liners.
ASTM D 5994	Standard Test Method for Measuring Core Thickness of Textured Geomembrane.
ASTM D 6391	Standard Test Method for Field Measurement of Hydraulic Conductivity Limits of Porous Materials Using Two Stages of Infiltration from a Borehole.
ASTM D 6392	Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
ASTM D 6496	Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners.
ASTM D 6693	Standard Test Method for Determining Tensile Properties of Nonreinforced Flexible Polyethylene and Nonreinforced Polypropylene Geomembranes.
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

Geosynthetic Research Institute (GRI):

GRI GC7	Determination of Adhesion and Bond Strength of Geocomposites.
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Attachment E

Operations Manual

Operations Manual

**Avery County C&D Landfill
Ingalls, North Carolina
NC Solid Waste Permit No. 06-03**

Prepared for:



**Avery County
Newland, North Carolina**

PERMIT ISSUE DOCUMENTS

February 2009



PRINTED ON 100% RECYCLED PAPER

AVERY COUNTY C&D LANDFILL

OPERATIONS MANUAL

TABLE OF CONTENTS

	<u>Page</u>
1.0 GENERAL FACILITY OPERATIONS	
1.1 Overview	1.0-1
1.2 Contact Information	1.0-1
1.2.1 Avery County	1.0-1
1.2.2 North Carolina Department of Environment and Natural Resources	1.0-1
1.3 Access Control	1.0-2
1.3.1 Physical Restraints	1.0-2
1.3.2 Security	1.0-2
1.4 Signage	1.0-2
1.5 Communications	1.0-3
1.6 Facility Operating Hours	1.0-3
1.7 Fire and Safety	1.0-3
1.7.1 Fire Triangle	1.0-3
1.7.2 Equipment Safety	1.0-3
1.7.3 Fire Management Strategies	1.0-4
1.7.4 Coordination	1.0-4
1.8 Litter Control	1.0-4
1.9 Severe Weather Conditions	1.0-4
1.9.1 Ice Storms	1.0-4
1.9.2 Heavy Rains	1.0-4
1.9.3 Electrical Storms	1.0-5
1.9.4 Windy Conditions	1.0-5
1.9.5 Violent Storms	1.0-5
1.10 Equipment Requirements	1.0-5
1.11 Personnel Requirements	1.0-5
1.12 Health And Safety	1.0-5
1.12.1 Personal Hygiene	1.0-6
1.12.2 Personal Protective Equipment	1.0-6
1.12.3 Mechanical Equipment Hazard Prevention	1.0-6
1.12.4 Employee Health and Safety	1.0-7
1.12.5 Physical Exposure	1.0-7
1.12.5 Material Safety Data Sheets	1.0-7
1.13 Utilities	1.0-7
1.14 Record Keeping Program	1.0-7
2.0 WASTE HANDLING OPERATIONS	
2.1 Overview	2.0-1

Table of Contents (Continued)

	<u>Page</u>
2.2	Acceptable Wastes 2.0-1
2.3	Waste Screening Programs 2.0-1
	2.3.1 Waste Receiving and Inspection 2.0-2
	2.3.2 Hazardous Waste Contingency Plan 2.0-2
2.4	Facility Operations 2.0-3
	2.4.1 Operating Capacity 2.0-3
	2.4.2 Service Area 2.0-3
	2.4.3 Personnel Requirements 2.0-3
	2.4.4 Equipment Requirements 2.0-4
2.5	Waste Disposal 2.0-4
	2.5.1 Access 2.0-4
	2.5.2 General Procedures 2.0-4
	2.5.3 Special Waste Management 2.0-5
	2.5.3.1 Asbestos Management 2.0-5
	2.5.4 Periodic Cover 2.0-6
	2.5.5 Intermediate Cover 2.0-6
	2.5.6 Height Monitoring 2.0-6
2.6	Deconstruction of Mobile Homes 2.0-6

3.0 ENVIRONMENTAL MANAGEMENT

3.1	Overview 3.0-1
3.2	Surface Water Control 3.0-1
	3.2.1 Surface Water Run-On Control 3.0-1
	3.2.2 Erosion Control 3.0-1
	3.2.3 Sedimentation Control 3.0-2
3.3	Water Quality Monitoring 3.0-2
3.4	Landfill Gas Management 3.0-2
3.5	Vector Control 3.0-3
3.6	Odor Control 3.0-3
3.7	Dust Control 3.0-3

APPENDICES

Appendix A	Waste Screening Form
Appendix B	Mobile Home Deconstruction

SECTION 1.0 GENERAL FACILITY OPERATIONS

1.1 OVERVIEW

This Operations Manual was prepared for operations of the Avery County C&D Landfill facility permit No. 06-03 located in Ingalls, North Carolina as shown in **Figure 1**. This document discusses the operation of the following solid waste management activities:

- C&D landfill; and
- Mobile home deconstruction area.

Refer to **Figure 2** (Facility Plan) of the Permit Drawings for the location of existing landfill units and other solid waste management activities.

1.2 CONTACT INFORMATION

All correspondence and questions concerning the operation of the Avery County C&D Landfill should be directed to the appropriate County and State personnel listed below. For fire or police emergencies dial 911.

1.2.1 Avery County

Avery County Landfill (Site and Scale house)
2175 Brushy Creek Road
Newland, NC 28657

Avery County Solid Waste Department (Office)
175 Linville Street
Ingalls, NC 28657
Phone: 828-737-5420
Contact: Henry "Buddy" Norris

1.2.2 North Carolina Department of Environment and Natural Resources

North Carolina DENR - Raleigh Central Office (RCO)
401 Oberlin Road, Suite 150
Raleigh, NC 27605
Phone: (919) 508-8400
Fax: (919) 715-3605

North Carolina DENR - Asheville Regional Office
2090 U.S. Highway 70
Swannanoa, NC 28778
Phone: (828) 296-4500
Fax: (828) 299-7043

Division of Waste Management (DWM) - Solid Waste Section:

Field Operations Branch Head: Mark Poindexter (RCO)
Western Regional Supervisor: Deb Aja
Waste Management Specialist: Bill Wagner (RCO)

Division of Land Resources - Land Quality Section:

Regional Engineer: Janet Boyer, PE

1.3 ACCESS CONTROL

Limiting access to the landfill facility is important for the following reasons:

- Unauthorized and illegal dumping of waste materials is prevented.
- Trespassing, and injury resulting therefrom, is discouraged.
- The risk of vandalism is greatly reduced.

Access to active areas of the landfill will be controlled by a combination of fences and natural barriers, and strictly enforced operating hours. A landfill attendant will be on duty at all times when the facility is open for public use to enforce access restrictions.

1.3.1 Physical Restraints

The site will be primarily accessed by the existing entrance on Brushy Creek Road. Scales and a scale house and office are provided at this entrance. All waste will have been weighed prior to being placed in the landfill. Each entrance will have a gate which will be securely locked during non-operating hours.

1.3.2 Security

Frequent inspections of gates and fences will be performed by landfill personnel. The County will arrange for a random security patrol of the main gate to further discourage trespassing. Evidence of trespassing, vandalism, or illegal operation will be reported to the County Solid Waste Director.

1.4 SIGNAGE

A prominent sign(s) containing the information required by the DWM will be placed at the main landfill entrance. This sign(s) will provide information on operating hours, operating procedures, and acceptable wastes. Additional signage will be provided as necessary within the landfill complex to distinctly distinguish the roadway to the active landfill unit. Service and maintenance roads for use by operations personnel will be clearly marked and barriers (e.g., traffic cones, barrels, etc.) will be provided as required.

1.5 COMMUNICATIONS

Two way radio communication will be maintained between the active landfill unit and the landfill scale house and office. The scale house and office have telephones in case of emergency and for the conduct of day-to-day business. Emergency telephone numbers are displayed in the scale house and office.

1.6 FACILITY OPERATING HOURS

Normal hours of operation will be 8:00 A.M. to 4:30 P.M. Monday to Friday and 7:00 A.M. to 12:00 noon on Saturday. Facility will be closed on Sunday.

In the event of disaster or other emergency situations the supervisor will request approval from the commission's regional office to allow additional temporary operating hours.

1.7 FIRE AND SAFETY

The possibility of fire at the C&D landfill must be anticipated in the daily operation of the facility. Potential fire hazards include both surface conditions and subsurface conditions. Surface conditions include equipment operations. Subsurface conditions include underground fires caused by decomposition of the C&D materials previously landfilled.

1.7.1 Fire Triangle

The "triangle" illustrates the rule that in order to ignite and burn, a fire requires three (3) elements: heat, fuel, and oxygen. A fire is prevented or extinguished by "removing" any one of them. A fire naturally occurs when the elements are combined in the right mixture (e.g., more heat needed for igniting some fuels, unless there is concentrated oxygen). These principles are integral in the prevention and management of potential fire situations.



1.7.2 Equipment Safety

A combination of factory installed fire suppression systems and/or portable fire extinguishers will be operational on all pieces of heavy equipment at all times. Potential fire hazards at the C&D landfill are created from the build-up of fine, dry dust particles on and around operational motors and control panels. The presence of these build-ups can cause overheating and potential fire if periodic equipment cleaning and maintenance are not practiced. Portable fire extinguishers should be maintained in a state of readiness at the screen location and on each piece of moving equipment and equipment should be cleaned periodically.

1.7.3 Fire Management Strategies

Each fire situation is site specific, however, general strategies for active fire management include the following (in no particular order):

- Accelerated high temperature combustion (displacing fuel);
- Covering of the landfill burn area with soil (reduce oxygen);
- Covering of the burn area with foams (reduce oxygen);
- Flooding the burn area with water (reduce heat);
- Injecting an inert gas such as CO₂ (reduce oxygen); and
- Excavating the burning material (displacing fuel) and then extinguishing it in small controlled areas.

1.7.4 Coordination

A copy of the site Operations Manual will be filed with the local fire department including all contact information for the facility.

1.8 LITTER CONTROL

The vegetative trees/bushes act as a barrier to keep litter contained within the site. Landfill Operators pick up litter within the site daily and respond to weather and heavy wind conditions that may spread litter.

The litter control crew picks up litter outside the site and on access roads each weekday. Any load that is not secured in a manner that would prevent material from leaving the vehicle while it is in motion is subject to an additional fee. Also, trailers are covered by heavy tarp lids to minimize litter and potential for birds to enter the trailer and spread litter.

1.9 SEVERE WEATHER CONDITIONS

Unusual weather conditions can directly affect the operation of the landfill facility. Some of these weather conditions and recommended operational responses are as follows.

1.9.1 Ice Storms

An ice storm can make access to the landfill dangerous, prevent movement or placement of cover soil, and, thus, may require closure of the landfill until the ice is removed or has melted.

1.9.2 Heavy Rains

Exposed soil surfaces can create a muddy situation in some portions of the landfill during rainy periods. The control of drainage and use of crushed stone on unpaved roads should provide all-weather access for the site and promote drainage away from critical areas. In areas where the aggregate surface is washed away or otherwise damaged, new aggregate

should be used for repair.

Intense rains can affect newly constructed drainage structures such as swales, diversions, cover soils, and vegetation. After such a rain event, inspection by landfill personnel will be initiated and corrective measures taken to repair any damage found before the next rainfall.

1.9.3 Electrical Storms

The open area of a landfill is susceptible to the hazards of an electrical storm. If necessary, landfilling activities will be temporarily suspended during such an event. To guarantee the safety of all field personnel, refuge will be taken in the on-site buildings or in rubber-tired vehicles.

1.9.4 Windy Conditions

Landfill operations during a particularly windy period may require that the working face be temporarily shifted to a more sheltered area. When this is done, the previously exposed face will be immediately covered with daily cover.

1.9.5 Violent Storms

In the event of hurricane, tornado, or severe winter storm warning issued by the National Weather Service, landfill operations may be temporarily suspended until the warning is lifted. Daily cover will be placed on exposed waste and buildings and equipment will be properly secured.

1.10 EQUIPMENT REQUIREMENTS

The County will maintain on-site equipment required to perform the necessary landfill activities (see **Section 2.4.4**). Periodic maintenance of all landfilling equipment, and minor and major repair work will be performed at designated maintenance zones outside of the landfill.

1.11 PERSONNEL REQUIREMENTS

At least one member of the landfill supervisory staff will be certified as a Manager of Landfill Operations (MOLO) by the Solid Waste Association of North America (SWANA). Each landfill employee will go through an annual training course (led by supervisory staff) and is certified by SWANA as Landfill Operations personnel. As part of this training, personnel learn to recognize loads which may contain prohibited wastes. The personnel requirements for operation and maintenance of the site are listed in **Section 2.4.3**.

1.12 HEALTH AND SAFETY

All aspects of the transfer and C&D landfill operations were developed with the health and safety of the operating staff, customers, and neighbors in mind. Prior to commencement of operations of the facility, a member of the operating staff will be designated site safety officer. This individual, together with the facility's management will modify the site safety and

emergency

response program to remain consistent with National Solid Waste Management Association and Occupational Safety and Health Administration (OSHA) guidance.

Safety equipment provided includes equipment rollover protective cabs, seat belts, audible reverse warning devices, hard hats, safety shoes, and first aid kits. Facility personnel will be encouraged to complete the American Red Cross Basic First Aid Course. Other safety requirements as designated by the Owner will also be implemented.

Each facility employee will go through annual training course in health and safety (led by supervisory staff). All training shall be documented and attested to by signatures of the trainer and trainee. The following are some general recommendations for the health and safety of workers at the Avery County facility.

1.12.1 Personal Hygiene

The following items are recommended as a minimum of practice:

- Wash hands before eating, drinking, or smoking.
- Wear personal protective equipment as described in **Section 1.12.2**.
- Wash, disinfect, and bandage ANY cut, no matter how small it is. Any break in the skin can become a source of infection.
- Keep fingernails closely trimmed and clean (dirty nails can harbor pathogens).

1.12.2 Personal Protective Equipment

Personal Protective Equipment (PPE) must be evaluated as to the level of protection necessary for particular operating conditions and then made available to facility employees. The list below includes the PPE typically used and/or required in a solid waste management facility workplace.

- Safety shoes with steel toes.
- Noise reduction protection should be used in areas where extended exposure to continuous high decibel levels are expected.
- Disposable rubber latex or chemical resistant gloves for handling and/or sampling of waste materials.
- Dust filter masks

Following use, PPE's should be disposed of or adequately cleaned, dried, or readied for reuse.

1.12.3 Mechanical Equipment Hazard Prevention

The loaders and other equipment should be operated with care and caution. All safety equipment such as horns, backup alarms, and lights should be functional. A Lockout-Tagout program shall be used to identify equipment in need or under repair and insure that operation is "off-limits" prior to maintenance or repair. All operators shall be

trained in the proper operation of equipment.

1.12.4 Employee Health and Safety

Some general safety rules are:

- Consider safety first when planning and conducting activities.
- Review the equipment Manual prior to attempting repairs/changes.
- Remember the buddy system in case of repair of mechanical equipment
- Post emergency contact phone numbers.
- Provide easy and visible access to the Right to Know materials.
- Provide easy and visible access to the first aid kit and fire extinguishers.

1.12.5 Physical Exposure

Facility personnel may come in contact with the fluids, solids, and airborne constituents found at the C&D landfill. Routine training should be conducted regarding the individual and collective materials and their associated hazards. Training concerning safe work practices around these potential exposures should use equipment and proper disposal procedures.

1.12.6 Material Safety Data Sheets

Material Safety Data Sheets (MSDS) shall be collected on every waste (if available) that enters the facility. Information shall also be made available for all chemicals stored on site for use by the facility. MSDS sheets shall be stored in a location with all other Right to Know information for the site

1.13 UTILITIES

Electrical power, water, and telephone will be provided at the landfill scale house and office and restroom will be provided at the transfer station.

1.14 RECORD KEEPING PROGRAM

The County will maintain the following records in an operating record at the landfill:

- A. Waste inspection records (see **Section 2.3.1**);
- B. Daily tonnage records - including source of generation;
- C. Waste determination records;
- D. Quantity, location of disposal, generator, and special handling procedures for all special wastes disposed of at the site;
- E. List of generators and haulers that have attempted to dispose of restricted wastes;
- F. Employee training procedures and records of training completed;
- G. Documentation of cell activation;
- H. Documentation of mobile home deconstruction (see **Appendix B**)
- I. Gas monitoring results and remediation measures as required (see **Section 3.4**);
- J. All ground water monitoring and surface water quality information (See the

current **Water Quality Monitoring Plan**) including:

1. Monitoring well construction records;
 2. Sampling dates and results;
 3. Statistical analyses; and
 4. Results of inspections, repairs, etc.
- K. Annual landfill reports;
- L. All closure and post-closure information, where applicable, including:
1. Testing;
 2. Certification; and
 3. Recording.
- M. Cost estimates or financial assurance documentation.

The operating record will be kept up to date by the Solid Waste Director or his designee. It will be presented upon request to the DWM for inspection. A copy of this Operations Manual will be kept at the landfill and will be available for use at all times.

SECTION 2.0 WASTE HANDLING OPERATIONS

2.1 OVERVIEW

This section describes the required waste handling operations for the Avery County Landfill facility.

2.2 ACCEPTABLE WASTES

Only the following wastes generated within the approved service area may be disposed of in the C&D landfill unit (Note list is in accordance with existing permit):

- Land Clearing and Inert Debris: as defined in 15A NCAC 13B.0101(54) means a facility for the disposal of land-clearing waste, concrete, brick, concrete block, uncontaminated soil, gravel and rock, untreated and unpainted wood, and yard trash.
- Land Clearing Waste: as defined in 15A NCAC 13B.0101(53) means solid waste which is generated solely from land-clearing activities, limited to stumps, trees, limbs, brush, grass, and other naturally occurring vegetative material.
- Asphalt: in accordance with NCGS 130A-294(m).
- Construction and Demolition Debris: as defined in NCGS 130A-290(a)(4) means solid waste resulting solely from construction, remodeling, repair, or demolition operations on pavement, buildings, or other structures, but does not include inert debris, land-clearing debris, or yard debris.
- C&D-Like Waste: wastes that are similar to waste typically found in the land clearing-inert debris and C&D waste streams consisting of: roofing shingle waste from the manufacturer, waste building materials from mobile home/modular home manufacturer, and wooden pallets.
- Other Wastes as Approved by the Solid Waste Section of the Division of Waste Management.

In addition, waste from the deconstruction of mobile homes described in **Section 2.6** and the special wastes (asbestos only) described in **Section 2.5.3** and may also be disposed of in the C&D landfill unit.

2.3 WASTE SCREENING PROGRAMS

In order to assure that prohibited wastes are not entering the landfill facility, screening programs have been implemented at the landfill. Waste received at both the scale house entrance and waste taken to the working face is inspected by trained personnel. These individuals have been trained to spot indications of suspicious wastes, including: hazardous placarding or markings, liquids, powders or dusts, sludges, bright or unusual colors, drums or commercial size containers, and "chemical" odors. Screening programs for visual and olfactory characteristics of prohibited wastes are an ongoing part of the landfill operation.

2.3.1 Waste Receiving and Inspection

All vehicles must stop at the scale house located at the main entrance of the facility and visitors are required to sign-in. All waste transportation vehicles are weighed and the content of the load assessed. The scale attendant(s) requests from the driver of the vehicle a description of the waste it is carrying to ensure that unacceptable waste is not allowed into the landfill. The attendant(s) then visually checks the vehicle as it crosses the scale. Signs informing users of the acceptable and unacceptable types of waste are posted at the scale house. Once passing the scales, the vehicles are routed to the C&D landfill, MSW transfer station, or other area (mobile home deconstruction, etc.) as appropriate.

Vehicles are randomly selected for screening on a regular basis, depending on personnel available. At least one vehicle per week, but not less than 1% by weight of the waste stream entering the landfill (based on the previous week's total), will be randomly selected by inspection personnel. A random truck number and time will be selected (e.g., the tenth load after 10:00 a.m.) on the day of inspections. However, if something looks suspicious is spotted in any waste load, that load is inspected further.

Vehicles selected for inspection are directed to an area of intermediate cover adjacent to the working face where the vehicle will be unloaded. Waste is carefully spread using suitable equipment. An attendant trained to identify wastes that are unacceptable at the landfill inspects the waste discharged at the screening site. If unacceptable waste is found, including wastes generated from outside of the service area, the load will be isolated and secured by berming off the area. For unacceptable wastes that are non-hazardous, the Solid Waste Director will then notify officials of the DWM (see **Section 1.2.2**) within 24 hours of attempted disposal of any waste the landfill is not permitted to receive in order to determine the proper course of action. For unacceptable wastes that are hazardous, the Hazardous Waste Contingency Plan outlined in **Section 2.3.2** will be followed. The hauler is responsible for removing unacceptable waste from the landfill property.

If no unacceptable waste is found, the load will be pushed to the working face and incorporated into the daily waste cell. All random waste inspections will be documented by landfill staff using the waste screening form provided in **Appendix A**.

In addition to random waste screening described above, waste unloaded on the active face will be inspected by the equipment operators, trained to spot unacceptable wastes, before and during spreading and compaction. Any suspicious looking waste is reported immediately to the designated primary inspector for further evaluation.

2.3.2 Hazardous Waste Contingency Plan

In the event that identifiable hazardous waste or waste of questionable character is detected at the landfill, appropriate equipment, protective gear, personnel, and materials as necessary will be employed to isolate the wastes. The DWM will be notified

immediately (see **Section 1.2.2**) that an attempt was made to dispose of hazardous waste at the landfill. If the vehicle attempting disposal of such waste is known, all attempts will be made to prevent that vehicle from leaving the site or, if the vehicle has left the site, immediate notice will be served on the owner of the vehicle that hazardous waste, for which they have responsibility, has been disposed of at the landfill.

The County will assist the DWM as necessary and appropriate in the removal and disposition of the hazardous waste and in the prosecution of responsible parties. If needed, the hazardous waste will be covered with either on-site soils or other tarping material until such time when an appropriate method can be implemented to properly handle the waste. The cost of the removal and disposing of the hazardous waste will be charged to the owner of the vehicle involved. Any vehicle owner or operator who knowingly dumps hazardous waste in the landfill may be barred from using the landfill.

Should an incident where hazardous waste is found at the landfill occur, the event will be documented by landfill staff using the waste screening form provided in **Appendix A**.

Records of information gathered as part of the waste screening programs will be maintained at the landfill site during its active life and as long as required by the County and the DWM.

2.4 FACILITY OPERATIONS

2.4.1 Operating Capacity

The Operating Capacity for the solid waste facility is estimated to be approximately 10,000 tons per year of C&D waste.

2.4.2 Service Area

The anticipated service area for the facility (subject to change) is generally anticipated to be concentrated as shown in **Figure 3**.

2.4.3 Personnel Requirements

The anticipated personnel requirements for operation and maintenance of the site are listed in the following table.

Description	Primary Function (Allocation)
1) Site Manager (1)	Overall management of the facility
2) Scale house Attendant (1)	Receiving and weight for incoming loads
3) Operators (1)	Management of active proposed area.
4) Labor (1)	General labor and operational staff around the site

2.4.4 Equipment Requirements

The anticipated equipment requirements for operation and maintenance of the site are listed in the following table.

Description	Primary Function (Allocation)
1) Excavator (1)	Soil cover loading, and site maintenance
2) Front End Loader (1)	Loading, and site cleanup
3) Dump Truck	Hauling material around site

2.5 WASTE DISPOSAL

2.5.1 Access

Traffic will be clearly directed to the appropriate active access road. The location of access roads during waste placement will be determined by operations personnel in order to reflect waste placement strategy.

2.5.2 General Procedures

Waste transportation vehicles will arrive at the working face at random intervals. There may be a number of vehicles unloading waste at the same time, while other vehicles are waiting. In order to maintain control over the unloading of waste, a certain number of vehicles will be allowed on the working face at a time. The actual number will be determined by the truck spotter. This procedure will be used in order to minimize the potential of unloading unacceptable waste and to control disposal activity. Operations at the working face will be conducted in a manner which will encourage the efficient movement of transportation vehicles to and from the working face, and to expedite the unloading of waste.

The approach to the working face will be maintained such that two or more vehicles may safely unload side by side. A vehicle turn-around area large enough to enable vehicles to arrive and turn around safely with reasonable speed will be provided adjacent to the unloading area. The vehicles will back to a vacant area near the working face to unload. Upon completion of the unloading operation, the transportation vehicles will immediately leave the working face area. Personnel will direct traffic necessary to expedite safe movement of vehicles.

Waste unloading at the landfill will be controlled to prevent disposal in locations other than those specified by site management. Such control will also be used to confine the working face to a minimum width, yet allow safe and efficient operations. The width and length of the working face will be maintained as small as practical in order to maintain the appearance of the site, control windblown waste, and minimize the amount of cover

required each day. Normally, only one working face will be active on any given day, with all deposited waste in other areas covered by either periodic, intermediate, or final cover, as appropriate.

The procedures for placement and compaction of solid waste include: unloading of vehicles, spreading of waste into 2 foot lifts, and compaction on relatively flat slopes (i.e. 5H:1V max.) using a dozer and a minimum number of three full passes.

Wind screens adjacent to the working face may be used as required to control windblown waste.

The use of portable signs with directional arrows and portable traffic barricades will facilitate the unloading of wastes to the designated disposal locations. These signs and barricades will be placed along the access route to the working face of the landfill or other designated areas which may be established.

2.5.3 Special Waste Management

2.5.3.1 Asbestos Management

The County may dispose of asbestos within the C&D landfill. Asbestos will only be accepted if it has been processed and packaged in accordance with State and Federal (40 CFR 61) regulations. Asbestos will arrive at the site in vehicles that contain only the asbestos waste and only after advance notification by the generator.

Once the hauler brings the asbestos to the landfill, the hauler will be directed to the designated asbestos disposal area by operations personnel. The designated disposal area will be prepared by operations personnel by leveling a small area using a dozer or loader. Prior to disposal, the landfill operators will stockpile cover soil near the designated asbestos disposal area. The volume of soil stockpiled will be sufficient to cover the waste and to provide any berms, etc. to maintain temporary separation from other landfill traffic.

Once placed in the prepared area, the asbestos waste will be covered with a minimum of 18 inches of cover soil placed in a single lift. The surface of the cover soil will be compacted and graded using a tracked dozer or loader. The landfill dozer will be prohibited from operating over asbestos disposal areas until at least 18 inches of cover are in-place.

The landfill staff will record the approximate location and elevation of the asbestos waste once cover is in-place. The Solid Waste Director will then review pertinent disposal and location information to assure compliance with regulatory requirements and enter the information into the Operating Record.

Once disposal and recording for asbestos waste is completed, the disposal area may be covered with waste. No excavation into designated asbestos disposal areas will be permitted.

2.5.4 Periodic Cover

At the completion of waste placement each week, or sooner if the area of exposed waste exceeds one acre in size, a 6-inch layer of earthen material or other material as approved by the DWM will be placed over the exposed waste. This periodic cover is intended to control vectors, fire, odors, and blowing debris.

2.5.5 Intermediate Cover

A 12 inch layer of soil cover should be placed on all waste surfaces that have not received waste in 30 days but are below final elevation. This intermediate cover should be seeded immediately and graded such that all precipitation run-off is channeled to the surface water systems.

2.5.7 Height Monitoring

Approximately every month, the landfill staff will monitor landfill top and side slope elevations with a level. When such elevations approach design grades, the final top-of-waste grades will be staked to limit over-placement of waste.

2.6 DECONSTRUCTION OF MOBILE HOMES

The deconstruction of mobile homes is handled in an area adjacent to the C&D landfill unit. A description of the process is provided in **Appendix B**.

SECTION 3.0 ENVIRONMENTAL MANAGEMENT

3.1 OVERVIEW

This section reviews the overall environmental management tasks required for the successful operation of the landfill facility.

3.2 SURFACE WATER CONTROL

As used herein, the definition of “surface water” is water which results from precipitation or site run-on that has not contacted the waste.

Proper control of surface water at the landfill will accomplish the following goals:

- Prevent the run-on of surface water into the landfill unit or the active face(s);
- Limit the erosion caused by surface waters; and
- Limit sediments carried off-site by surface waters.

Separate erosion and sedimentation control plan(s) have been provided for the facility. These plans describe both short and long term engineered features and practices for preventing erosion and controlling sedimentation at this site. The following is a brief discussion of some of these features and practices, focusing more on the landfill units.

3.2.1 Surface Water Run-On Control

The perimeter channels around the landfill unit are designed to prevent the run-on of surface water from adjacent land into the landfill. Additional structures such as diversion berms, channels, down pipes, etc. carry surface water away from the landfill.

3.2.2 Erosion Control

The serviceability of the landfill relies heavily on soil berms, barrier layers, and agricultural layers that are readily eroded by flowing water. Erosion control provisions incorporated in the landfill include the following:

- The slope of the working face must be no steeper than 5H:1V where practical to limit erosion of the periodic cover.
- Intermediate cover that has been exposed for more than 30 days must be seeded immediately and repaired when erosion features are identified.
- Drainage breaks (diversion berms, etc.) are provided on the final cover to

limit the flow length of run-off.

- Water collected by each drainage break is routed to stormwater drainage channels or down pipes so that the run-off volume does not accumulate going down the slope.
- The vegetative soil layer placed over the final cover must be seeded immediately.

Additional erosion control measures have been taken within the drainage channels and at points of stormwater discharge. All final cover should be inspected regularly for erosion damage and promptly repaired.

3.2.3 Sedimentation Control

Stormwater run-off from the landfill unit is conveyed to the on site sediment basin. This basin should be inspected regularly for sediment build-up or erosion damage. The basin should be cleaned out when sediment fills the lower half of the basin.

3.3 WATER QUALITY MONITORING

The monitoring program and procedures outlined in the current Water Quality Monitoring Plan will be followed for the monitoring of site groundwater monitoring wells and surface water monitoring locations. The results of the water quality monitoring program will be placed in the facility operating record as described in **Section 1.14**.

3.4 LANDFILL GAS MANAGEMENT

Monitoring shall be performed to identify (if any) subsurface migration of landfill gas at explosive levels are present in on-site structures and/or at the property boundary in gas monitoring probes. Methane or other explosive gas concentrations shall not exceed 25 percent of the lower explosive limit (LEL) (1.25% of CH₄) in on-site structures, such as scale houses, or 100% of the LEL (5% of CH₄) at the facility property boundary. Subsurface methane monitoring wells are installed between the landfill perimeter and the property line, and are spaced approximately 500 feet apart. Additional wells will be installed as necessary and consistent with landfill expansion.

If landfill gas levels exceed these limits, the following must be performed:

- Immediately take all steps necessary for the protection of personnel, staff, or neighboring properties and notify the DWM;
- Within seven (7) days, place in the operating record a description of events taken following the detection event; and

- Within 60 days, implement a remediation plan for the explosive gas releases, place a copy in the operating record, and notify the DWM that the plan has been implemented

3.5 VECTOR CONTROL

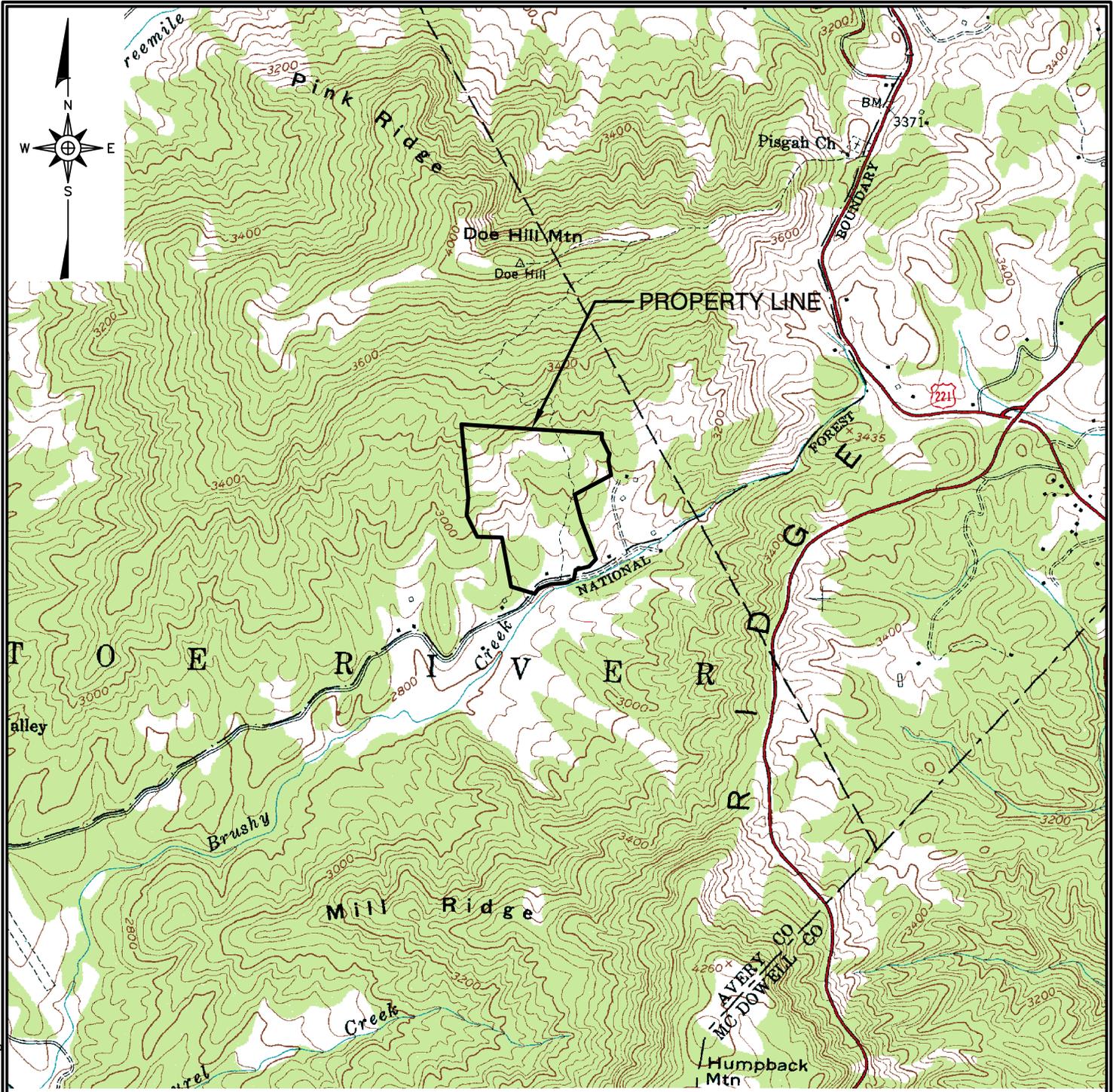
Due to the nature of the waste disposed in the C&D landfill unit, vector control is not anticipated to be of concern. Note that the use of periodic cover will discourage animals from nesting in the waste.

3.6 ODOR CONTROL

Due to the nature of the waste disposed in the C&D landfill unit, odor control is not anticipated to be of concern. However, if odors do occur, additional cover will be placed or other mitigation alternatives will be provided.

3.7 DUST CONTROL

Dust related to waste hauler traffic on the access roads will be minimized by using a water truck to limit dust on the gravel portion of the road. Dust generated by excavation of cover soil will be limited by watering the cut soil areas if accessible to the water truck.



REFERENCES

1. U.S.G.S. QUADRANGLE "LINVILLE FALLS, NC" 1956, PHOTO INSPECTED 1984
2. SITE PROPERTY LINE FROM FIELD SURVEY DATED 1/14/08, BY SURVEYING SOLUTIONS, P.C.



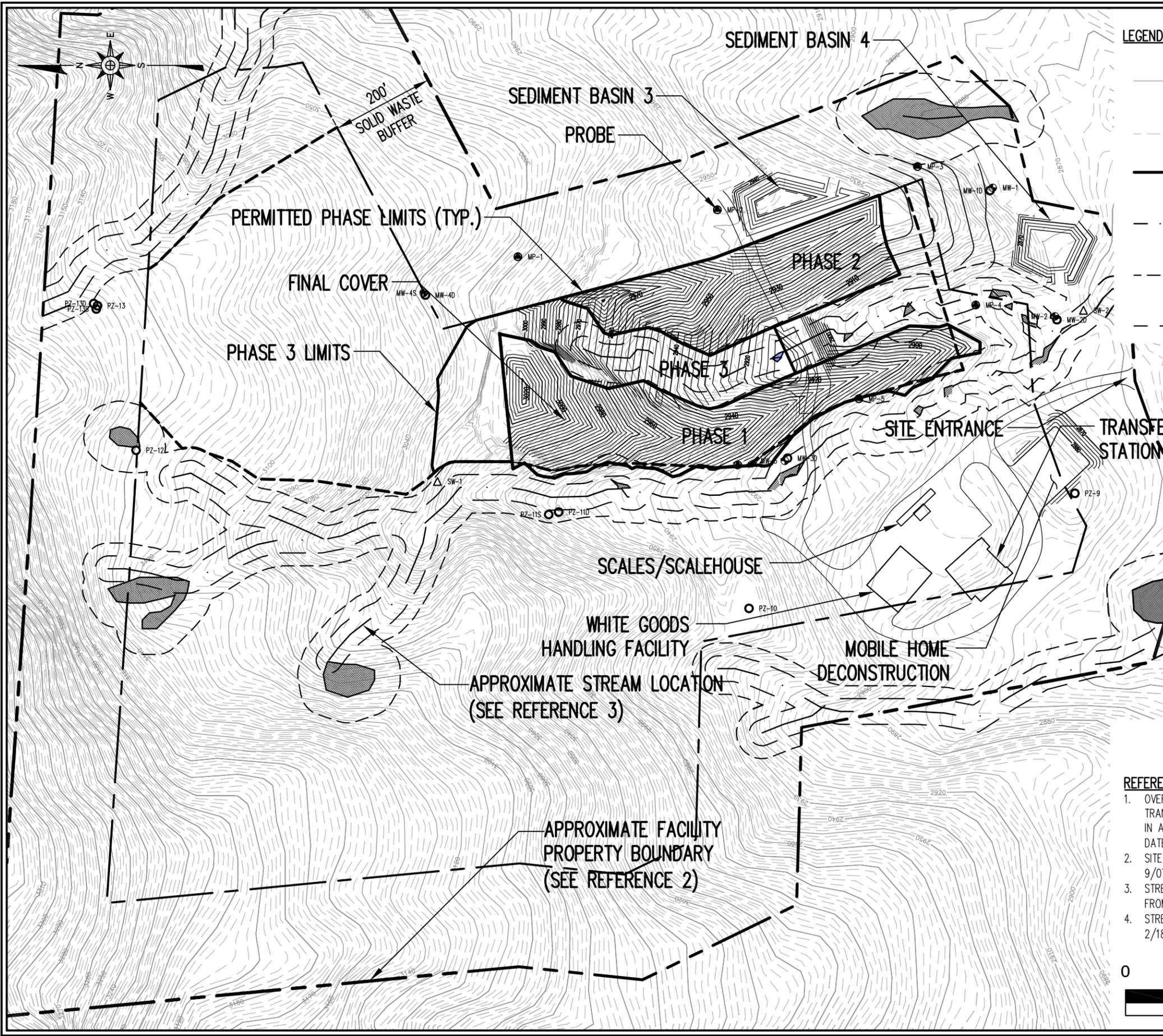
**AVERY COUNTY C&D LANDFILL
SITE VICINITY MAP**

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SCALE: AS SHOWN	DRAWN BY: J.A.L.	CHECKED BY: J.A.S.	DATE: Jul. 2008	PROJECT NO. AVERY 07-1	FIGURE NO. 1	FILE NAME AVERY-A0048
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LEGEND

	EXISTING 10' CONTOUR (SEE REFERENCE 1)
	EXISTING 2' CONTOUR
	PROPERTY LINE (SEE REFERENCE 2)
	APPROX. STREAM LOCATION (SEE REFERENCES 3, 4)
	50-FOOT STREAM AND WETLAND BUFFER
	25-FOOT TROUT STREAM BUFFER
	WETLANDS (SEE REFERENCES 3, 4)
	MONITORING WELL
	PIEZOMETER
	METHANE GAS MONITORING PROBE

PRELIMINARY
NOT FOR CONSTRUCTION

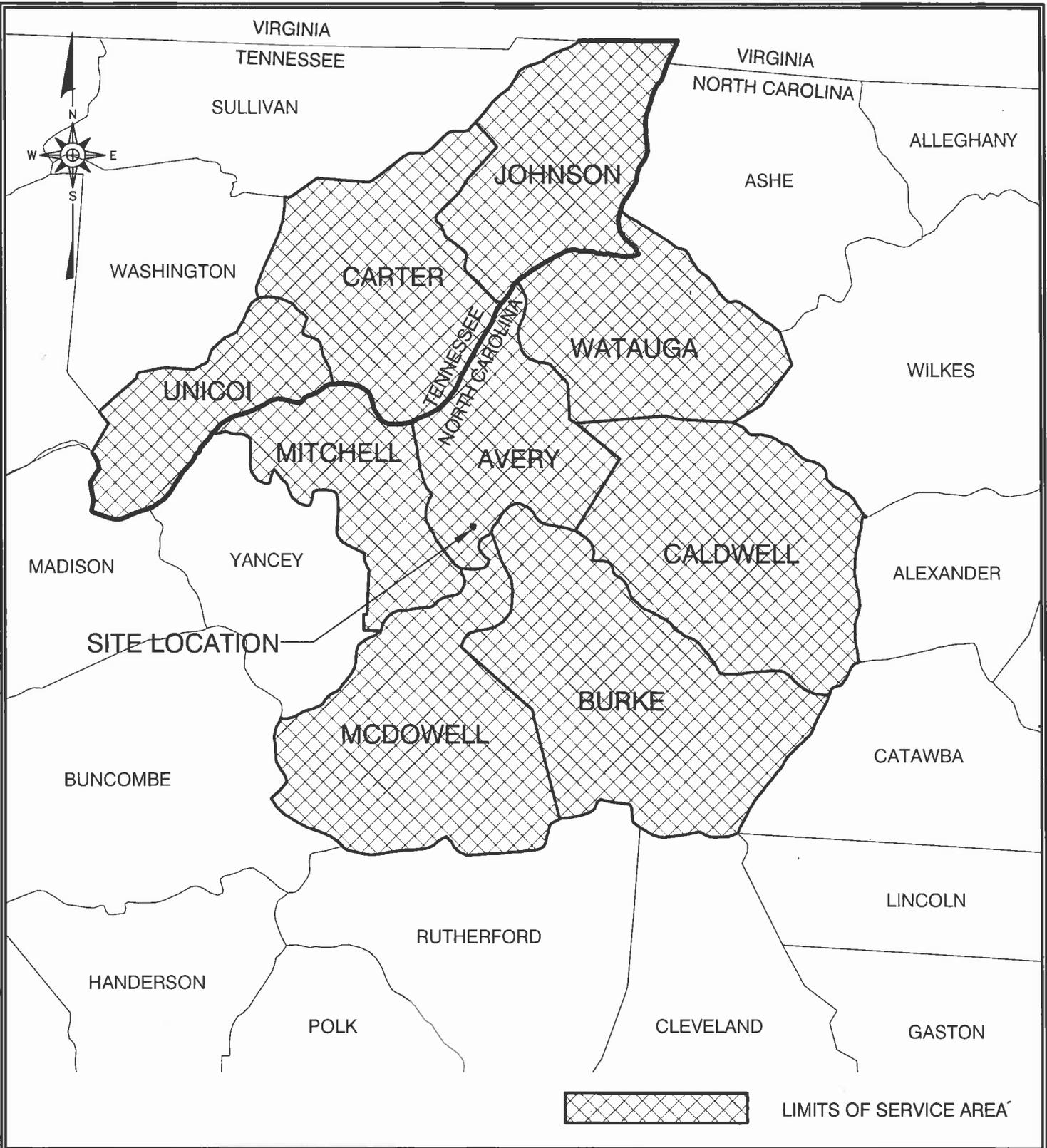
- REFERENCES**
- OVERALL SITE TOPOGRAPHY FROM NORTH CAROLINA DEPARTMENT OF TRANSPORTATION, DATA GENERATED FROM LIDAR DATED MARCH 2005, TOPO IN AREAS IN AND SURROUNDING PHASES 1 AND 2 FROM FIELD SURVEY DATED 9/07, BY SURVEYING SOLUTIONS, P.C.
 - SITE PROPERTY LINE AND MONITORING WELLS FROM FIELD SURVEYS DATED 9/07 AND 1/14/08, BY SURVEYING SOLUTIONS, P.C.
 - STREAM AND WETLAND LOCATIONS IN NORTHERN SECTOR OF SITE OBTAINED FROM GPS FIELD SURVEY DATED 4/07, BY CAROLINA ECOSYSTEMS, INC.
 - STREAMS AND WETLANDS NEAR PHASE 1 AND 2 FROM FIELD SURVEY DATED 2/18/08 BY SURVEYING SOLUTIONS, P.C.



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FIGURE NO.	2
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FILE NAME	AVERY-B0076
PROJECT NO.	AVERY 08-7
DATE:	Feb. 2009

TITLE:
AVERY COUNTY FACILITY PLAN



**AVERY COUNTY LANDFILL
FACILITY SERVICE AREA**



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Appendix A

Waste Screening Form

Avery County C&D Landfill
Permit No. 06-03
(828) 737-5420

WASTE SCREENING FORM

Day / Date: _____ Time Weighed in: _____
Truck Owner: _____ Driver Name: _____
Truck Type: _____ Vehicle ID / Tag No: _____
Weight _____ Tare: _____
Waste Generator / Source: _____

Reason Load Inspected: Random Inspection _____ Staff Initials _____
Detained at Scales _____ Staff Initials _____
Detained by Operating Staff _____ Staff Initials _____

Inspection Location: _____

Approved Waste Determination Form Present? Yes _____ No _____ N/A _____

Description of Load: _____

Load Accepted (signature) _____ Date _____
Load Not Accepted (signature) _____ Date _____

Reason Load Not Accepted (complete only if load not accepted)

Description of Suspicious Contents: Color _____ Haz. Waste Markings _____
Texture _____
Drums Present _____ Smell _____
Est. Cu. Yds. Present in Load _____
Est. Tons Present in Load _____

Avery County Emergency Management Contacted? Yes _____ No _____

Company or Authority Contacted? _____

Hazardous Materials Present: _____

Hauler Notified (if waste not accepted) Phone: _____ Time Contacted: _____
Other Observations: _____

Final Disposition
Signed _____ Date _____
Waste Screening Inspector or Solid Waste Director

Attach related correspondence to this form.
File completed form in Operating Record.

Appendix B

Mobile Home Deconstruction

AVERY COUNTY C&D LANDFILL
OPERATIONS MANUAL
APPENDIX B: MOBILE HOME DECONSTRUCTION

TABLE OF CONTENTS

	<u>Page</u>
1.0 OVERVIEW	1
2.0 MOBILE HOME DECONSTRUCTION PROCESS	1
2.1 Access	1
2.2 Waste Disposal	1
2.3 White Goods	1
2.4 Asbestos	2
2.5 Deconstruction of Mobile Homes	2
2.6 Holding Time for Mobile Homes	2
2.7 Holding Time for Recyclables	2
3.0 RECORD KEEPING PROGRAM	2

AVERY COUNTY C&D LANDFILL

OPERATIONS MANUAL

APPENDIX D: MOBILE HOME DECONSTRUCTION

1.0 OVERVIEW

This portion of the Operations Manual was prepared for the Mobile Home Deconstruction Area located adjacent to the Avery County Construction and Demolition Debris (C&D) Landfill unit. The Mobile Home Deconstruction Area is strictly for the deconstruction of mobile homes in order to recycle materials from the mobile homes. Avery County plans to recycle as many varieties of materials as possible as end users are available. Initially, scrap metal recycling will be conducted. Once an end-user of another material (i.e. glass) is located, these other materials may be recycled. Any non-recyclable material will be disposed of appropriately by the County upon completion of the deconstruction process.

2.0 MOBILE HOME DECONSTRUCTION PROCESS

Mobile homes will be deconstructed using the following processes.

2.1 Access

Mobile home owners seeking disposal will contact the landfill facility and be placed on a waiting list. No more than TWO (2) mobile homes will be allowed on-site for deconstruction at one time. Once space is available for a mobile home, landfill personnel will contact the next owner on the waiting list. The owner will have a 48 hour window in which to contact the landfill facility with information regarding the delivery date and hauler. If owner cannot arrange delivery within this initial 48 hour period, the owner may make alternate arrangements for delivery and must notify the landfill facility a minimum of 48 hours prior to planned delivery. The delivered mobile home will not be weighed on the scales at time of delivery, but the owner will be charged based upon the size and dimensions of the mobile home.

If delivery is not made within 48 hours of the scheduled delivery date, the owners name will be placed on the waiting list and the owner will be notified. If an owner has more than one mobile home, they will be rotated with others on the waiting list.

2.2 Waste Disposal

All mobile homes must be free of garbage, household hazardous waste, and all other non-construction and demolition waste prior to acceptance by the landfill.

2.3 White Goods

White goods will be accepted with the mobile home. White goods will be removed and handled in accordance with all State and Federal regulations. Any white goods containing CFC's will have them managed properly prior to removal of the white goods

and deconstruction of the mobile home.

2.4 Asbestos

Since asbestos may be located in the building materials of mobile homes constructed prior to 1983, all mobile homes built before 1/1/1983 will be thoroughly sprayed with water (both interior and exterior) to minimize dust. Upon demolition of a mobile home constructed prior to 1983, the waste generated will be placed in the C&D landfill and covered with six inches of soil or approved alternate cover.

2.5 Deconstruction of Mobile Homes

Once accepted, the mobile home will be placed in the mobile home deconstruction area. Mobile home deconstruction will be dependant upon weather conditions and manpower availability and will ONLY take place in the deconstruction area. Prior to deconstruction, mobile homes constructed before 1983 will be thoroughly sprayed with water to minimize dust (as noted above). The home will then be deconstructed using a track-hoe. The track-hoe will tear the trailer apart and lay the pieces on the ground to be separated by landfill personnel. The personnel will separate the non-recyclable materials from the recyclable materials. Initially, scrap metal is planned for recycling. As other end-users for other materials are available, other materials may be separated for recycling. All material not planned for recycling will be placed in the C&D landfill before the end of the day in which the deconstruction takes place. Material from mobile homes constructed prior to 1983 will be covered prior to the end of the day. All recyclable materials will be stockpiled in the deconstruction area for future recycling. **NO OPEN FLAMES OR CUTTING WITH TORCHES WILL BE ALLOWED WITHIN 100 FEET OF THE C&D LANDFILL.**

2.6 Holding Time for Mobile Homes

All mobile homes must be deconstructed within 45 days from acceptance into the deconstruction area. Upon receipt at the landfill, the date shall be painted on the side or end of the mobile home, or on the frame, for identification purposes for Solid Waste Section personnel.

2.7 Holding Time for Recyclables

Once a recyclable material is removed from a mobile home, it may be stockpiled in the mobile home deconstruction area for up to 45 days. No materials shall be kept in this area for more than 45 days, nor shall they be stockpiled in other areas awaiting recycling.

3.0 RECORD KEEPING PROGRAM

The County shall maintain the following records related to the Mobile Home Deconstruction in an operating record at the landfill (see also **Section 1.11** of the Operations Manual):

- A. Mobile Home Acceptance records including dates and description;
- B. Owner and hauler information for each mobile home;
- C. Date of deconstruction for each mobile home and materials to be recycled;
- D. Date and disposal information for all recycled materials ton include location and vendor of recipient of recycled materials.
- E. Date and certification of CFC's removed.

Attachment F

Closure and Post-Closure Plan

Closure And Post-Closure Plan

**Avery County C&D Landfill
Ingalls, North Carolina
NC Solid Waste Permit No. 06-03**

Prepared for:



**Avery County
Newland, North Carolina**

February 2008

PERMIT ISSUE DOCUMENTS

Prepared by:



PRINTED ON 100% RECYCLED PAPER

**AVERY COUNTY
C&D LANDFILL**

CLOSURE AND POST-CLOSURE PLAN

TABLE OF CONTENTS

	<u>Page</u>
1.0 CLOSURE PLAN	
1.1 Overview	1.0-1
1.2 Maximum Closure Area and Waste Capacity	1.0-1
1.3 Final Cover System	1.0-1
1.4 Landfill Gas System	1.0-2
1.5 Surface Water Systems	1.0-2
1.5.1 Incremental Operation	1.0-3
1.5.2 Required Maintenance	1.0-3
1.6 Closure Schedule	1.0-3
1.7 Closure Verification	1.0-3
2.0 POST-CLOSURE PLAN	
2.1 Overview	2.0-1
2.2 Post-Closure Contact	2.0-1
2.3 Post-Closure Use	2.0-1
2.4 Maintenance	2.0-2
2.4.1 Repair of Security Control Devices	2.0-2
2.4.2 Erosion Damage Repair	2.0-2
2.4.3 Correction of Settlement, Subsidence, and Displacement	2.0-2
2.4.4 Repair of Run-On/Run-Off Control Structures	2.0-2
2.4.5 Landfill Gas System	2.0-2
2.4.6 Groundwater Monitoring Wells	2.0-3
2.5 Monitoring Plan	2.0-3
2.5.1 Inspection Frequencies	2.0-3
2.5.2 Quarterly Inspections	2.0-3
2.5.3 Semi-Annual Inspections	2.0-4
2.6 Engineering Certification	2.0-4
3.0 CLOSURE/POST-CLOSURE COST ANALYSIS	
3.1 Overview	3.0-1
3.2 Estimated Closure Costs	3.0-1
3.3 Estimated Post-Closure Costs	3.0-1

SECTION 1.0 CLOSURE PLAN

1.1 OVERVIEW

This plan is intended to serve as a guide for the proposed closure of the Avery County C&D Landfill. A formalized Closure Plan (or incremental portion thereof) will be submitted to the Solid Waste Section of the North Carolina Department of Environment and Natural Resources Division of Waste Management (DWM) for approval prior to beginning closure construction.

1.2 MAXIMUM CLOSURE AREA AND WASTE CAPACITY

A Final Cover Grading Plan (**Drawing No. S4**) is provided in **Attachment H** as modified from the permit¹ drawings in accordance with 15A NCAC 13B .0543. for the Avery County C&D Landfill. The following are the estimated areas and capacity for each landfill unit to be closed under this plan.

Phase	Area (Ac.)	Operating Capacity (CY)	
		Gross ¹	Net ²
Phase 1*	2.95	10,800	10,800
Phase 2*	2.06	11,500	11,500
Phase 3 - Cell 1	0.84	49,000	43,600
Phase 3 - Cell 2	0.36	47,000	44,700
Phase 3 - Cell 3	0.90	33,000	27,200
Total:	7.11	151,300	137,800

* Phases 1 & 2 volumes are based on vertical expansion grades proposed in correspondence dated 10-23-08 and will be consumed in accordance with the waste relocation and mitigation plan dated October 2008 by RSG.

Notes:

- Gross capacity for the expansion is based on final cover grades provided on **Drawing No. S4** and assumes subgrades as shown on **Drawing No. S2**, both of which are provided in **Attachment H**. It is also noted that the capacity does not include volume included in the current permitted area (Phase 1 and 2), but reflects gains in "layover".
- The net capacity is determined by deductions for final and intermediate cover soils from the gross capacity.

1.3 FINAL COVER SYSTEM

The final cover system will consist of the following components (top-down):

- a 18-inch thick vegetative soil layer (including 6 inches of topsoil)
- a 18-inch thick layer of low permeability material (1×10^{-5} cm/sec); and
- a 12-inch thick intermediate cover layer.

The final cover system will be placed on prepared intermediate cover at a maximum slope of 3H:1V as approved in the current Permit Application¹. A stability evaluation was prepared which demonstrated a stable and safe configuration and is included in the Facility and Engineering Plan provided in **Attachment B**. It is noted that the facility is near capacity and has relative shallow waste placement, providing a safe configuration. A landfill gas (LFG) control (venting) system and surface water control devices will also be incorporated into the final cover. The final cover surface will be vegetated upon completion of the final cover installation according to the project seeding specifications.

Technical specifications and construction quality assurance requirements for final cover system components can be found in **Attachment C**. Final cover system details are shown on **Drawing No. MD1** (Miscellaneous Details) as modified from the original permit drawings.

Placement of the low permeability soil layer shall be closely monitored for moisture and density to achieve the minimum requirements set forth in the specifications. The vegetative soil layer should receive no compaction other than that provided by the dozer tracks. Pans or other heavy equipment should not operate on the vegetative soil layer.

1.4 LANDFILL GAS SYSTEM

A landfill gas control (venting) system is provided in the final cover system. This system includes a system of collection wells or trenches placed within the waste immediately below the cover to capture the gas passively. The collection wells should be placed before any low permeability soils are placed. The location of gas system components are shown on **Drawing No. S4** (Final Grading Plan).

1.5 SURFACE WATER SYSTEMS

Precipitation falling on the cover will infiltrate into the cover or run off the cover. Short-term the stormwater (run-off) flows down the surface of the intermediate cover. Long-term the run-off is controlled by silt fences surrounding the landfill until such time that vegetation is established. Flow is routed from the base of the landfill to the site sediment basin or sediment traps.

¹ Permit Application, Avery County C&D Landfill & LCID Landfill dated October 1995 prepared by Municipal Engineering Services Company, P.A.

1.5.1 Incremental Operation

During much of the life of the landfill, surface run-off will be handled by the intermediate cover system. Operations must strive to provide operational grading that encourages run-off from the intermediate cover to drain to the basin and traps. Corrugated polyethylene (CPE) piping and temporary soil berms must be installed if required to accomplish this run-off routing.

1.5.2 Required Maintenance

The surface water systems must be inspected annually and immediately after every major storm. Sediment build-up in the drainage features/devices must be cleaned out on a regular basis to promote run-off. Sediments removed can be used as daily or intermediate cover.

1.6 CLOSURE SCHEDULE

Closure activities must begin on the following schedule:

- No later than 30 days after the date on which the C&D landfill (unit) last receives waste (known final receipt of wastes);
- No later than 30 days after the date that a ten (10) acre or greater area of waste, is within 15 feet of final design grades; and
- No later than one (1) year after the most recent receipt of wastes, if the C&D landfill (unit) has remaining capacity.

All closure activities shall be completed within 180 days. Exemptions and extensions may be approved by the DWM. Prior to initiation of any closure event, a Notice of Intent shall be submitted to the DWM and placed in the operating record.

1.7 CLOSURE VERIFICATION

The following procedures will be implemented following closure:

- A Construction Quality Assurance (CQA) report will be submitted to the DWM. This report will describe the observations and tests used before, during, and upon completion of construction to ensure that the construction materials meet the final cover design specifications and the construction and certification requirements. The CQA report will contain as-built drawings.
- A signed certification from a registered Professional Engineer verifying that closure has been completed in accordance with the closure plan will be submitted to the DWM.

- Following final receipt of waste and full facility closure, at least one sign notifying all persons of the closing of the landfill (or incremental portions thereof) and that wastes are no longer accepted will be posted. Suitable barriers will be installed as necessary at former access points to prevent new waste from being deposited.
- Within 90 days, a survey plat, prepared by a registered Professional Land Surveyor, indicating the location and dimensions of landfill disposal areas, will be prepared.
- A notation will be recorded on the deed notifying any potential purchaser of the property that the land has been used as a landfill facility and that future use is restricted under the approved closure plan. A copy of the deed notation as recorded will be filed with the operating record.

SECTION 2.0 POST-CLOSURE PLAN

2.1 OVERVIEW

This Post-Closure Plan has been developed to outline steps to be taken to ensure the integrity of the landfill during its post-closure care period. The post-closure care period will last at least 30 years after final closure and, at a minimum, will consist of the following:

- Maintaining the integrity and effectiveness of final cover system;
- Performing groundwater and surface water monitoring;
- Maintaining and operating a gas monitoring system; and
- Maintaining run-on/run-off controls.

No wastes will remain exposed after closure of the landfill. Access to the closed site by the public will not pose a health hazard.

2.2 POST-CLOSURE CONTACT

All correspondence and questions concerning the post-closure care of the unit should be directed to:

Mr. Buddy Norris
Avery County Solid Waste (Office)
175 Linville Street
Newland, North Carolina 28657
Phone: (828) 737-5420

2.3 POST-CLOSURE USE

After filling operations cease at the landfill and the landfill is officially closed in accordance with the Closure Plan, the landfill will be maintained as a grassy hill. Avery County Landfill will maintain control of the property and prevent public access to it during the post-closure period.

There may be (an) access road(s) on the final cover to allow proper maintenance during post-closure. Precise location of the access road(s) will be determined as a part of operations. Low ground pressure and rubber tire vehicles will be used for maintenance.

2.4 MAINTENANCE

2.4.1 Repair of Security Control Devices

All security control devices will be inspected and maintained as necessary to ensure access to the site is controlled. Locks, vehicular gates, and fencing will be replaced if functioning improperly. Warning signs will be kept legible at all times and will be replaced if damaged by inclement weather or vandalism.

2.4.2 Erosion Damage Repair

If erosion of the final cover occurs during post-closure, the affected area will be repaired and reseeded as necessary. If necessary, rolled erosion control products (RECPs) will be used to expedite rapid revegetation of slopes and to secure topsoil in place.

2.4.3 Correction of Settlement, Subsidence, and Displacement

Minimum slopes of 5 percent will be maintained after settlement in order to prevent ponding and allow for proper drainage without infiltration. If vertical or horizontal displacement occurs due to differential settlement, cracks will be filled with appropriate material and final cover will be reestablished. Excessive vertical displacement is not anticipated.

2.4.4 Repair of Run-On/Run-Off Control Structures

All drainage swales, ditches, and perimeter channels will be repaired, cleaned, or realigned in order to maintain their original condition. Any culverts that are damaged will be repaired or replaced.

2.4.5 Landfill Gas Control System

The landfill gas control (venting) system will be maintained by Avery County Landfill. Proper operation of the system is verified through periodic testing of the subsurface monitoring wells around the perimeter of the landfill.

If landfill gas vents do not function as a result of irregular settlement, accumulation of liquids (condensate, leachate, water), binding or corrosion, additional and/or replacement wells/vents can be installed if necessary as shown on the Permit Drawings.

Monitoring shall be performed to identify (if any) subsurface migration of landfill gas at explosive levels are present in on-site structures and/or at the property boundary in accordance with **Table 2.1**. Methane or other explosive gas concentrations shall not exceed 25 percent of the lower explosive limit (LEL) (1.25% of CH₄) in on-site structures, such as scale houses, or 100% of the LEL (5% of CH₄) at the facility property boundary. Subsurface methane monitoring wells are installed between the landfill perimeter and the property line, and are spaced approximately 500 feet apart. Additional

wells will be installed as necessary and consistent with landfill expansion.

If landfill gas levels exceed these limits, the following must be performed:

- Immediately take all steps necessary for the protection of personnel, staff, or neighboring properties and notify the DWM;
- Within seven (7) days, place in the operating record a description of events taken following the detection event; and
- Within 60 days, implement a remediation plan for the explosive gas releases, place a copy in the operating record, and notify the DWM that the plan has been implemented

2.4.6 Groundwater Monitoring Wells

Procedures outlined in the current Water Quality Monitoring (WQM) Plan or subsequent revision will take precedence; however, a brief description follows. All groundwater monitoring wells have been installed with concrete pads and protective casings to prevent accidental damage by vehicles and equipment. The wells are also equipped with a locking cap to discourage vandalism. Groundwater wells will be inspected regularly (at the time of sampling) to ensure integrity. Persons inspecting a well should look at the overall condition of the well, for signs of well tampering, and cracking or degradation of the concrete pad. Should a well require replacement, the defective well should be abandoned in accordance with specifications provided in the WQM Plan and a new well installed at a location that is approved by the DWM.

2.5 MONITORING PLAN

The closed unit will be monitored for a minimum of 30 years. A series of inspections will be scheduled to ensure the integrity and effectiveness of the final cover system, surface water systems, groundwater monitoring system, landfill gas system, and to protect human health and the environment.

2.5.1 Inspection Frequencies

Inspections to be conducted during the post-closure care period will occur regularly as shown in **Table 2.1**.

2.5.2 Quarterly Inspections

Quarterly inspections of the closed site will be conducted by Avery County Landfill. These inspections will include examination of the security control devices for signs of deterioration or vandalism to ensure access to the site is limited to authorized persons. Each disposal area will be checked to ensure the integrity of the final cover system is maintained, erosion damage is repaired, vegetative cover persists, and that cover

settlement, subsidence, and displacement are minimal. Drainage swales and channels will be cleared of litter and debris and benchmark integrity will be noted and maintained.

2.5.3 Semi-Annual Inspections

Semi-annual inspections of the site during the post-closure period will be conducted by Avery County Landfill with attention paid to integrity and drainage of the final cover system and condition of the groundwater and gas monitoring systems.

A report of findings will be made to the responsible party, including recommendations for actions deemed necessary to ensure the site continues to meet the closure performance standard.

2.6 ENGINEERING CERTIFICATION

Based on Avery County Landfill's monitoring reports, annual certifications by a registered engineer will be placed in the operating record. They will certify that the closure plan has been followed, noting discrepancies along with the corrective actions undertaken. At the end of the post closure period, the individual certifications will be compiled into a final document and forwarded to the DWM.

TABLE 2.1: POST-CLOSURE INSPECTION FREQUENCIES

INSPECTION ACTIVITY	YEAR 1	YEARS 2-30
Security Control Devices	Quarterly	Quarterly
Vegetative Cover Condition	Quarterly ¹	Quarterly
Surface Water Systems	Quarterly ¹	Quarterly
Erosion Damage	Quarterly ¹	Quarterly
Cover Drainage System	Quarterly ¹	Semi-Annually
Cover Settlement, Subsidence, and Displacement	Quarterly ¹	Semi-Annually
Landfill Gas Control System	Quarterly ³	Semi-Annually ³
Groundwater Monitoring System	Semi-Annually	Semi-Annually ²
Benchmark Integrity	Annually	Annually

Notes:

1. These items will be inspected after each large storm event (i.e. ≥ 1 inch in any 24 hours).
2. Or in accordance with groundwater monitoring schedule described in the current Water Quality Monitoring Plan.
3. Or in accordance with the current Landfill Gas Management Plan.

SECTION 3.0 CLOSURE/POST-CLOSURE COST ANALYSIS

3.1 OVERVIEW

The purpose of this section is to provide a written estimate in current dollars of all activities and costs associated with all activities specified in the written closure and post-closure plans which have been developed for the Avery County Landfill.

3.2 ESTIMATED CLOSURE COSTS

Table 3.1 summarizes the estimated costs for complete closure of Phases 1 and 2 (the current maximum area to be closed). This cost estimate is based on a third party providing the necessary services and includes labor in the unit prices given. The estimated closure costs will be reviewed and updated as required to reflect adjustments for inflation, rising costs of anticipated closure care, increased costs in construction or materials, or any other adjustments to the Closure Plan.

3.3 ESTIMATED POST-CLOSURE COSTS

Table 3.2 summarizes the estimated costs for the post-closure care maintenance activities. This cost estimate is based on a third party providing the necessary services and includes labor in the unit prices given. The estimated post-closure costs will be reviewed and updated as required to reflect adjustments for inflation, rising costs of anticipated post-closure care, or any other adjustments to the Post-Closure Plan.



Table 3.1

DATE: 16-Feb-09
BY: SAS

Avery County C&D Landfill (NC SW Permit No. 06-03)
Engineer's Closure Construction Cost Estimate

Item No.	Item Description	Unit	Contractor			Comments
			Quantity	Unit Price	Total Price	
Closure Area (Horizontal Plan) ---->		AC	7.1			
1.0	Pre-Construction			Subtotal	\$18,550.00	
1.1	Construction Documents & Bidding	AC	7	\$15k + \$500/AC	\$18,550.00	RSG Estimate
2.0	Construction				\$339,735.00	References 1 and 2.
2.1	Surveys and Layout	AC	7	\$1,000.00	\$7,100.00	RSG Historical Estimate
2.2	Mobilization	AC	7	\$2,500.00	\$17,750.00	~4% of Construction Cost
2.3	Site Preparation (repairs to intermediate cover layer)	AC	7	\$500.00	\$3,550.00	Assumed estimate for repair of erosion rills.
2.4	18" On-site Low Permeability Soil	CY	17,182	\$8.00	\$137,456.00	RSG Estimate
2.5	18" Vegetative Support Layer	CY	17,182	\$4.50	\$77,319.00	RSG Estimate
2.6	Landfill Gas Venting System	AC	7	\$3,500.00	\$24,850.00	RSG Estimate
2.7	Cap Drainage Structures (berms, piping, etc.)	AC	7	\$7,500.00	\$53,250.00	RSG Historical Estimate
2.8	Erosion & Sediment Control (grading, silt fence, maintenance, etc.)	AC	7	\$800.00	\$5,680.00	RSG Historical Estimate
2.9	Revegetation	AC	7	\$1,800.00	\$12,780.00	Site Historical Estimate
3.0	Quality Assurance, Certification, & Deed Notation				\$46,535.00	
3.1	Field Monitoring	AC	7	\$3,000.00	\$21,300.00	RSG Estimate
3.2	Laboratory Testing	AC	7	\$2,500.00	\$17,750.00	RSG Estimate
3.3	Engineering Certification	AC	7	\$5k + \$250/AC	\$6,775.00	RSG Estimate
3.4	Surveying and Deed Notation	AC	7	\$100.00	\$710.00	RSG Historical Estimate
4.0	Miscellaneous Costs to Close				\$8,875.00	
4.1	Erosion and Stormwater Control (outside landfill footprint)	AC	7	\$1,000.00	\$7,100.00	RSG Historical Estimate
4.2	Engineering and Reporting	AC	7	\$250.00	\$1,775.00	RSG Historical Estimate
5.0	Total Closure Costs					
Construction Estimate ---->					\$413,695	
Cost per Acre ---->					\$58,267	
Total Estimate ---->					\$413,695 (2009\$) (See Note 1)	

Notes:

- All costs are presented in current dollars and should be increased at an inflation rate of 1.5% if additional review is not performed annually.
- This ESTIMATE has been prepared for financial assurance purposes only and shall not be considered a replacement for an actual bid from a licensed contractor and is considered acceptable within a +/- 10% of the Total Estimate value.

References:

- Avery County Construction and Demolition Landfill and Land Clearing and Inert Debris Landfill Permit Application by Municipal Engineering Services Company dated October 1995.

Denotes values calculated in spreadsheet.

Table 3.2

DATE: 16-Feb-09
BY: SAS

**Avery County C&D Landfill (NC SW Permit No. 06-03)
Engineer's Post Closure Estimate**

Item	Quantity	Unit	Comments
Groundwater Monitoring			
Monitoring wells	6	wells	Reference 1
Surface water point	2	points	Reference 1
Sampling frequency	2	events	Reference 1
Field sampling, collection, and shipping	\$800	per event	RSG estimate
Laboratory Analysis	\$325	per well	RSG estimate
Data review, statistics, and reporting	\$2,000	per event	RSG estimate
Maintenance and repair	\$1,000	per well	RSG historical estimate
Subtotal Cost	\$16,800	per year	
Landfill Gas Management			
Control System Vents	10	vents	Per Ref. 1
Sub-Surface Monitoring Probes	4	probes	Per Ref. 1
Control system monitoring, maintenance and repair	\$50	per vent per year	RSG estimate
Semi-Annual Perimeter Monitoring	\$50	per probe per year	RSG estimate
Subtotal Cost	\$700	per year	Averaged over post-closure period
Final Cover Management			
Area of maintenance	7.1	acres	Extends to area immediately around landfill.
Mowing	\$100	per acre	Site historical estimate
Erosion and sediment control maintenance	\$200	per acre	Site historical estimate
Topdressing (seed & fertilizer)	\$150	per acre	Site historical estimate
Vector and rodent control	\$10	per acre	Site historical estimate
Maintenance mobilization	\$1,000	per year	Site historical estimate
Subtotal Cost	\$4,266	per year	
Administration, Inspections, and Reportir			
Administration and record keeping	\$1,000	per year	Site historical estimate
Inspection	\$1,000	per year	Site historical estimate
Miscellaneous engineering	\$1,500	per year	Site historical estimate
Subtotal Cost	\$3,500	per year	
Total Post-Closure Costs			
Estimated Average Annual Costs	\$25,266	per year (2009\$)	
Number of Years for Post-Closure	30	years (see Note 1)	
Total Post Closure Costs	\$757,980	(2009\$) (See Note 2)	

Notes:

- All costs are presented in current dollars and should be increased at an inflation rate of 1.5% if additional review is not performed annually.
- This ESTIMATE has been prepared for financial assurance purposes only and shall not be considered a replacement for an actual bid from a licensed contractor and is considered acceptable within a +/- 10% of the Total Estimate value.

References:

- Avery County Construction and Demolition Landfill and Land Clearing and Inert Debris Landfill Permit Application by Municipal Engineering Services Company dated October 1995.

Denotes values calculated in spreadsheet.

Attachment G

Erosion and Sedimentation Control Plan

EROSION AND SEDIMENTATION CONTROL PLAN

The Erosion and Sedimentation Control Plan is provided in the Stormwater Management Plan, part of the Trout Stream Buffer Variance Request¹ that has been submitted to the U.S Army Corps of Engineers (USACE), North Carolina Wildlife Resources Commission (NCWRC), NCDENR Division of Water Quality (DWQ), and the DLR. Approval for this request has been granted by the USACE, the NCWRC, and DWQ and is provided in **Attachment J**. Approval is expected from the DLR in the near future.

Summary

The Erosion and Sedimentation Control Plan includes a written description of the erosion control and stormwater measures proposed on the Site. Upon closure of the landfill cell, the waste will be covered with a low permeability soil cap and vegetated.

The stormwater runoff from this site will be routed through the proposed basins, which will be converted into dry detention basins in compliance with the NCDENR Stormwater BMP Manual. Although no trout habitat was found on the site, measures have been included to benefit downstream trout waters. The basins have a cool water release through a series of cascade features (stepped boulder structures) in the discharge channel prior to release in the stream buffer to limit temperature fluctuations.

Additionally, shading has been incorporated into appropriate areas. The discharged water will predominantly flow through seepage within the riprap outlet structures (stepped boulder structures or cascades) rather than on the surface, further aerating and cooling the water.

The Erosion and Sediment Control Plan is included under separate cover, provided in the Trout Stream Buffer Variance Request.

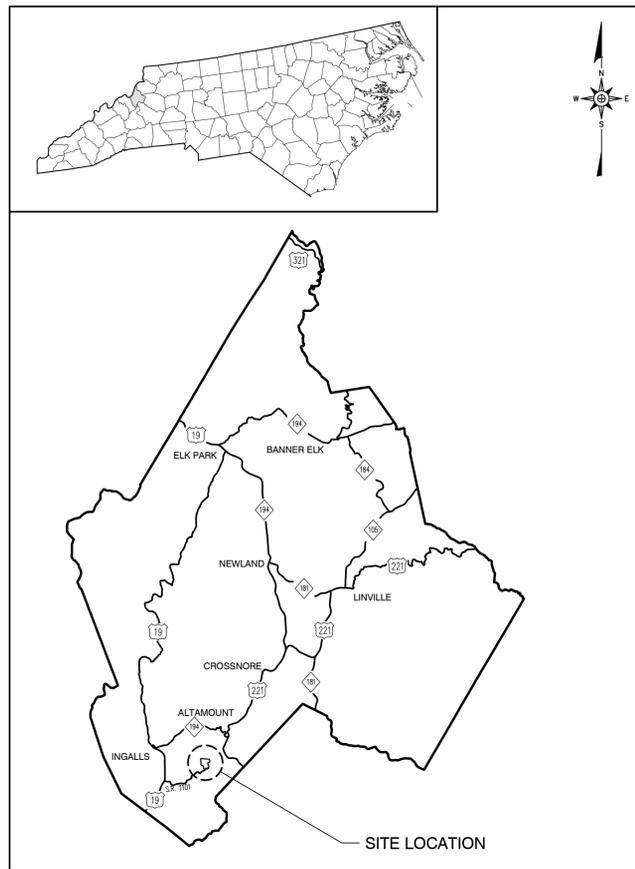
¹ Trout Stream Buffer Variance Request and 401/404 Nationwide Permit No. 39 Application.
Avery County C&D Landfill Expansion. Richardson Smith Gardner and Associates, September 2008.

Attachment H

Permit Drawings

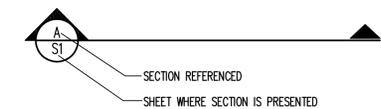
AVERY COUNTY SOLID WASTE DEPARTMENT
AVERY COUNTY, NORTH CAROLINA
CONSTRUCTION & DEMOLITION LANDFILL
PHASE III PERMIT TO CONSTRUCT
FEBRUARY 2009

PERMIT ISSUE
NOT FOR CONSTRUCTION

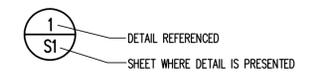


SHEET NO.	DRAWING NO.	TITLE
1		TITLE – COVER SHEET
2	S1	EXISTING CONDITIONS
3	S2	BASE GRADING PLAN
4	S3	STREAM AND WETLAND MITIGATION PLAN
5	S4	FINAL GRADING PLAN
6	P1	PHASING PLAN
7	X1	SECTIONS
8	EC1	STORMWATER MANAGEMENT DETAILS (SHEET 1 OF 3)
9	EC2	STORMWATER MANAGEMENT DETAILS (SHEET 2 OF 3)
10	EC3	STORMWATER MANAGEMENT DETAILS (SHEET 1 OF 3)
11	EC4	CASCADE AND RESTORATION DETAILS
12	D1	UNDERDRAIN DETAILS
13	MD1	MISCELLANEOUS DETAILS

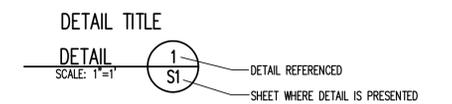
STANDARD SECTION LOCATION (SHEET AND DETAIL)



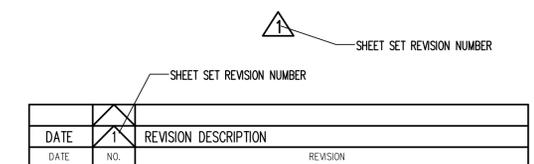
STANDARD DETAIL CALLOUT



STANDARD DETAIL TITLE AND CALLOUT



STANDARD REVISION CALLOUT (SHEET AND DETAIL)

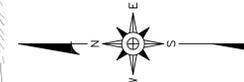
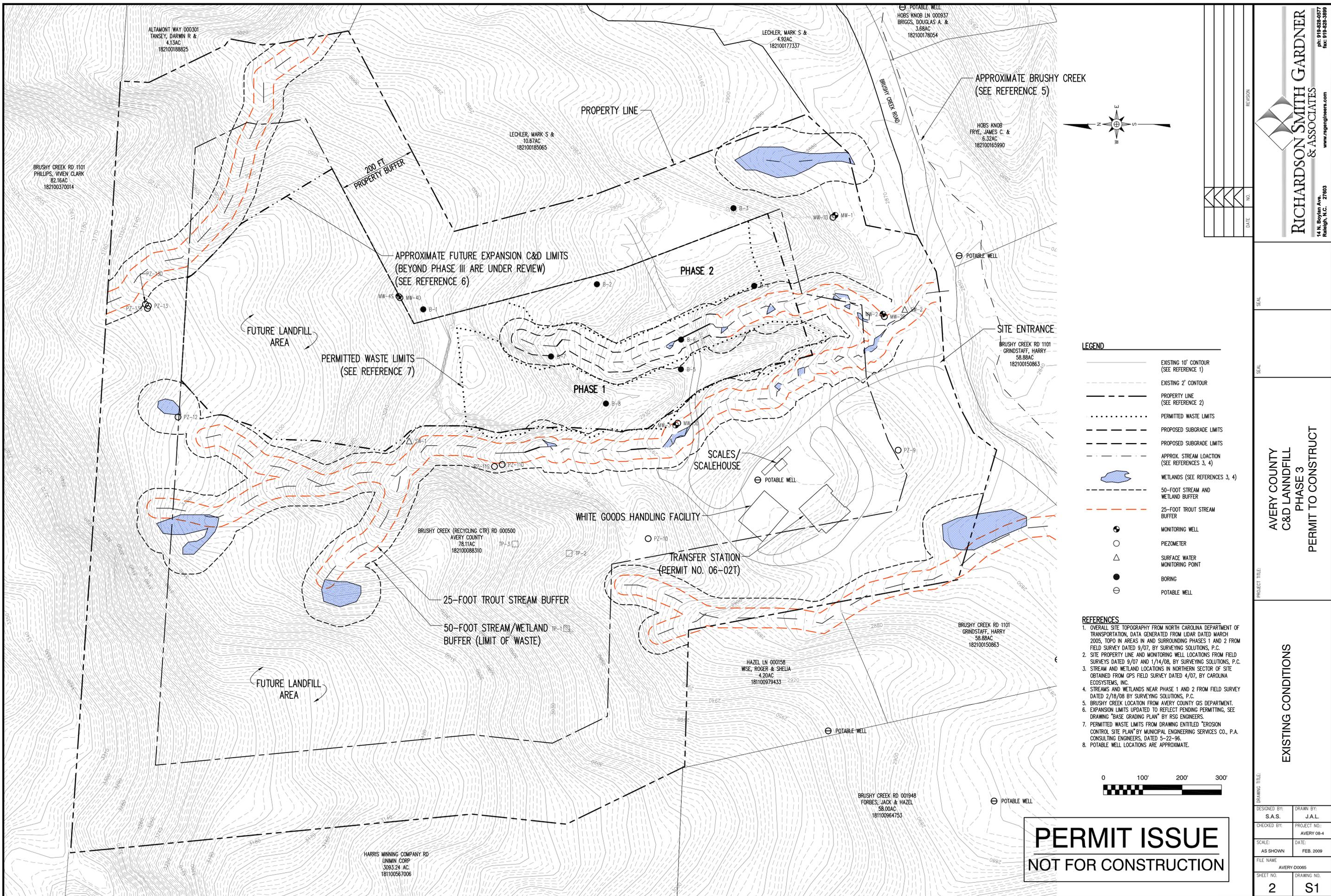



RICHARDSON SMITH GARDNER
& ASSOCIATES
 14 N. Boylan Ave.
 Raleigh, N.C. 27603
 www.rsgengineers.com
 ph: 919-828-0577
 fax: 919-828-3899

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FILE NAME
AVERY-DO064

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LEGEND

- EXISTING 10' CONTOUR (SEE REFERENCE 1)
- EXISTING 2' CONTOUR
- PROPERTY LINE (SEE REFERENCE 2)
- PERMITTED WASTE LIMITS
- PROPOSED SUBGRADE LIMITS
- PROPOSED SUBGRADE LIMITS
- APPROX. STREAM LOCATION (SEE REFERENCES 3, 4)
- WETLANDS (SEE REFERENCES 3, 4)
- 50-FOOT STREAM AND WETLAND BUFFER
- 25-FOOT TROUT STREAM BUFFER
- MONITORING WELL
- PIEZOMETER
- SURFACE WATER MONITORING POINT
- BORING
- POTABLE WELL

REFERENCES

1. OVERALL SITE TOPOGRAPHY FROM NORTH CAROLINA DEPARTMENT OF TRANSPORTATION, DATA GENERATED FROM LIDAR DATED MARCH 2005, TOPO IN AREAS IN AND SURROUNDING PHASES 1 AND 2 FROM FIELD SURVEY DATED 9/07, BY SURVEYING SOLUTIONS, P.C.
2. SITE PROPERTY LINE AND MONITORING WELL LOCATIONS FROM FIELD SURVEYS DATED 9/07 AND 1/14/08, BY SURVEYING SOLUTIONS, P.C.
3. STREAM AND WETLAND LOCATIONS IN NORTHERN SECTOR OF SITE OBTAINED FROM GPS FIELD SURVEY DATED 4/07, BY CAROLINA ECOSYSTEMS, INC.
4. STREAMS AND WETLANDS NEAR PHASE 1 AND 2 FROM FIELD SURVEY DATED 2/16/08 BY SURVEYING SOLUTIONS, P.C.
5. BRUSHY CREEK LOCATION FROM AVERY COUNTY GIS DEPARTMENT.
6. EXPANSION LIMITS UPDATED TO REFLECT PENDING PERMITTING, SEE DRAWING "BASE GRADING PLAN" BY RSG ENGINEERS.
7. PERMITTED WASTE LIMITS FROM DRAWING ENTITLED "EROSION CONTROL SITE PLAN" BY MUNICIPAL ENGINEERING SERVICES CO., P.A. CONSULTING ENGINEERS, DATED 5-22-96.
8. POTABLE WELL LOCATIONS ARE APPROXIMATE.



PERMIT ISSUE
NOT FOR CONSTRUCTION

DATE: _____ NO. _____

REVISION

RICHARDSON SMITH GARDNER & ASSOCIATES
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.rsgengineers.com
ph: 919-828-0077
fax: 919-828-3899

PROJECT TITLE: **EXISTING CONDITIONS**

DESIGNED BY: S.A.S. DRAWN BY: J.A.L.

CHECKED BY: PROJECT NO.: AVERY 08-4

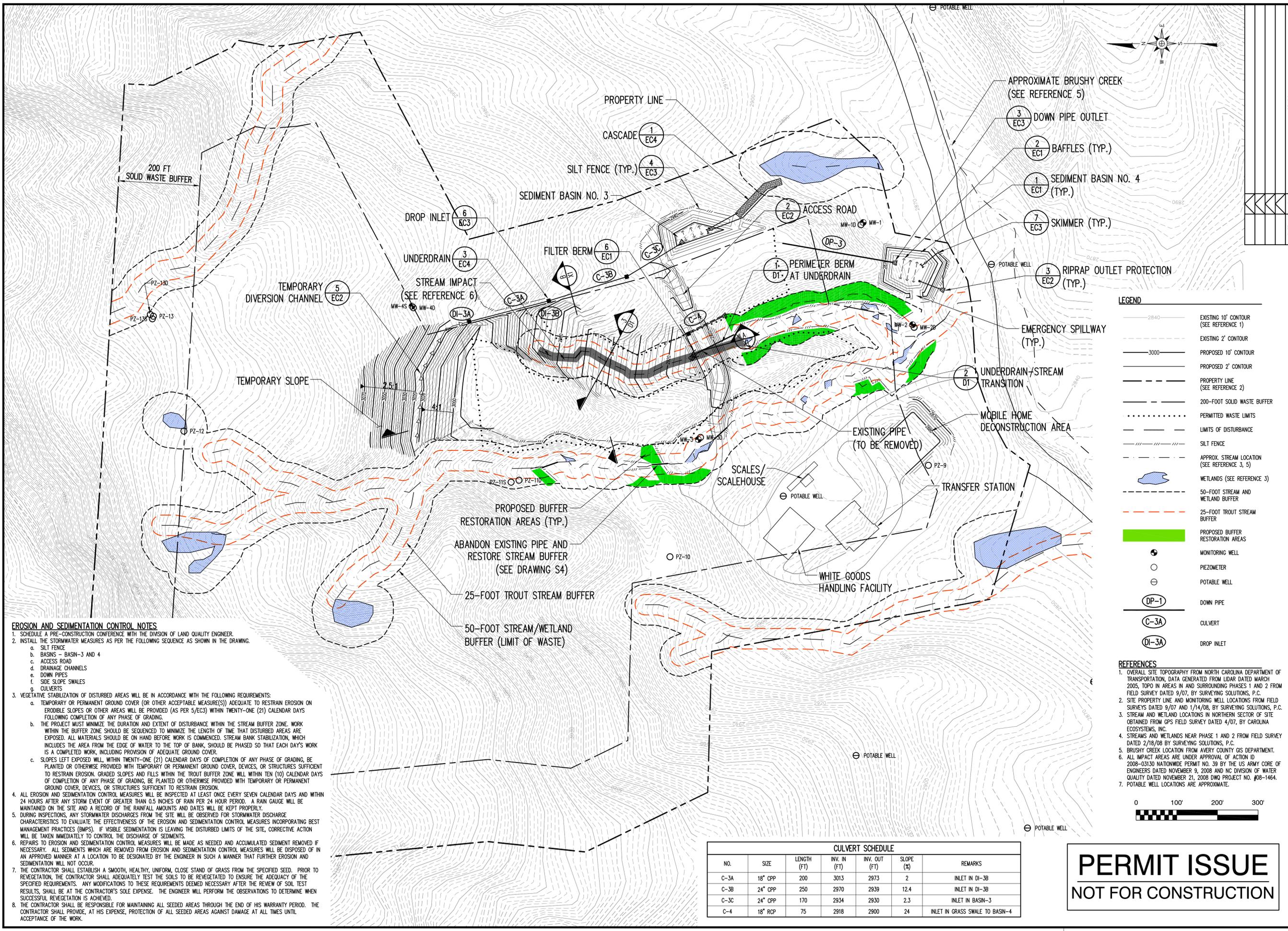
SCALE: DATE: FEB. 2009

FILE NAME: AVERY-00065

SHEET NO. DRAWING NO.

2 S1

**AVERY COUNTY
C&D LANDFILL
PHASE 3
PERMIT TO CONSTRUCT**



- EROSION AND SEDIMENTATION CONTROL NOTES**
- SCHEDULE A PRE-CONSTRUCTION CONFERENCE WITH THE DIVISION OF LAND QUALITY ENGINEER.
 - INSTALL THE STORMWATER MEASURES AS PER THE FOLLOWING SEQUENCE AS SHOWN IN THE DRAWING.
 - SILT FENCE
 - BASINS - BASIN-3 AND 4
 - ACCESS ROAD
 - DRAINAGE CHANNELS
 - DOWN PIPES
 - SIDE SLOPE SWALES
 - CULVERTS
 - VEGETATIVE STABILIZATION OF DISTURBED AREAS WILL BE IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS:
 - TEMPORARY OR PERMANENT GROUND COVER (OR OTHER ACCEPTABLE MEASURE(S)) ADEQUATE TO RESTRAIN EROSION ON ERODIBLE SLOPES OR OTHER AREAS WILL BE PROVIDED (AS PER 5/EC3) WITHIN TWENTY-ONE (21) CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING.
 - THE PROJECT MUST MINIMIZE THE DURATION AND EXTENT OF DISTURBANCE WITHIN THE STREAM BUFFER ZONE. WORK WITHIN THE BUFFER ZONE SHOULD BE SEQUENCED TO MINIMIZE THE LENGTH OF TIME THAT DISTURBED AREAS ARE EXPOSED. ALL MATERIALS SHOULD BE ON HAND BEFORE WORK IS COMMENCED. STREAM BANK STABILIZATION, WHICH INCLUDES THE AREA FROM THE EDGE OF WATER TO THE TOP OF BANK, SHOULD BE PHASED SO THAT EACH DAY'S WORK IS A COMPLETED WORK, INCLUDING PROVISION OF ADEQUATE GROUND COVER.
 - SLOPES LEFT EXPOSED WILL, WITHIN TWENTY-ONE (21) CALENDAR DAYS OF COMPLETION OF ANY PHASE OF GRADING, BE PLANTED OR OTHERWISE PROVIDED WITH TEMPORARY OR PERMANENT GROUND COVER, DEVICES, OR STRUCTURES SUFFICIENT TO RESTRAIN EROSION. GRADED SLOPES AND FILLS WITHIN THE TROUT BUFFER ZONE WILL WITHIN TEN (10) CALENDAR DAYS OF COMPLETION OF ANY PHASE OF GRADING, BE PLANTED OR OTHERWISE PROVIDED WITH TEMPORARY OR PERMANENT GROUND COVER, DEVICES, OR STRUCTURES SUFFICIENT TO RESTRAIN EROSION.
 - ALL EROSION AND SEDIMENTATION CONTROL MEASURES WILL BE INSPECTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS AFTER ANY STORM EVENT OF GREATER THAN 0.5 INCHES OF RAIN PER 24 HOUR PERIOD. A RAIN GAUGE WILL BE MAINTAINED ON THE SITE AND A RECORD OF THE RAINFALL AMOUNTS AND DATES WILL BE KEPT PROPERLY.
 - DURING INSPECTIONS, ANY STORMWATER DISCHARGES FROM THE SITE WILL BE OBSERVED FOR STORMWATER DISCHARGE CHARACTERISTICS TO EVALUATE THE EFFECTIVENESS OF THE EROSION AND SEDIMENTATION CONTROL MEASURES INCORPORATING BEST MANAGEMENT PRACTICES (BMPs). IF VISIBLE SEDIMENTATION IS LEAVING THE DISTURBED LIMITS OF THE SITE, CORRECTIVE ACTION WILL BE TAKEN IMMEDIATELY TO CONTROL THE DISCHARGE OF SEDIMENTS.
 - REPAIRS TO EROSION AND SEDIMENTATION CONTROL MEASURES WILL BE MADE AS NEEDED AND ACCUMULATED SEDIMENT REMOVED IF NECESSARY. ALL SEDIMENTS WHICH ARE REMOVED FROM EROSION AND SEDIMENTATION CONTROL MEASURES WILL BE DISPOSED OF IN AN APPROVED MANNER AT A LOCATION TO BE DESIGNATED BY THE ENGINEER IN SUCH A MANNER THAT FURTHER EROSION AND SEDIMENTATION WILL NOT OCCUR.
 - THE CONTRACTOR SHALL ESTABLISH A SMOOTH, HEALTHY, UNIFORM, CLOSE STAND OF GRASS FROM THE SPECIFIED SEED. PRIOR TO REVEGETATION, THE CONTRACTOR SHALL ADEQUATELY TEST THE SOILS TO BE REVEGETATED TO ENSURE THE ADEQUACY OF THE SPECIFIED REQUIREMENTS. ANY MODIFICATIONS TO THESE REQUIREMENTS DEEMED NECESSARY AFTER THE REVIEW OF SOIL TEST RESULTS, SHALL BE AT THE CONTRACTOR'S SOLE EXPENSE. THE ENGINEER WILL PERFORM THE OBSERVATIONS TO DETERMINE WHEN SUCCESSFUL REVEGETATION IS ACHIEVED.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL SEEDED AREAS THROUGH THE END OF HIS WARRANTY PERIOD. THE CONTRACTOR SHALL PROVIDE, AT HIS EXPENSE, PROTECTION OF ALL SEEDED AREAS AGAINST DAMAGE AT ALL TIMES UNTIL ACCEPTANCE OF THE WORK.

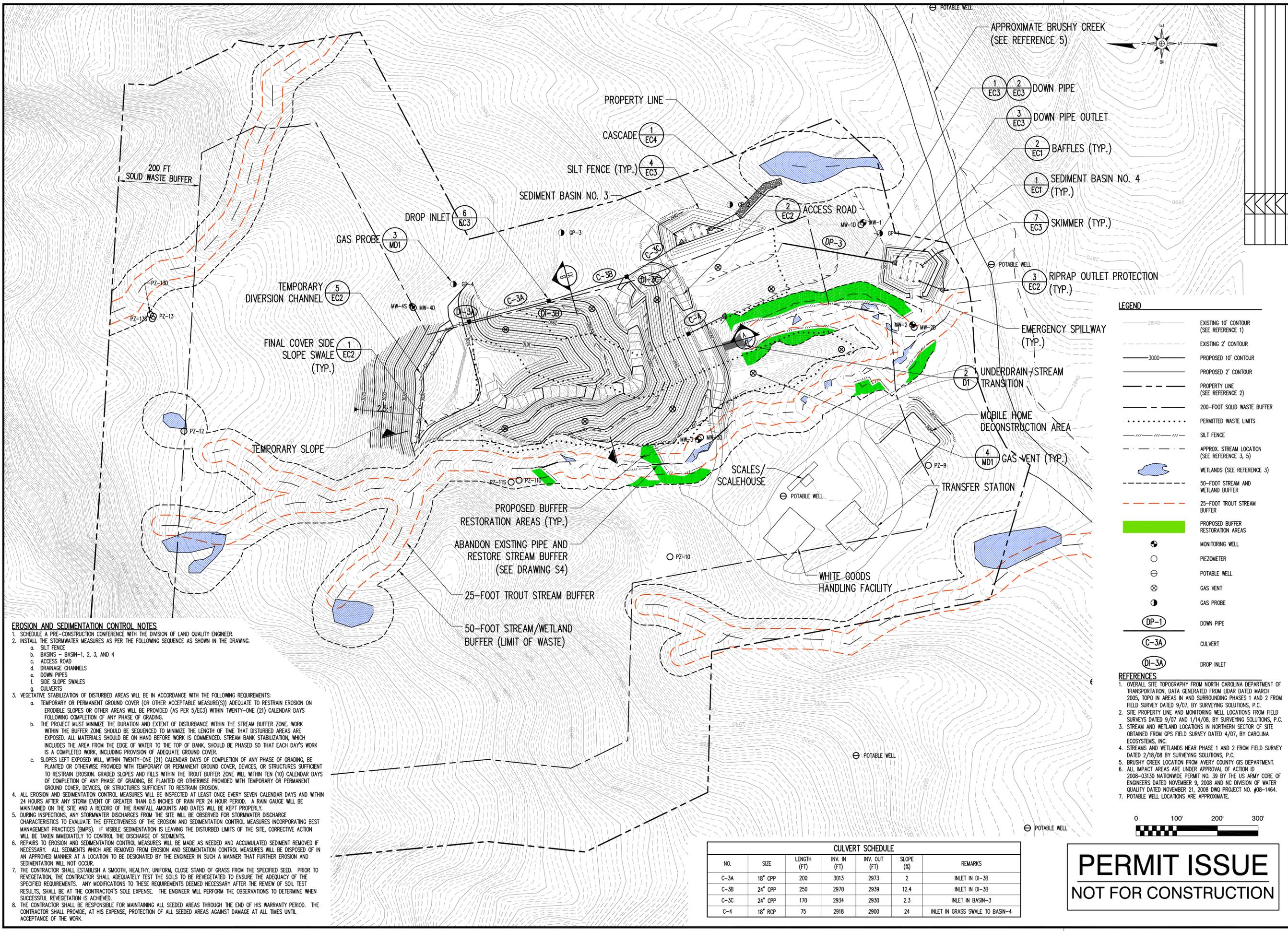
- LEGEND**
- 2840 — EXISTING 10' CONTOUR (SEE REFERENCE 1)
 - — — EXISTING 2' CONTOUR
 - 3000 — PROPOSED 10' CONTOUR
 - — — PROPOSED 2' CONTOUR
 - — — PROPERTY LINE (SEE REFERENCE 2)
 - — — 200-FOOT SOLID WASTE BUFFER
 - PERMITTED WASTE LIMITS
 - — — LIMITS OF DISTURBANCE
 - — — SILT FENCE
 - — — APPROX. STREAM LOCATION (SEE REFERENCE 3, 5)
 - WETLANDS (SEE REFERENCE 3)
 - — — 50-FOOT STREAM AND WETLAND BUFFER
 - — — 25-FOOT TROUT STREAM BUFFER
 - PROPOSED BUFFER RESTORATION AREAS
 - MONITORING WELL
 - PIEZOMETER
 - ⊕ POTABLE WELL
 - DP-1 DOWN PIPE
 - C-3A CULVERT
 - DI-3A DROP INLET

- REFERENCES**
- OVERALL SITE TOPOGRAPHY FROM NORTH CAROLINA DEPARTMENT OF TRANSPORTATION, DATA GENERATED FROM LIDAR DATED MARCH 2005, TOPO IN AREAS IN AND SURROUNDING PHASES 1 AND 2 FROM FIELD SURVEY DATED 9/07, BY SURVEYING SOLUTIONS, P.C.
 - SITE PROPERTY LINE AND MONITORING WELL LOCATIONS FROM FIELD SURVEYS DATED 9/07 AND 1/14/08, BY SURVEYING SOLUTIONS, P.C.
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 - STREAMS AND WETLANDS NEAR PHASE 1 AND 2 FROM FIELD SURVEY DATED 2/18/08 BY SURVEYING SOLUTIONS, P.C.
 - BRUSHY CREEK LOCATION FROM AVERY COUNTY GIS DEPARTMENT.
 - ALL IMPACT AREAS ARE UNDER APPROVAL OF ACTION ID 2008-03130 NATIONWIDE PERMIT NO. 39 BY THE US ARMY CORE OF ENGINEERS DATED NOVEMBER 9, 2008 AND NC DIVISION OF WATER QUALITY DATED NOVEMBER 21, 2008 DWO PROJECT NO. #08-1464.
 - POTABLE WELL LOCATIONS ARE APPROXIMATE.

CULVERT SCHEDULE

NO.	SIZE	LENGTH (FT)	INV. IN (FT)	INV. OUT (FT)	SLOPE (%)	REMARKS
C-3A	18" CPP	200	3013	2973	2	INLET IN DI-3B
C-3B	24" CPP	250	2970	2939	12.4	INLET IN DI-3B
C-3C	24" CPP	170	2934	2930	2.3	INLET IN BASIN-3
C-4	18" RCP	75	2918	2900	24	INLET IN GRASS SWALE TO BASIN-4

PERMIT ISSUE
NOT FOR CONSTRUCTION



- LEGEND**
- 2640 — EXISTING 10' CONTOUR (SEE REFERENCE 1)
 - 3000 — EXISTING 2' CONTOUR
 - 3000 — PROPOSED 10' CONTOUR
 - 3000 — PROPOSED 2' CONTOUR
 - - - - - PROPERTY LINE (SEE REFERENCE 2)
 - - - - - 200-FOOT SOLID WASTE BUFFER
 - - - - - PERMITTED WASTE LIMITS
 - - - - - SILT FENCE
 - - - - - APPROX. STREAM LOCATION (SEE REFERENCE 3, 5)
 - WETLANDS (SEE REFERENCE 3)
 - 50-FOOT STREAM AND WETLAND BUFFER
 - 25-FOOT TROUT STREAM BUFFER
 - PROPOSED BUFFER RESTORATION AREAS
 - MONITORING WELL
 - PIEZOMETER
 - POTABLE WELL
 - GAS VENT
 - GAS PROBE
 - DP-1 DOWN PIPE
 - C-3A CULVERT
 - DI-3A DROP INLET

- REFERENCES**
1. OVERALL SITE TOPOGRAPHY FROM NORTH CAROLINA DEPARTMENT OF TRANSPORTATION, DATA GENERATED FROM LIDAR DATED MARCH 2005, TOPO IN AREAS IN AND SURROUNDING PHASES 1 AND 2 FROM FIELD SURVEY DATED 9/07, BY SURVEYING SOLUTIONS, P.C.
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 7. POTABLE WELL LOCATIONS ARE APPROXIMATE.

EROSION AND SEDIMENTATION CONTROL NOTES

1. SCHEDULE A PRE-CONSTRUCTION CONFERENCE WITH THE DIVISION OF LAND QUALITY ENGINEER.
2. INSTALL THE STORMWATER MEASURES AS PER THE FOLLOWING SEQUENCE AS SHOWN IN THE DRAWING.
 - a. SILT FENCE
 - b. BASINS - BASIN-1, 2, 3, AND 4
 - c. ACCESS ROAD
 - d. DRAINAGE CHANNELS
 - e. DOWN PIPES
 - f. SIDE SLOPE SWALES
 - g. CULVERTS
3. VEGETATIVE STABILIZATION OF DISTURBED AREAS WILL BE IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS:
 - a. TEMPORARY OR PERMANENT GROUND COVER (OR OTHER ACCEPTABLE MEASURE(S)) ADEQUATE TO RESTRAIN EROSION ON ERODIBLE SLOPES OR OTHER AREAS WILL BE PROVIDED (AS PER 5/EC3) WITHIN TWENTY-ONE (21) CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING.
 - b. THE PROJECT MUST MINIMIZE THE DURATION AND EXTENT OF DISTURBANCE WITHIN THE STREAM BUFFER ZONE. WORK WITHIN THE BUFFER ZONE SHOULD BE SEQUENCED TO MINIMIZE THE LENGTH OF TIME THAT DISTURBED AREAS ARE EXPOSED. ALL MATERIALS SHOULD BE ON HAND BEFORE WORK IS COMMENCED. STREAM BANK STABILIZATION, WHICH INCLUDES THE AREA FROM THE EDGE OF WATER TO THE TOP OF BANK, SHOULD BE PHASED SO THAT EACH DAY'S WORK IS A COMPLETED WORK, INCLUDING PROVISION OF ADEQUATE GROUND COVER.
 - c. SLOPES LEFT EXPOSED WILL, WITHIN TWENTY-ONE (21) CALENDAR DAYS OF COMPLETION OF ANY PHASE OF GRADING, BE PLANTED OR OTHERWISE PROVIDED WITH TEMPORARY OR PERMANENT GROUND COVER, DEVICES, OR STRUCTURES SUFFICIENT TO RESTRAIN EROSION. GRADED SLOPES AND FILLS WITHIN THE TROUT BUFFER ZONE WILL WITHIN TEN (10) CALENDAR DAYS OF COMPLETION OF ANY PHASE OF GRADING, BE PLANTED OR OTHERWISE PROVIDED WITH TEMPORARY OR PERMANENT GROUND COVER DEVICES, OR STRUCTURES SUFFICIENT TO RESTRAIN EROSION.
4. ALL EROSION AND SEDIMENTATION CONTROL MEASURES WILL BE INSPECTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS AFTER ANY STORM EVENT OF GREATER THAN 0.5 INCHES OF RAIN PER 24 HOUR PERIOD. A RAIN GAUGE WILL BE MAINTAINED ON THE SITE AND A RECORD OF THE RAINFALL AMOUNTS AND DATES WILL BE KEPT PROPERLY.
5. DURING INSPECTIONS, ANY STORMWATER DISCHARGES FROM THE SITE WILL BE OBSERVED FOR STORMWATER DISCHARGE CHARACTERISTICS TO EVALUATE THE EFFECTIVENESS OF THE EROSION AND SEDIMENTATION CONTROL MEASURES INCORPORATING BEST MANAGEMENT PRACTICES (BMPs). IF VISIBLE SEDIMENTATION IS LEAVING THE DISTURBED LIMITS OF THE SITE, CORRECTIVE ACTION WILL BE TAKEN IMMEDIATELY TO CONTROL THE DISCHARGE OF SEDIMENTS.
6. REPAIRS TO EROSION AND SEDIMENTATION CONTROL MEASURES WILL BE MADE AS NEEDED AND ACCUMULATED SEDIMENT REMOVED IF NECESSARY. ALL SEDIMENTS WHICH ARE REMOVED FROM EROSION AND SEDIMENTATION CONTROL MEASURES WILL BE DISPOSED OF IN AN APPROVED MANNER AT A LOCATION TO BE DESIGNATED BY THE ENGINEER IN SUCH A MANNER THAT FURTHER EROSION AND SEDIMENTATION WILL NOT OCCUR.
7. THE CONTRACTOR SHALL ESTABLISH A SMOOTH, HEALTHY, UNIFORM, CLOSE STAND OF GRASS FROM THE SPECIFIED SEED. PRIOR TO REVEGETATION, THE CONTRACTOR SHALL ADEQUATELY TEST THE SOILS TO BE REVEGETATED TO ENSURE THE ADEQUACY OF THE SPECIFIED REQUIREMENTS. ANY MODIFICATIONS TO THESE REQUIREMENTS DEEMED NECESSARY AFTER THE REVIEW OF SOIL TEST RESULTS, SHALL BE AT THE CONTRACTOR'S SOLE EXPENSE. THE ENGINEER WILL PERFORM THE OBSERVATIONS TO DETERMINE WHEN SUCCESSFUL REVEGETATION IS ACHIEVED.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL SEEDED AREAS THROUGH THE END OF HIS WARRANTY PERIOD. THE CONTRACTOR SHALL PROVIDE, AT HIS EXPENSE, PROTECTION OF ALL SEEDED AREAS AGAINST DAMAGE AT ALL TIMES UNTIL ACCEPTANCE OF THE WORK.

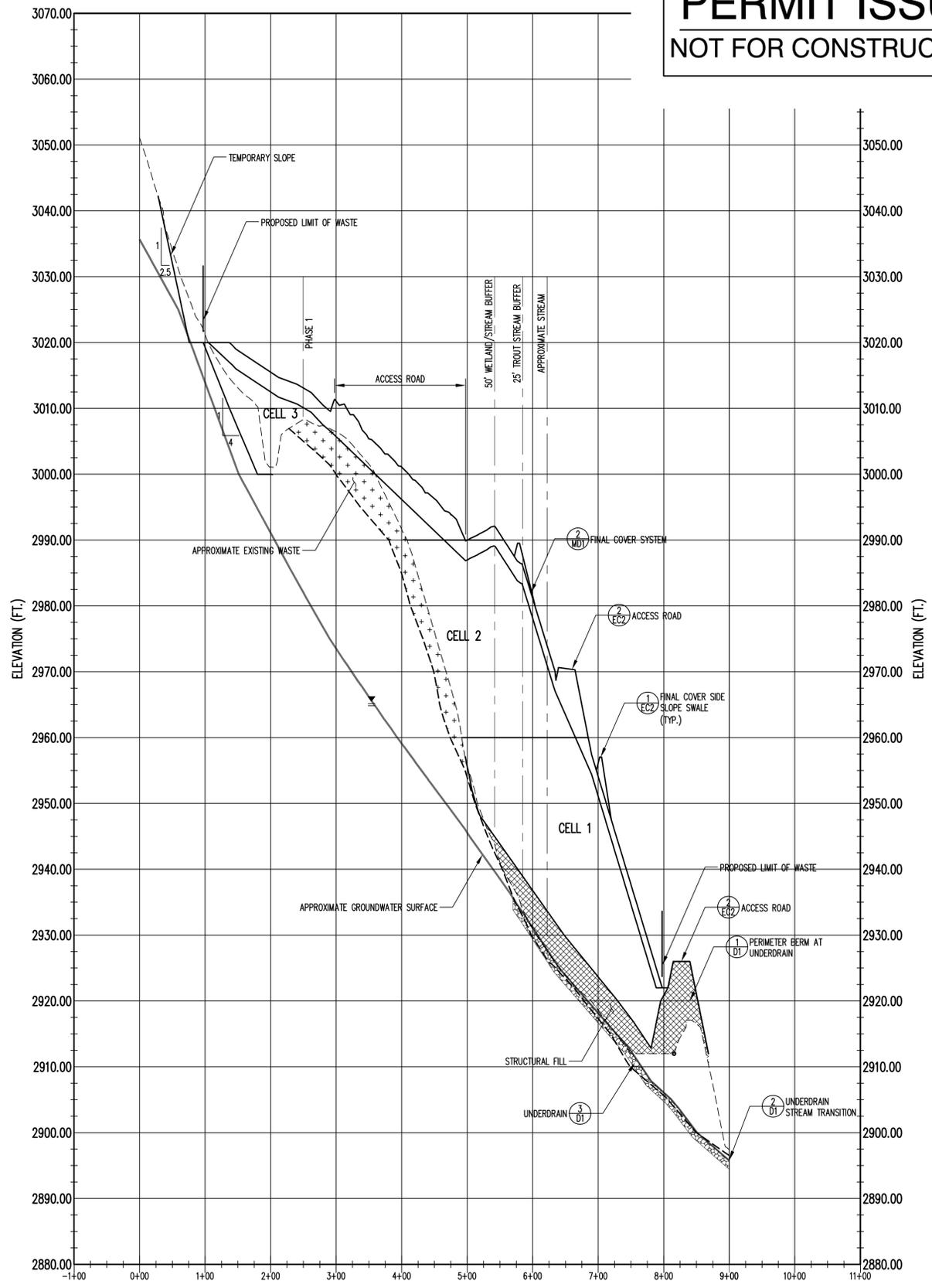
CULVERT SCHEDULE

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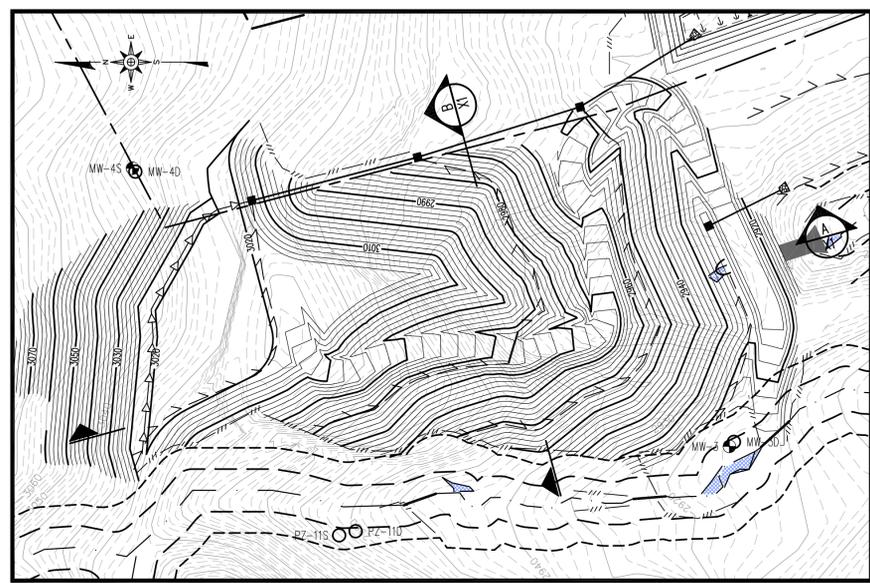
**PERMIT ISSUE
 NOT FOR CONSTRUCTION**

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**PERMIT ISSUE
NOT FOR CONSTRUCTION**



SECTION AA
DETAIL A
NOT TO SCALE X1



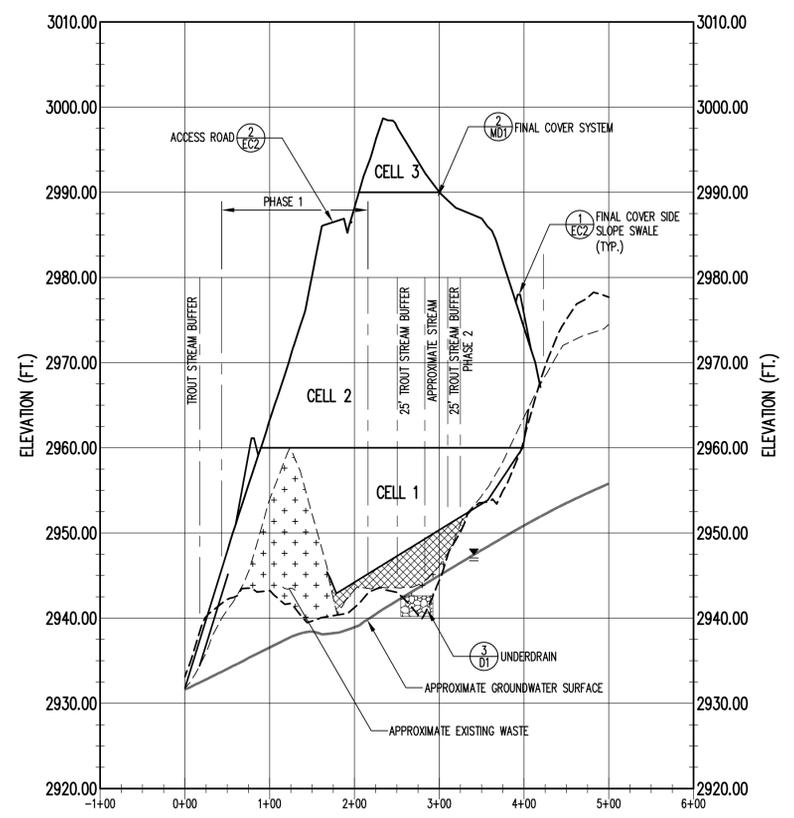
SECTION LOCATION MAP
SCALE: 1" = 100'

LEGEND

- 2840 — EXISTING 10' CONTOUR (SEE REFERENCE 1)
- - - - - EXISTING 2' CONTOUR
- 3000 — PROPOSED 10' CONTOUR
- - - - - PROPOSED 2' CONTOUR
- - - - - PROPERTY LINE (SEE REFERENCE 2)
- - - - - 200-FOOT SOLID WASTE BUFFER
- PERMITTED WASTE LIMITS
- - - - - SILT FENCE
- - - - - APPROX. STREAM LOCATION (SEE REFERENCE 3, 5)
- WETLANDS (SEE REFERENCE 3)
- - - - - 50-FOOT STREAM AND WETLAND BUFFER
- - - - - 25-FOOT TROUT STREAM BUFFER

REFERENCES

1. OVERALL SITE TOPOGRAPHY FROM NORTH CAROLINA DEPARTMENT OF TRANSPORTATION, DATA GENERATED FROM LIDAR DATED MARCH 2005, TOPO IN AREAS IN AND SURROUNDING PHASES 1 AND 2 FROM FIELD SURVEY DATED 9/07, BY SURVEYING SOLUTIONS, P.C.
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4. STREAMS AND WETLANDS NEAR PHASE 1 AND 2 FROM FIELD SURVEY DATED 2/18/08 BY SURVEYING SOLUTIONS, P.C.
5. BRUSHY CREEK LOCATION FROM AVERY COUNTY GIS DEPARTMENT, DRAWING ENTITLED "CONCEPTUAL DESIGN, SHEET 1 OF 1", DATED 6/22/95, PREPARED BY MUNICIPAL ENGINEERING SERVICES, P.A. EXPANSION LIMITS UPDATED TO REFLECT PENDING PERMITTING, SEE DRAWING "BASE GRADING PLAN" BY RSG ENGINEERS.



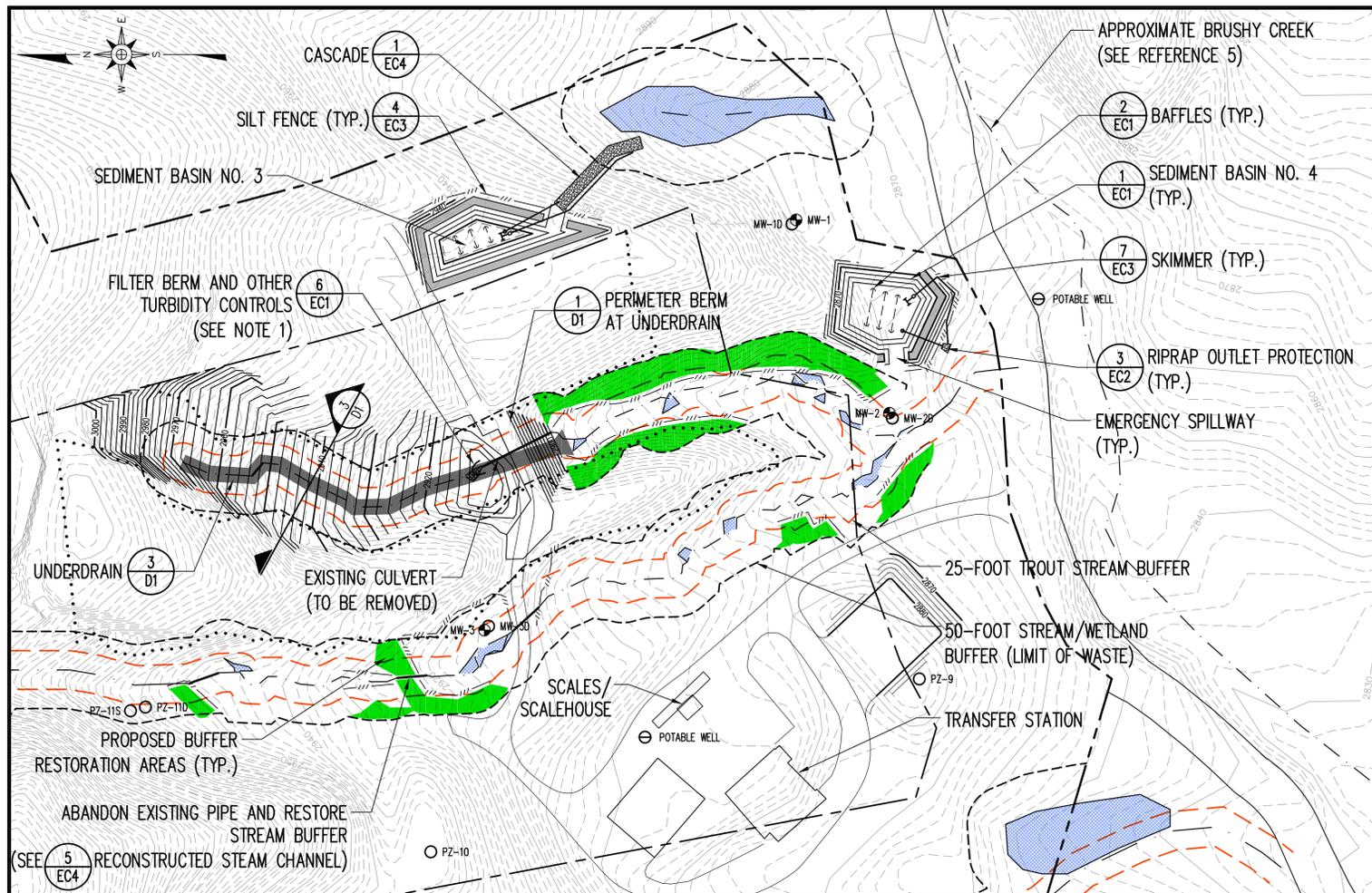
SECTION BB
DETAIL B
NOT TO SCALE X1

RICHARDSON SMITH GARDNER & ASSOCIATES
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.rsgengineers.com
ph: 919-828-0077
fax: 919-828-3899

SEAL
SEAL
PROJECT TITLE:
**AVERY COUNTY
C&D LANDFILL
PHASE 3
PERMIT TO CONSTRUCT**

SECTIONS

DESIGNED BY: S.A.S.	DRAWN BY: J.A.L.
CHECKED BY:	PROJECT NO.: AVERY 08-4
SCALE: AS SHOWN	DATE: FEB. 2009
FILE NAME: AVERY-00068	DRAWING NO.:
SHEET NO. 7	DRAWING NO. X1



LEGEND

- 2840 EXISTING 10' CONTOUR (SEE REFERENCE 1)
- EXISTING 2' CONTOUR
- 3000 PROPOSED 10' CONTOUR
- PROPOSED 2' CONTOUR
- PROPERTY LINE (SEE REFERENCE 2)
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- 50-FOOT STREAM AND WETLAND BUFFER
- 25-FOOT TROUT STREAM BUFFER
- WETLAND IMPACT AREA
- PROPOSED BUFFER RESTORATION AREAS
- MONITORING WELL
- PIEZOMETER
- SKIMMER, ANCHOR BLOCK AND LOW-FLOW EFFLUENT COOLING PIPE

NOTE

1. TURBIDITY CONTROL: IF THE AMOUNT OF SURFACE FLOW AND GROUNDWATER EXCEEDS THE CAPACITY OF THE FILTER BERM TO CONTROL TURBIDITY (AS DEFINED BY NPDES REQUIREMENTS), THEN RUNOFF MUST BE CONTAINED, MIXED WITH POLYACRYLAMIDE FLOCCULANT, AND PUMPED THROUGH A GEOTEXTILE DEWATERING BAG.

REFERENCES

- OVERALL SITE TOPOGRAPHY FROM NORTH CAROLINA DEPARTMENT OF TRANSPORTATION, DATA GENERATED FROM LIDAR DATED MARCH 2005, TOPO IN AREAS IN AND SURROUNDING PHASES 1 AND 2 FROM FIELD SURVEY DATED 9/07, BY SURVEYING SOLUTIONS, P.C.
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- BRUSHY CREEK LOCATION FROM AVERY COUNTY GIS DEPARTMENT.

0 100' 200' 300'

RESTORATION PLANTING

Step 1
Soil must be uncompacted with a good quality topsoil in the upper part. The soil should be moist to the surface at time of planting.

Step 2
Dig hole to a depth equal to the height of the root ball. The hole should be dug at an angle and large enough to allow roots to hang without excessive bending.

Step 3
Refill hole with previously dug soil. Air pockets may remain.

Step 4
Firm soil to remove air pockets and to get root to soil contact. Do not compact the soil! Leave the ground level.

Step 5
Add an organic mulch layer.

DETAIL 1 S4
NOT TO SCALE

PERMIT ISSUE
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ph: 919-228-0577
fax: 919-228-3889

DATE: _____
NO. _____
REVISION: _____

SCALE: _____

PROJECT TITLE: _____

DRAWING TITLE: _____

RESTORATION PLAN

Avery County Landfill On-Site Mitigation Plan

This on-site mitigation plan has been developed based on the need to have a stable, healthy, and natural plant community established along the on-site streams where disturbance has occurred or waste will be removed. The site and surrounding area was investigated to determine existing conditions and to develop the target plant community to restore to these areas. It was determined that the Chestnut Oak Forest community type as described in *Classification of the Natural Communities of North Carolina - Third Approximation* was the appropriate target community for these stream buffer areas. This plan will provide for a stable stream buffer with plant species that should restore these areas to the natural plant communities that was likely here prior to their disturbance.

In addition, this plan addresses the remediation of previous impacts to the streams on site. This includes removal of sediment from the perennial channel between the landfill cells and removal of an existing 40' pipe in the channel to the west of the landfill. This work is intended to allow the aquatic habitat in the streams to recover, and to improve water quality in the streams and downstream trout habitat.

1.0 Stream Buffer Restoration Plan

1.1 Soil Preparation

The site will undergo large earth moving activities prior to the restoration efforts. These activities will likely result in compacted soil and subsoil. The areas to be restored as stream buffer will need to be properly prepared to ensure adequate growing conditions. If compaction or loss of topsoil has occurred, the following actions must be taken in the stream buffer restoration areas before final seeded/woody planting preparation begins.

- All disturbed areas within the buffer restoration zones that have been compacted must be rip-tilled in such a manner as to allow plant root growth in the subsoil. All heavy equipment such as large excavators/bulldozers is prohibited from entering the restoration zone after the rip-tilling has been completed.
- In disturbed areas within the buffer restoration zones, final grade elevations shall be attained by the application of 6 to 10 inches of topsoil to all disturbed areas within the restoration zones.
- The topsoil shall be disked to ensure proper connection with the subsoil and prevention of surface compaction. This activity shall be done in dry weather conditions with satisfactory soil moisture.
- All erosion control/permanent seeding soil preparation criteria shall then be implemented. See **Erosion Control Notes** for details.

1.2 Stream Buffer Plant List

(SB): All disturbed areas denoted on plans as SB shall be planted with plants selected from the following list.

Scientific Name	Common Name	Layer	Spacing (ft) On-Center	Plant Size	Distribution
<i>Pinus strobus</i>	White Pine	Tree	8x8	Container	Random
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree	8x8	Container	Random
<i>Quercus prinus</i>	Chestnut Oak	Tree	8x8	Container	Random
<i>Quercus rubra</i>	Northern Red Oak	Tree	8x8	Container	Random
<i>Quercus coccinea</i>	Scarlet Oak	Tree	8x8	Container	Random
<i>Fagus grandifolia</i>	American Beech	Tree	8x8	Container	Random
<i>Acer rubrum</i>	Red Maple	Tree	8x8	Container	Random
<i>Carpinus caroliniana</i>	Ironwood	Tree	8x8	Container	Random
<i>Kalmia latifolia</i>	Mountain Laurel	Shrub	8x8	Container	Random
<i>Rhododendron maximum</i>	Great Laurel	Shrub	8x8	Container	Random

1.3 Planting Requirements

- The Stream Buffer Zone shall be planted with at least six (6) of the above species.
- No species shall make up more than 30% of the total planted stems in each SB area.
- No species shall make up less than 10% of the total planted stems in each SB area.
- No plant substitutions beyond the list above are allowed.

The following are the weather and soil conditions that must be present at the site during all planting of the stream buffer zones.

- Temperature greater than 35°F and less than 85°F
- Relative Humidity greater than 30%
- Wind less than 10 miles/hour
- Soil is moist to the surface
- Soil surface is protected by an organic mulch layer or equivalent protection
- Soil has been ripped and disked such that compaction will not inhibit growth

The stream buffer restoration areas should be adequately marked before planting commences.

The correct spacing of vegetation should be checked by the On-Site Supervisor on a regular basis.

1.3.1 Plant Distribution

Random Distribution - take all six (6) plant species selected for planting from the plant list in the proper percentages to meet the planting requirements. Mix the plants so that they are all planted randomly at the 8' spacing called for in this plan. If done properly, sometimes two or more of the same species will be planted adjacent to each other and other times there may only be one plant of a species completely surrounded by one or more other species.

1.3.2 Planting Method

The following describes the general planting techniques to be followed when installing the plants. However, these techniques may be modified if the contractor believes that other techniques will improve health and survival of the plants.

Containerized Plants (equal to or larger than 16 cubic inches)

- Containerized plants must be robust healthy growing plants.
- The root system must be vigorous and dense enough to hold the shape of the container once removed.
- Container vegetation must always be handled by the container and never by the tops of the plants.
- Containerized plants must be stored in the shade and kept moist until installation.
- If soil is compacted, the area of planting shall be loosened to a depth equal to that of the root ball for a radius of one (1) feet around each plant.
- Install containerized plants only when soil is moist and/or wet.
- Before installation, remove any damaged roots and loosen any circling or compacted roots.
- Install containerized plants using an appropriate implement such that a hole is created that will allow the plant to be inserted without any bending, binding, or breaking of roots.
- Container stock shall be planted in a vertical position with the root collar approximately 0.5 inches below the soil surface. The planting trench or hole shall be deep and wide enough to permit roots to spread out and down without J-rooting.
- After planting, the soil shall be tamped firmly to eliminate air pockets.
- A 2 foot radius of a 3- to 4-inch layer of organic mulch such as straw must then be placed on the soil surface around the entire plant.
- If dry conditions occur following planting, a method to water the plants should be developed and implemented.

Plant spacing is called out on a grid basis such as 8 x 8, etc. This spacing refers to planting the plants 8 feet apart from each other in all directions within a planting zone. This spacing does not relate to planting distance from other zones or the planting distance at the zone boundary.

Planting shall begin 2' in from the planting zone boundary nearest to the stream. Planting will then proceed away from the stream on an 8' spacing. The plants will be planted along all other boundaries to within a distance of 4 feet or less from any boundary edge. This is likely to result in an outer row being planted closer than the designated 8' spacing.

Some existing stream buffer areas are to remain undisturbed. These areas should be protected from encroachment and no additional planting will be done in these areas. If some of these areas are impacted during construction activities, then the stream buffer restoration plan shall be implemented for those areas as well.

In addition to the woody plants to be planted in the stream buffer areas, the soil will be prepared, seeded and protected according to the temporary and permanent seeding requirements for the entirety of the site. However, no fescue, lespedeza, or other aggressive nonnative grasses are allowed to be planted in the stream buffer areas.

1.3.3 Planting Warranty

For all planted material, the contractor shall warrant an 80% survival rate against defects including mortality and poor growth, except for defects resulting from abuse by other parties and abnormal weather conditions.

2.0 Stream Daylighting and Remediation

2.1 Stream Daylighting

The approximate 40' pipe within the stream channel just west of the existing landfill, and within the proposed buffer restoration area, will be removed and the banks returned to natural conditions. This will be accomplished through the following steps:

- Removing the pipe during a dry period with low-flow conditions in the stream channel.
- Reestablishing the banks to match upstream and downstream contours.
- Stabilizing the stream banks with erosion control blanket down to, but not including, the bed of the stream.
- Planting the stream bank as described in Section 1.0 of this plan, along with the associated buffers.
- Appropriate sediment and erosion control measures will be used during this work.

2.2 Sediment Removal

The perennial channel between the two landfill cells, from the road crossing down to its confluence with the larger stream, will be enhanced through the removal of deposited sediment from within the channel. This will be accomplished in the following manner:

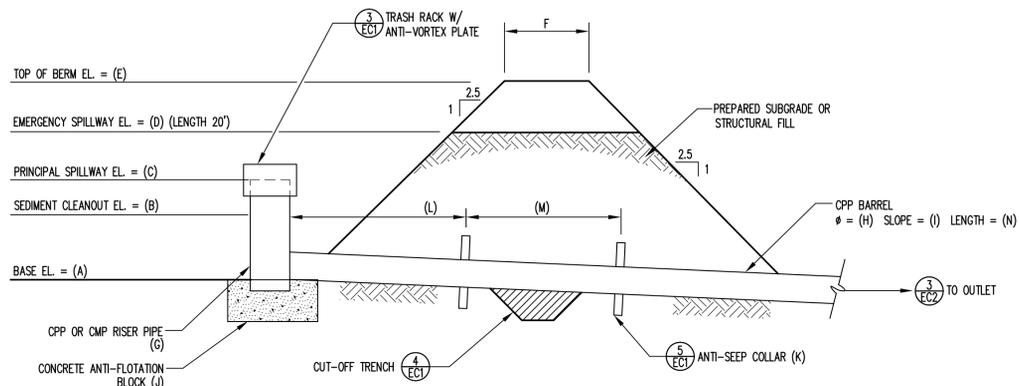
- Carolina Ecosystems, Inc. or other qualified personnel will inspect the stream channel prior to the start of the work, and place staking along the banks to indicate the areas and approximate depth of the sediment removal.
- Removal of the sediment will be performed by hand using shovels or other hand tools. No mechanized equipment will be used within the channel.
- Several staging areas for excavated materials will be established along the channel for deposition of the material. This material will then be moved by on-site equipment to an appropriate location with adequate sediment and erosion controls.
- The staging areas will be located in coordination with the buffer restoration and will be planted as described in Section 1.0 when work is completed. Each staging area will have silt fence placed on the downstream sides to prevent material from re-entering the channel.
- Sediment will be removed down to a depth just above the original bed of the stream in order to not disturb the channel dimensions.
- This work will be performed during a low-flow or dry period and appropriate sediment and erosion control measures will be implemented during this work.

3.0 Conclusions

This plan will be implemented in conjunction with the Avery County Landfill expansion. It will serve to provide compensation for the removal of 408 linear feet of intermittent channel that currently does not provide significant aquatic habitat, and to remediate previous secondary impacts from landfill operations. The result of this work will be a decrease in sedimentation of downstream trout habitat, an increase in the stability of temperature fluctuations within the channel, and a re-colonization of the affected stream channel by typical aquatic macrobenthos over the long term.

EROSION CONTROL BLANKET NOTE

1. FOLLOWING SEEDING, APPLY A 4' STRIP OF EROSION CONTROL BLANKET TO ALL DISTURBED STREAM BANKS. THE BLANKET WILL BEGIN AT THE TOE OF THE STREAM BANK AT THE MOST DOWNSTREAM POINT OF THE PROJECT (THIS IS SO THE OVERLAPS WILL GO WITH THE FLOW OF THE STREAM). THE BOTTOM EDGE SHOULD BE HEEL OR TACKED INTO THE SOIL SO AS TO PREVENT FLOATING. WHEN A NEW PIECE OF BLANKET IS USED, IT MUST BE PLACED ON TOP OF THE PREVIOUSLY INSTALLED BLANKET AND OVERLAPPED BY TWO OR MORE FEET. BRING THE BLANKET UP AND OVER THE TOP OF THE STREAM BANK AND HEEL IN THE TOP EDGE. APPLY DEGRADABLE BLANKET STAKES TO ENSURE GOOD CONTACT WITH THE SOIL. ALL OTHER SEEDING AREAS WILL BE PROPERLY COVERED WITH WHEAT STRAW TO PROTECT THE SOIL SURFACE.



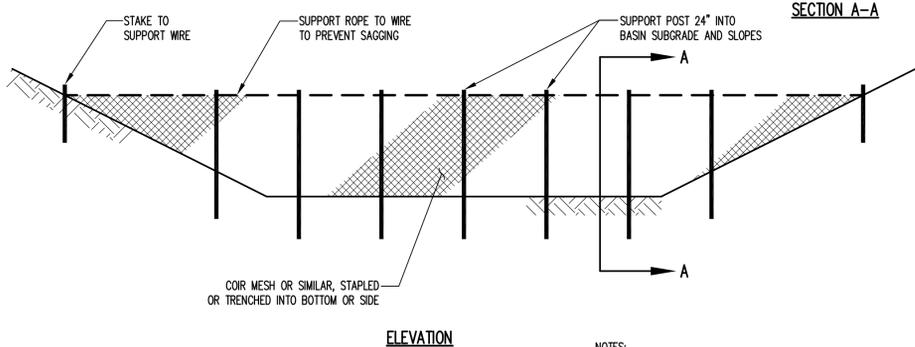
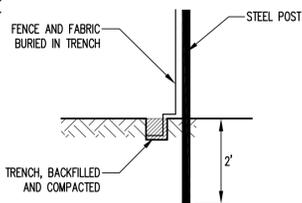
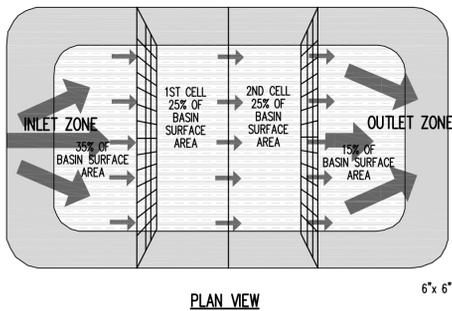
BASIN #	A (FT)	B (FT)	C (FT)	D (FT)	E (FT)	F (FT)	G (IN)	H (IN)	I (%)	J (FT)	K (FT)	L (FT)	M (FT)	N (FT)
3	2,929.0	2,931.2	2,934.0	2,935.0	2,936.0	10.0	18	15	1.0	3.0x3.0x1.5	3.5x3.5	10	16	100
4	2,864.0	2,865.2	2,867.0	2,868.5	2,870.0	10.0	18	15	6.7	3.0x3.0x2.0	3.0x3.0	10	12	60

NOTE:
 1. REFER TO DETAIL (7) FOR SKIMMER DETAIL.
 2. A SKIMMER SHALL BE PROVIDED IN EACH BASIN.

TYPICAL SEDIMENT BASIN CROSS SECTION

DETAIL 1 EC1
 NOT TO SCALE

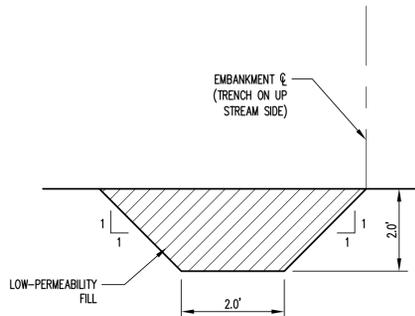
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STANDARD BAFFLES

DETAIL 2 EC1
 NOT TO SCALE

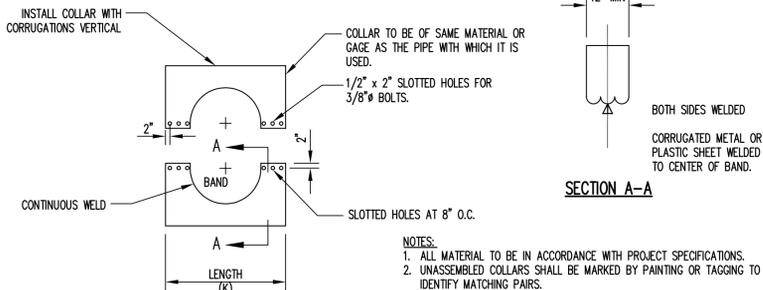
NOTES:
 1. BAFFLE MATERIAL SHOULD BE SECURED AT THE BOTTOM AND SIDES USING STAPLES OR BY TRENCHING AS FOR SILT FENCE.
 2. MOST OF THE SEDIMENT WILL ACCUMULATE IN THE FIRST BAY, WHICH SHOULD BE READILY ACCESSIBLE FOR MAINTENANCE.
 3. PROVIDE 3 BAFFLES (USE TWO IF LESS THAN 20 FEET IN LENGTH).
 4. BAFFLE SHALL BE 700 g/m² COIR EROSION BLANKET.
 5. TOPS OF BAFFLES SHOULD BE 2 INCHES LOWER THAN THE TOP OF THE BERMS.
 6. INSPECT BAFFLES FOR REPAIR ONCE A WEEK AND AFTER EACH RAINFALL.



NOTES:
 1. CUT-OFF TRENCH SHALL BE LOCATED IN UNDISTURBED SOIL.
 2. CUT-OFF TRENCH SHALL EXTEND THE LENGTH OF THE EMBANKMENT TO THE PRINCIPAL SPILLWAY CREST ELEVATION AT EACH END.

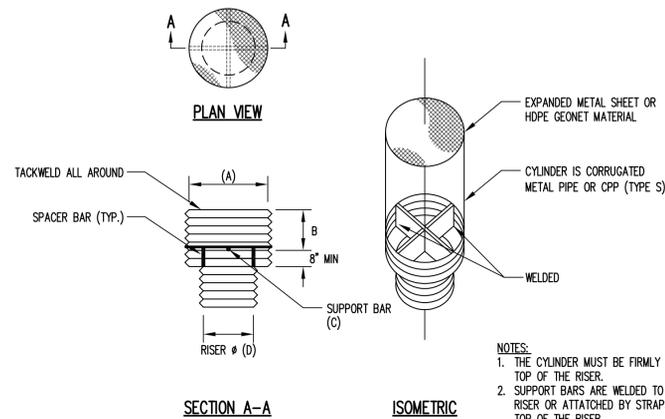
CUTOFF TRENCH

DETAIL 4 EC1
 NOT TO SCALE



ANTI-SEEP METAL

DETAIL 5 EC1
 NOT TO SCALE

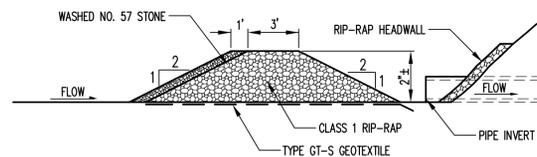
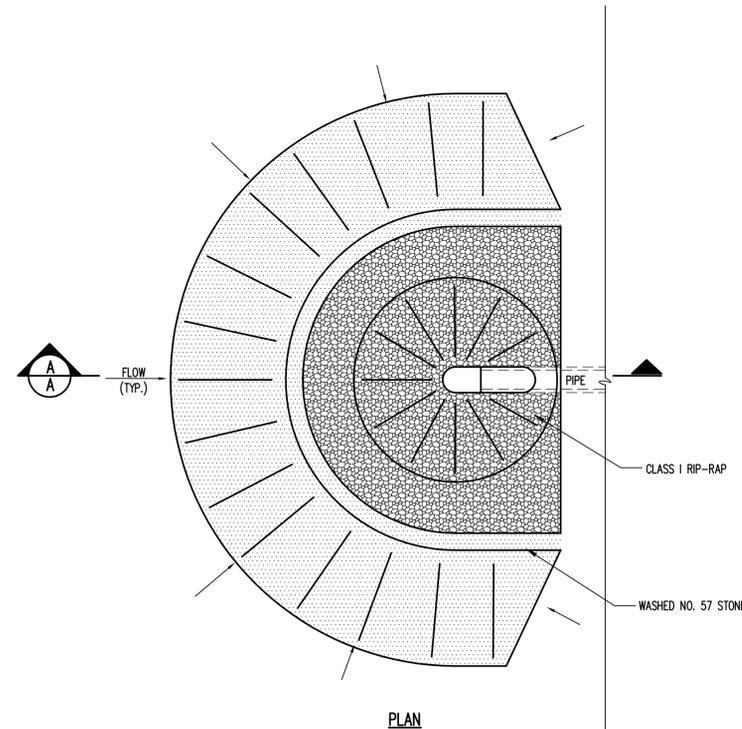


NOTES:
 1. THE CYLINDER MUST BE FIRMLY FASTENED TO THE TOP OF THE RISER.
 2. SUPPORT BARS ARE WELDED TO THE TOP OF THE RISER OR ATTACHED BY STRAPS BOLTED TO THE TOP OF THE RISER.

TRASH RACK ANTI-VORTEX

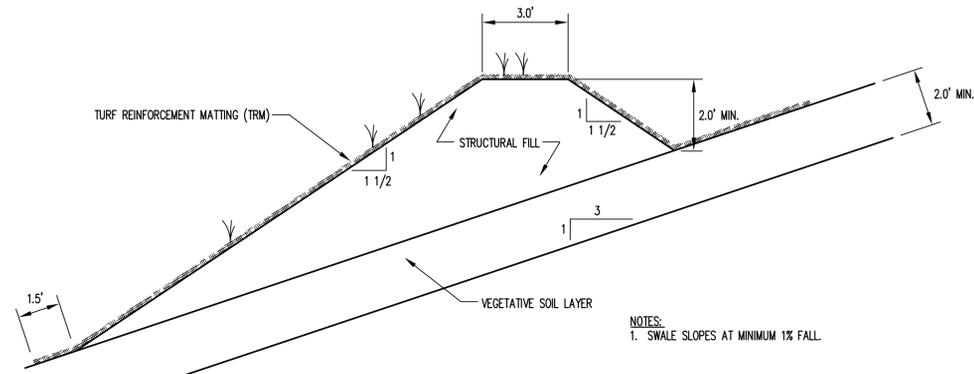
DETAIL 3 EC1
 NOT TO SCALE

TRASH RACK SCHEDULE				
BASIN	A (N)	B (N)	C (N)	D (N)
3	30	15	1/2	18
4	30	15	1/2	18



FILTER BERM

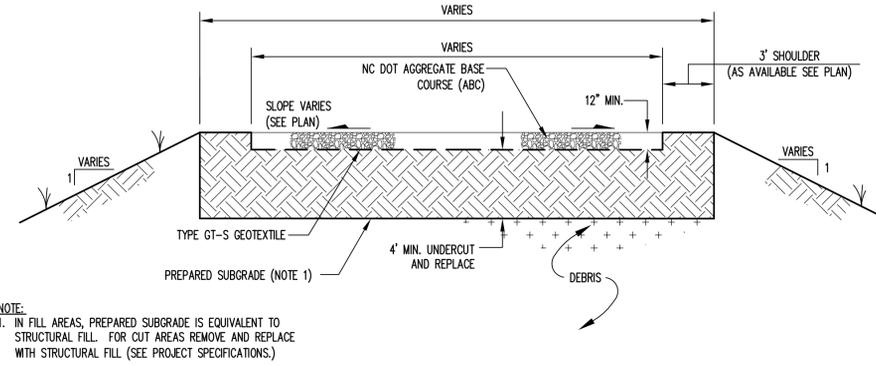
DETAIL 6 EC1
 NOT TO SCALE



FINAL COVER SIDE SLOPE SWALE

DETAIL 1 EC2
NOT TO SCALE

NOTES:
1. SWALE SLOPES AT MINIMUM 1% FALL.

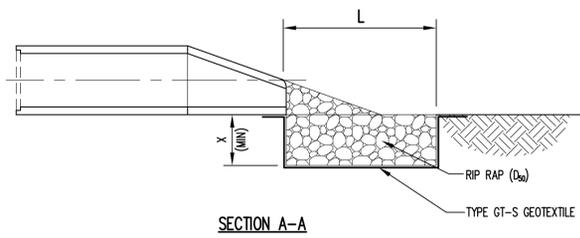


TYPICAL ROADWAY CROSS SECTION

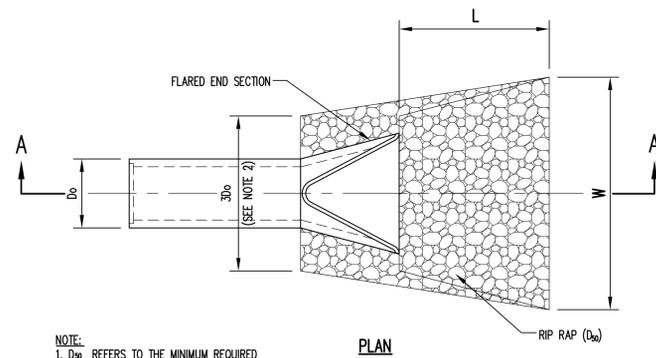
DETAIL 2 EC2
NOT TO SCALE

NOTE:
1. IN FILL AREAS, PREPARED SUBGRADE IS EQUIVALENT TO STRUCTURAL FILL. FOR CUT AREAS REMOVE AND REPLACE WITH STRUCTURAL FILL (SEE PROJECT SPECIFICATIONS.)

RIP RAP OUTLET PROTECTION SCHEDULE					
PIPE	D _o (IN)	L (FT)	W (FT)	D ₅₀ (FT)	X (FT)
BASIN-3	15	10	11.5	0.5	1.0
BASIN-4	15	10	11.5	0.5	1.0
DP-1	18	18	19.5	0.75	1.5
DP-2	18	20	21.5	0.75	1.5
DP-3	18	15	19.5	0.75	1.5
C-3C	24	18	20	0.5	1.0
C-4	18	10	11.5	0.25	0.5



SECTION A-A

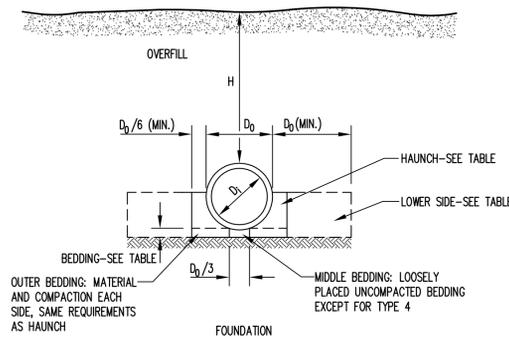


PLAN

NOTE:
1. D₅₀ REFERS TO THE MINIMUM REQUIRED AVERAGE STONE SIZE
2. FOR MORE THAN ONE PIPE, EXTEND RIP RAP 1.0' MIN. BEYOND OUTSIDE EDGES OF PIPES.

RIP RAP OUTLET PROTECTION

DETAIL 3 EC2
NOT TO SCALE



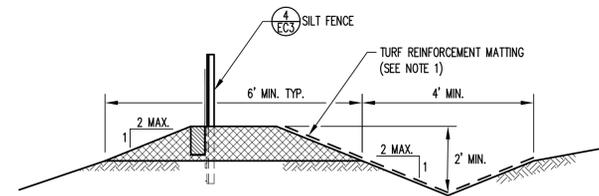
CONCRETE PIPE INSTALLATION

DETAIL 4 EC2
NOT TO SCALE

(BASED ON AMERICAN CONCRETE PIPE ASSOCIATION RECOMMENDATIONS)

STANDARD EMBANKMENT INSTALLATION SOILS AND MINIMUM COMPACTION REQUIREMENTS			
INSTALLATION TYPE	BEDDING THICKNESS	HAUNCH AND OUTER BEDDING	LOWER SIDE
TYPE 1	D _o /24*(600mm) MINIMUM, NOT LESS THAN 3"(75mm). IF ROCK FOUNDATION, USE D _o /12*(300mm) MINIMUM, NOT LESS THAN 6"(150mm).	95% SW, SP, GW, GP	90% SW, SP, GW, GP; 95% ML, SM, GM OR GC, SC WITH <20% PASSING NO.200 SIEVE; OR 100% CL, MH, SC, GC, CH.
TYPE 2	D _o /24*(600mm) MINIMUM, NOT LESS THAN 3"(75mm). IF ROCK FOUNDATION, USE D _o /12*(300mm) MINIMUM, NOT LESS THAN 6"(150mm).	90% SW, SP, GW, GP; OR 95% ML, SM, GM OR GC, SC WITH <20% PASSING NO.200 SIEVE	85% SW, SP, GW, GP; 90% ML, SM, GM OR GC, SC WITH <20% PASSING NO.200 SIEVE; OR 95% CL, MH, SC, GC, CH.
TYPE 3	D _o /24*(600mm) MINIMUM, NOT LESS THAN 3"(75mm). IF ROCK FOUNDATION, USE D _o /12*(300mm) MINIMUM, NOT LESS THAN 6"(150mm).	85% SW, SP, GW, GP; 90% ML, SM, GM OR GC, SC WITH <20% PASSING NO.200 SIEVE; OR 95% CL, MH, SC, GC, CH	85% SW, SP, GW, GP; 90% ML, SM, GM OR GC, SC WITH <20% PASSING NO.200 SIEVE; OR 95% CL, MH, SC, GC, CH.
TYPE 4	NO BEDDING REQUIRED, EXCEPT IF ROCK FOUNDATION, USE D _o /12*(300mm) MINIMUM, NOT LESS THAN 6"(150mm).	NO COMPACTION REQUIRED, EXCEPT IF CL, MH, SC, GC, CH USE 85%.	NO COMPACTION REQUIRED, EXCEPT IF CL, MH, SC, GC, CH USE 85%.

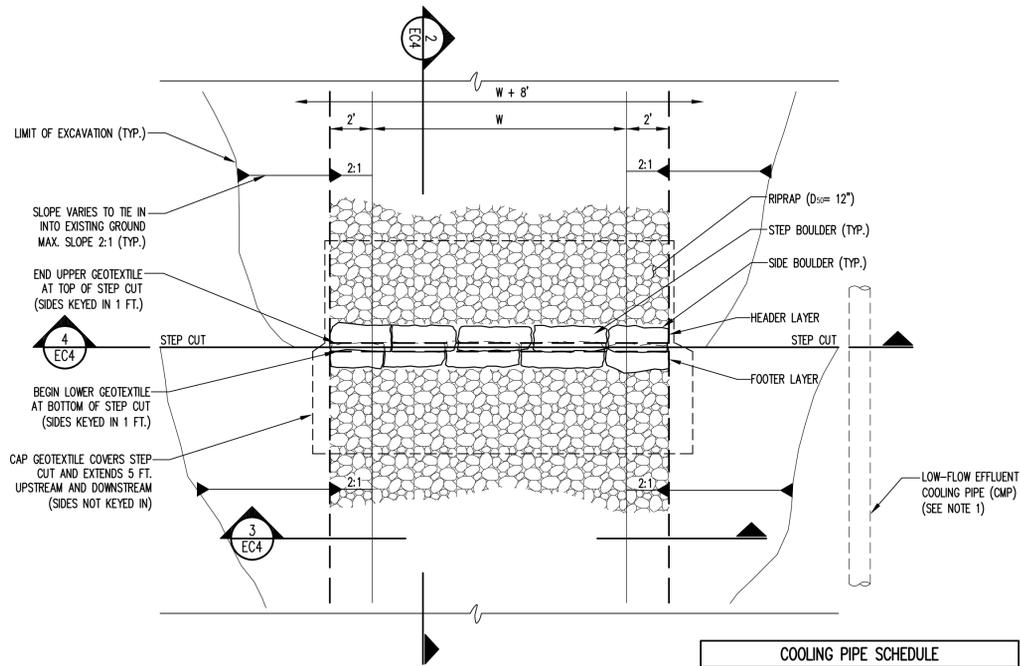
NOTES:
1. COMPACTION AND SOIL SYMBOLS (95% SW) REFER TO SW SOIL MATERIAL (USCS CLASSIFICATION) WITH A MINIMUM STANDARD PROCTOR COMPACTION (ASTM D 698) OF 95%.
2. SOIL IN THE OUTER BEDDING, HAUNCH, AND LOWER SIDE ZONES, EXCEPT WITHIN D_o/3 FROM THE PIPE SPRINGLINE, SHALL BE COMPACTED TO AT LEAST THE SAME COMPACTION AS THE MAJORITY OF THE SOIL IN THE OVERFILL ZONE.
3. SUBTRENCHES:
3.1. A SUBTRENCH IS DEFINED AS A TRENCH WITH ITS TOP BELOW FINISHED GRADE BY MORE THAN 0.1H OR, FOR ROADWAYS, ITS TOP IS AT AN ELEVATION LOWER THAN 1(0.3m) BELOW THE BOTTOM OF THE PAVEMENT BASE MATERIAL.
3.2. THE MINIMUM WIDTH OF A SUBTRENCH SHALL BE 1.33 D_o OR WIDER IF REQUIRED FOR ADEQUATE SPACE TO ATTAIN THE SPECIFIED COMPACTION IN THE HAUNCH AND BEDDING ZONES.
3.3. FOR SUBTRENCHES WITH WALLS OF NATURAL SOIL, ANY PORTION OF THE LOWER SIDE ZONE IN THE SUBTRENCH WALL SHALL BE AT LEAST AS FIRM AS AN EQUIVALENT SOIL PLACED TO THE COMPACTION REQUIREMENTS SPECIFIED FOR THE LOWER SIDE ZONE AND AS FIRM AS THE MAJORITY IF THE SOIL IN THE OVERFILL ZONE, OR SHALL BE REMOVED AND REPLACED WITH SOIL COMPACTED TO THE SPECIFIED LEVEL.



TEMPORARY DIVERSION CHANNEL

DETAIL 5 EC2
NOT TO SCALE

PERMIT ISSUE
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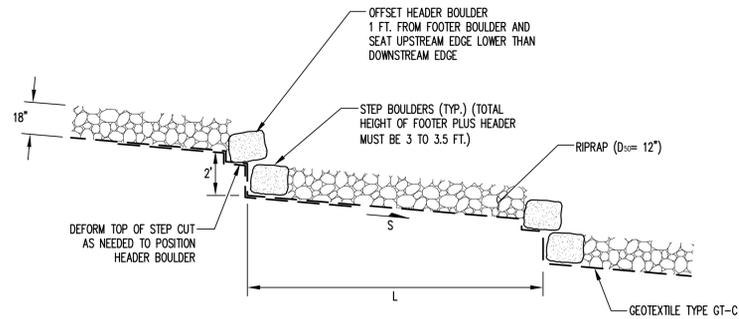


- NOTE:
1. LOW-FLOW EFFLUENT COOLING PIPES SHALL HAVE A MINIMUM SLOPE OF 0.5% AND SHALL DISCHARGE INTO RIP-RAP LINED AREAS, A FLARED END SECTION.
 2. MINIMUM SLOPE = 0.5%

TYPICAL PLAN - CASCADE

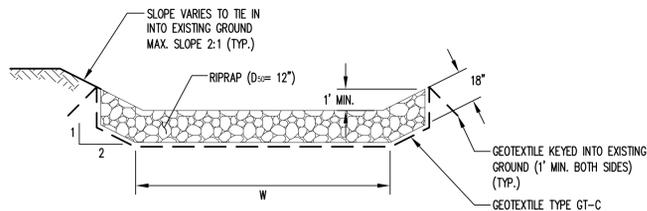
DETAIL 1 EC4
NOT TO SCALE

COOLING PIPE SCHEDULE		
BASIN	DIAMETER (INCHES)	AVERAGE SLOPE (%) (SEE NOTE 2)
1	6	0.9
2	6	12.0
3	6	10.4
4	6	2.2



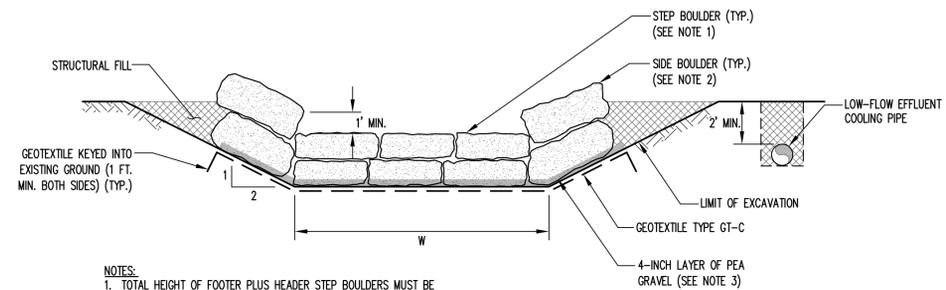
TYPICAL PROFILE - CASCADE

DETAIL 2 EC4
NOT TO SCALE



TYPICAL SECTION - CASCADE

DETAIL 3 EC4
NOT TO SCALE



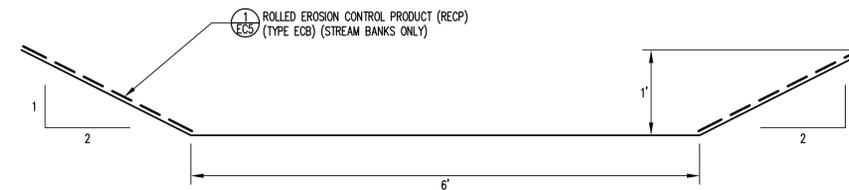
- NOTES:
1. TOTAL HEIGHT OF FOOTER PLUS HEADER STEP BOULDERS MUST BE 3 TO 3.5 FT.
 2. SIDE BOULDERS SHALL BE LARGER THAN STEP BOULDERS. TOTAL HEIGHT OF FOOTER PLUS HEADER SIDE BOULDERS MUST BE 3.5 TO 4.5 FT. AND MUST FORM A MIN. 1 FT. DEEP CHANNEL.
 3. PLACE 4-INCH LAYER OF PEA GRAVEL ON GEOTEXTILE BEFORE SETTING BOULDERS IN PLACE. PEA GRAVEL IS NOT REQUIRED UNDER RIPRAP.

TYPICAL SECTION - STEP

DETAIL 4 EC4
NOT TO SCALE

CASCADE STEP SCHEDULE					
STEP NO. FROM TOP DOWN	H (FEET)	TYPICAL L (FEET)	S (INTERSTEP SLOPE)	W (FEET)	REMARKS
CASCADE I.D.: SB-3 OUTLET					
1-17	2	7	5%	8	AVERAGE GROUND SLOPE = 32.0%

- NOTES:
1. FIELD ADJUST L TO MAINTAIN CHANNEL EXCAVATION BETWEEN 2.5 AND 4.5 FEET AND MATCH REQUIRED CASCADE LENGTH.
 2. CONTRACTOR SHALL PERFORM WORK IN THE PRESENCE OF AND TO THE SATISFACTION OF THE COA ENGINEER.
 3. CONTRACTOR MUST OBTAIN APPROVAL OF THE COA ENGINEER FOR EACH BOULDER PLACED.



- NOTE:
1. UPSTREAM AND DOWNSTREAM ENDS OF RECONSTRUCTED STREAM CHANNEL WILL BE ADAPTED IN THE FIELD TO MATCH EXISTING BANKS.
 2. THIS DETAIL IS PROVIDED FOR GENERAL GUIDANCE WHERE ACTUAL STREAM BANK AND BED SHALL PREVAIL AT THE DIRECTION OF THE ENGINEER.

RECONSTRUCTED STREAM CHANNEL

DETAIL 5 EC4
NOT TO SCALE

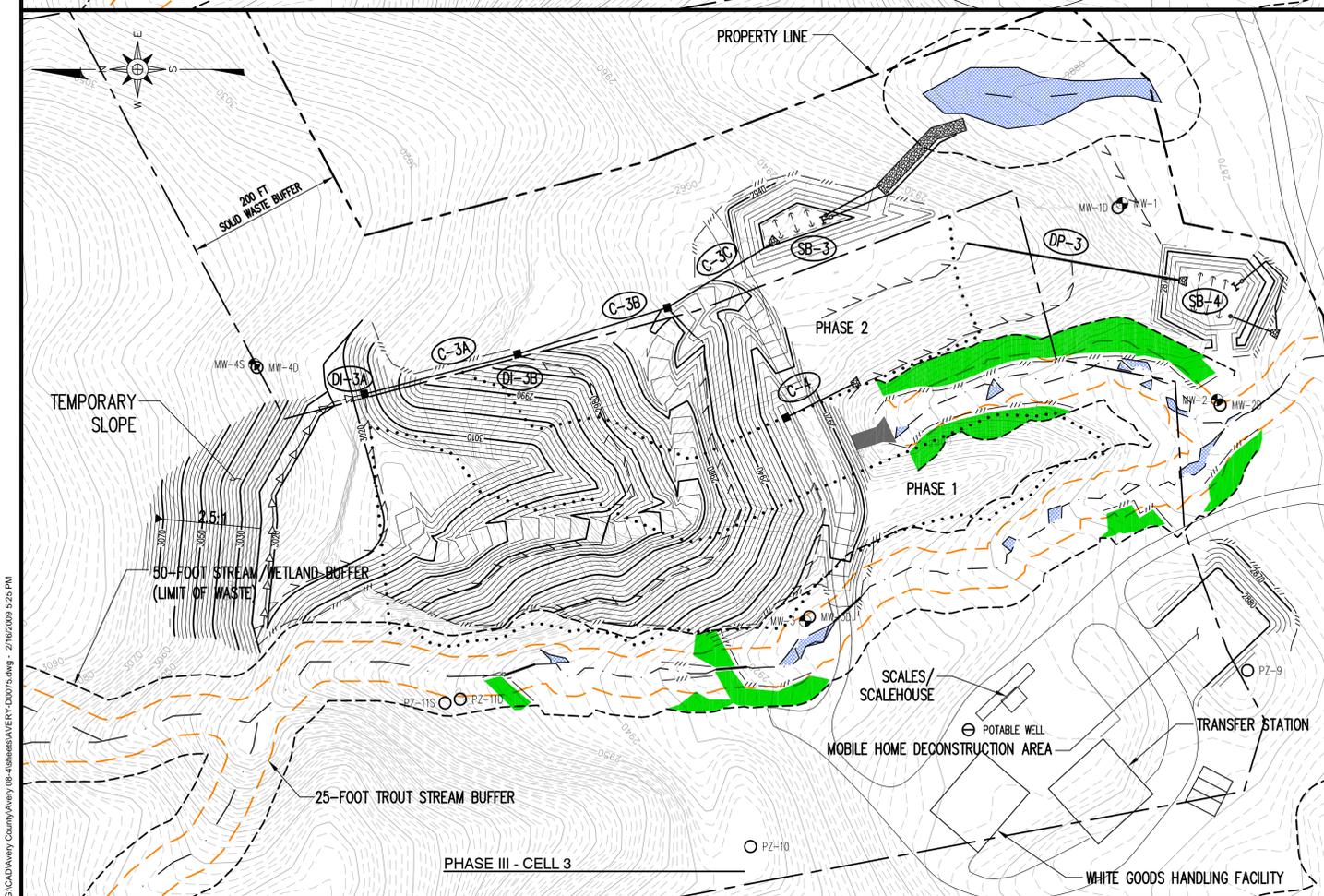
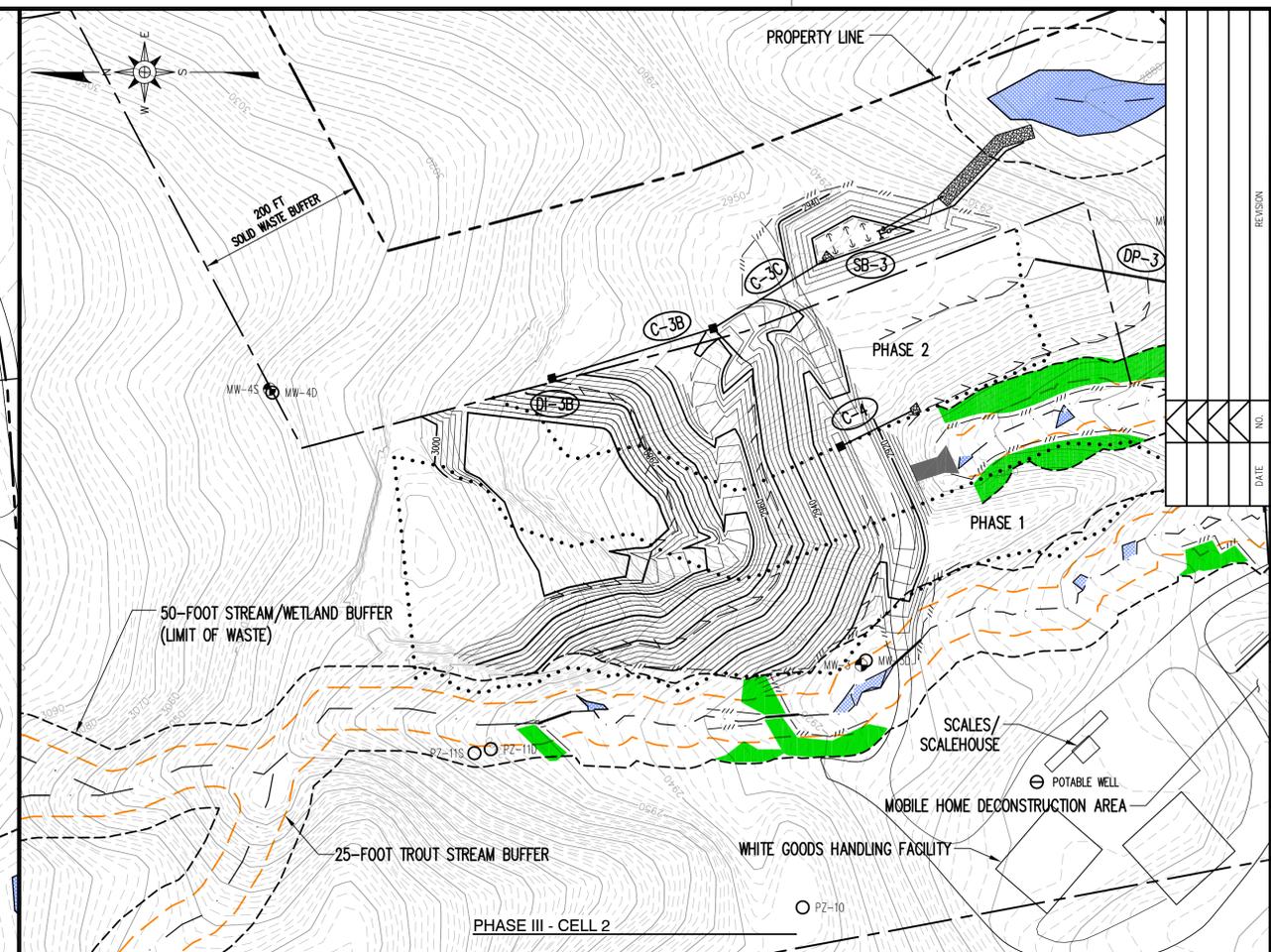
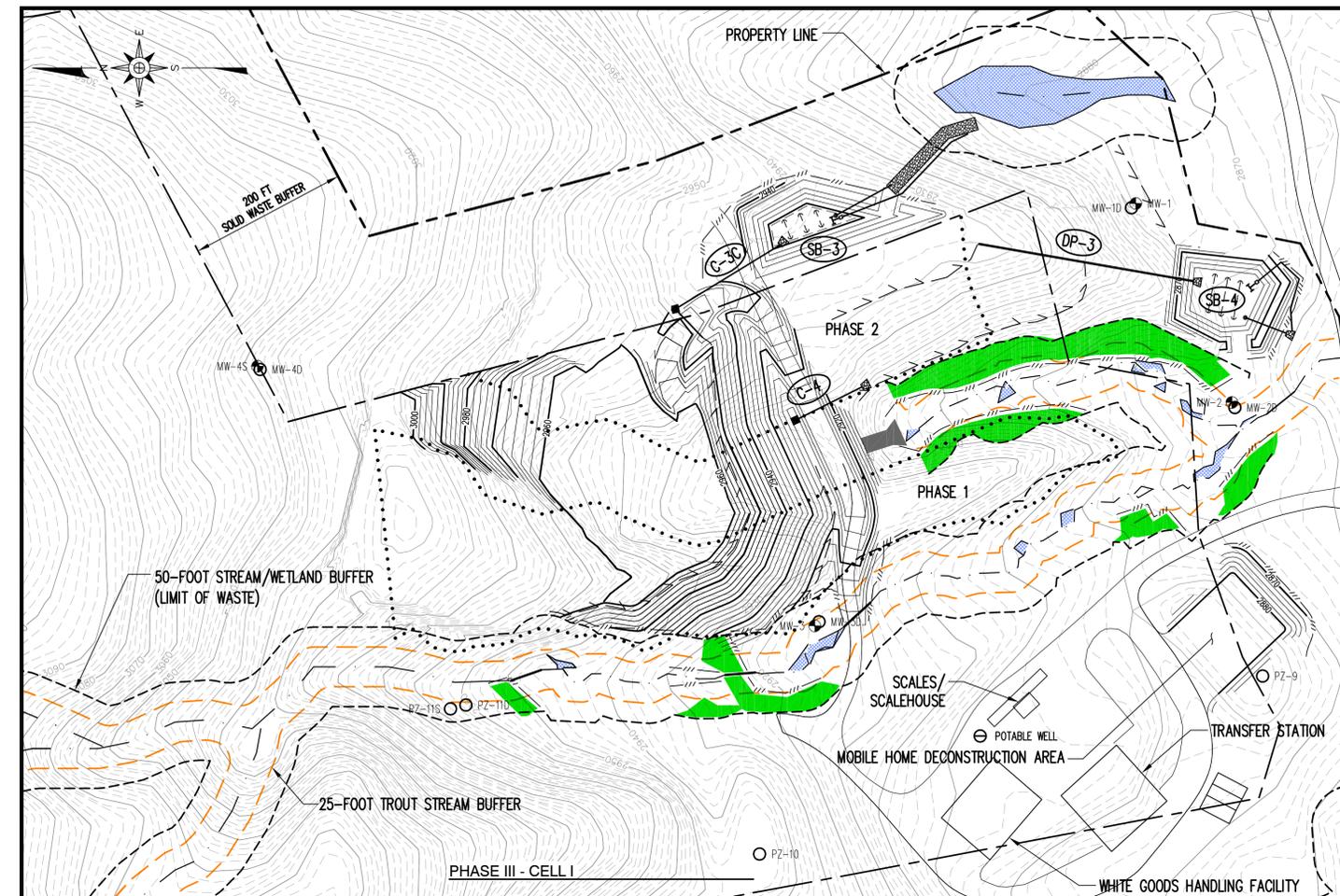
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NO.	DATE	REVISION

PROJECT TITLE:
**AVERY COUNTY
C&D LANDFILL
PHASE 3
PERMIT TO CONSTRUCT**

DRAWING TITLE:
**CASCADE AND RESTORATION
DETAILS**

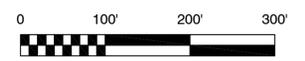
DESIGNED BY: T.B.M.	DRAWN BY: C.T.J.
CHECKED BY:	PROJECT NO.: AVERY 08-4
SCALE: AS SHOWN	DATE: FEB. 2009
FILE NAME: AVERY-D0073	DRAWING NO.:
SHEET NO. 11	DRAWING NO. EC4



LEGEND

	EXISTING 10' CONTOUR (SEE REFERENCE 1)
	EXISTING 2' CONTOUR
	PROPOSED 10' CONTOUR
	PROPOSED 2' CONTOUR
	PROPERTY LINE (SEE REFERENCE 2)
	200-FOOT SOLID WASTE BUFFER
	PERMITTED WASTE LIMITS
	SILT FENCE
	APPROX. STREAM LOCATION (SEE REFERENCE 3, 5)
	WETLANDS (SEE REFERENCE 3)
	50-FOOT STREAM AND WETLAND BUFFER
	25-FOOT TROUT STREAM BUFFER
	PROPOSED BUFFER RESTORATION AREAS
	MONITORING WELL
	PIEZOMETER
	POTABLE WELL
	DOWN PIPE
	CULVERT
	DROP INLET
	SEDIMENT BASIN

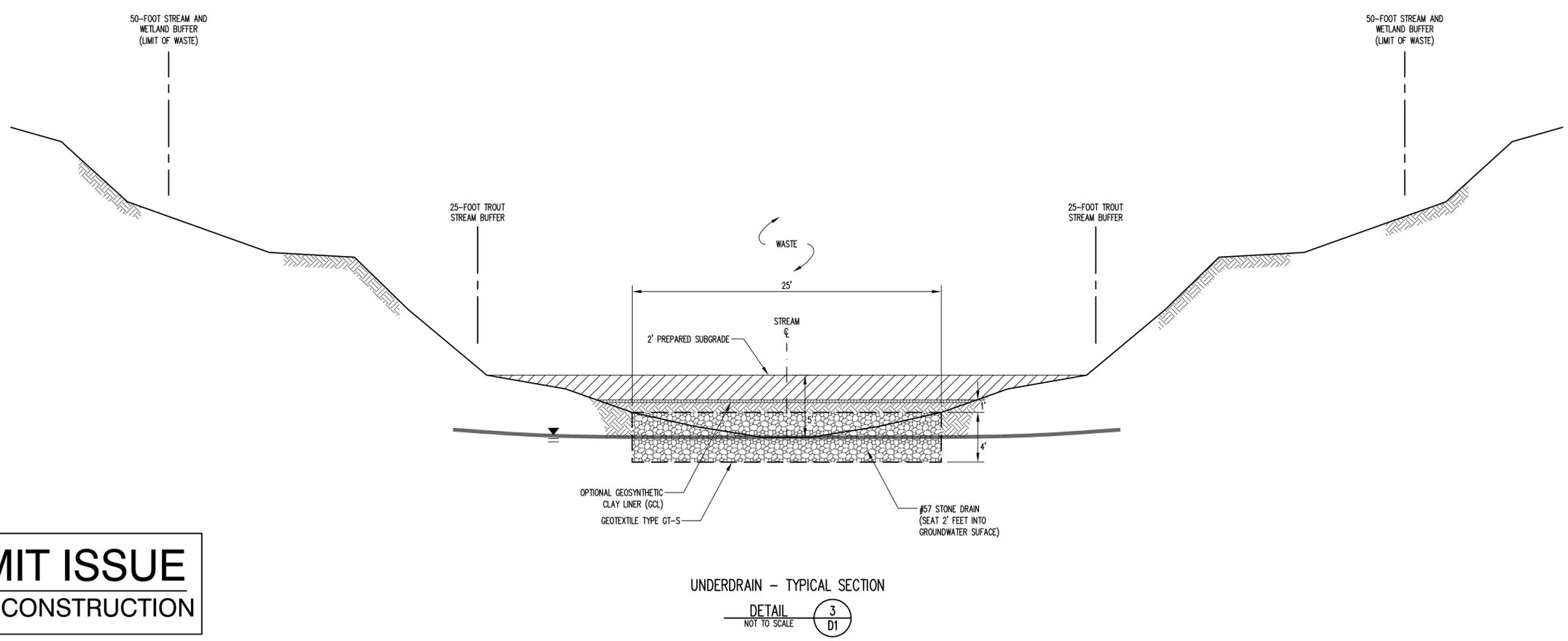
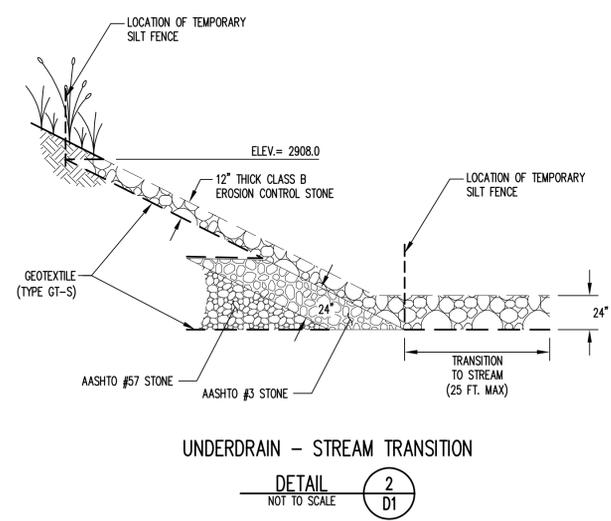
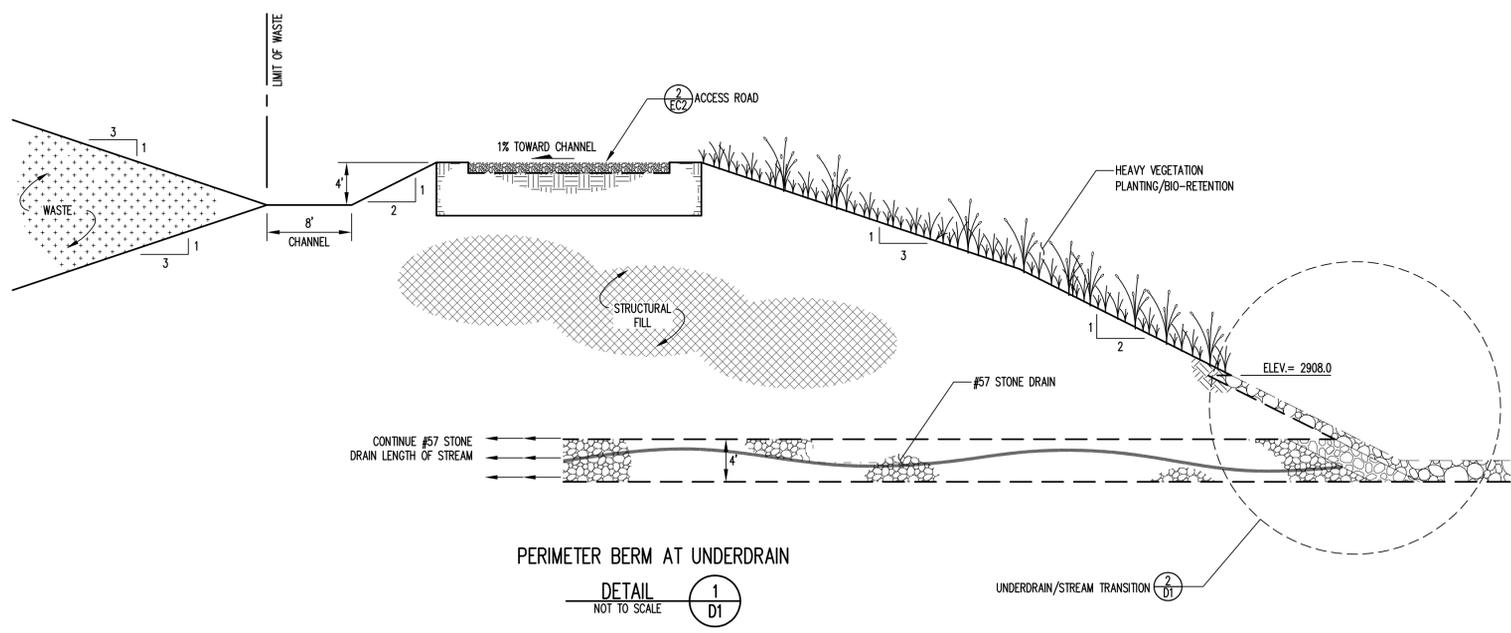
- REFERENCES**
- OVERALL SITE TOPOGRAPHY FROM NORTH CAROLINA DEPARTMENT OF TRANSPORTATION, DATA GENERATED FROM LIDAR DATED MARCH 2005, TOPO IN AREAS IN AND SURROUNDING PHASES 1 AND 2 FROM FIELD SURVEY DATED 9/07, BY SURVEYING SOLUTIONS, P.C.
 - SITE PROPERTY LINE AND MONITORING WELL LOCATIONS FROM FIELD SURVEYS DATED 9/07 AND 1/14/08, BY SURVEYING SOLUTIONS, P.C.
 - STREAM AND WETLAND LOCATIONS IN NORTHERN SECTOR OF SITE OBTAINED FROM GPS FIELD SURVEY DATED 4/07, BY CAROLINA ECOSYSTEMS, INC.
 - STREAMS AND WETLANDS NEAR PHASE 1 AND 2 FROM FIELD SURVEY DATED 2/18/08 BY SURVEYING SOLUTIONS, P.C.
 - BRUSHY CREEK LOCATION FROM AVERY COUNTY GIS DEPARTMENT.
 - ALL IMPACT AREAS ARE UNDER APPROVAL OF ACTION ID 2008-03130 NATIONWIDE PERMIT NO. 39 BY THE US ARMY CORE OF ENGINEERS DATED NOVEMBER 9, 2008 AND NC DIVISION OF WATER QUALITY DATED NOVEMBER 21, 2008 DWQ PROJECT NO. #08-1464.



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CHECKED BY:	PROJECT NO.: AVERY 08-4
SCALE: AS SHOWN	DATE: FEB. 2009
FILE NAME: AVERY-D0075	DRAWING NO.:
SHEET NO. 6	DRAWING NO. P1

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REVISION	NO.	DATE

RICHARDSON SMITH GARDNER & ASSOCIATES
14 N. Boylan Ave.
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fax: 919-828-3899

PROJECT TITLE:
**AVERY COUNTY
C&D LANDFILL
PHASE 3
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DRAWING TITLE: UNDERDRAIN DETAILS	
DESIGNED BY: S.A.S.	DRAWN BY: J.A.L.
CHECKED BY:	PROJECT NO.: AVERY 08-4
SCALE: AS SHOWN	DATE: FEB. 2009
FILE NAME: AVERY-D0076	SHEET NO.: 12
DRAWING NO.:	D1

Attachment I

Water Quality Monitoring Plan

Water Quality Monitoring Plan

**Avery County C&D Landfill
Ingalls, North Carolina
NC Solid Waste Permit No. 06-03**

Prepared for:



**Avery County
Newland, North Carolina**

February 2009

PERMIT ISSUE DOCUMENTS

Prepared by:



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WATER QUALITY MONITORING PLAN

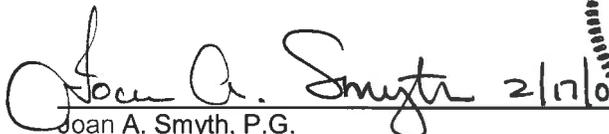
Avery County C&D Landfill Avery County, North Carolina

Prepared for:



Avery County
Newland, North Carolina

RSG Project No. **Avery-08-4**


Joan A. Smyth, P.G.
Senior Hydrogeologist



February 2009



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**AVERY COUNTY
C&D LANDFILL**

WATER QUALITY MONITORING PLAN

TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	
1.1 Plan Background	1.0-1
1.2 Site Contact Information	1.0-2
1.3 Site Background	1.0-2
1.3.1 Geology	1.0-2
1.3.2 Hydrogeology	1.0-2
2.0 MONITORING PROGRAM	
2.1 Monitoring Network and Analytical Parameters	2.0-1
2.2 Groundwater Sample Collection	2.0-1
2.2.1 Introduction	2.0-1
2.2.1.1 Guidance Documents	2.0-1
2.2.1.2 Fuel Powered Equipment	2.0-2
2.2.1.3 Equipment Decontamination	2.0-2
2.2.2 Water Level Measurements	2.0-3
2.2.2.1 Static Levels	2.0-3
2.2.2.2 Contamination Prevention	2.0-3
2.2.2.3 Equipment	2.0-3
2.2.3 Well Monitor Evaluations	2.0-4
2.2.3.1 Description	2.0-4
2.2.3.2 Contamination Preventions	2.0-4
2.2.3.3 Calculation	2.0-4
2.2.3.4 Well Purging	2.0-4
2.2.3.5 Purge Rate	2.0-5
2.2.3.6 Purge Water Disposal	2.0-5
2.2.3.7 Non-Dedicated Equipment	2.0-5
2.2.4 Sample Collection	2.0-5
2.2.4.1 Field Parameters	2.0-6
2.2.4.2 Sample Equipment	2.0-6
2.2.4.3 Sample Transference	2.0-6
2.2.4.4 Observation	2.0-6
2.2.4.5 Decontamination	2.0-7
2.2.4.6 Sample Preservation	2.0-7
2.2.4.7 Field Quality Assurance	2.0-7
2.2.4.8 Sample Containers	2.0-8
2.3 Surface Water Sample Collection	2.0-8
2.3.1 Surface Water Level Observations	2.0-8
2.3.1.1 Monitoring Conditions	2.0-8
2.3.1.2 Monitoring Condition Modification	2.0-9
2.3.2 Sample Collection	2.0-9

2.3.2.1	Collection Procedures	2.0-9
2.3.2.2	Field Parameters	2.0-9
2.3.2.3	Observation	2.0-9
2.3.2.4	Decontamination	2.0-10
2.3.2.5	Sample Containers	2.0-10
3.0	FIELD QA/QC PROGRAM	
3.1	Trip Blank	3.0-1
3.2	Trip Blank Concentrations	3.0-1
3.3	Field Instruments	3.0-1
4.0	SAMPLE PRESERVATION AND SHIPMENT	4.0-1
4.1	Sample Preservation	4.0-1
4.2	Storage/Transport Conditions	4.0-1
4.3	Sample Delivery	4.0-1
4.4	Chain of Custody	4.0-1
5.0	FIELD LOGBOOK	5.0-1
6.0	LABORATORY ANALYSIS	6.0-1
6.1	Laboratory Quality Assurance/Quality Control	6.0-1
6.2	Laboratory Quality Control Check	6.0-1
6.3	Data Review	6.0-1
7.0	RECORD KEEPING AND REPORTING	7.0-1
7.1	Groundwater Systems Evaluations	7.0-1
7.2	Result Reporting	7.0-1
8.0	MONITORING PROGRAM MODIFICATIONS	8.0-1
8.1	Laboratory Quality Assurance/Quality Control	8.0-1
8.2	Laboratory Quality Control Check	8.0-1
8.3	Data Review	8.0-1
9.0	DATA EVALUATION	9.0-1
TABLES		
Table 1		TABLE 1
Table 2		TABLE 2
FIGURES		
Figure 1		FIGURE 1
Figure 2		FIGURE 2
ATTACHMENT		
Attachment 1		ATTACHMENT 1

SECTION 1.0 INTRODUCTION

1.1 PLAN BACKGROUND

This Water Quality Monitoring Plan (WQMP) specifies the procedures and requirements to satisfy North Carolina Solid Waste Management Rule 15A NCAC 13B.0544 (b) and (c). The WQMP addresses the following two (2) major elements; monitoring/sampling of the groundwater system and monitoring/sampling of the surface water.

The WQMP will meet the following requirements:

- *Represent the quality of the background groundwater that has not been affected by leakage from the unit (.0544 (b)(1)(A)).*
- *Represent the quality of the groundwater passing the relevant point of compliance as approved by the Division (.0544 (b)(1)(B)).*
- *The groundwater monitoring programs must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and down-gradient wells (.0544 (b)(1)(C)).*
- *Detection Groundwater monitoring program (.0544 (b)(1)(D)).*
- *The sampling procedures and frequency must be protective of human health and the environment (.0544 (b)(1)(E)).*
- *Responsibility of sample collection and analysis must be defined as a part of the monitoring plan (.0544 (c)(2)).*

This WQMP also addresses the following subjects:

- Sample preservation and shipment
- Laboratory analytical procedures
- Sample Chain-of-custody control
- Quality assurance/quality control programs

The methods and procedures described in the WQMP are intended to facilitate the collection of true and representative samples and test data. Field procedures are presented in **Section 2.0** in their general order of implementation. Equipment requirements for each field task are presented within the applicable section. Laboratory procedures, quality assurance methods and record keeping requirements are presented in **Sections 3.0 through 8.0**.

Strict adherence to the procedures stipulated in this plan is required. Any variations from these procedures should be thoroughly documented.

1.2 SITE CONTACT INFORMATION

In case of emergencies, or if questions arise during the implementation of this program, please contact the following:

Henry “Buddy” Norris Avery County Landfill Solid Waste Manager Office: (828) 737-5420	Joan Smyth, P.G. RSG Office: (919) 828-0577 ext. 122 Cell: (919) 815-1494	Bill Wagner NC DENR - DWM Waste Management Specialist Office: (828) 296-4705
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1.3 SITE BACKGROUND

The Avery County C&D Landfill (Permit 42-04), located at 2175 Brushy Creek Drive Spruce Pine, NC, was in operation between 1996 and 2008. The Facility is located 1.82 miles northeast of the intersection of Highway 19 East and Brushy Creek Road or 1.5 miles northeast from the Avery County Airport. The site location is shown on **Figure 1**. There is residential development in the site vicinity (within 2000 feet) and commercial development within two (2) miles. The site currently consists of approximately 5.4 acres of C&D waste, and the site is currently bounded by forested, undeveloped land to the north, and by low density residential development to the south, east and west. The site and monitoring network are shown in **Figure 2**.

1.3.1 Geology

The Avery County C&D landfill is located in the Blue Ridge Province of North Carolina, approximately 12 miles from the Brevard Fault zone. Local bedrock is comprised of the Aligator Back formation which is a finely laminated gneiss. Micaceous conglomerate, schist and phyllite are also found within this formation. Amphibolite was noted in central to northern portions of the site. The site has been investigated with a total of 16 monitoring wells and piezometers that range in depth from approximately 20 feet below grade to 88 feet below grade. Bedrock at the site was encountered at depths that ranged from 31 feet below grade to 88 feet below grade.

Unconsolidated sediments at the site consist of variably micaceous clayey silt to silty sand weathered from the underlying bedrock. The unconsolidated sediments are grouped into two lithological units. Unit 1A consists of sediments exhibiting a standard penetration test of less than 100 blows per foot, while Unit 1B consists of sediments exhibiting a standard penetration test of greater than 100 blows per foot. The monitoring network and analytical parameters are further discussed in **Section 1.3** and are summarized in **Tables 1 and 2**.

1.3.2 Hydrogeology

Groundwater flow at the site is from north to south toward the discharge points of on-site streams and Brushy Creek (located across Brushy Creek Road). Depth to groundwater ranges

from approximately 5.00 feet (measured from top of casing) to approximately 47 feet below top of casing elevations with an average gradient of 0.12 ft/ft and an average groundwater velocity of 1.57 ft/day. Lithological Unit 1A has an average hydraulic conductivity of 1.40 ft/day, while Unit 1B has an average hydraulic conductivity of 2.05 ft/day. The bedrock aquifer (Unit 2) has an average hydraulic conductivity of 4.65 ft/day.

Several nested pairs of monitoring wells/piezometers were installed at the site to evaluate vertical gradients at the site. In general, vertical gradients across the site were found to move in a downward direction with the exception of the pairs located near the discharge point of Brushy Creek (MW-1s/1d and MW-2s/2d). These pairs indicated upward gradients which are typically associated with groundwater discharge points.

This Water Quality Monitoring Plan (WQMP) has been prepared to meet the field sampling and laboratory analysis requirements of ongoing monitoring at the site. The WQMP details field and laboratory protocols that must be followed to meet the data objectives of semi-annual groundwater monitoring.

SECTION 2.0 MONITORING PROGRAM

2.1 MONITORING NETWORK AND ANALYTICAL PARAMETERS

The monitoring network for the C&D landfill includes three (3) compliance groundwater monitoring wells (MW-1S, MW-2S, and MW-3S) and a background (upgradient) well (MW-4S) which was installed in November 2007. Previously no upgradient well for the site had been installed. These wells are monitored for constituents referenced in 15A NCAC 13B 0.544(b)(1)(D) on a semi-annual basis. One (1) on-site potable well¹ will be monitored along with the groundwater monitoring wells listed above. These locations are shown on **Figure 1**.

There are two (2) surface water monitoring points (SW-1, SW-2) that will also be sampled on a semi-annual basis. These surface water monitoring points are also shown on **Figure 1**. Analytical parameters for each well are outlined in **Table 1**, and well completion information is included in **Table 2**.

Additionally, applicable local, state, and federal health and safety requirements will be followed. Requirements for the disposal of any investigation derived wastes will also be followed.

2.2 GROUNDWATER SAMPLE COLLECTION

2.2.1 Introduction

This section presents details of the procedures and equipment required to perform groundwater field measurements and sampling from monitoring wells during each monitoring event. **Where possible, phases of work will proceed from the upgradient (background) wells to downgradient (compliance) wells.**

2.2.1.1 Guidance Documents

Sampling, analysis and submittals shall be performed in accordance with this plan and the following guidance documents:

1. Groundwater, Surface Water and Soil Sampling for Landfills - NCDENR Guidance updated April 2008
2. October 26, 2006 Memo from NCDENR entitled "New Guidelines for Electronic Submittal of Environmental Monitoring Data"
3. February 23, 2007 Memo from NCDENR entitled Addendum to October 27, 2006, North Carolina Solid Waste Section Memorandum Regarding New Guidelines for Electronic Submittal of Environmental Data

¹ **Section 5.2 of Waste Relocation and Mitigation Plan**, Avery County C&D Landfill. Richardson Smith Gardner and Associates, October 2008

4. October 16, 2007 Memo from NCDENR entitled Environmental Monitoring Data for North Carolina Solid Waste Management Facilities

2.2.1.2 Fuel Powered Equipment

Fuel-powered equipment, such as generators for pumps, must be situated away and downwind from all site activities (ie. purging and sampling). If field conditions prevent such placement, then the fuel source must be placed as far away as possible from the sampling activities. The conditions of sampling must be described in detail in the field notes.

If fuel must be handled, it should be done the day before sampling. Effort should be made to avoid handling fuels on the day of sampling. If fuels must be dispensed during sampling activities, dispense fuel downwind and well away from any sampling locations. Wear gloves while working with fuel and dispose of the gloves away from sampling activities. Wash hands thoroughly after handling any fuels.

2.2.1.3 Equipment Decontamination

All non-dedicated equipment that will come in contact with the well casing and water will be decontaminated between wells. The procedure for decontaminating non-dedicated equipment is as follows:

1. Don new powder-free Nitrile gloves
2. Clean item with tap water and phosphate-free laboratory detergent (Liquinox or equivalent), using a brush if necessary to remove particulate matter and surface films.
3. Rinse thoroughly with pesticide grade isopropanol and allow to air dry.
4. Rinse with organic-free water (Milli-Q water or other ultra-pure water) and allow to air dry.
5. Wrap with commercial-grade aluminum foil, if necessary, to prevent contamination of equipment during storage or transport.

It should be noted that Liqui-Nox detergent solutions will be stored in a clearly marked HDPE or PP container. Containers for pesticide-grade isopropanol will be made of inert materials such as Teflon, stainless steel, or glass.

Sampling will be planned and conducted in such a way as to minimize the need for decontamination in the field through the use of dedicated sampling equipment, or a new disposable Teflon bailer at each well. Unclean equipment will be segregated from clean equipment during all field activities. All clean equipment will remain in the manufacturer's packaging until use, or will be wrapped in commercial-grade aluminum foil or untreated butcher paper.

2.2.2 Water Level Measurements

2.2.2.1 Static Levels

Static water level and depth to the well bottom will be measured in each well prior to any purging or sampling activities. Static water level and well depth measurements are necessary to calculate the volume of stagnant water in the well prior to purging. Additionally these measurements provide a field check on well integrity, degree of siltation, and are used to prepare potentiometric maps, calculate aquifer flow velocities and monitor changes in site hydrogeologic conditions.

Groundwater depths will be measured to a vertical accuracy of 0.01 feet relative to established wellhead elevations, provided in **Table 2**. Each well will have a permanent, easily identified reference point on the lip of the well riser from which all water level measurements will be taken. The elevation of the reference point will be established by a Registered Land Surveyor.

2.2.2.2 Contamination Prevention

Upon opening each well, new latex or nitrile surgical gloves will be donned. Appropriate measures will be taken during all measurement activities to prevent soils, decontamination supplies, precipitation, and other potential contaminants from entering the well or contacting clean equipment.

2.2.2.3 Equipment

An electronic water level indicator will be used to accurately measure depth to groundwater in each well and/or piezometer. The electronic water level indicator will be constructed of inert materials such as stainless steel and Teflon (example). **Between each well, the device will be thoroughly decontaminated by washing with non-phosphate (Liqui-Nox) soap and rinsing with organic-free water to prevent cross contamination from one well to another.**

The following measurements will be recorded in a dedicated field book prior to sample collection(see Section 5.0 for detailed description of field notes to be collected):

- Depth to static water level and well bottom (to the nearest 0.01 foot)
- Height of water column in the riser (based upon measured depth of well)
- Condition of wellhead protective casing, base pad and riser
- Changes in condition of well and surroundings.

2.2.3 Well Monitor Evaluations

2.2.3.1 Description

Water accumulated in each well may be stagnant and unrepresentative of surrounding aquifer conditions, and therefore must be removed to insure that fresh formation water is sampled. Each well will be purged of standing water in the well casing following the measurement of the static water level. Monitoring well evacuation should be performed in upgradient wells first, and moving to downgradient wells.

2.2.3.2 Contamination Prevention

New latex or nitrile surgical gloves will be donned for all well purging and sampling activities and whenever handling decontaminated field equipment. Appropriate measures will be taken during all measurement, purging and sampling activities to prevent surface soils, decontamination supplies, precipitation, and other potential contaminants from entering the well or contacting cleaned equipment.

2.2.3.3. Calculation

The volume of standing water in the well riser and screen will be calculated immediately before well evacuation during each monitoring event. A standing water volume will be calculated for each well using measured static water level, well depth and well casing diameter according to the following equation:

$$V = (TD - SWL) \times C$$

Where:

V = One well volume

TD = Total depth of the well (in feet)

SWL = Static water level (in feet)

C = Volume constant for given well diameter (gallons/foot)

C = 0.163 gal/ft for two-inch wells.

C = 0.653 gal/ft for four-inch wells.

2.2.3.4 Well Purging

After the volume of standing water within the casing is established, a minimum of three and a maximum of five well casing volumes of water will be evacuated from each well. New, disposable bailers with either double or bottom check-valves will be used to purge each well. Disposable purge bailers will be constructed of fluorocarbon resin (Teflon) or inert plastic suitable for the well and ground conditions. Each bailer will be factory-clean and remain sealed in a plastic sleeve until use. A new Teflon-coated stainless steel, inert mono-filament line or nylon cord will be used for each well to retrieve the bailers.

2.2.3.5 Purge Rate

Wells will be purged at a rate that will not cause recharge water to be excessively agitated or cascade through the screen. Care will also be taken to minimize disturbance to the well sidewalls and bottom which could result in the suspension of silt and fine particulate matter. The volume of water purged from each well and the relative rate of recharge will be documented in sampling field notes. Wells which are of very low recharge rates will be purged once until dry. Damaged, dry or low yielding, and high turbidity wells will be noted for reconsideration before the next sampling event.

2.2.3.6 Purge Water Disposal

Purge water will be managed to prevent possible soil and surface water contamination. Well site management options may include temporary containment and disposal as leachate or portable activated carbon filtration.

2.2.3.7 Non-Dedicated Equipment

Durable, non-dedicated equipment to be lowered into the well or which may contact the water samples will be thoroughly decontaminated before each use. Equipment shall be disassembled to the degree practical, washed with (non-phosphate) soapy potable tap water, and triple rinsed using de-ionized water. Detailed equipment decontamination procedures are detailed in **Section 2.2.1.3**.

2.2.4 Sample Collection

After purging activities are complete, groundwater samples will be collected for laboratory analysis. Sampling is undoubtedly the most critical stage and the focus of the water quality monitoring program. Samples should be collected from least contaminated location(s) first, followed by locations of increasing contamination across the site. Prior to sample collection, all sample labels should be properly filled-out with permanent ink, such as Sharpie Pen. At a minimum, the label should identify the sample with the following information:

- Sample Location or Well Number
- Sample Identification Number
- Date and Time of Collection
- Analysis Required
- Sampler's Initials
- Preservative Used (if any)

- Other Pertinent Information As Necessary

Upon completion of the sample label, the label should be affixed to the sample bottle prior to sampling.

Sampling will occur within 24 hours of the purging of each well and as soon after well recovery as possible. Wells which fail to recharge or produce an adequate sample volume within 24 hours of purging will not be sampled.

2.2.4.1 Field Parameters

Field measurements of temperature, pH, and specific conductivity will be made immediately prior to sampling each monitoring point. The field test specimens will be collected with the sampling bailer and placed in a clean, non-conductive glass or plastic container for observation. The calibration of the pH, temperature, conductivity and turbidity meters will be completed according to the manufacturers' specifications and consistent with Test Methods for Evaluating Solid Waste -Physical/Chemical Methods (SW-846). A pocket thermometer and litmus paper will be available in case of meter malfunction.

2.2.4.2 Sample Equipment

Each well will be sampled using a new, factory-cleaned, disposable Teflon bailer with bottom check-valve and sample discharge mechanism. A new segment of Teflon-coated stainless steel wire, inert mono-filament line or nylon cord will be used to lower and retrieve each bailer. The bailer will be lowered into each well to the point of groundwater contact, then allowed to fill as it sinks below the water table. Bottom contact will be avoided in order to avoid suspending sediment in the samples. The bailer will be retrieved and emptied in a manner which minimizes sample agitation.

2.2.4.3 Sample Transference

Samples will be transferred directly from the Teflon bailer into a sample container that has been specifically prepared for the preservation and storage of compatible parameters. A bottom emptying device provided will be used to transfer samples from bailer to sample container. The generation air bubbles and sample agitation will be minimized during bailer discharge. Groundwater samples will be collected and contained in the order of volatilization sensitivity.

2.2.4.4 Observation

Initially, only purgeable organics and total metals samples will be collected for laboratory analysis. Subsequently, other analytical methods may be required. When collected, the following order of sampling will be observed:

- Volatile Organics and Volatile Inorganics
- Extractable Organics, Petroleum Hydrocarbons, Aggregate Organics and Oil and Grease
- Total Metals
- Inorganic Nonmetallics, Physical and Aggregate Properties and Biologicals
- Microbiologicals
- Measurements of pH, temperature, DO, ORP, conductivity and turbidity

Note: If the pump used to collect groundwater samples is not suitable to collect volatile or extractable organics then collect all other parameters and withdraw the pump and tubing. Then collect the volatile and extractable organics.

All samples will be collected and analyzed in an **unfiltered** state during sampling events. Samples for dissolved metal analysis, if subsequently required, will be prepared by field filtration using a decontaminated peristaltic pump and a disposable 0.45 micron filter cartridge specifically manufactured for this purpose.

2.2.4.5 Decontamination

All reusable sampling equipment including water level probes, pH/conductivity meters, interface probes, and filtering pumps which might contact aquifer water or samples will be thoroughly decontaminated between wells by washing with non-phosphate soapy, de-ionized water and rinsing with isopropanol and organic-free water. Detailed equipment decontamination procedures are detailed in **Section 2.2.1.3**.

2.2.4.6 Sample Preservation

Upon completion of sampling at each location, the sample bottles will be placed in a cooler with ice, that is sealed in Ziploc bags, for preservation.

2.2.4.7 Field Quality Assurance

Field and trip blanks will be prepared, handled and analyzed as groundwater samples to ensure cross-contamination has not occurred. One set of trip blanks, as described later in this document, will be prepared before leaving the laboratory to ensure that the sample containers or handling processes have not affected the quality of the samples. One set of field (equipment) blanks will be created in the field at the time of sampling to ensure that the field conditions, equipment, and handling during sampling collection have not affected the quality of the samples. A duplicate groundwater sample may be collected from a single well as a check of laboratory accuracy. Blanks and duplicate

containers, preservatives, handling, and transport procedures for surface water samples will be identical to those noted for groundwater samples.

2.2.4.8 Sample Containers

Sample containers will be provided by the laboratory for each sampling event. Containers must be either new and factory-certified analytically clean by the manufacturer, or cleaned by the laboratory prior to shipment for sampling. Laboratory cleaning methods will be based on the bottle type and analyte of interest. Metal containers are thoroughly washed with non-phosphate detergent and tap water, and rinsed with (1:1) nitric acid, tap water, (1:1) hydrochloric acid, tap water, and deionized water, in that order. Organic sample containers are thoroughly washed with non-phosphate detergent in hot water and rinsed with tap water, distilled water, acetone, and pesticide quality hexane, in that order. Other sample containers are thoroughly washed with non-phosphate detergent and tap water, rinsed with tap water, and rinsed with deionized water. The laboratory shall provide proper preservatives in the sample containers prior to shipment (see **Section 6.0**).

2.3 SURFACE WATER SAMPLE COLLECTION

This section presents details of the procedures and equipment required to perform surface water field measurements and sampling from springs, streams and ponds during each monitoring event.

2.3.1 Surface Water Level Observations

Surface water quality analyses are particularly sensitive to site hydrologic conditions and recent precipitation events. Water levels may fluctuate significantly in comparison the groundwater table and may result in either diluting or increasing contaminant loadings. The scheduling of sampling events and the interpretation surface water data must take into account climatic, recent weather and sampling station conditions.

2.3.1.1 Monitoring Conditions

Surface water level and sampling station conditions will be observed one day prior to, and during each sampling event. Surface water observations will include the flood stage in streams, seasonal base flow conditions, and confirm location and timing for meaningful surface water quality sampling. The following objective observations will be recorded in a dedicated field book prior to sample collection:

- Relative stream water level
- Surface water clarity
- Changes in surface monitoring station conditions and surroundings

2.3.1.2 Monitoring Condition Modification

Modifications to surface sampling station conditions may be required prior to each sampling event. These modifications may include the removal of surface and submerged debris, slightly deepening the station to allow sample container immersion, or channeling/piping to consolidate local discharge. When modifications are required, sufficient time will be allowed for settlement of suspended solids between the disturbance and sample collection. A minimum settling period of four hours prior to sampling will be observed.

2.3.2 Sample Collection

2.3.2.1 Collection Procedure

Surface water samples will be obtained from areas of minimal turbulence and aeration. New latex or nitrile surgical gloves will be donned prior to sample collection. The following procedure will be implemented regarding sampling of surface waters:

1. Put on new latex or nitrile surgical gloves.
2. Hold the bottle in the bottom with one hand, and with the other, remove the cap.
3. Push the sample container slowly into the water and tilt up towards the current to fill. A water depth of six inches is generally satisfactory. Care will be taken to avoid breaching the surface or losing sample preservatives while filling the container.
4. If there is little current movement, the container should be moved slowly, in a lateral, side to side direction, with the mouth of the container pointing upstream.

2.3.2.2 Field Parameters

Temperature, pH, specific conductivity and turbidity will be taken at the start of sampling as a measure of field conditions and check on the stability of the water samples over time. Measurements of temperature, pH, specific conductivity and turbidity will be recorded for all surface water samples. The calibration of the pH, temperature, conductivity, and turbidity meters will be completed at the beginning of each sampling event, according to the manufacturers' specifications and consistent with Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (SW-846).

2.3.2.3 Observation

Surface water samples will be collected and contained in the order of volatilization sensitivity of the parameters as follows:

- Volatile Organics and Volatile Inorganics
- Extractable Organics, Petroleum Hydrocarbons, Aggregate Organics and Oil and Grease
- Total Metals
- Inorganic Nonmetallics, Physical and Aggregate Properties and Biologicals
- Microbiologicals
- Measurements of pH, temperature, DO, ORP, conductivity and turbidity

All surface water samples will be collected unfiltered. If future dissolved metal analysis is required, samples will be prepared by field filtration using a decontaminated peristaltic filtering pump (or equivalent) and a disposable 0.45 micron filter cartridge specifically manufactured for this purpose.

Surface water samples will be collected from surface water monitoring points shown on the attached **Figure 2**. Samples will be collected directly from the station in the container that has been specifically prepared for the preservation and storage of compatible parameters. Samples will be collected in a manner that assures minimum agitation. Additional blanks and duplicate samples will not be taken with the surface water samples.

2.3.2.4 Decontamination

All field meters which might contact surface water samples will be thoroughly decontaminated between stations by washing with non-phosphate soapy, de-ionized water and rinsed with isopropanol and organic-free water. Detailed equipment decontamination procedures are detailed in **Section 2.2.1.3**.

2.3.2.5 Sample Containers

Sample containers shall be prepared and provided by the laboratory for each surface water sampling event. Each sample container's preparation and preservatives shall be the same as those utilized for groundwater sampling and addressed previously in **Section 2.2.4.8**.

SECTION 3.0 FIELD QA/QC PROGRAM

Field Quality Assurance/Quality Control (QA/QC) requires the routine collection and analysis of trip blanks to verify that the handling process has not affected the quality of the samples. Any contaminants found in the trip blanks could be attributed to:

1. interaction between the sample and the container,
2. contaminated source water, or
3. a handling procedure that alters the sample.

3.1 TRIP BLANK

The laboratory will prepare a trip blank by filling each type of sample bottle with laboratory grade distilled or deionized water. Trip blanks will be placed in bottles of the specific type required for the analyzed parameters and taken from a bottle pack specifically assembled by the laboratory for each groundwater sampling event. Trip blanks will be taken prior to the sampling event and transported with the empty bottle packs. The blanks will be analyzed for volatile and purgeable organics only.

3.2 TRIP BLANK CONCENTRATIONS

The concentration levels of any contaminants found in the trip blank will be reported but will not be used to correct the groundwater data. In the event that elevated parameter concentrations are found in a blank, the analysis will be flagged for future evaluation and possible re-sampling.

3.3 FIELD INSTRUMENTS

All field instruments utilized to measure groundwater characteristics will be calibrated prior to entering the field, and recalibrated in the field as required, to insure accurate measurement for each sample. The specific conductivity and pH meter shall be recalibrated utilizing two prepared solutions of known concentration in the range of anticipated values (between 4 and 10). A permanent thermometer, calibrated against a National Bureau of Standards Certified thermometer, will be used for temperature meter calibration.

SECTION 4.0 SAMPLE PRESERVATION AND SHIPMENT

Methods of sample preservation, shipment, and chain-of-custody procedures to be observed between sampling and laboratory analysis are presented in the following sections.

4.1 SAMPLE PRESERVATION

Pre-measured chemical preservatives will be provided by the analytical laboratory. Hydrochloric acid will be used as a chemical stabilizer and preservative for volatile and purgeable organic specimens. Nitric acid will be used as the preservative for samples for metals analysis.

4.2 STORAGE/TRANSPORT CONDITIONS

Proper storage and transport conditions must be maintained in order to preserve the integrity of samples between collection and analysis. Ice and chemical cold packs will be used to cool and preserve samples, as directed by the analytical laboratory. Samples will be maintained at a temperature of 4° C. **Dry ice is not to be used.** Samples will be packed and/or wrapped in plastic bubble wrap to inhibit breakage or accidental spills.

Chain-of-Custody control documents will be placed in a waterproof pouch and sealed inside the cooler with the samples for shipping. Tape and/or custody seals shall be placed on the outside of the shipping coolers, in a manner to prevent and detect tampering with the samples.

4.3 SAMPLE DELIVERY

Samples shall be delivered to the analytical laboratory within a 24-hour period in person or using an overnight delivery service to insure holding times are not exceeded. Shipment and receipt of samples will be coordinated with the laboratory. Do NOT store or ship highly contaminated samples (concentrated wastes, free product, etc.) or samples suspected of containing high concentrations of contaminants in the same cooler or shipping container with other environmental samples.

4.4 CHAIN-OF-CUSTODY

Chain-of-Custody control will be maintained from sampling through analysis to prevent tampering with analytical specimens. Chain-of-Custody control procedures for all samples will consist of the following:

1. Chain-of-Custody will originate at the laboratory with the shipment of prepared sample bottles and a sealed trip blank. Identical container kits will be shipped by express carrier to the sampler or site or picked up at the laboratory in sealed coolers.
2. Upon receipt of the sample kit, the sampler will inventory the container kit and

check its consistency with number and types of containers indicated in the Chain-of-Custody forms and required for the sampling event.

3. Labels for individual sample containers will be completed in the field, indicating the site, time of sampling, date of sampling, sample location/well number, and preservation methods used for the sample.
4. Collected specimens will be placed in the iced coolers and will remain in the continuous possession of the field technician until shipment or transferral as provided by the Chain-of-Custody form has occurred. If continuous possession can not be maintained by the field technician, the coolers will be temporarily sealed and placed in a secured area.
5. Upon delivery to the laboratory, samples will be given laboratory sample numbers and recorded into a logbook indicating client, well number, and date and time of delivery. The laboratory director or his designee will sign the Chain-of-Custody control forms and formally receive the samples. The field technician, project manager and the laboratory director will work together to insure that proper refrigeration of the samples is maintained.
6. Copies of the complete Chain-of-Custody forms will be placed in the laboratory's analytical project file and attached to the laboratory analysis report upon completion.

Chain-of-Custody forms will be used to transfer direct deliveries from the sampler to the laboratory. A coded, express delivery shipping bill shall constitute the Chain-of Custody between the sampler and laboratory for overnight courier deliveries.

SECTION 5.0 FIELD LOGBOOK

The field technician will keep an up-to-date logbook documenting important information pertaining to the technician's field activities. The field logbook will document the following:

- Site Name and Location
- Date and Time of Sampling
- Climatic Conditions During Sampling Event
- Sampling Point/Well Identification Number
- Well Static Water Level
- Height of Water Column in Well
- Purged Water Volume and Well Yield (High or Low)
- Presence of Immiscible Layers and Detection Method
- Observations on Purging and Sampling Event
- Time of Sample Collection
- Temperature, pH, Temperature, DO, ORP, Turbidity, and Conductivity Readings
- Signature of Field Technician
- Relative stream water level
- Surface water clarity
- Changes in surface monitoring station conditions and surroundings

SECTION 6.0 LABORATORY ANALYSIS

The ground and surface water parameters will be analyzed for field indicators of water quality (pH, conductivity, temperature and turbidity) and those constituents listed in **Table 1**. All analytical methods are taken from Test Methods For Evaluating Solid Waste - Physical/Chemical Methods (SW-846) or Methods For the Chemical Analysis of Water and Wastes and will be consistent with Division of Waste Management's policies regarding analytical methods and reporting limits. Analysis will be performed by a laboratory certified by the North Carolina DENR for the analyzed parameters.

6.1 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Formal environmental laboratory Quality Assurance/Quality Control (QA/QC) procedures are to be utilized at all times. The owner/operator of the landfill is responsible for selecting a laboratory contractor and insuring that the laboratory is utilizing proper QA/QC procedures. The laboratory must have a QA/QC program based upon specific routine procedures outlined in a written laboratory Quality Assurance/Quality Control Manual. The QA/QC procedures listed in the manual shall provide the lab with the necessary assurances and documentation that accuracy and precision goals are achieved in all analytical determinations. Internal quality control checks shall be undertaken regularly by the lab to assess the precision and accuracy of analytical procedures.

6.2 LABORATORY QUALITY CONTROL CHECKS

The internal quality control checks include the use of calibration standards, standard references, duplicate samples and spiked or fortified samples. Calibration standards shall be verified against a standard reference obtained from an outside source. Calibration curves shall be developed using at least one blank and three standards. Samples shall be diluted if necessary to insure that analytical measurements fall on the linear portion of the calibration curve. Duplicate samples shall be processed at an average frequency of 10 percent to assess the precision of testing methods, and standard references shall be processed monthly to assess accuracy of analytical procedures. Spiked or fortified samples shall be carried through all stages of sample preparation and measurement to validate the accuracy of the analysis.

6.3 DATA REVIEW

During the course of the analyses, quality control data and sample data shall be reviewed by the laboratory manager to identify questionable data and determine if the necessary QA/QC requirements are being followed. If a portion of the lab work is subcontracted, it is the responsibility of the contracted laboratory to verify that all subcontracted work is completed by certified laboratories, using identical QA/QC procedures.

SECTION 7.0 RECORD KEEPING AND REPORTING

After each monitoring event, the potentiometric surface will be evaluated to determine whether the monitoring system remains adequate and to determine the rate and direction of groundwater flow at the site.

7.1 GROUNDWATER SYSTEM EVALUATIONS

The direction of groundwater flow will be determined by a comparison of groundwater surface elevations across the site through the construction of a potentiometric surface map. Groundwater flow rate will be determined using the following equation:

$$V = KI/n$$

Where:

- V = Velocity (feet/day)
- K = Hydraulic Conductivity (feet/day)
- I = Hydraulic Gradient (foot/foot)
- n = Effective Porosity of aquifer soils (unitless)

If these evaluations indicate the groundwater monitoring system is insufficient in meeting the requirements of the Rules, the monitoring system will be modified accordingly and a work plan will be submitted to NCDENR for review prior to modifications to enhance the monitoring system.

7.2 RESULT REPORTING

Copies of all laboratory analytical data will be forwarded to the SWS within 60 calendar days of the receipt of laboratory data. The analytical data submitted will specify the date of sample collection, the sampling point identification and include a map of sampling locations. Should a significant concentration of contaminants be detected in ground and surface water, as defined in North Carolina Solid Waste Rules, Groundwater Quality Standards, or Surface Water Quality Standards, the owner/operator of the landfill shall notify the SWS and will place a notice in the landfill records as to which constituents were detected.

All monitoring reports will be submitted with the following:

- An evaluation of potentiometric surface
- Analytical laboratory reports and summary tables
- A Solid Waste Environmental Monitoring Data Form (included in **Attachment A**)
- Laboratory Data submitted in accordance with the Electronic Data Deliverable Template.

Monitoring reports may be submitted electronically by e-mail or in paper copy form. Copies of all laboratory results and water quality reports for the Avery County Landfill will be kept at the Avery County Landfill office. Reports summarizing all groundwater quality results and data evaluation will be submitted to the Division of Waste Management for each sampling event. Depending upon the analytical results received, graphical analyses may be performed to evaluate plume movement and contaminant trends over time.

SECTION 8.0 MONITORING PROGRAM MODIFICATIONS

8.1 WELL ABANDONMENT/REHABILITATION

After each groundwater monitoring event, the potentiometric surface will be evaluated to determine whether the monitoring system remains adequate and to determine the rate and direction of groundwater flow at the site.

Should wells become irreversibly damaged or require rehabilitation, the SWS shall be notified. If monitoring wells and/or piezometers are damaged irreversibly they shall be abandoned under the direction of the SWS. The abandonment procedure in unconsolidated materials will consist of over-drilling and/or pulling the well casing and plugging the well with an impermeable, chemically-inert sealant such as neat cement grout and/or bentonite clay. For bedrock well completions the abandonment will consist of plugging the interior well riser and screen with an impermeable neat cement grout and/or bentonite clay sealant.

8.2 ADDITIONAL WELL INSTALLATIONS

Any additional well installations will be carried out in accordance with SWS directives. If the potentiometric maps reveal that the depths, location, or number of wells is insufficient to monitor potential releases of solid waste constituents from the solid waste management area, new well locations and depths will be submitted to the SWS for approval.

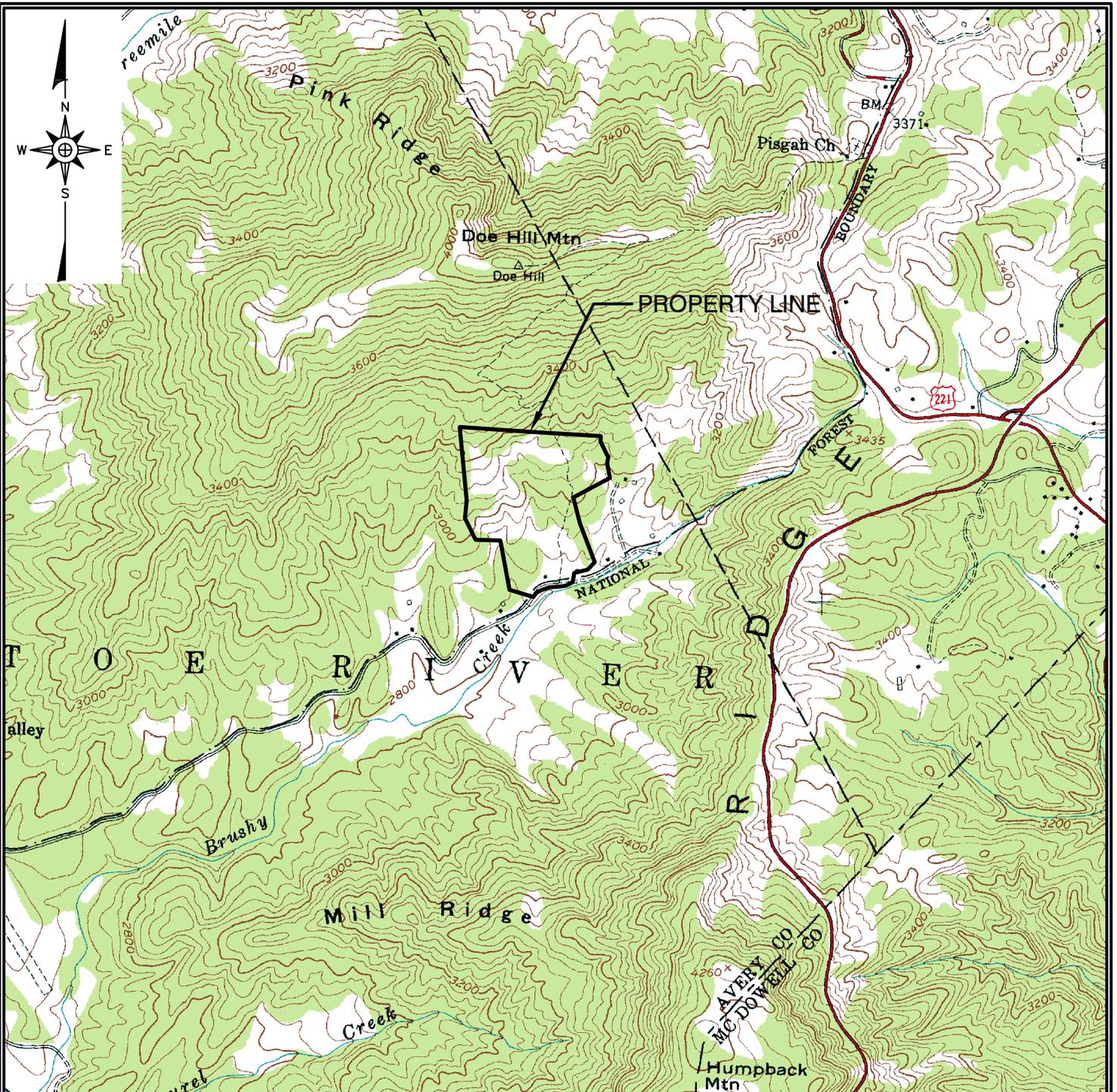
All monitoring wells shall be installed under the supervision of a geologist or engineer who is registered in North Carolina and who will certify to the SWS that the installation complies with the North Carolina Regulations. Upon installation of future wells the documentation for the construction of each well will be submitted by the registered geologist or engineer within 30 days after well construction.

8.3 IMPLEMENTATION SCHEDULE

This Monitoring Program will be implemented upon approval of this Water Quality Monitoring Plan.

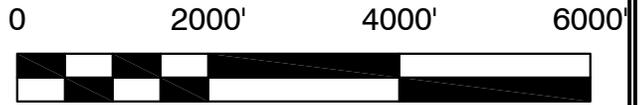
Figures

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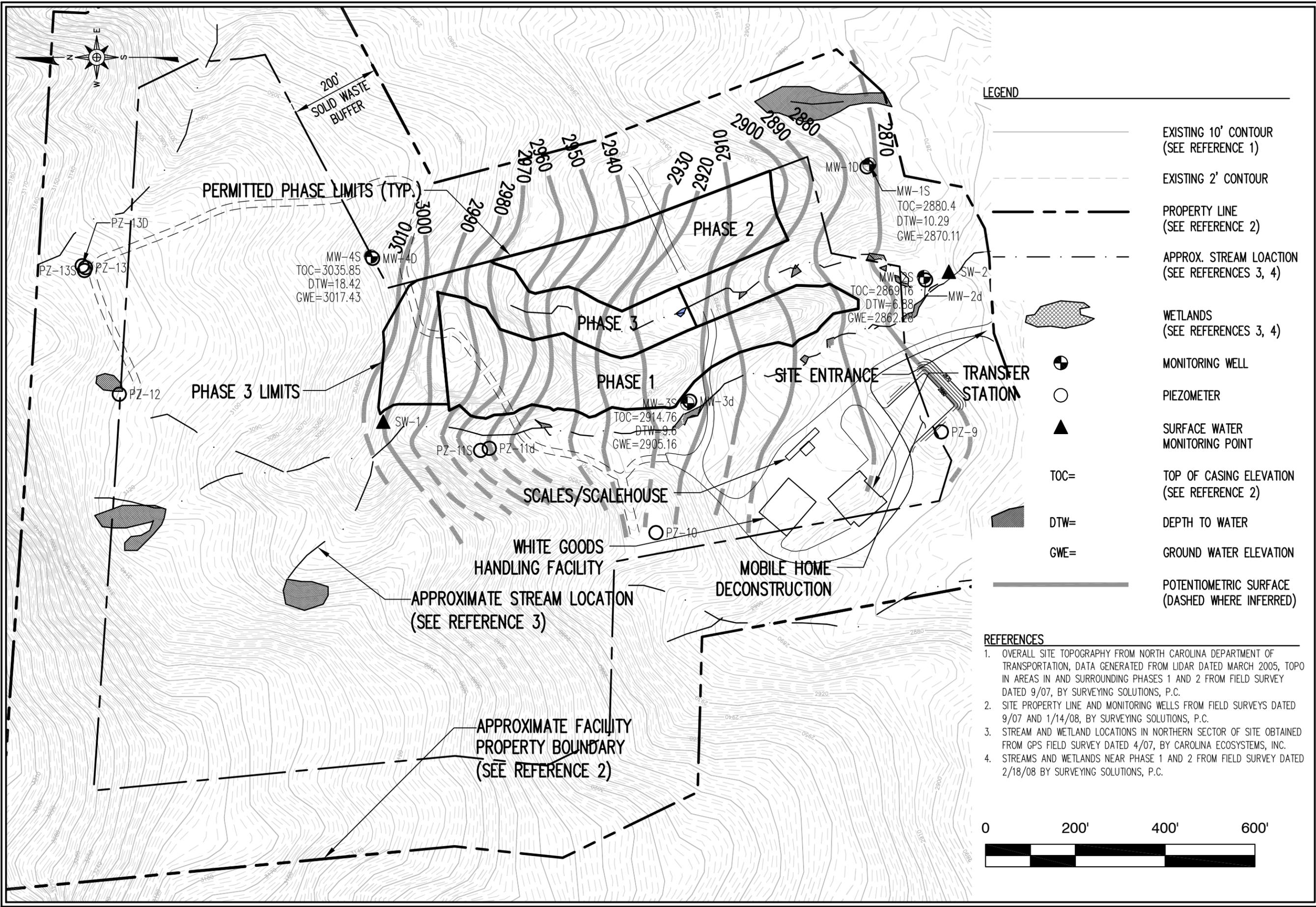
**AVERY COUNTY C&D LANDFILL
SITE VICINITY MAP**



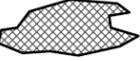
**RICHARDSON SMITH GARDNER
& ASSOCIATES**
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.rsgengineers.com
ph: 919-828-0577
fax: 919-828-3899

SCALE: AS SHOWN	DRAWN BY: J.A.L.	CHECKED BY: J.A.S.	DATE: Jul. 2008	PROJECT NO. AVERY 07-1	FIGURE NO. 1	FILE NAME AVERY-A0048
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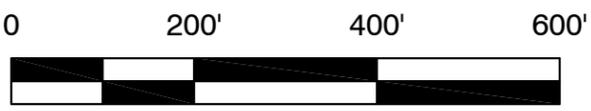


LEGEND

-  EXISTING 10' CONTOUR (SEE REFERENCE 1)
-  EXISTING 2' CONTOUR
-  PROPERTY LINE (SEE REFERENCE 2)
-  APPROX. STREAM LOCATION (SEE REFERENCES 3, 4)
-  WETLANDS (SEE REFERENCES 3, 4)
-  MONITORING WELL
-  PIEZOMETER
-  SURFACE WATER MONITORING POINT
-  TOC= TOP OF CASING ELEVATION (SEE REFERENCE 2)
-  DTW= DEPTH TO WATER
-  GWE= GROUND WATER ELEVATION
-  POTENTIOMETRIC SURFACE (DASHED WHERE INFERRED)

REFERENCES

1. OVERALL SITE TOPOGRAPHY FROM NORTH CAROLINA DEPARTMENT OF TRANSPORTATION, DATA GENERATED FROM LIDAR DATED MARCH 2005, TOPO IN AREAS IN AND SURROUNDING PHASES 1 AND 2 FROM FIELD SURVEY DATED 9/07, BY SURVEYING SOLUTIONS, P.C.
2. SITE PROPERTY LINE AND MONITORING WELLS FROM FIELD SURVEYS DATED 9/07 AND 1/14/08, BY SURVEYING SOLUTIONS, P.C.
3. STREAM AND WETLAND LOCATIONS IN NORTHERN SECTOR OF SITE OBTAINED FROM GPS FIELD SURVEY DATED 4/07, BY CAROLINA ECOSYSTEMS, INC.
4. STREAMS AND WETLANDS NEAR PHASE 1 AND 2 FROM FIELD SURVEY DATED 2/18/08 BY SURVEYING SOLUTIONS, P.C.



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FIGURE NO.	2	FILE NAME	AVERY-B0077
SCALE:	AS SHOWN	PROJECT NO.	AVERY 08-7
CHECKED BY:		DATE:	Feb. 2009
DRAWN BY:	J.A.L.		

TITLE:
AVERY COUNTY C&D LANDFILL
POTENTIOMETRIC MAP FALL '08

Tables

Table 1
Appendix I Analyte List with C&D Landfill Indicator Analytes

Appendix I Constituents	EPA Method	Synonyms
Antimony	7041	
Arsenic	7060/7061	
Barium	7080/6010	
Beryllium	7091	
Cadmium	7131	
Chloride	SM4500 CLB	
Chromium	7191	
Cobalt	7201	
Copper	7210/6010	
Iron	7300	
Lead	7421	
Manganese	200.7	
Mercury	245.1	
Nickel	7520/6010	
Selenium	7740/7741	
Silver	7761	
Sulfate	SM4500	
Thallium	7841	
Vanadium	7911	
Zinc	7950/6010	
Temperature	Field	
pH	Field	
Specific Conductance	Field	
Alkalinity	SM2320B	
Total Dissolved Solids	SM2540C	
Acetone	8260	2-Propanone
Acrylonitrile	8260	2-Propenenitrile
Benzene	8260	
Bromochloromethane	8260	Chlorobromomethane
Bromodichloromethane	8260	Dibromochloromethane
Bromoform	8260	Tribromomethane
Carbon Disulfide	8260	
Carbon Tetrachloride	8260	Tetrachloromethane
Chlorobenzene	8260	
Chloroethane	8260	Ethyl chloride
Chloroform	8260	Trichloromethane
Dibromochloromethane	8260	Chlorodibromomethane
1,2-Dibromo-3-chloropropane	8260	DBCP
1,2-Dibromoethane	8260	Ethylene dibromide, EDB
1,2-Dichlorobenzene	8260	o-Dichlorobenzene
1,4-Dichlorobenzene	8260	p-Dichlorobenzene
trans-1,4-Dichloro-2-butene	8260	
1,1-Dichloroethane	8260	Ethylidene chloride
1,2-Dichloroethane	8260	Ethylene dichloride
1,1-Dichloroethylene	8260	Vinylidene chloride
cis-1,2-Dichloroethylene	8260	
trans-1,2-Dichloroethylene	8260	
1,2-Dichloropropane	8260	Propylene dichloride
cis-1,3-Dichloropropene	8260	
trans-1,3-Dichloropropene	8260	
Ethylbenzene	8260	
2-Hexanone	8260	Methyl butyl ketone
Methyl bromide	8260	Bromomethane
Methyl chloride	8260	Chloromethane
Methyl ethyl ketone	8260	2-Butanone
Methyl iodide	8260	Iodomethane
4-Methyl-2-pentanone	8260	Methyl isobutyl ketone
Methylene bromide	8260	Dibromomethane
Methylene chloride	8260	Dichloromethane
Styrene	8260	Ethenylbenzene
1,1,1,2-Tetrachloroethane	8260	
1,1,2,2-Tetrachloroethane	8260	
Tetrachloroethylene	8260	Perchloroethylene
Toluene	8260	Methyl benzene
1,1,1-Trichloroethane	8260	Methyl chloroform
1,1,2-Trichloroethane	8260	
Trichloroethylene	8260	
Trichlorofluoromethane	8260	CFC-11
1,2,3-Trichloropropane	8260	
Vinyl acetate	8260	Acetic acid, ethenyl ester
Vinyl chloride	8260	Choroethene
Xylenes	8260	Dimethyl benzene

All concentrations in ug/l
NC 2L is the ground water standard for each constituent. Detections above these levels are considered to require assessment and possible remediation.
Where no 2L Groundwater standard is listed, the laboratory should analyze to the lowest possible level in ug/l.

Table 2

**Semi-Annual Monitoring Summary
Avery County C&D Landfill
Avery County, North Carolina**

Monitoring Location⁴	Location Northing	Location Easting	Top of Casing Elevation (ft mean sea level)	Ground Elevation (ft mean sea level)	Depth to Bottom of Well¹ (feet)	Screened Interval² (feet below grade)	Bottom Elevation (feet)	Relative Location	Monitoring Program
MW-1S	817312.1812	1121257.846	2880.37	2878.22	20.1	10-20	2858.12	Downgradient	C&D Detection ³
MW-2S	817190.8551	1121007.601	2869.16	2866.54	20	10-20	2846.54	Downgradient	C&D Detection
MW-3S	817717.5985	1120726.571	2914.76	2912.38	20.6	10-20	2891.78	Downgradient	C&D Detection
MW-4S	818421.6598	1121053.033	3035.85	3033.03	32	22-32	3001.03	Upgradient	C&D Detection
POTABLE WELL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Downgradient	C&D Detection
SW-1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Upgradient in Stream	C&D Detection
SW-2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Downgradient in Stream	C&D Detection

1 As measured during drilling from ground surface.

2 Measurements are based upon “scratch pole” tests, by RSG on 3/17/08, to determine screened interval. No boring logs could be located for these wells

3 C & D Detection = Constituents listed in 15A NCAC .0544(b)(1)(d) which includes Appendix I constituents Mercury, Chloride, Manganese, Sulfate, Iron, Specific Conductance, pH, Temperature, Alkalinity, and Total Dissolved Solids. See Table 1 for more detail.

4 Monitoring locations have been surveyed by Surveying Solutions, P.C. dated on January 14, 2008.

* All monitoring will be done on a semi-annual basis.

Attachment A

DENR USE ONLY:

Paper Report

Electronic Data - Email CD (data loaded: Yes / No)

Doc/Event #:

NC DENR

Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- Prepare one form for each individually monitored unit.
- Please type or print legibly.
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i)).
- In accordance with NC General Statutes Chapter 89C and 89E and NC Solid Waste Management Rules 15A NCAC 13B, be sure to affix a seal to the bottom of this page, when applicable.
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: _____ Phone: _____
 E-mail: _____

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)

Environmental Status: (Check all that apply)

- Initial/Background Monitoring Detection Monitoring Assessment Monitoring Corrective Action

Type of data submitted: (Check all that apply)

- | | |
|--|---|
| <input type="checkbox"/> Groundwater monitoring data from monitoring wells | <input type="checkbox"/> Methane gas monitoring data |
| <input type="checkbox"/> Groundwater monitoring data from private water supply wells | <input type="checkbox"/> Corrective action data (specify) _____ |
| <input type="checkbox"/> Leachate monitoring data | <input type="checkbox"/> Other(specify) _____ |
| <input type="checkbox"/> Surface water monitoring data | |

Notification attached?

- No. No groundwater or surface water standards were exceeded.
- Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
- Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Facility Representative Name (Print)	Title	(Area Code) Telephone Number
Signature	Date	Affix NC Licensed/ Professional Geologist/Engineer Seal here:

Attachment J

Wetland and Stream Impacts

**U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT**

Action ID. 2008-03130

County: Avery

USGS Quad: Linville Falls

GENERAL PERMIT (REGIONAL AND NATIONWIDE) VERIFICATION

Property Owner / Authorized Agent: Avery County Solid Waste / Attn: Buddy Norris

Address: P.O. Box 305

Newland, NC 28657

Telephone No.: 828-737-5420

Size and location of property (water body, road name/number, town, etc.): The site is located at 2175 Brushy Creek Road, near Ingles, Avery County, North Carolina.

Description of projects area and activity: This permit authorizes placement of fill and culverts for the expansion of an existing landfill. Impacts to stream channels authorized by this permit total 408 linear feet (0.03 acre) of intermittent stream channel and 0.01 acre of wetland. The N.C. Wildlife Resource Commission recommended that the trout moratorium be waived along with other recommendations which are attached for your review. The mitigation plan as proposed exceeds our regulatory requirements to mitigate for 408 linear feet of channel that exhibits little aquatic function, therefore we are only including a portion of the mitigation plan as a condition of this authorization. Any additional stream channel preservation and stream buffer enhancement/restoration is voluntary but also encouraged as best management practices. Special Condition: 1) The permittee will enhance 569 linear feet of perennial stream channel on-site through sediment removal techniques. 2) The permittee will also remove 40 linear feet of culvert and restore the channel to pre-construction conditions. 3) All required mitigation work shall be completed by November 9, 2009.

Applicable Law: Section 404 (Clean Water Act, 33 USC 1344)
 Section 10 (Rivers and Harbors Act, 33 USC 403)

Authorization: Regional General Permit Number:
Nationwide Permit Number: 39

Your work is authorized by the above referenced permit provided it is accomplished in strict accordance with the attached conditions and your submitted plans. Any violation of the attached conditions or deviation from your submitted plans may subject the permittee to a stop work order, a restoration order and/or appropriate legal action.

This verification will remain valid until the expiration date identified below unless the nationwide authorization is modified, suspended or revoked. If, prior to the expiration date identified below, the nationwide permit authorization is reissued and/or modified, this verification will remain valid until the expiration date identified below, provided it complies with all requirements of the modified nationwide permit. If the nationwide permit authorization expires or is suspended, revoked, or is modified, such that the activity would no longer comply with the terms and conditions of the nationwide permit, activities which have commenced (i.e., are under construction) or are under contract to commence in reliance upon the nationwide permit, will remain authorized provided the activity is completed within twelve months of the date of the nationwide permit's expiration, modification or revocation, unless discretionary authority has been exercised on a case-by-case basis to modify, suspend or revoke the authorization.

Activities subject to Section 404 (as indicated above) may also require an individual Section 401 Water Quality Certification. You should contact the NC Division of Water Quality (telephone (919) 733-1786) to determine Section 401 requirements.

For activities occurring within the twenty coastal counties subject to regulation under the Coastal Area Management Act (CAMA), prior to beginning work you must contact the N.C. Division of Coastal Management.

This Department of the Army verification does not relieve the permittee of the responsibility to obtain any other required Federal, State or local approvals/permits.

If there are any questions regarding this verification, any of the conditions of the Permit, or the Corps of Engineers regulatory program, please contact Amanda Jones at 828-271-7980.

Corps Regulatory Official Amanda Jones

Date: November 9, 2008

Expiration Date of Verification: November 24, 2010

Determination of Jurisdiction:

- A. Based on preliminary information, there appear to be waters of the US including wetlands within the above described project area. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331).
- B. There are Navigable Waters of the United States within the above described project area subject to the permit requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- C. There are waters of the US and/or wetlands within the above described project area subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- D. The jurisdictional areas within the above described project area have been identified under a previous action. Please reference jurisdictional determination issued _____. Action ID _____

Basis of Jurisdictional Determination: The site contains wetlands as indicated by the 1987 USACE Wetland Delineation Manual and also contains stream channels that exhibit indicators of ordinary high water marks. The stream channel on the property is an unnamed tributary to Brushy Creek which ultimately flows into the French Broad River and ultimately flows to the Atlantic Ocean through the Gulf of Mexico.

Appeals Information: (This information does not apply to preliminary determinations as indicated by paragraph A. above).

Attached to this verification is an approved jurisdictional determination. If you are not in agreement with that approved jurisdictional determination, you can make an administrative appeal under 33 CFR 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

District Engineer, Wilmington Regulatory Program
Attn: Amanda Jones, Project Manager
151 Patton Avenue, Room 208
Asheville, North Carolina 28801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address within 60 days from the *Issue Date* below.

****It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.****

Corps Regulatory Official: Amanda Jones

Issue Date: November 9, 2008

Expiration Date: Five years from *Issue Date*

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete the Customer Satisfaction Survey located at our website at <http://regulatory.usacesurvey.com/> to complete the survey online.

**SURVEY PLATS, FIELD SKETCH, WETLAND DELINEATION FORMS, PROJECT PLANS, ETC.,
MUST BE ATTACHED TO THE FILE COPY OF THIS FORM, IF REQUIRED OR AVAILABLE.**

Copy Furnished:

Carolina Ecosystems, Inc., Attn: Phil May, 8208 Brian Court, Garner, NC 27529

Permit Number: 2008-03130
Permit Type: NW39
Name of County: Avery
Name of Permittee: Avery County Solid Waste / Attn: Buddy Norris
Date of Issuance: November 9, 2008
Project Manager: Amanda Jones

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

U.S. Army Corps of Engineers
Attention: CESA-W-RG-A
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Signature of Permittee

Date

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND
REQUEST FOR APPEAL

Applicant: Avery County Solid Waste / Attn: Buddy Norris File Number: 2008-03130 Date: November 9, 2008

Attached is: See Section below

	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
X	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at <http://www.usace.army.mil/inet/functions/cw/cecwo/reg> or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **OBJECT:** If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **APPEAL:** If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- **ACCEPT:** You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- **APPEAL:** If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

RIGHT OF CONTACT FOR OBJECTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:

Amanda Jones, Project Manager
USACE, Asheville Regulatory Field Office
151 Patton Ave, Room 208
Asheville, NC 28806
828-271-7980

If you only have questions regarding the appeal process you may also contact:

Mr. Michael F. Bell,
Administrative Appeal Review Officer
CESAD-ET-CO-R
U.S. Army Corps of Engineers, South Atlantic Division
60 Forsyth Street, Room 9M15
Atlanta, Georgia 30303-8801

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____	Date:	Telephone number:
Signature of appellant or agent.		

For appeals on Initial Proffered Permits and approved Jurisdictional Determinations send this form to:

District Engineer, Wilmington Regulatory Division, Attn:Amanda Jones, Project Manager, Asheville Regulatory Field Office, 151 Patton Avenue, Room 208, Asheville, NC 28801.

For Permit denials and Proffered Permits send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Mike Bell, Administrative Appeal Officer, CESAD-ET-CO-R, 60 Forsyth Street, Room 9M15, Atlanta, Georgia 30303-8801



☒ North Carolina Wildlife Resources Commission ☒

Gordon Myers, Executive Director

MEMORANDUM

TO: Amanda Jones, USACOE
Asheville Regulatory Field Office

Gray Hauser, NC Division of Land Resources
NC Department of Environment and Natural Resources

FROM: Ron Linville, Regional Coordinator
Habitat Conservation Program

DATE: October 7, 2008

SUBJECT: Avery County C&D Landfill Expansion, Headwater Tributary Brushy Creek,
Avery County

The applicant proposes to expand an existing landfill. Biologists with the North Carolina Wildlife Resources Commission are familiar with habitat values in the area. These comments are provided in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667d) and the North Carolina Environmental Policy Act (G.S. 113A-1 through 113A-10; NCAC 25).

The expansion project will impact 408 linear feet of intermittent jurisdictional stream and 0.01 (0.004) acres of headwater forest wetland. Removal of waste and restoration of a 50' buffer will be provided to enhance buffer functions. Current site conditions are poor and no trout are known for these waters. Mitigation is proposed through on-site perennial buffer restoration and sediment removal within the same reach. The total mitigation package includes 5,045 linear feet of preservation, 569 linear feet of sediment removal (enhancement) plus 40 linear feet of crossing removal (daylighting). In addition to this Clean Water Act mitigation, the project's proponents indicate that trout buffer impact mitigation will be provided for 0.524 acres of impact. This mitigation includes 4.20 acres of preservation, future preservation of 7.4 acres and restoration of 0.66 acres of buffer on perennial waters. Project proponents are requesting our concurrence with Clean Water Act permits and certifications as well as concurrence with a trout buffer waiver.

Based on our review of the submittal, we will not object to the project as proposed. We believe the project as proposed should improve aquatic ecosystems below the site. It is possible that repopulation by aquatic life could occur once the project is completed and stabilized. Accordingly, 404 Permits and 401 Certifications should include the proposed mitigation measures. Additionally, we recommend that the NCDLR allow a trout waiver for the project.

The following non-prioritized recommendations are provided for permit and certification considerations:

1. Stringent erosion control measures should be installed where soil is disturbed and maintained until project completion. If appropriate, sediment and erosion control measures should adhere to the design standards for sensitive watersheds (15A NCAC 4B .0024).
2. If any concrete will be used, work must be accomplished so that wet concrete does not contact stream water.
3. Heavy equipment should be operated from banks rather than in the stream channel in order to minimize sedimentation/turbidity and to reduce potential introduction of petroleum pollutants into area streams. If practicable, suction dredging and filter bags should be used for sedimentation removal. If this is not practicable or feasible, appropriate erosion control measures should be used.
4. Native plants should be used for stream buffer vegetation. Temporary or permanent native herbaceous vegetation should be established on all bare soil within five (5) days of ground disturbing activities in the twenty-five (25) foot trout buffer to provide long-term erosion control. In addition to the trees and shrubs proposed, we recommend using annual oats or wheat for temporary vegetation. Natural fiber matting is recommended over plastic matting that can impinge and entrap small animals.
5. Stormwater and infiltration management should be provided to intercept landfill drainage using bio-filters or similar devices such as Low Impact Development (LID) measures and techniques. Information on LID practices and techniques can be found at www.lowimpactdevelopment.org, <http://www.epa.gov/owow/nps/lid/lidnatl.pdf> and <http://www.stormwatercenter.net/>.

Thank you for the opportunity to review and comment on this project during the early planning stages. If you have any questions regarding these comments, please contact me at 336/769-9453.

E-copy: Kevin Barnett, Linda Wiggs, DWQ-ARO



Michael F. Easley, Governor

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Coleen H. Sullins, Director
Division of Water Quality

November 21, 2008

DWQ Project # 08-1464
Avery County

Buddy Norris, Solid Waste Director
Avery County
Post Office Box 305
Newland, North Carolina 28657.

Subject Property: Avery County Landfill Expansion
UT to Brushy Creek (FRB06, 7-2-29, C;Tr)

Approval of 401 Water Quality Certification with Additional Conditions

Dear Mr. Norris:

You have our approval, in accordance with the attached conditions and those listed below, to place fill within or otherwise impact 0.004 acres of wetlands and 408 feet of intermittent streams for the purpose of expansion of the Avery County Solid Waste Landfill at the subject property, as described within your application received by the N.C. Division of Water Quality (DWQ) on September 24, 2008. After reviewing your application, we have decided that the impacts are covered by General Water Quality Certification Number(s) 3705 (GC3705). The Certification(s) allows you to use Nationwide Permit(s) 39 when issued by the US Army Corps of Engineers (USACE). In addition, you should obtain or otherwise comply with any other required federal, state or local permits before you go ahead with your project including (but not limited to) Erosion and Sediment Control, Non-discharge, and stormwater regulations. **Also, this approval to proceed with your proposed impacts or to conduct impacts to waters as depicted in your application shall expire upon expiration of the 404 or CAMA Permit.**

This approval is for the purpose and design that you described in your application. If you change your project, you must notify us and you may be required to send us a new application. If the property is sold, the new owner must be given a copy of this Certification and approval letter and is thereby responsible for complying with all conditions. If total fills for this project (now or in the future) exceed one acre of wetland or 150 linear feet of stream, compensatory mitigation may be required as described in 15A NCAC 2H .0506 (h). This approval requires you to follow the conditions listed in the attached certification and any additional conditions listed below.

The Additional Conditions of the Certification are:

One
North Carolina
Naturally

North Carolina Division of Water Quality 2090 U.S. Highway 70 Swannanoa, NC 28778 Phone (828) 296-4500 Customer Service
Internet: www.ncwaterquality.org FAX (828) 299-7043 1-877-623-6748

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1. Impacts Approved

The following impacts **are** hereby approved as long as **all of the other** specific and general conditions of this Certification (or Isolated Wetland Permit) **are met**. No other impacts **are approved** including incidental impacts:

	Amount Approved (Units)	Plan Location or Reference
Stream	408 (feet)	UT to Brushy Creek
404/CAMA Wetlands	0.004 (acres)	Wetlands

2. Compensatory Mitigation (Final Plan Needed)

As the submitted mitigation is the restoration / enhancement of a stream impacted from the land disturbing activities on-site, this is not suitable mitigation for the proposed impacts. Mitigation must be provided for the proposed impacts as specified in the table below. A final compensatory mitigation plan must be approved in writing by this Office before any of the impacts approved herein are conducted. Additionally, the compensatory mitigation plan must be completely constructed and implemented according to the plans approved by this Office before any permanent building or road associated with the project is occupied or opened. The mitigation must be maintained according to the approved plan and permanently protected by the use of conservation easements or similar protections. Any repairs or adjustments to the mitigation site must be made according to the approved plan or must receive written approval from this Office to make the repairs or adjustments.

	Compensatory Credit Mitigation Required
Stream	204 (linear feet) (0.5:1 ratio multiplier added)
Wetlands	0.004 (acres)

3. Turbidity Standard

The turbidity standard of 10 NTUs (Nephelometric Turbidity Units) shall not be exceeded as described in 15 A NCAC 2B. 0200. Appropriate sediment and erosion control practices must be used to meet this standard.

4. No Impacts Beyond those in Application

No waste, spoil, solids, or fill of any kind shall occur in wetlands, waters, or riparian areas beyond the footprint of the impacts depicted in the Pre-Construction Notification. All construction activities, including the design, installation, operation, and maintenance of sediment and erosion control Best Management Practices, shall be performed so that no violations of state water quality standards, statutes, or rules occur.

5. No Sediment and Erosion Control Measures in Wetlands and Waters

Sediment and erosion control measures shall not be placed in wetlands or waters to the maximum extent practicable. If placement of sediment and erosion control devices in wetlands and waters is unavoidable, they shall be removed and the natural grade restored within six months of the date that the Division of Land Resources or locally delegated program has released the project.

6. Trout Moratorium

The stream is a Class C Trout Waters. In order to protect downstream uses for Class C Trout Waters a requirement of this Certification is that any additional work conducted within the stream may not occur between the dates of October 15 through April 15.

7. Sediment Removal

All sediment within the perennial section of the UT to Brushy Creek shall be removed and the impacted area returned to the original grade, including each stream's original cross sectional dimensions, planform pattern, and longitudinal bed and bed profile by May 15, 2009 and the various sites shall be stabilized with natural woody vegetation (except for the maintenance areas of permanent utility crossings) and restored to prevent erosion.

Violations of any condition herein set forth may result in revocation of this Certification and may result in criminal and/or civil penalties. The authorization to proceed with your proposed impacts or to conduct impacts to waters as depicted in your application and as authorized by this Certification shall expire upon expiration of the 404 or CAMA Permit.

If you do not accept any of the conditions of this Certification (associated with the approved wetland or stream impacts), you may ask for an adjudicatory hearing. You must act within 60 days of the date that you receive this letter. To ask for a hearing, send a written petition, which conforms to Chapter 150B of the North Carolina General Statutes to the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, N.C. 27699-6714. This certification and its conditions are final and binding unless you ask for a hearing.

This letter completes the review of the Division of Water Quality under Section 401 of the Clean Water Act. If you have any questions, please telephone Kevin Barnett in the DWQ Asheville Regional Office at 828-296-4500.

Sincerely,

Roque C. Edwards
for Coleen H. Sullins, Director

CHS/khb

Enclosures: GC 3705
Certificate of Completion

cc: Phil May,
Carolina Ecosystems, Inc.
8208 Brian Court
Garner, NC 27529
USACE Asheville Regulatory Field Office
DWQ Asheville Regional Office
File Copy
Central Files

Filename: 08-1464.AveryCountyLandfill.Approval



DWQ Project No.: _____ County: _____
Applicant: _____
Project Name: _____
Date of Issuance of 401 Water Quality Certification: _____

Certificate of Completion

Upon completion of all work approved within the 401 Water Quality Certification or applicable Buffer Rules, and any subsequent modifications, the applicant is required to return this certificate to the 401/Wetlands Unit, North Carolina Division of Water Quality, 1650 Mail Service Center, Raleigh, NC, 27699-1650. This form may be returned to DWQ by the applicant, the applicant's authorized agent, or the project engineer. It is not necessary to send certificates from all of these.

Applicant's Certification

I, _____, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature: _____ Date: _____

Agent's Certification

I, _____, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature: _____ Date: _____

If this project was designed by a Certified Professional

I, _____, as a duly registered Professional _____ (i.e., Engineer, Landscape Architect, Surveyor, etc.) in the State of North Carolina, having been authorized to observe (periodically, weekly, full time) the construction of the project, for the Permittee hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature _____ Registration No. _____

Date _____



Water Quality Certification N^o. 3705

**GENERAL CERTIFICATION FOR PROJECTS ELIGIBLE
FOR U.S. ARMY CORPS OF ENGINEERS NATIONWIDE PERMIT
NUMBERS 18 (MINOR DISCHARGES), 29 (RESIDENTIAL DEVELOPMENT),
39 (COMMERCIAL AND INSTITUTIONAL DEVELOPMENTS),
41 (RESHAPING EXISTING DRAINAGE DITCHES), 42 (RECREATIONAL FACILITIES),
44 (MINING ACTIVITIES), AND 46 (DISCHARGES IN DITCHES),
AND RIPARIAN AREA PROTECTION RULES (BUFFER RULES)**

Water Quality Certification Number 3705 is issued in conformity with the requirements of Section 401, Public Laws 92-500 and 95-217 of the United States and subject to the North Carolina Division of Water Quality (DWQ) Regulations in 15A NCAC 2H, Section .0500 and 15A NCAC 2B .0200 for the discharge of fill material to waters and adjacent wetland areas or to wetland areas that are not a part of the surface tributary system to interstate waters or navigable waters of the United States () as described in 33 CFR 330 Appendix A (B) (18, 29, 39, 41, 42, 43, 44, and 46) of the Corps of Engineers regulations (i.e., Nationwide Permit No. 39) and for the Riparian Area Protection Rules (Buffer Rules) in 15A NCAC 2B .0200.

The State of North Carolina certifies that the specified category of activity will not violate applicable portions of Sections 301, 302, 303, 306 and 307 of the Public Laws 92-500 and 95-217 if conducted in accordance with the conditions hereinafter set forth.

Activities meeting any one (1) of the following criteria require written approval from the Division of Water Quality (the "Division"):

- I. Stream and/or buffer impacts:
 - a. Any impacts to perennial waters (as depicted on the most recent USGS 1:24000 topographic map or as otherwise determined by the local government,) and their associated riparian buffers in Water Supply (WS), High Quality Water (HQW), or Outstanding Resource Water (ORW) watersheds. Only water-dependent activities, public projects, and structures with diminimus increases in impervious surfaces will be allowed as outlined in those rules [15A NCAC 2B .0212 through .0215]. All other activities require a variance from the delegated local government and/or the NC Environmental Management Commission before the application for the 401 Water Quality Certification can be processed.
 - b. Any impacts to streams and buffers in the Neuse, Tar-Pamlico, Randleman and Catawba River Basins (or any other basins with Riparian Area Protection Rules [Buffer Rules] in effect at the time of application [in accordance with 15A NCAC 2B .0200]), *unless* the activities are listed as "EXEMPT" from these Rules.
 - c. Any impacts to streams involving excavation or dredging.
 - d. Total stream impacts equal to or greater than 150 linear feet of intermittent and/or perennial stream to be filled, culverted, rip rapped, or relocated, including temporary and/or permanent impacts.
- II. Impacts (temporary and/or permanent) to waters:
 - a. Equal to or greater than one-third (1/3) of an acre East of Interstate 95 (I-95).
 - b. Equal to or greater than one-tenth (1/10) acre West of Interstate 95 (I-95).
- III. Wetland impacts (temporary and/or permanent):
 - a. Equal to or greater than one-third (1/3) acre East of Interstate-95.
 - b. Equal to or greater than one-tenth (1/10) acre West of Interstate-95.
 - c. Any impacts to wetlands adjacent to waters designated as: ORW, SA, WS-I, WS-II, or Trout, or wetlands contiguous to waters designated as a North Carolina or National Wild and Scenic River.
 - d. Any impacts to coastal wetlands [15A NCAC 7H .0205], or Unique Wetlands (UWL) [15A NCAC 2H .0506].

Water Quality Certification N^o. 3705

IV. If the activity is associated with or in response to a Notice of Violation or an enforcement action initiated by the Division and/or the Division of Land Resources.

In accordance with North Carolina General Statute Section 143-215.3D(e), written approval for a 401 Water Quality General Certification must include the appropriate fee. If a project also requires a CAMA Permit, then one payment to both agencies shall be submitted and will be the higher of the two fees.

Activities that are below the thresholds, or otherwise do not meet the criteria listed above in this General Certification do *not* require written approval from the Division of Water Quality as long as they comply with the Conditions of Certification listed below, including the Stormwater Management Plan condition. If the project requires a Stormwater Management Plan, but is otherwise below the written approval thresholds, the applicant may provide a courtesy copy of the Pre-Construction Notification along with a copy of the Stormwater Management Plan (and approval letter from the appropriate locally delegated state program where applicable). If any of these Conditions cannot be met, then written approval from the Division is required.

Conditions of Certification:

1. **No Impacts Beyond those Authorized** in the Written Approval or Beyond the Threshold of Use of this Certification

No waste, spoil, solids, or fill of any kind shall occur in wetlands, waters, or riparian areas beyond the footprint of the impacts depicted in the Pre-Construction Notification and authorized in the written approval from the Division, including incidental impacts. All construction activities, including the design, installation, operation, and maintenance of sediment and erosion control Best Management Practices, shall be performed so that no violations of state water quality standards, statutes, or rules occur.

2. Standard Erosion and Sediment Control Practices

Erosion and sediment control practices must be in full compliance with all specifications governing the proper design, installation and operation and maintenance of such Best Management Practices:

- a. Design, installation, operation, and maintenance of the sediment and erosion control measures must be such that they equal, or exceed, the requirements specified in the most recent version of the *North Carolina Sediment and Erosion Control Manual*. The devices shall be maintained on all construction sites, borrow sites, and waste pile (spoil) projects, including contractor-owned or leased borrow pits associated with the project.
- b. For borrow pit sites, the erosion and sediment control measures must be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Surface Mining Manual*.
- c. Reclamation measures and implementation must comply with the reclamation in accordance with the requirements of the Sedimentation Pollution Control Act and the Mining Act of 1971.
- d. Sufficient materials required for stabilization and/or repair of erosion control measures and stormwater routing and treatment shall be on site at all times.
- e. If the project occurs in waters or watersheds classified as Primary Nursery Areas (PNAs), Trout (Tr), SA, WS-I, WS-II, High Quality (HQW), or Outstanding Resource (ORW) waters, then the sediment and erosion control requirements contained within *Design Standards in Sensitive Watersheds* (15A NCAC 04B .0124) supercede all other sediment and erosion control requirements.

Water Quality Certification N^o. 3705

3. No Sediment and Erosion Control Measures in Wetlands or Waters

Sediment and erosion control measures should not be placed in wetlands or waters without **prior** approval by the Division. If placement of sediment and erosion control devices in wetlands and waters is unavoidable, then design and placement of temporary erosion control measures shall not be conducted in a manner that may result in dis-equilibrium of wetlands or stream beds or banks, adjacent to or upstream and down stream of the above structures. All sediment and erosion control devices shall be removed and the natural grade restored within **two (2) months** of the date **that the Division of Land Resources or locally delegated program has released the project.**

4. Construction Stormwater Permit NCG010000

Upon the approval of an Erosion and Sedimentation Control Plan issued by the Division of Land Resources (DLR) or a DLR delegated local erosion and sedimentation control program, **an NPDES General stormwater permit (NCG010000) administered by the Division is automatically issued to the project.** This General Permit allows stormwater to be discharged during land disturbing construction activities as stipulated by conditions in the permit. If your project is covered by this permit [applicable to construction projects that disturb one (1) or **more acres**], full compliance with permit conditions including the sedimentation control plan, self-monitoring, record keeping and reporting requirements are required. A copy of this permit **and monitoring report forms may be found at** http://h2o.enr.state.nc.us/su/Forms_Documents.htm.

5. Construction Moratoriums and Coordination

If activities must occur during periods of high biological activity (i.e. **sea** turtle or bird nesting), **then** biological monitoring may be required at the request of **other** state or federal agencies **and** coordinated with these activities. This condition can be waived through written concurrence on a case by case basis upon reasonable justification.

All moratoriums on construction activities established by the NC Wildlife Resources Commission (WRC), US Fish and Wildlife Service (USFWS), NC Division of Marine Fisheries (DMF), or National Marine Fisheries Service (NMFS) to lessen impacts on trout, anadromous fish, larval/post-larval fishes and crustaceans, or other aquatic species of concern shall be implemented. This condition can be waived through written concurrence on a **case** by case basis upon reasonable justification.

Work within the twenty-five (25) designated trout counties or identified state or federal endangered or threatened species habitat shall be coordinated with the appropriate WRC, USFWS, NMFS, and/or DMF personnel.

6. Work in the Dry

All work in or adjacent to stream waters shall be conducted in a dry work area. Approved best management practices from the most current version of the NC Sediment and Erosion Control Manual, or the NC DOT Construction and Maintenance Activities Manual, such as sandbags, rock berms, cofferdams, and other diversion structures shall be used to minimize excavation in flowing water. Exceptions to this condition require submittal to, and approval by, the Division of Water Quality.

Water Quality Certification N^o. 3705

7. Riparian Area Protection (Buffer) Rules

Activities located in the protected 50-foot wide riparian areas (whether jurisdictional wetlands or not), within the Neuse, Tar-Pamlico, Catawba, or Randleman (or any other basin with buffer rules), shall be limited to "uses" identified within and constructed in accordance with 15A NCAC 2B .0233, .0259, .0250 and .0243, and shall be located, designed, constructed, and maintained to have minimal disturbance to protect water quality to the maximum extent practicable through the use of best management practices. All buffer rule requirements, including diffuse flow requirements, must be met.

8. Water Supply Watershed Buffers

The 30-foot wide vegetative buffer (low-density development) or the 100-foot wide vegetative buffer (high-density development) shall be maintained adjacent to all perennial waters except for allowances as provided in the Water Supply Watershed Protection Rules [15A NCAC 2B .0212 through .0215].

9. If concrete is used during the construction, then a dry work area should be maintained to prevent direct contact between curing concrete and stream water. Water that inadvertently contacts uncured concrete should not be discharged to surface waters due to the potential for elevated pH and possible aquatic life/fish kills.

10. Compensatory Mitigation

In accordance with 15A NCAC 2H .0506 (h), compensatory mitigation may be required for losses of 150 linear feet or more of streams and/or one (1) acre or more of wetlands. For linear, public transportation projects, impacts equal to or exceeding 150 linear feet per stream shall require mitigation.

Compensatory stream mitigation shall be required at a 1:1 ratio for all perennial and intermittent stream impacts in watersheds classified as ORW, HQW, Trout, WS-I and WS-II.

Buffer mitigation may be required for any project with Buffer Rules in effect at the time of application for buffer impacts resulting from activities classified as "Allowable with Mitigation" within the "Table of Uses" section of the Buffer Rules or require a variance under the Buffer Rules.

A determination of buffer, wetland and stream mitigation requirements shall be made for any General Water Quality Certification for this Nationwide Permit. Design and monitoring protocols shall follow the US Army Corps of Engineers Wilmington District *Stream Mitigation Guidelines* (April 2003), or its subsequent updates. Compensatory mitigation plans shall be submitted for written Division approval as required in those protocols. Alternatively, the Division will accept payment into an in-lieu fee program or credit purchase from a mitigation bank.

Finally, the mitigation plan must be implemented and/or constructed before any permanent building or structure on site is occupied. In the case of public road projects, the mitigation plan must be implemented before the road is opened to the public. Proof of payment to an in-lieu fee program or mitigation bank must be provided to the Division to satisfy this requirement.

Water Quality Certification N^o. 3705

11. For all activities requiring re-alignment of streams, a stream relocation plan must be included for written Division approval. Relocated stream designs should include the same dimensions, patterns and profiles as the existing channel (or a stable reference reach if the existing channel is unstable), to the maximum extent practical. The new channel should be constructed in the dry and water shall not be turned into the new channel until the banks are stabilized. Vegetation used for bank stabilization shall be limited to native woody species, and should include establishment of a 30-foot wide wooded and an adjacent 20-foot wide vegetated buffer on both sides of the relocated channel to the maximum extent practical. A transitional phase incorporating appropriate erosion control matting materials and seedling establishment is allowable. Rip-rap, A-Jacks, concrete, gabions or other hard structures may be allowed if it is necessary to maintain the physical integrity of the stream; however, the applicant must provide written justification and any calculations used to determine the extent of rip-rap coverage. Please note that if the stream relocation is conducted as a stream restoration as defined in the US Army Corps of Engineers Wilmington District, April 2003 *Stream Mitigation Guidelines* (or its subsequent updates), the restored length can be used as compensatory mitigation for the impacts resulting from the relocation.

12. Stormwater Management Plan Requirements

A. For applicants other than the North Carolina Department of Transportation, a Stormwater Management Plan in accordance with the version of *Stormwater Management Plan (SMP) Requirements for Applicants other than the North Carolina Department of Transportation* posted on the Division web site at the time of application shall be provided for any project that meets both of the following two criteria:

- i. Requires a 404 Permit or Isolated Wetlands Permit (regardless of whether written authorization is required by the Division), AND
- ii. Contains one or more drainage areas that are anticipated to have impervious surface cover of equal to or greater than 24 percent. When drainage areas are difficult to delineate or when a pocket of high density exists within a drainage area, the Division shall use best professional judgment to apply the SMP requirement as appropriate.

B. For the North Carolina Department of Transportation, compliance with NCDOT's Individual NPDES permit NCS000250 shall serve to satisfy this condition.

13. Placement of Culverts and Other Structures in Waters and Wetlands

Culverts required for this project shall be designed and installed in such a manner that the original stream profiles are not altered and allow for aquatic life movement during low flows. Existing stream dimensions (including the cross section dimensions, pattern, and longitudinal profile) must be maintained above and below locations of each culvert. Placement of culverts and other structures in waters and streams must be placed below the elevation of the streambed by one foot for all culverts with a diameter greater than 48 inches, and 20 percent of the culvert diameter for culverts having a diameter less than or equal to 48 inches, to allow low flow passage of water and aquatic life.

Installation of culverts in wetlands must ensure continuity of water movement and be designed to adequately accommodate high water or flood conditions. Additionally, when roadways, causeways or other fill projects are constructed across FEMA-designated floodways or wetlands, openings such as culverts or bridges must be provided to maintain the natural hydrology of the system as well as prevent constriction of the floodway that may result in destabilization of streams or wetlands.

Water Quality Certification N^o. 3705

If site-specific topographic constraints preclude the ability to bury the culverts as described above and/or the applicant can demonstrate that burying the culvert would result in destabilization of the channel and head-cutting upstream, the Division will consider alternative design proposals.

Any riprap required for normal pipe burial and stabilization shall be buried such that the original stream elevation is restored and maintained.

The establishment of native, woody vegetation and other soft stream bank stabilization techniques must be used where practicable instead of riprap or other bank hardening methods.

14. Additional site-specific conditions may be added to the written approval letter for projects proposed under this Water Quality Certification in order to ensure compliance with all applicable water quality and effluent standards.
15. If an environmental document is required under the National or State Environmental Policy Act (NEPA or SEPA), then this General Certification is not valid until a Finding of No Significant Impact (FONSI) or Record of Decision (ROD) is issued by the State Clearinghouse.
16. If this Water Quality Certification is used to access building sites, then all lots owned by the applicant must be buildable without additional impacts to streams or wetlands. The applicant is required to provide evidence that the lots are buildable without requiring additional impacts to wetlands, waters or buffers if required to do so in writing by the Division. For road construction purposes, this Certification shall only be utilized from natural high ground to natural high ground.
17. Deed notifications or similar mechanisms shall be placed on all retained jurisdictional wetlands, waters and protective buffers in order to assure compliance for future wetland, water and buffer impact. These mechanisms shall be put in place at the time of recording of the property, or of individual lots, whichever is appropriate. A sample deed notification can be downloaded from the 401/Wetlands Unit web site at <http://h2o.enr.state.nc.us/ncwetlands>. The text of the sample deed notification may be modified as appropriate to suit to a specific project.
18. When written authorization is required for use of this certification, upon completion of all permitted impacts included within the approval and any subsequent modifications, the applicant shall be required to return the certificate of completion attached to the approval. One copy of the certificate shall be sent to the DWQ Central Office in Raleigh at 1650 Mail Service Center, Raleigh, NC, 27699-1650.
19. This General Certification shall expire three (3) years from the date of issuance of the written letter from the Division or on the same day as the expiration date of the corresponding Nationwide Permit. The conditions in effect on the date of issuance of Certification for a specific project shall remain in effect for the life of the project, regardless of the expiration date of this Certification. If the construction process for approved activities will overlap the expiration and renewal date of the corresponding 404 Permit and the Corps allows for continued use of the 404 Permit, then the General Certification shall also remain in effect without requiring re-application and re-approval to use this Certification for the specific impacts already approved.

Water Quality Certification N^o. 3705

20. The applicant/permittee and their authorized agents shall conduct all activities in a manner consistent with State water quality standards (including any requirements resulting from compliance with §303(d) of the Clean Water Act), and any other appropriate requirements of State and Federal Law. If the Division determines that such standards or laws are not being met, including failure to sustain a designated or achieved use, or that State or Federal law is being violated, or that further conditions are necessary to assure compliance, then the Division may reevaluate and modify this General Water Quality Certification.

Non-compliance with or violation of the conditions herein set forth by a specific fill project may result in revocation of this General Certification for the project and may also result in criminal and/or civil penalties.

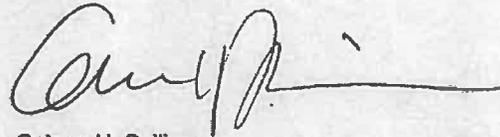
The Director of the North Carolina Division of Water Quality may require submission of a formal application for Individual Certification for any project in this category of activity, if it is determined that the project is likely to have a significant adverse effect upon water quality including state or federally listed endangered or threatened aquatic species or degrade the waters so that existing uses of the wetland or downstream waters are precluded.

Public hearings may be held for specific applications or group of applications prior to a Certification decision if deemed in the public's best interest by the Director of the North Carolina Division of Water Quality.

Effective date: November 1, 2007

DIVISION OF WATER QUALITY

By



Coleen H. Sullins

Director

History Note: Water Quality Certification Number 3705 replaces Water Quality Certification Numbers 3106 and 3108 issued on February 11, 1997, Water Quality Certification Number 3287 issued on June 1, 2000, Water Quality Certification Number 3362 issued March 18, 2002, Water Quality Certification Number 3402 issued March, 2003, and Water Quality Certification Number 3631 issued March 19, 2007. This Water Quality Certification is rescinded when the Corps of Engineers re-authorizes Nationwide Permits 18, 29, 39, 41, 42, 43 or 44 or when deemed appropriate by the Director of the Division of Water Quality.