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Backus	09/17/2013	19810	9228-CDLF-2001



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 TEL: 919 828.0577
 WEB: www.smithgardnerinc.com

April 19, 2013

Ms. Patricia (Pat) M. Backus, P.E.
 Environmental Engineer
 NC DENR - Division of Waste Management
 217 W. Jones Street
 Raleigh, North Carolina 27603

RE: **Permit to Operate Renewal Application – Response to Comments
 Red Rock Disposal, LLC
 NC Solid Permit No. 92-28**

Dear Pat:

On behalf of Red Rock Disposal, LLC (a Waste Industries Company), Smith Gardner, Inc. (S+G) is pleased to provide additional information for the review of the above referenced application. Per our discussions, the site historical permitting has included a variety of minor revisions to the permit documents. In our recent application, some of the assumed unchanged sections were incorporated by reference only. After further review, and to assist in the Division’s review of the application, S+G has assembled each of the previous documents for replacement in the existing renewal application as follows:

Executive Summary

- Attachment D – Facility and Engineering Plan (Formerly Facility Report)
- Attachment E – Technical Specifications
- Attachment F – Construction Quality Assurance Plan
- Attachment H – Closure and Post-Closure Plan
- Attachment L – Project Drawings

Should you have any questions or require clarification, please contact me at (919) 828-0577 or by email below.

Sincerely,
SMITH GARDNER, INC.

Stacey A. Smith, P.E.
 Project Manager, ext. 127
stacey@smithgardnerinc.com



jwc/sas

Att.

CC: Mr. Don Plessinger, Red Rock Disposal, LLC
 Mr. David Pepper, Waste Industries
 Ms. Shawn McKee, NCDENR
 File

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Executive Summary

General

The following Permit Renewal Application has been prepared on behalf of Red Rock Disposal, LLC, a wholly owned subsidiary of Waste Industries USA, Inc. for the renewal of the Permit to Operate (PTO) of the construction and demolition (C&D) landfill facility covered under North Carolina Permit No. 92-28 located in Holly Springs, North Carolina. The current permit expires on July 3, 2013. A copy is provided in **Attachment A**. It is the intent of Red Rock Disposal, LLC to continue with the facility operations upon approval of this application.

According to the most recently completed survey conducted on February 2, 2012 by GeoData Corporation, the Red Rock landfill facility has a remaining constructed capacity of approximately 1,661,140 cubic yards. Based upon a density of 0.55 TCY, the average annual receiving rate at the facility is approximately 60,000 tons or approximately 110,000 cubic yards per year, much less than the remaining volume at the facility.

C&D in the state remains impacted by the economy. At the average annual receiving rate, the facility, as constructed, has greater than five (5) years of volume remaining. Therefore, it is our opinion that the projected volume is suitable for the permit term.

Contact Information

All correspondence and questions concerning the operation of the Red Rock landfill facility should be directed to the appropriate site management listed below:

Red Rock Disposal, LLC
7130 New Landfill Road
Holly Springs, North Carolina 27540
Phone: (919) 557-9583
Fax: (919) 557-9523
Contact: Don Plessinger
Email: don.plessinger@wasteindustries.com

Regulatory Reference

This submission has been prepared in general accordance with the requirements of the North Carolina Solid Waste Management Rule 15A NCAC 13B .0531-.0547, and applicable sections of the North Carolina General Assembly's Session Law 2007-500 (Solid Waste Management Act of 2007). The following documents (with applicable rule(s) in italics) either required by the rules for renewal or provided for general reference are summarized below:

Property Description (15A NCAC 13B .0536);
Local Government Approvals (15A NCAC 13B .0536);
Facility and Engineering Plan (15A NCAC 13B .0539);

Construction Quality Assurance Plan (15A NCAC 13B .0541);
 Operations Manual (15A NCAC 13B .0542);
 Closure and Post Closure Plan (15A NCAC 13B .0543);
 Monitoring Plan (15A NCAC 13B .0544); and
 Financial Assurance (General Statutes Article 9, Chapter 130A-295.2).

Property Description

The Red Rock landfill facility owns and operates on the following tracts of property as described in the table below. Legal descriptions for these properties are included in **Attachment B**.

Wake County, NC Register of Deeds				
Deed Book	Page No.	Grantor	Grantee	Acreage
8101	854	Curtis L. Jones, Sr. and Shirley L. Jones; and Curtis L. Jones Jr. and Georgianna K. Jones	Holly Springs Landfill, LLC	51.834
9250	1180-1185	Waste Industries Landco, LLC	Red Rock Disposal, LLC	172.78
Book of Maps 2002	308	Recombination survey		
Book of Maps 2002	726	Road easement survey		
Total Acreage				224.61

Local Government Approvals

The Franchise Agreement repeated in the application for clarity was completed in January of 2007. The process strictly followed the requirements of (recodified) G.S. 130A-294(b1)(3), which became effective on August 23, 2006 and the provisions of the applicable requirements of Wake County. As part of the Franchise Agreement Amendment process, the following summarizes key dates and activities:

1. November 17, 2006 - Application for Amendment of Construction & Demolition Debris Landfill Franchise Agreement submitted to Wake County.
2. December 4, 2006 - Regular Meeting of the Wake County Board of Commissioners Meeting; first vote taken upon Application - Action: Passed and referred to the next regular meeting of the Board for Public Hearing. (January 8, 2007).
3. December 7, 2006 - Notice of Public Hearing published in News & Observer, Raleigh, NC. A copy of the Certified Affidavit of Publication for the News & Observer, dated

December 7, 2006 was provided in the March 16, 2007 Request for Service Area Expansion to the Department.

It is noted that this substantial amendment application was submitted to the Department and confirms fulfillment of the requirements that were in effect at the time this application was submitted (November 17, 2006) and initially approved and referred to Public Hearing by the Board of Commissioners of Wake County (December 4, 2006) which were: G.S. 130A-294(b1)(2) and G.S. 153A-46 and the requirements of Wake County for the Amendment of the subject Franchise. It is further noted that the provisions of 15A NCAC 13B.0536(c)(11) were not effective until January 1, 2007, which date was subsequent to the first regular meeting of Board at which the Ordinance was passed (December 4, 2006) and was subsequent to the December 7, 2006 date of publication for the second regular (Public Hearing) meeting.

4. December 8, 2006 - Delivery of Facility Plans and Documents to Holly Springs and Fuquay-Varina Public Libraries. It is noted that the permit application and related information supporting the Franchise Agreement Amendment were placed in the two libraries closest to the site area, rather than the single closest library, which was the requirement at that time of G.S.130A-294(b1)(3).
5. December 8, 2006 - Posting of Property for Notice of Hearing. It is noted that the property was posted at two locations along the public road adjacent to the property (Rex Road). That is, it was posted where the property abuts Rex Road and it was posted at the facility entrance along Rex Road (the facility shares an entrance with the Hanson Quarry).
6. January 8, 2007 - Regular meeting of the Wake County Board of Commissioners at which, after a Public Hearing the Ordinance Granting the Amendment of the Franchise to Red Rock Disposal, LLC was passed and the Ordinance was adopted.

Within DENR's revised C&D Rules (effective January 1, 2007), the requirements for local approval, including, the Franchise Agreement process were revised. Although the final vote by Wake County occurred on January 8, 2007, after the effective date of the new C&D rules, the first regular meeting was held December 4, 2006 and the final meeting was legally Noticed on December 7, 2006 and therefore met the statutory requirements in effect at that time (G.S. 130A-294(b1)(2)).

Additionally please note the following documents/records which are included for clarity with this response as **Attachment C** as summarized in correspondence by Mr. John M. Gardner, P.E. dated March 2007.

Facility and Engineering Plan (Formerly Facility Report)

The Facility and Engineering Plan ("Facility Report") for Phase I of the C&D landfill was originally prepared and included in the Permit to Construct (PTC) application submitted in 2001

and periodically updated most recently in 2008¹. The 2008 update expanded the service area by the issuance of the Permit to Operate. A copy of the most current Facility Report is provided in **Attachment D**.

Technical Specifications

The Technical Specifications for the C&D landfill facility were previously approved in the original Phase I PTC application (2001). However, the technical specifications were updated in 2008 to include Section 02250 (Soil Liner) for the new C&D landfill rules (15A NCAC 13B .0547) effective January 1, 2007. A copy of the most current and complete specifications are provided in **Attachment E**.

Construction Quality Assurance Plan

The Construction Quality Assurance (CQA) plan for the C&D landfill facility was previously approved in the Phase I PTC application (2001). The CQA plan was updated to in 2008 include a Soil Liner CQA section for the new C&D landfill rules (15A NCAC 13B .0547) effective January 1, 2007. A copy of the most current plan is provided in **Attachment F**.

Operations Manual

The Operations Manual outlines the protocols for the facility's operations and maintenance and was prepared to provide on-site personnel with a clear understanding of how the Design Engineer assumed that the facility should be operated. Along with the project drawings, the Operations Manual was prepared in general accordance with the requirements as outlined in 15A NCAC 13B .0542. A copy of the Operations Manual is provided in **Attachment G**.

Closure and Post-Closure Plan

The closure and post closure plan for the construction and demolition landfill facility was most recently updated in 2008 for the new C&D landfill rules (15A NCAC 13B .0547) effective January 1, 2007. A copy of the most current plan is provided in **Attachment H**.

Monitoring Plans

The Water Quality Monitoring Plan (WQMP) was previously approved as part of the PTC application and subsequently updated in June 2011. The WQMP has been certified by a Licensed Geologist and includes information related to the existing groundwater monitoring system, sampling and analysis protocols and requirements, and detection monitoring requirements. A copy of the revised plan is provided in **Attachment I**.

¹ Permit to Construct – Red Rock Disposal, LLC - Construction and Demolition Debris Landfill Phase 1, G.N. Richardson & Associates, Inc. May 2001, Revised April 2004.

The Landfill Gas (LFG) Management Plan has been prepared to address requirements for the Division of Waste Management and the Division of Air Quality. A copy of the LFG Management Plan is presented in **Attachment J**.

Financial Assurance

In accordance with the North Carolina General Statutes 130A-295.2, financial assurance will be provided for the facility and will be provided to the Department by Waste Industries USA, Inc. An Engineer's Estimate has been prepared to address the financial assurance requirements for remedial activities promulgated by the General Assembly's Session Law 550. The financial assurance estimate directly correlates to the constructed operating areas. A copy of the estimate is provided in **Attachment K**.

Project Drawings

The project drawings were originally submitted in the Phase 1 Permit to Construct Application in 2003. The project drawings were updated in 2008 for the new C&D landfill rules (15A NCAC 13B .0547) effective January 1, 2007. A complete permit set has been assembled for clarity and is provided in **Attachment L**.

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Attachment D

Facility and Engineering Plan (Formerly Facility Report)

**Permit Renewal Application
Red Rock Disposal, LLC
NC Solid Waste Permit No. 92-28**

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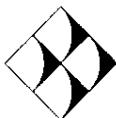
Facility Report

**Red Rock Disposal, L.L.C.
C&D Landfill
Wake County, North Carolina**

Prepared for:
**Red Rock Disposal, L.L.C.
Holly Springs, North Carolina**

**October 2003
Revised February 2008**

PERMIT ISSUE DOCUMENTS



Richardson Smith Gardner & Associates, Inc.
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

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**RED ROCK DISPOSAL, L.L.C.
C&D LANDFILL**

FACILITY REPORT

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**RED ROCK DISPOSAL, LLC
C&D LANDFILL**

FACILITY REPORT

1.0 OVERVIEW

This section presents a plan for development of Red Rock Disposal's construction and demolition (C&D) debris landfill. This report presents revision of the Facility Plan to: expand the service area to the subject facility. Specifically, it is proposed to expand the service area from eight counties (Wake County and all contiguous counties including Chatham, Durham, Franklin, Granville, Harnett, Johnston, and Nash) to 59 counties which generally represents all counties within an approximate 100-mile radius distance from the Red Rock C&D Landfill. A list of all counties proposed for the expanded service area is provided as **Table 3** to this report. *All other aspects of the previously approved Facility Plan and attachments (dated October 2003) are unchanged.* Consequently, only the following sections have been modified: Section (1.0 Overview), Section 2.1 Facility Services, Section 2.3 Disposal Rate, and Section 2.4 Service Area. All other elements of the site including site capacity, engineering and design calculations, operations, maintenance, etc. are unchanged and the previous appendices are therefore not included in this report.

2.0 FACILITY SERVICES AND WASTE STREAM

2.1 Facility Services

Currently, Red Rock Disposal, LLC operates a C&D landfill. The former LCID facility was converted to a C&D landfill and expanded from its former size (approximately 23 acres over 6 cells) up to approximately 117.7 acres (waste footprint) in five major phases.

2.2 Types of Waste

The Red Rock Disposal Landfill facility will accept C&D waste and LCID waste. Other wastes may also be accepted for disposal at the proposed C&D site, as specifically approved by the North Carolina Department of Environment and Natural Resources (NCDENR).

2.3 Disposal Rate

Following some waste "ramp-up", a typical year will include approximately 286 operations days (averaging about 5-1/2 days/week). Thus, based on a maximum of 2,000 tons per day, approximately 572,000 tons per year of waste could be disposed at the facility. Note that actual daily amounts of waste are expected to vary considerably.

2.4 Service Area

As recently approved by Wake County, this site may provide service to counties generally within a 100-mile radius to the site which includes the 59 counties presented in **Table 3** of this report. Based on the updated Census of 2005, as compiled by the United States Census Bureau, the population of these 59 counties is approximately 6,830,000 people.

2.5 Procedures for Waste Segregation

Employees at the landfill are trained in the safety procedures for the handling and detection of unapproved 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 active working (tipping) area. When unacceptable waste is detected at the scalehouse, the load is rejected and not permitted into the landfill. If unapproved waste is found at the tipping area, identification of the truck or persons is made (if possible) and documented. The waste is then identified and placed into an appropriate container and taken to a facility specifically approved to accept that type of waste for proper disposal. When this occurs, the event is reported to the appropriate authorities.

2.6 Equipment Requirements

Red Rock Disposal will maintain on-site equipment required to perform the necessary landfill activities. Periodic maintenance of all landfilling equipment will either be performed on-site or at designated maintenance facilities outside of the landfill.

3.0 LANDFILL CAPACITY

3.1 Total Operating Capacity and Life Expectancy

Drawing E3 (Facility Plan - Final Cover Grades), identifies the final configuration for Phases 1 through 5 of the C&D landfill. The top elevation of the final grades is at approximately 516 feet. The exterior side slopes will be at a 3H to 1V slope.

The estimated total gross operating capacity, net capacity (accounts for periodic and final cover), disposal area, and life expectancy for Phases 1 through 5 are shown in **Table 1**.

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

The capacities obtained above were based on a 5 percent periodic cover ratio and a waste + soil cover density of about 1,250 pounds per cubic yard (0.625 tons/CY). The assumed periodic cover ratio and density is typical for C&D waste

4.0 AVAILABLE SOIL RESOURCES AND REQUIRED SOIL QUANTITIES

The soils required to construct and operate the proposed landfill will be obtained from both on-site as well as off-site borrow sources. The soils removed during excavation of Phases 1 through 5 will likely be used for structural fill, unclassified fill, periodic cover, and/or final cover.

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**. These quantities do not account for the fact that some areas that will be graded more than once due to phased construction.

4.2 Periodic Cover

Assuming the previously mentioned periodic cover ratio of 5 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 Vegetative Soil Layer

On the basis of the 2-foot-thick vegetative soil layer of the C&D landfill final cover, the estimated in-place volume required is shown in **Table 2**. For this preliminary estimate, no slope correction factor was used.

4.4 Soil Summary

The above-referenced soil quantities are summarized in **Table 2**. Note that, based on the current base and final cover grades shown on **Drawings E2 and E3**, respectively, there is expected to be a deficit of on-site soil. Consequently, additional soil will be needed from off-site borrow sources outside of the C&D landfill property. In this regard, there is currently an agreement between Red Rock Disposal and the adjacent rock quarry (owned/operated by Hanson Aggregates) stating that the quarry will supply soil (overburden) to the landfill as needed. **Refer to the agreement between Red Rock Disposal and Hanson Aggregates included in Appendix A to this Facility Report.**

5.0 FACILITY DESIGN CRITERIA

The Red Rock Disposal C&D landfill is designed and will operate in accordance with Sections .0503 and .0505 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 (per Solid Waste Section policy), the minimum buffer between private residences and wells and the disposal boundary is 500 feet, and the minimum buffer between any surface water (stream, river, creek) and the disposal boundary is 50 feet.

5.2 Vertical Separation Requirements

The bottom elevation of the waste in Phase 1 (and subsequent phases) will meet the minimum requirement of four feet above the seasonal high groundwater table.

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 B and C**, respectively.

6.1 Landfill Subgrade and Perimeter Berms

The subgrade elevations will generally 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, organic or otherwise not desirable) will be made. Where unsuitable soils are found, the soils will be undercut, removed, and backfilled with structural fill.

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

It is noted that within the first cell of the Phase 1 area (Phase 1A covering about 6.4 acres), the current LCID site occupies about 2.9 acres. The design includes incorporating leaving this existing LCID waste in-place and providing a layover of C&D waste onto the LCID slopes. **A letter from Sullivan Surveying (Leonard H. Sullivan, Jr., PLS-2821) referencing previous bottom elevations within the existing LCID area is included in Appendix A to this attachment.**

6.2 Final Cover System

In accordance with 15A NCAC 13B.0543, the final cover system will consist of the following components (top-down) or approved alternative:

- an 18-inch thick vegetative soil layer; and,
- an 18-inch thick soil barrier layer ($k \leq 1 \times 10^{-5}$ cm/sec).

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 site erosion and sedimentation control for Phase 1 can be found in the Project Erosion And Sedimentation Control Plan (**Attachment E**).

6.4 Landfill Gas Control

Due to the nature of the C&D waste disposed in this landfill, landfill gas control is neither required nor anticipated to be of concern.

6.5 Access and Roadways

Access is currently along an existing driveway easement (New Landfill Drive) shared by Hanson Quarry and the existing LCID facility per a variance granted by the Wake County Board of Commissioners. The driveway easements connect from SR1127 (Rex Road) to the landfill and quarry sites. Access agreements exist with owners of properties through which the driveways cross. The proposed C&D landfill development also includes provisions for future, alternative driveway access directly from SR1127 which would be located entirely within property controlled by the landfill owner (Red Rock Disposal, LLC). At a future date when constructed, this alternate access will be designed to meet all NCDOT standards with respect to ingress/egress from SR1127, as determined to be necessary to ensure public health and safety.

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.

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

Phase	Disposal Area (Ac.) (Waste Footprint)	Operating Capacity (CY)		Life Expectancy
		Gross	Net	
1	44.2	3,758,814	3,435,386	4.5 Years
2 - 5	73.5	15,233,985	14,246,984	15.6 Years
Total:	117.7	18,992,799	17,682,370	20.1 Years

**TABLE 2
SOIL SUMMARY**

Material	Quantity (CY)		
	Phase 1	Phases 2 - 5	Total
Excavation	299,138	726,761	1,025,899
Structural Fill	(203,829)	(55,688)	(259,517)
Periodic Cover	(180,810)	(749,228)	(930,038)
Vegetative Soil Layer	(142,619) based on 44.2 ac.	(237,160) based on 73.5 ac.	(379,779)
Total:	(228,120)	(315,315)	(543,435)

TABLE 3			
PROPOSED SERVICE AREA - RED ROCK DISPOSAL, LLC			
NO.	COUNTY	NO.	COUNTY
		30	LENIOR
1	ALAMANCE	31	MARTIN
2	ANSON	32	MECKLENBURG
3	BEAUFORT	33	MONTGOMERY
4	BERTIE	34	MOORE
5	BLADEN	35	NASH
6	BRUNSWICK	36	NEW HANOVER
7	CABARRUS	37	NORTHAMPTON
8	CASWELL	38	ONSLow
9	CHATHAM	39	ORANGE
10	COLUMBUS	40	PENDER
11	CRAVEN	41	PERSON
12	CUMBERLAND	42	PITT
13	DAVIDSON	43	RANDOLPH
14	DAVIE	44	RICHMOND
15	DUPLIN	45	ROBESON
16	DURHAM	46	ROCKINGHAM
17	EDGEcombe	47	ROWAN
18	FORSYTH	48	SAMPSON
19	FRANKLIN	49	SCOTLAND
20	GRANVILLE	50	STANLY
21	GREENE	51	STOKES
22	GUILFORD	52	SURRY
23	HALIFAX	53	UNION
24	HARNETT	54	VANCE
25	HOKE	55	WAKE
26	IREDELL	56	WARREN
27	JOHNSTON	57	WAYNE
28	JONES	58	WILSON
29	LEE	59	YADKIN

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Appendix A

Correspondence (2 Letters)

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January 22, 2001

Hanson Aggregates East
Southeast Region
Holly Springs Plant
7000 Cases Holt Road
Holly Springs, North Carolina
27540
Tel 919-567-9512
Fax 919-567-9516
Plant Manager-Jim Hilton
Off. Mang.-Michelle
McDougald

I, Jim Hilton (Plant Manager), on behalf of Hanson Aggregates-Holly Springs Plant, give permission to Red Rock Disposal to remove overburden from the Quarry as necessary for use at the landfill site.

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SULLIVAN SURVEYING
1143-D EXECUTIVE CIRCLE
CARY, NC 27511
(919) 469-4738

01 MAY 2001

RE: CURTIS JONES LCID/HOLLY SPRINGS LANDFILL
ELEVATIONS

ELEVATIONS OF PIT IN AREA 2 OF LANDFILL WERE AT A BASIC BOTTOM
ELEVATION OF 280' MSL WITH THE LOWEST ELEVATION SHOT IN THE PIT OF
277.76'.

THESE ELEVATION SHOTS WERE TAKEN ON JANUARY 24, 1999.




LEONARD H. SULLIVAN, JR.
PLS-2821

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Appendix B

Landfill Design Calculations

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**RED ROCK DISPOSAL, L.L.C.
C&D LANDFILL - PHASE 1**

**FACILITY REPORT
APPENDIX B: LANDFILL DESIGN CALCULATIONS**

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- 1.0 Landfill Life Expectancy
- 2.0 Earthwork Quantities
- 3.0 Slope Stability Evaluation

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PROJECT Red Rock Disposal C&D Landfill - Phase 1

SUBJECT Landfill Life Expectancy

SHEET 1 OF 4

JOB NO. CURTIS-3

DATE 6/18/01

COMPUTED BY PKS

CHECKED BY _____

Objective To determine the expected life of the landfill given the proposed contours and the expected loading rate.

Assumptions 1. Density of Waste.
2. Waste to Periodic Cover Ratio.

Analysis The volume will be calculated by taking cross sections of the landfill, using a planimeter to measure the area of the cross sections, and using the average end area method. Alternatively, AutoCAD will be used to generate volumes.

LIFE.WPD



G.N. RICHARDSON & ASSOCIATES
Engineering and Geological Services
425 N. Boylan Avenue, Raleigh, NC 27603
Telephone: (919) 828-0577

G.N. Richardson & Associates

ENGINEERING AND GEOLOGICAL SERVICES

Red Rock Disposal C&D Landfill - Phase 1 Analysis of Life Expectancy

SHEET: 214

JOB #: CURTIS-3

DATE: 6/18/01

BY: PKS

CHKD BY:

Waste Parameters:

Unit Weight (pcy) =	1250
Unit Weight (tcy) =	0.625
Percentage of Periodic Cover =	5
Area of Waste Footprint (Ac.) =	35.80

Waste Loading Parameters:

0 - 6 Months:

Incoming Tonnage (TPD) =	500
Number of Operations Days in Period =	143 (5.5 Days Per Week)

6 - 12 Months:

Incoming Tonnage (TPD) =	1000
Number of Operations Days in Period =	143 (5.5 Days Per Week)

12 - 18 Months:

Incoming Tonnage (TPD) =	1500
Number of Operations Days in Period =	143 (5.5 Days Per Week)

18+ Months:

Incoming Tonnage (TPD) =	2000
Number of Operations Days/Year =	286 (5.5 Days Per Week)

Volume Calculations:

Volume From AutoCAD =	3745809 cy	(See Attached)
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Adjustment For Other Layers:

2 feet (Avg.) of Final Cover =	<u>115515 cy</u>
Sum =	115515 cy

Volume of Waste and Periodic Cover (cy) =	3630294
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Volume of Periodic Cover (cy) =	181515
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Volume of Waste (cy) =	3448780
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Volume of Waste (tons) =	2155487
--------------------------	---------

Landfill Life Expectancy (years) =	<u>4.5</u>
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G.N. Richardson & Associates

ENGINEERING AND GEOLOGICAL SERVICES

Red Rock Disposal C&D Landfill - Phases 2 - 6 Analysis of Life Expectancy

SHEET: 3,4
JOB #: CURTIS-3
DATE: 6/18/01
BY: PKS
CHKD BY:

Waste Parameters:

Unit Weight (pcy) =	1250
Unit Weight (tcy) =	0.625
Percentage of Periodic Cover =	5
Area of Waste Footprint (Ac.) =	85.70

Waste Loading Parameters:

Annual Tonnage = 572000 (2000 TPD - 286 Days per Year)

Volume Calculations:

Volume From AutoCAD = 16789643 cy (See Attached)

Adjustment For Other Layers:

2 feet (Avg.) of Final Cover =	<u>276525 cy</u>
Sum =	276525 cy

Volume of Waste and Periodic Cover (cy) = 16513118

Volume of Periodic Cover (cy) = 825656

Volume of Waste (cy) = 15687462

Volume of Waste (tons) = 9804664

Landfill Life Expectancy (years) = 17.1

4/4

Project: land projects Fri May 18 14:32:05 2001

Site Volume Table: Unadjusted

	Cut yards	Fill yards	Net yards	Method
=====				
Site: PHASE 1 EXPN				
Stratum: phase 1 phase 1 sgrd-pberm phase 1 fcvr	0	3745810	3745809	(F) Composite
Stratum: phase 1 subgrade eg phase 1 sgrd-pberm	301245	111715	189530	(C) Composite

PH. 1 WASTE FOOTPRINT: 1561279.63 = 35.84 AC

Project: land projects Fri May 18 15:02:40 2001

Site Volume Table: Unadjusted

	Cut yards	Fill yards	Net yards	Method
=====				
Site: EXPANSION - INCL PH1*				
Stratum: expn subgrade eg expn sgrd-pberm	1015913	478993	536920	(C) Composite
Stratum: expn expn sgrd-pberm expn fcvr	2	20535453	20535451	(F) Composite

EXPANSION WASTE FOOTPRINT: 5293248.22 = 121.52 AC

- 35.84 (PH.1)

 85.68 AC

* PH.2+ $Cut = 1,015,913 - 301,245_{(PH1)} \Rightarrow 714,668 \text{ CY}$

$Fill = 478,993 - 111,715_{(PH1)} \Rightarrow 367,278 \text{ CY}$

GROSS CAPACITY = $20,535,453 - 3,745,810_{(PH.1)} \Rightarrow 16,789,643$



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PROJECT Red Rock Disposal C&D Landfill - Phase 1

SUBJECT Earthwork Quantities

SHEET 1 OF 4

JOB NO. CURTIS-3

DATE 6/26/01

COMPUTED BY PKS

CHECKED BY _____

Objective

To determine the required volumes of soil and aggregate required for the construction and operation of the landfill.

Analysis

The volumes of each material will be calculated by taking design thicknesses and/or cross sections and multiplying by design areas and/or lengths. Areas and lengths are determined using AutoCAD, a planimeter, and/or direct measurement.

EARTHWORK.WPD



G.N. RICHARDSON & ASSOCIATES

Engineering and Geological Services

425 N. Boylan Avenue, Raleigh, NC 27603

Telephone: (919) 828-0577

G.N. Richardson & Associates

ENGINEERING AND GEOLOGICAL SERVICES

Red Rock Disposal Landfill - Phase 1 Earthwork Quantities

SHEET: 214
JOB #: CURTIS-3
DATE: 6/26/01
BY: PKS
CHKD BY:

Subgrade Cut and Fill Volumes:

Volume of Cut (cy) = 301,245 (User Input - From AutoCAD - See Attached)
Volume of Fill (cy) = 111,715 (User Input - From AutoCAD - See Attached)

Periodic Cover Volume:

Volume of Protective Cover (cy) = 181,515 (User Input - From Life Expectancy Calcs.)

Vegetative Soil Layer (VSL) Volume:

Area of VSL (Ac.) = 35.8 (User Input - From AutoCAD)
Thickness of VSL (ft) = 2 (User Input)
Volume of VSL (cy) = 115,515

G.N. Richardson & Associates

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Red Rock Disposal Landfill - Phases 2 - 4 Earthwork Quantities

SHEET: 34

JOB #: CURTIS-3

DATE: 6/26/01

BY: PKS

CHKD BY:

Subgrade Cut and Fill Volumes:

Volume of Cut (cy) = 714,668 (User Input - From AutoCAD - See Attached)
Volume of Fill (cy) = 367,278 (User Input - From AutoCAD - See Attached)

Periodic Cover Volume:

Volume of Protective Cover (cy) = 825,656 (User Input - From Life Expectancy Calcs.)

Vegetative Soil Layer (VSL) Volume:

Area of VSL (Ac.) = 85.7 (User Input - From AutoCAD)
Thickness of VSL (ft) = 2 (User Input)
Volume of VSL (cy) = 276,525

4/4

Project: land projects Fri May 18 14:32:05 2001

Site Volume Table: Unadjusted

Cut	Fill	Net	Method
yards	yards	yards	

Site: PHASE 1 EXPN

Stratum: phase 1	phase 1 sgrd-pberm	phase 1 fcvr	
	0	3745810	3745809 (F) Composite
Stratum: phase 1	subgrade eg	phase 1 sgrd-pberm	
	301245	111715	189530 (C) Composite

PH. 1 WASTE FOOTPRINT: 1561279.63 = 35.84 AC

Project: land projects Fri May 18 15:02:40 2001

Site Volume Table: Unadjusted

Cut	Fill	Net	Method
yards	yards	yards	

Site: EXPANSION - INCL PH1*

Stratum: expn	subgrade eg	expn sgrd-pberm	
	1015913	478993	536920 (C) Composite
Stratum: expn	expn sgrd-pberm	expn fcvr	
	2	20535453	20535451 (F) Composite

EXPANSION WASTE FOOTPRINT: 5293248.22 = 121.52 AC

- 35.84 (PH.1)

85.68 AC

* PH.2+ Cut = 1,015,913 - 301,245 (PH1) ⇒ 714,668 CY

Fill = 478,993 - 111,715 (PH1) ⇒ 367,278 CY

GROSS CAPACITY = 20,535,453 - 374,5810 (PH.1)
⇒ 16,789,643



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PROJECT Red Rock Disposal C&D Landfill - Phase 1

SHEET 1 OF 15

JOB NO. CURTIS-3

DATE 6/2/01

SUBJECT Slope Stability Evaluation

COMPUTED BY PKS

CHECKED BY _____

Objective

To perform a slope stability evaluation for the C&D landfill. Both static and seismic analyses were performed even though the landfill is not in a seismic impact zone ($a_{peak} = 0.09 < 0.10$). This evaluation was performed based on EPA guidance (EPA/600/R-95/051) for MSW landfills which requires that the completed landfill have minimum factors of safety against slope failures of 1.5 statically and 1.0 dynamically.

Analysis

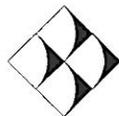
The slope stability evaluations for the overall Phase 1 area were obtained using the computer program STABL5M, a computer program developed by Purdue University.

Slope stability evaluations were performed for the final geometry section shown on the attached figure. The shear strength values used for the waste in these evaluations were cohesion = 500 psf and $\phi = 25$ degrees; which is conservative for C&D wastes.

Results

Based on the stability evaluations for static and seismic conditions, the minimum factors of safety satisfy EPA guidelines. Results for each of the analyses are attached.

STABILITY.WPD



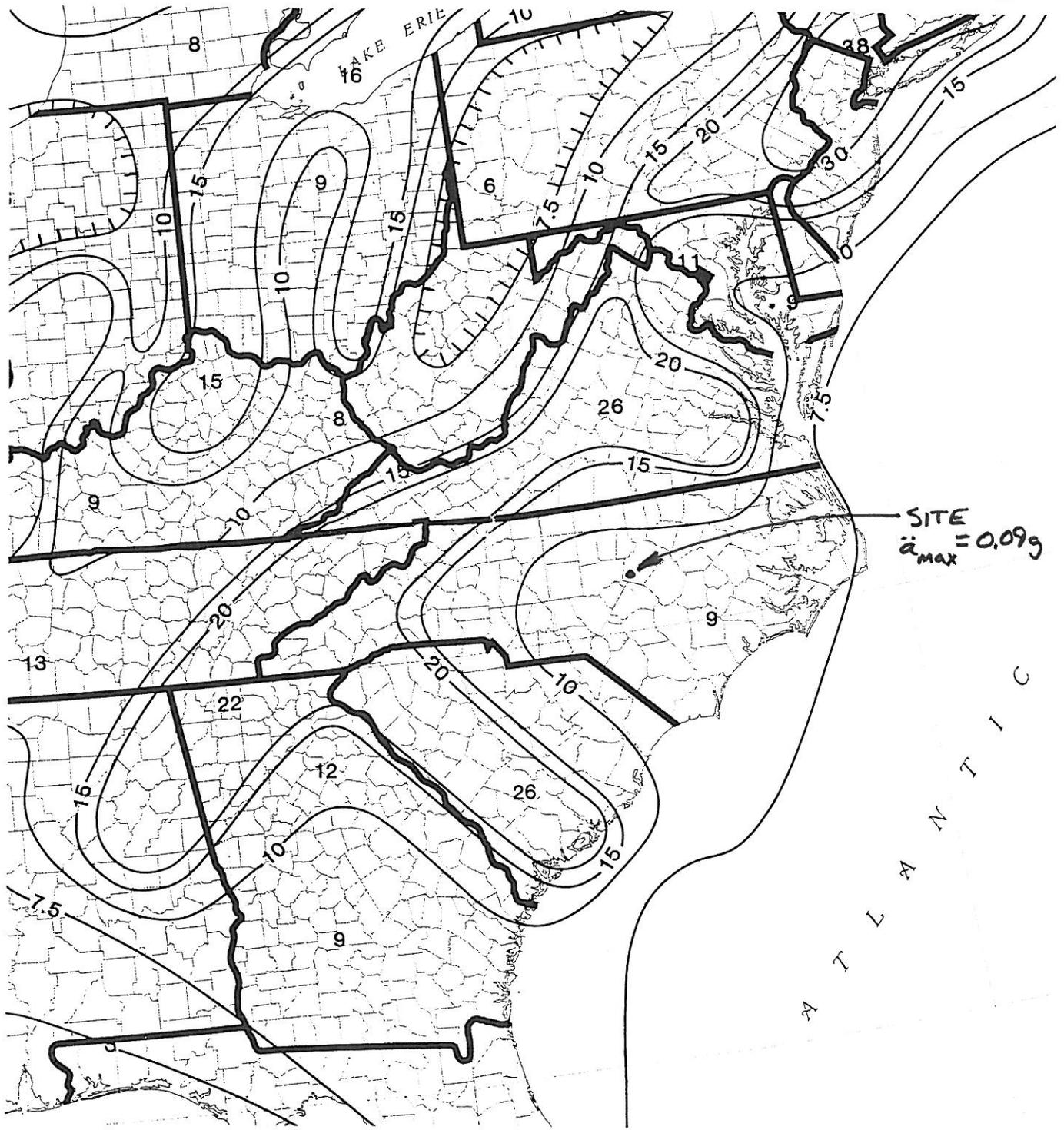
G.N. RICHARDSON & ASSOCIATES

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Telephone: (919) 828-0577

3/15



I:\AD\GNRA\GNRA-A0003.dwg DATE: APR 25, 1998 TIME: 7:26 AM

USGS MF-2120
 PEAK BEDROCK ACCELERATIONS AS A PERCENT
 OF GRAVITY (90% PROBABILITY OF NOT BEING
 EXCEEDED IN 250 YEARS)

G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services

425 N. Boylan Avenue Raleigh, North Carolina
 (919)-828-0577 Fax:(919)-828-3899 www.gnra.com

SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
AS SHOWN	OTHERS	P.K.S.			2	GNRA-A0003

by
Purdue University

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

Run Date: 05-18-01
Time of Run: 11:40am
Run By: PKS
Input Data Filename: C:RRAGCS.IN
Output Filename: C:RRAGCS.OUT
Plotted Output Filename: C:RRAGCS.PLT

EXAMPLE
OUTPUT

PROBLEM DESCRIPTION Red Rock Disposal - Section A-A
Global - Circular - Static

BOUNDARY COORDINATES

9 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	274.00	70.00	274.00	1
2	70.00	274.00	122.00	276.00	1
3	122.00	276.00	206.00	284.00	1
4	206.00	284.00	252.00	286.50	1
5	252.00	286.50	292.00	286.50	1
6	292.00	286.50	680.00	416.00	2
7	680.00	416.00	780.00	424.00	2
8	780.00	424.00	810.00	424.00	2
9	810.00	424.00	970.00	416.00	2
10	292.00	286.50	300.00	286.50	1
11	300.00	286.50	321.00	276.00	1
12	321.00	276.00	338.00	276.00	1
13	338.00	276.00	538.00	282.00	1
14	538.00	282.00	590.00	284.00	1
15	590.00	284.00	628.00	286.00	1
16	628.00	286.00	730.00	294.00	1
17	730.00	294.00	830.00	296.00	1
18	830.00	296.00	970.00	296.00	1

ISOTROPIC SOIL PARAMETERS

6/15

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	110.0	250.0	30.0	.00	.0	1
2	70.0	70.0	500.0	25.0	.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	270.00
2	200.00	270.00
3	850.00	280.00
4	970.00	282.00

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

4000 Trial Surfaces Have Been Generated.

100 Surfaces Initiate From Each Of 40 Points Equally Spaced Along The Ground Surface Between X = .00 ft. and X = 400.00 ft.

Each Surface Terminates Between X = 600.00 ft. and X = 970.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 260.00 ft.

37.00 ft. Line Segments Define Each Trial Failure Surface.

7/15

**** ERROR - RC11 ****

>>200 attempts to generate failure surface have failed. Revise limitations.

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 Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	307.69	291.74
2	343.94	284.29
3	380.72	280.28
4	417.71	279.73
5	454.60	282.66
6	491.05	289.03
7	526.73	298.80
8	561.35	311.86
9	594.59	328.12
10	626.16	347.42
11	655.77	369.59
12	683.18	394.45
13	704.67	417.97

*** 2.114 ***

Individual data on the 13 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force		Tie Force		Earthquake Force		Surcharge Load Lbs(kg)
			Top Lbs(kg)	Bot Lbs(kg)	Norm Lbs(kg)	Tan Lbs(kg)	Hor Lbs(kg)	Ver Lbs(kg)	
1	36.2	24788.4	.0	.0	.0	.0	.0	.0	.0
2	36.8	71283.4	.0	.0	.0	.0	.0	.0	.0
3	37.0	109486.4	.0	.0	.0	.0	.0	.0	.0
4	36.9	137914.9	.0	.0	.0	.0	.0	.0	.0
5	36.4	155641.1	.0	.0	.0	.0	.0	.0	.0
6	35.7	162323.1	.0	.0	.0	.0	.0	.0	.0
7	34.6	158215.0	.0	.0	.0	.0	.0	.0	.0
8	33.2	144153.0	.0	.0	.0	.0	.0	.0	.0
9	31.6	121520.3	.0	.0	.0	.0	.0	.0	.0
10	29.6	92190.6	.0	.0	.0	.0	.0	.0	.0
11	24.2	53213.9	.0	.0	.0	.0	.0	.0	.0

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12	3.2	5149.0	.0	.0	.0	.0	.0	.0	.0
13	21.5	16403.0	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	317.95	295.16
2	354.07	287.16
3	390.81	282.73
4	427.80	281.92
5	464.69	284.74
6	501.13	291.14
7	536.77	301.09
8	571.27	314.47
9	604.29	331.16
10	635.52	351.00
11	664.65	373.81
12	691.42	399.35
13	707.66	418.21

*** 2.122 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	307.69	291.74
2	344.08	285.04
3	380.91	281.50
4	417.91	281.15
5	454.80	283.99
6	491.31	290.01
7	527.16	299.15
8	562.09	311.34
9	595.85	326.50
10	628.16	344.52
11	658.81	365.26
12	687.55	388.56
13	714.17	414.25
14	718.38	419.07

*** 2.122 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	328.21	298.58
2	363.84	288.63
3	400.34	282.56
4	437.28	280.43
5	474.23	282.26
6	510.78	288.05
7	546.49	297.71
8	580.97	311.15
9	613.80	328.20
10	644.63	348.67
11	673.08	372.33
12	698.83	398.89
13	714.32	418.75

*** 2.122 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	307.69	291.74
2	343.86	283.91
3	380.57	279.30
4	417.54	277.94
5	454.49	279.84
6	491.13	284.99
7	527.18	293.34
8	562.35	304.83
9	596.37	319.37
10	628.98	336.85
11	659.93	357.14
12	688.96	380.07
13	715.87	405.46
14	728.69	419.89

*** 2.123 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
--------------	----------------	----------------

19/15

1	317.95	295.16
2	354.15	287.53
3	390.91	283.32
4	427.91	282.59
5	464.80	285.34
6	501.28	291.54
7	537.01	301.14
8	571.69	314.05
9	605.00	330.17
10	636.64	349.33
11	666.35	371.39
12	693.85	396.14
13	714.69	418.78

*** 2.125 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	328.21	298.58
2	363.94	288.98
3	400.47	283.10
4	437.41	281.03
5	474.37	282.78
6	510.95	288.33
7	546.76	297.62
8	581.43	310.56
9	614.57	327.00
10	645.85	346.77
11	674.91	369.67
12	701.46	395.44
13	721.46	419.32

*** 2.127 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	276.92	286.50
2	313.49	280.87
3	350.39	278.06
4	387.39	278.10

5	424.27	280.98
6	460.83	286.70
7	496.84	295.21
8	532.09	306.46
9	566.36	320.39
10	599.47	336.91
11	631.20	355.93
12	661.38	377.34
13	689.83	401.00
14	707.54	418.20

*** 2.127 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.18	286.50
2	323.44	279.13
3	360.19	274.88
4	397.18	273.80
5	434.12	275.88
6	470.75	281.12
7	506.79	289.47
8	541.99	300.87
9	576.08	315.25
10	608.82	332.49
11	639.97	352.46
12	669.29	375.03
13	696.57	400.02
14	713.75	418.70

*** 2.130 ***

Failure Surface Specified By 14 Coordinate Points

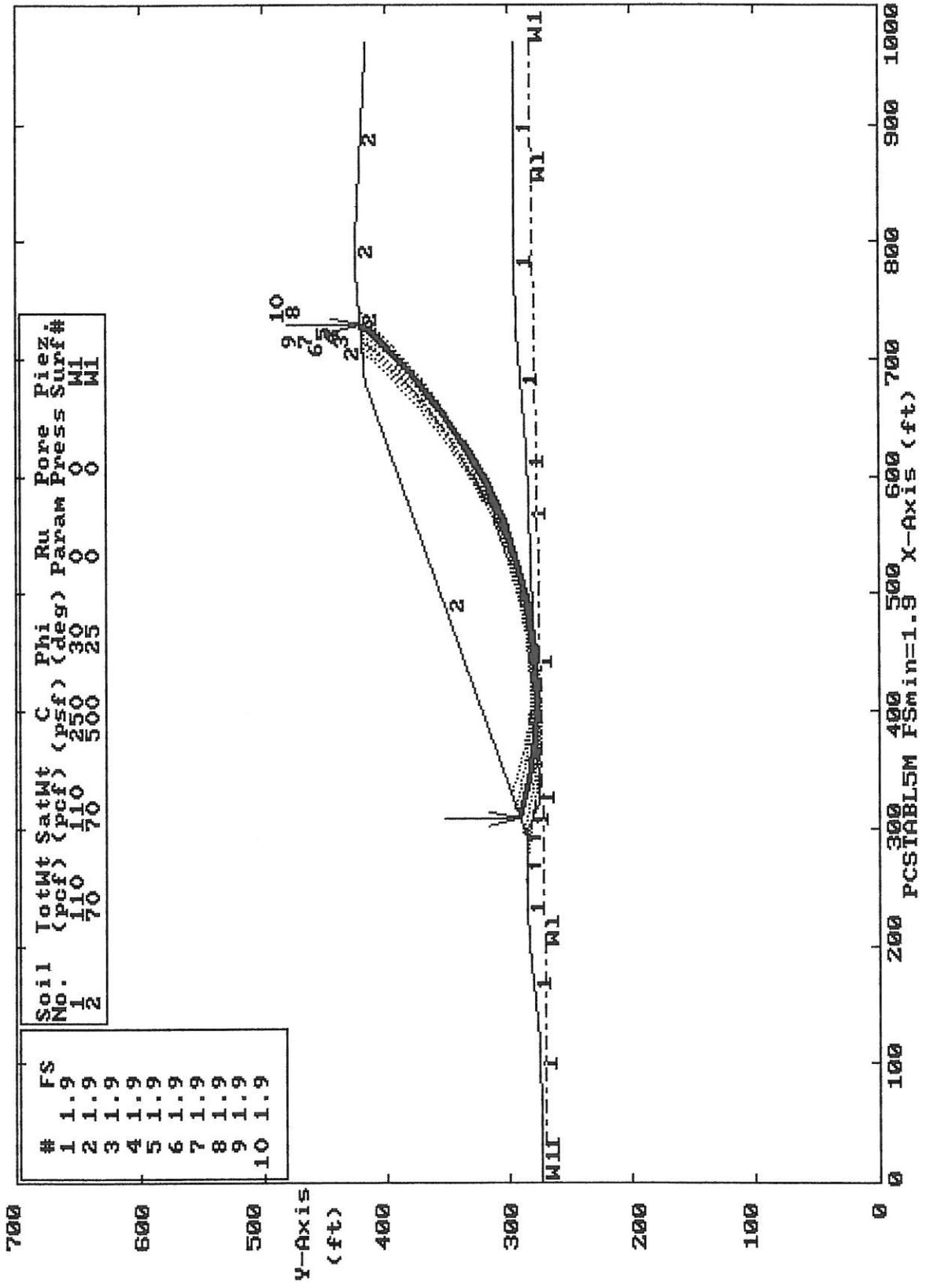
Point No.	X-Surf (ft)	Y-Surf (ft)
1	276.92	286.50
2	313.54	281.19
3	350.45	278.59
4	387.45	278.73
5	424.34	281.59
6	460.91	287.17
7	496.98	295.44

12/15

8	532.34	306.34
9	566.79	319.82
10	600.16	335.81
11	632.25	354.22
12	662.90	374.95
13	691.94	397.89
14	714.71	418.78

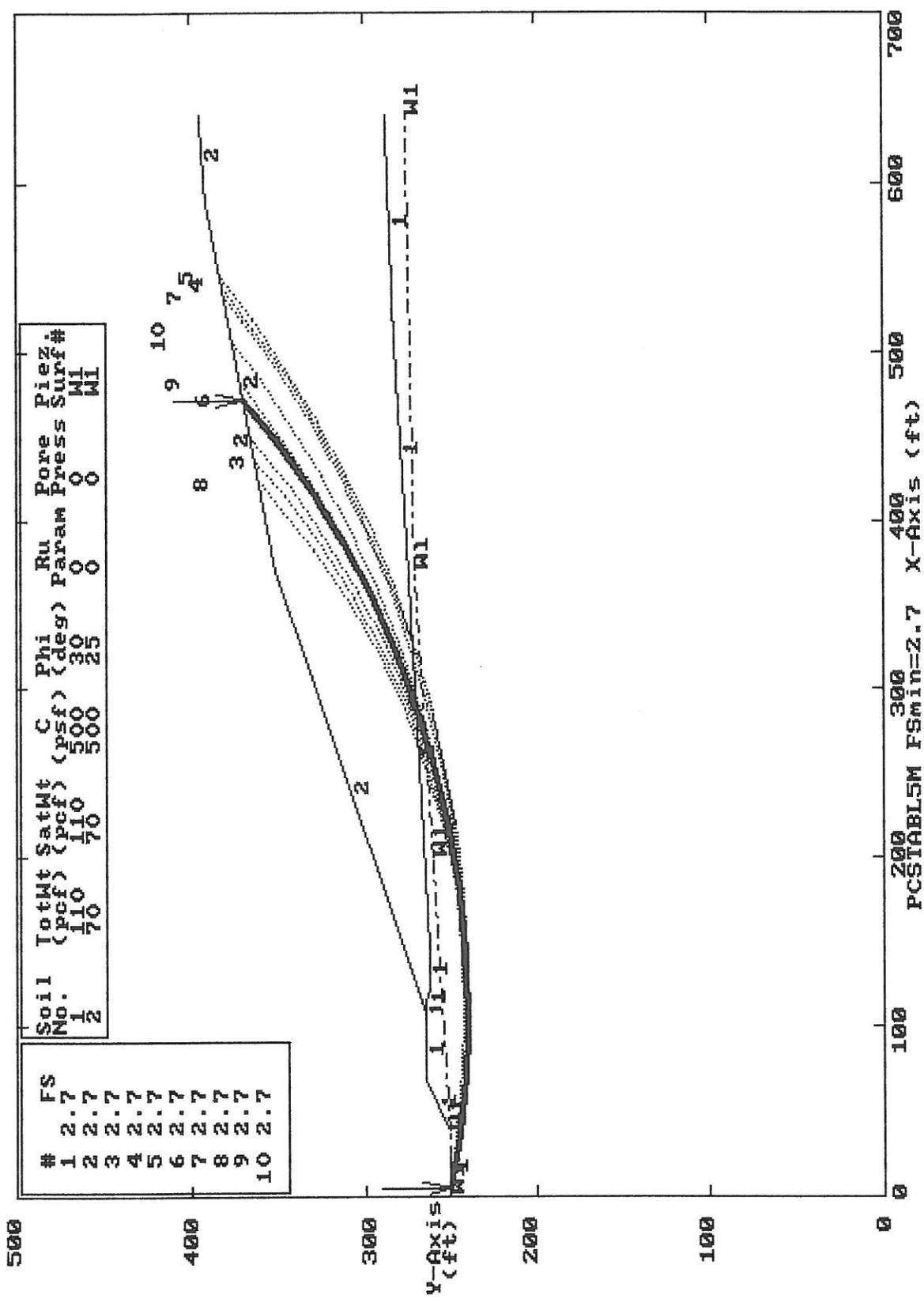
*** 2.130 ***

Red Rock Disposal - Section A-A Global - Circular - Dynamic
 Ten Most Critical. C:RRAGCD.PLT By: PKS 05-18-01 11:41am



14/15

Red Rock Disposal - Section B-B Global - Circular - Static
 Ten Most Critical. C:RRBCCS.PLT By: PKS 05-18-01 11:37am



Attachment E

Technical Specifications

**Permit Renewal Application
Red Rock Disposal, LLC
NC Solid Waste Permit No. 92-28**

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Technical Specifications

**Red Rock Disposal, L.L.C.
C&D Landfill - Phase 1
Wake County, North Carolina**

Prepared for:
**Red Rock Disposal, L.L.C.
Holly Springs, North Carolina**

**May 2001
Revised June 2008**

PERMIT ISSUE DOCUMENTS



G.N. Richardson & Associates, Inc.

Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

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**RED ROCK DISPOSAL, L.L.C.
C&D LANDFILL - PHASE 1**

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

<u>Section No.</u>	<u>Specification</u>
02110	Site Preparation
02222	Excavation
02223	Embankment
02229	Rock Removal
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
02720	Storm Water Systems
02930	Revegetation
03310	Concrete Work

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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 within the areas to be excavated or other designated areas.

Should it become necessary to remove a tree, bush, brush, or other plants adjacent to the area to be excavated, 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, bushes, and refuse 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 landfill containment area and related structures 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
Rock Removal	02229
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 some structures and piping. Areas defined as Embankment are indicated on the Contract Drawings.

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
Rock Removal	02229
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 2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 3017	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
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.

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 SM, SP, SC, ML, MH, CL-ML, CL or CH (ASTM D 2488) containing no topsoil or other deleterious material.
2. Stones or rock fragments shall not exceed one half the maximum lift thickness as compacted 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 and appurtenant structures.
2. Descriptive information on the location and source of 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)	Maximum Lift Thickness (Loose) (inches)
Embankment	95	8
Embankment Beneath Structures ¹ and Roads	98	6
Backfill Around Structures	95	8
Backfill in Pipe Trenches	95	6
Unclassified Fill	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.

END OF SECTION

SECTION 02229

ROCK REMOVAL

Rock Removal: Rock Removal refers to the removal of rock material of a size which cannot be excavated by traditional means.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Rock Removal which may be necessary during construction, 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
Embankment	02223

B. MATERIALS

For the purposes of this Project, Rock shall refer to any material occupying an original volume of at least one cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor or an excavator equipped with a rock ripping bucket having a minimum draw bar pull or stick crowd force rated at not less than 56,000 pounds (Caterpillar D 8K, D9, or equivalent dozers; Caterpillar 375 or equivalent excavator).

C. SUBMITTALS

The Contractor shall submit the following to the Engineer:

1. Submit Rock Removal procedures for review and approval in advance.
2. When conducting blasting operations within one hundred fifty (150) feet of an uninhabited structure or within three hundred (300) feet of any inhabited structure, copies of a pre-blast survey shall be furnished prior to commencement of work. This survey should include notation and photographs of any existing cracks or other irregularities.

3. Copies of all blasting and seismograph reports, on forms acceptable to the Division of State Fire Marshal, shall be submitted within three working days of each blast.

D. CONSTRUCTION

1. No rock shall be removed prior to authorization by the Engineer.
2. Where rock is encountered above design subgrade elevations, rock shall be removed to approximately 1 foot below the subgrade lines and grades indicated on the Contract Drawings as approved by the Engineer.

The subgrade will be brought back up to grade by placing suitable Embankment as described in Section 02223, Embankment, of these Specifications.

3. Blasting:
 - a. Blasting cannot be performed within the footprint of the liner system.
 - b. Blasting shall only be performed when all other reasonable methods fail to remove the rock.
 - c. All blasting shall be approved at least two weeks in advance by the Engineer and Owner and shall be conducted in accordance with all applicable ordinances and regulations.
 - d. The blasting shall be done by a licensed blaster.
 - e. Storage of explosive materials on the site will be prohibited.
 - f. All blasts within one hundred fifty (150) feet of an uninhabited structure or within three hundred (300) feet of any inhabited structure shall be monitored with a direct reading velocity seismograph. At the immediate location of an uninhabited structure the maximum peak particle velocity shall not exceed two inches per second. At the immediate location of an inhabited structure the maximum peak particle velocity shall not exceed one inch per second.
 - g. The Contractor shall be responsible for any and all damage or injury to persons or property resulting from the use of explosives. Any damage done shall be promptly repaired by the Contractor at his expense.
4. Disposal of excavated rock shall be in accordance with all applicable regulations.

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

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.

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 woven, nonwoven spunbonded, or nonwoven needlepunched synthetic fabric consisting of polyester or polypropylene manufactured in a manner approved by the Engineer and the Owner.
3. All Geotextiles shall conform to the properties listed in Table 1 of this section.

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 one copy of 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 (4" x 6") 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. 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.
4. 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. Installation of Geotextiles:

- a. The surface receiving the Geotextiles shall be prepared to a relatively smooth condition, free of obstructions, excessive depressions, debris, and very soft or loose pockets of soil. This surface shall be approved by the 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 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 Engineer. Geotextiles uplifted by wind may be reused upon approval by the Engineer.

4. Seams:

- a. All Geotextile seams shall be sewn. On slopes greater than 10 percent, all seams shall be oriented parallel to (in the direction of) the slope unless otherwise approved by the Engineer.
- b. 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. All seams must be approved by the Engineer.
- c. Alternately, the Contractor may overlap or heat bond adjacent panels with methods approved by the Engineer.

5. Repair Procedures:

- a. Any Geotextile that is torn or punctured shall be repaired or replaced, as directed by the 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 so as not to shift during cover placement.
- b. Slopes Less Than or Equal to 10 Percent: 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 Greater Than 10 Percent: 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 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
Geotextile Construction (NW = Nonwoven) (W = Woven)	-----	-----	NW ² or W ³
Mass per Unit Area (Unit Weight)	ASTM D 5261	oz/yd ²	N/A
Ultraviolet Resistance (500 hrs)	ASTM D 4355	%	70
Strength Class ⁴	AASHTO M 288	Class	2
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	70+
Permittivity	ASTM D 4491	sec ⁻¹	1.0

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 formed exclusively with slit film fibers are not acceptable.
4. AASHTO M 288 includes requirements for the following properties:
 - Grab Tensile Strength (ASTM D 4632),
 - Grab Tensile Elongation (ASTM D 4632),
 - Trapezoidal Tear Strength (ASTM D 4533),
 - Puncture Resistance (ASTM D 4833), and
 - Burst Strength (ASTM D 3786).

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>
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 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
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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 2488). 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 Engineer shall make frequent inspections of the placement operations and materials.
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 contain a minimum of 2% by weight of organics evenly blended into the material in order to support the growth of vegetative cover.

C. SUBMITTALS

The Contractor shall submit the following to the 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 of VSL shall be performed only when the Engineer is informed by the Contractor of intent to perform such work.
2. VSL shall be placed to the lines and grades shown on the Contract Drawings with the exception that a 2 inch overbuild at Contractor's expense is allowed. The Contractor will perform all surveys necessary to establish and verify lines and grades for all VSL.
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 to ensure:

- a. The specified thickness has been achieved.
- b. The top of the VSL slopes at grades specified on the Contract Drawings;
and
- c. VSL placed more than 2 inches 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 surveyor registered in the State of North Carolina.

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 $\frac{1}{2}$ 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	$\leq 1 \times 10^{-5}$ cm/s at a density of $\geq 95\%$ maximum standard dry density and a moisture content \geq 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 02270

EROSION AND SEDIMENTATION CONTROL

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

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of and maintain Erosion and Sedimentation Control facilities and other construction 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
Rip Rap	02271
Rolled Erosion Control Products	02275
Precast Concrete Structures	02608
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.
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 Basins:

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

2. Permanent Ditches, Swales, and Drainage Channels:

Permanent ditches, swales, and drainage channels 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 or wood 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. Temporary Sediment Traps:

Temporary sediment traps shall be constructed as shown on the Contract Drawings.

6. Filter Berms:

Filter berms shall be constructed as shown on the Contract Drawings.

7. Stone Check Dams:

Stone check dams shall be constructed as shown on the Contract Drawings.

8. Down Pipes:

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

9. Rip Rap:

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

10. 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.

11. Other Work:

In addition to the erosion 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.

12. Temporary and Permanent Ground Cover:

The Contractor shall provide temporary or permanent ground cover adequate to restrain erosion on erodible slopes or other areas within 15 working days following completion of any phase of grading. The Contractor shall provide permanent ground cover for all disturbed areas within 30 working days or 120 calendar days (whichever is shorter) following completion of construction.

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 Control Devices:
 - a. All erosion control structures 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 control devices may need to be adjusted on several occasions to reflect the current phase of construction.
 - c. Erosion control devices shall be established prior to the work in a given area. Where such practice is not feasible, the erosion control device(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 devices required for the control of erosion. The Contractor shall develop and implement such additional techniques as may be required to minimize erosion and off-site sedimentation.
 - e. The location and extent of erosion control devices 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. Maintenance of Erosion Control Devices:

- a. The Contractor shall furnish the labor, material, and equipment required for maintenance of all erosion control devices. Maintenance shall be scheduled as required for a particular device to maintain the removal efficiency and intent of the device.
- b. All erosion control devices shall be inspected immediately after each significant rainfall event, and appropriate maintenance conducted.
- c. Maintenance shall include, but not be limited to:
 - (1) The removal and satisfactory disposal of trapped sediments from basins or silt barriers;
 - (2) Replacement of filter fabrics used for silt fences upon loss of specified efficiency; and
 - (3) Replacement of any other components which are damaged or cannot serve the intended use.
- d. Sediments removed from erosion control devices shall be disposed of in locations that will not result in off-site sedimentation as approved by the Engineer.
- e. All erosion control structures shall be maintained to the satisfaction of the Engineer until the site has been stabilized.

3. Finish Grading:

All disturbed areas 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.

4. Seeding:

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

5. 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	VALUE ¹
Grab Tensile Strength ²	ASTM D 4632	lbs	100 x 100
Grab Elongation	ASTM D 4632	%	15 (Max.)
Trapezoidal Tear Strength ²	ASTM D 4533	lbs	50 x 50
Burst Strength	ASTM D 3786	psi	265
Puncture Resistance	ASTM D 4833	lbs	55
Ultraviolet Resistance (500 hrs)	ASTM D 4355	%	80
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	20 (Max.)/40 (Min.)
Permittivity	ASTM D 4491	sec ⁻¹	0.20

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 and channel protection.

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 erosion control blankets (ECB) and turf reinforcement matting (TRM) placed in channels and on slopes.

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 1777	Standard Test Method for Thickness of Textile Materials.
ASTM D 4355	Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
ASTM D 4595	Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
ASTM D 5035	Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method).
ASTM D 5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

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. Erosion Control Blanket (ECB) (Single Net):

ECB (single net) shall consist of a machine-produced mat of curled wood excelsior. At least 80 percent of the individual excelsior fibers shall be 6 inches or more in length. The excelsior fibers shall be evenly distributed over the entire blanket. The top side of the blanket shall be covered with a photodegradable extruded plastic or woven biodegradable mesh. The mesh shall be attached to the curled wood excelsior with degradable thread. ECB shall also conform to the properties listed in Table 1 of this section. ECB shall be CURLEX I, as manufactured by American Excelsior Company, or approved equal.

3. Turf Reinforcement Matting (TRM):

TRM shall consist of a machine-produced mat of mechanically or melt-bonded polymer nettings, monofilaments, or fibers entangled to form a strong, dimensionally stable, three dimensional permanent vegetation reinforcement structure. The mat shall be crush-resistant, pliable, water-permeable, and highly resistant to chemical and environmental degradation. TRM shall also conform to the properties listed in Table 1 of this section. TRM shall be LANDLOK TRM 450, as manufactured by Synthetic Industries, or approved equal.

4. Anchors: Anchors for RECPs shall consist of machine made staples of No. 8 gage 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 one copy of 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. 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 - Channels:

RECPs installed in channels shall be unrolled parallel to the direction of water flow. The first roll shall be centered longitudinally in the channel and anchored

with staples. Subsequent rolls shall be installed outward to the edges of the channel and be lapped to allow installation of a common row of anchors. RECP ends shall be overlapped with the upstream ends on top ("shingled"). Refer to the Contract Drawings for installation details.

4. 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 for installation details.

5. 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
Erosion Control Blanket (ECB) (Single Net)			
Mass per Unit Area (Unit Weight)	ASTM D 5261	lbs/yd ²	0.975 ± 10%
Aperture Size - Mesh	Measured	inches	1.0 x 1.0 (max.)
Maximum Permissible Shear Stress (Un-Vegetated)	-----	lb/ft ²	1.55
Turf Reinforcement Matting (TRM)			
Mass per Unit Area (Unit Weight)	ASTM D 5261	oz/yd ²	10.0
Thickness	ASTM D 1777	inches	0.50
Tensile Strength ²	ASTM D 5035	lbs/ft	170 x 125
Tensile Elongation	ASTM D 5035	%	50 (max.)
Porosity	Calculated	%	95
Resiliency	ASTM D 1777	%	80
UV Stability	ASTM D 4355	%	80
Maximum Permissible Velocity (Long-Term Vegetated)	-----	ft/sec	10 (Typ.)
Maximum Permissible Shear Stress (Long-Term Vegetated)	-----	lb/ft ²	4 (Typ.)

Notes:

1. Minimum Average Roll Value (MARV).
2. 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 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 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

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.

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 Base Course:

ABC shall be constructed in accordance with NCDOT Section 520.

END OF SECTION

SECTION 02608

PRECAST CONCRETE STRUCTURES

Precast Concrete Structures: Precast Concrete Structures are used as collection points for handling 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
Storm Water Systems	02720
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 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 789	Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.
ASTM C 850	Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 feet of Cover Subjected to Highway Loadings.
ASTM C 990	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

B. MATERIALS

1. Precast Concrete Manholes: All precast concrete manholes shall be constructed from non-shrink, 4000 psi compressive strength concrete in conformance with ASTM C 478 and as detailed on the Contract Drawings.
2. Precast Concrete Boxes: All precast concrete boxes shall be constructed from non-shrink, 4000 psi compressive strength concrete in conformance with ASTM C 789 or ASTM C 850, as applicable, and as detailed on the Contract Drawings.
3. 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.
4. 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.
5. 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.
6. 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 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 02720

STORM WATER SYSTEMS

Storm Water Systems: Storm Water Systems shall include all piping, pipe fittings, headwalls, flared end sections, drop inlets, manholes, 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
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 the reinforced concrete pipe shall have bell and spigot ends with flexible preformed plastic gaskets.

2. Corrugated Metal Pipe (CMP):

- a. Corrugated metal pipe and fittings shall be of the sizes shown or specified and shall conform to every aspect of AASHTO M 36.
- b. Corrugated metal pipe shall be fabricated from galvanized steel sheets. Corrugation profile shall be 2 $\frac{2}{3}$ inch crest to crest and $\frac{1}{2}$ inch crest to valley, and sheet thickness shall be 16 gage/.064 inch minimum.
- c. Pipe sections shall be helically corrugated with each pipe end rerolled to obtain no less than two (2) annular corrugations.

- d. Coupling Bands: CMP shall be firmly joined by coupling bands in accordance with the manufacturer's recommendations. These bands shall be not more than two nominal sheet thicknesses lighter than the thickness of the pipe to be connected and in no case lighter than 0.052 inches.
- e. All CMP utilized for permanent installation shall have gasketed joints.
- f. Asphaltic or bituminous coatings shall be applied in conformance with the manufacturer's requirements, as applicable.

3. 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).

4. 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.

5. Headwalls:

Headwalls shall be as described in the Contract Drawings.

6. 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 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 applicable sections of the Concrete Pipe Handbook as published by the American Concrete Pipe Association.

END OF SECTION

SECTION 02930

REVEGETATION

Revegetation: Revegetation includes permanent Revegetation of disturbed site areas as indicated on the Contract Drawings.

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 Section D.6 of this Specification.

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. 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.

2. 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.

3. 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.

4. 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	MINIMUM SEED PURITY (%)	APPLICATION RATE¹
Lime	-----	-----	4,000 lbs/acre
Fertilizer	-----	-----	1,000 lbs/acre
Seed	Tall Fescue Sericea Lespedeza Kobe Lespedeza Seasonal Nurse Crop ²	97 97 97 97	100 lbs/acre 30 lbs/acre 10 lbs/acre (See Note 2)
Mulch	-----	-----	4,000 - 5,000 lbs/acre
Binder	-----	-----	150 gallons/acre

Notes:

1. Application rates and/or chemical analysis shall be confirmed or established by a soil test.
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 15 - May 1: 40 lbs/acre Rye (Grain).

END OF SECTION

SECTION 03310

CONCRETE WORK

Concrete Work: Concrete will be placed around sediment basin risers to anchor these structures against hydrostatic uplift.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of all concrete 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>
Erosion and Sedimentation Control	02270
Storm Water Systems	02720

3. Reference Standards:

The latest revision of the following standards of the American Concrete Institute (ACI) and the American Society for Testing and Materials (ASTM) are hereby made a part of these specifications:

ACI 301	Specifications for Structural Concrete for Buildings.
ASTM C 31	Standard Method of Making and Curing Concrete Test Specimens in the Field.
ASTM C 39	Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C 94	Standard Specification for Ready Mixed Concrete.
ASTM C 143	Standard Method of Test for Slump of Portland Cement

Concrete.

ASTM C 150	Standard Specification for Portland Cement.
ASTM C 172	Standard Method of Sampling Fresh Concrete.
ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

B. MATERIALS

1. Portland Cement:

Cement shall be Portland cement Type II conforming to ASTM C 150, unless otherwise acceptable to the Engineer. Cement shall be proportioned in the mix for the specified class of concrete in conformity with the applicable provisions of ACI 301.

2. Water: Potable.

3. Class B Concrete:

Nonstructural concrete (Class B) may be used for fill concrete, thrust blocks, etc. Class B concrete shall conform to the following requirements:

Compressive Strength (28 day):	2500 psi
Minimum Cement Content:	545 lbs/cy
Maximum Slump:	4 inches

C. SUBMITTALS

The Contractor shall submit concrete mix designs to the Engineer for approval at least 15 days prior to the first concrete placement.

D. CONSTRUCTION

1. Concrete shall be placed per the procedures specified in ACI 301.

2. Inserted and Embedded Items:

Pipes, anchor bolts, steps, and other inserts, as indicated on the Contract Drawings or as required, shall be encased in concrete.

3. Structures shall be formed, chamfered, and finished in a workman-like manner.

END OF SECTION

Attachment F

Construction Quality Assurance Plan

**Permit Renewal Application
Red Rock Disposal, LLC
NC Solid Waste Permit No. 92-28**

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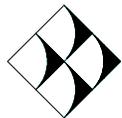
Construction Quality Assurance Manual

**Red Rock Disposal, L.L.C.
C&D Landfill - Phase 1
Wake County, North Carolina**

Prepared for:
**Red Rock Disposal, L.L.C.
Holly Springs, North Carolina**

**May 2001
Revised June 2008 with Appendix B**

PERMIT ISSUE DOCUMENTS



G.N. Richardson & Associates, Inc.
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

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**RED ROCK DISPOSAL, L.L.C.
C&D LANDFILL - PHASE 1**

CONSTRUCTION QUALITY ASSURANCE MANUAL

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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 soils components of the proposed construction

The CQA Manual is divided into the following sections:

- Section 1.0 General
- Section 2.0 CQA Documentation
- Section 3.0 Earthwork 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 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. 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.

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 CQA testing performed by the CQA Engineer.

1.2.4 Discrepancies Between Documents

The CQA Manual is intended to be a supporting document to improve the overall documentation of the work. The CQA Manual is less specific than the project specifications, and conflicts may exist between the documents. The Contractor is instructed to bring discrepancies to the attention of the CQA Engineer for resolution who shall then notify the Engineer. The Engineer has the sole authority to determine resolution of discrepancies existing within the Contract Documents. Unless otherwise determined by the Engineer, the more stringent requirement shall be the controlling resolution.

1.3 PARTIES TO CONSTRUCTION QUALITY ASSURANCE

1.3.1 Description of the Parties

The parties to Construction Quality Assurance and Quality Control include the Owner, Engineer, Contractor, CQA Engineer, and Soils CQA Laboratory. The organizational structure and lines of authority and communication for the parties are shown on **Figure 1.1**.

1.3.1.1 Owner

The Owner is Red Rock Disposal, L.L.C., 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 proposed construction. 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 shall also be responsible for proper resolution of all quality issues that arise during construction. The Engineer is G.N. Richardson & Associates, Inc.

1.3.1.3 Contractor

The Contractor is responsible for the construction of the earthwork. 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. 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.

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 used in structural fills. 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 proposed construction. 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 soils testing, 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, 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 components of the proposed construction 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 CQA Progress Meetings

Progress meetings will be held between the Engineer, the CQA Engineer, the Contractor, and representatives from any other involved parties at the frequency dictated in the project specifications. 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 report. 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.

1.7.2 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 shall 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
- 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 shall 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. The basic file will contain color prints; negatives will also be stored in a separate file in chronological order. 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 shall 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** shall be included in the Final CQA Report.

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 Summary and Conclusions
- 6.0 Project Certification

Appendices

- Appendix A Specification Clarifications/Modifications
- Appendix B Photographic Documentation
- Appendix C CQA Reporting
 - C1 CQA Reports
 - C2 CQA Meeting Minutes
- Appendix D Earthwork CQA Data
 - D1 CQA Test Results
- Appendix E Record Drawings

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 shall 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 shall 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 shall 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 shall be properly documented by the CQA Engineer. The Contractor will correct defects and deficiencies to the satisfaction of the CQA Engineer. The CQA Engineer shall 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:		
Loose Lift Thickness	-----	Each Lift
In-Place Density	ASTM D 2922 ¹	20,000 ft ² per lift & 1 per 500 LF/lift of Berms (< 200 ft. base width)
Moisture Content	ASTM D 3017 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.

Appendix A

Reference List of Test Methods

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**RED ROCK DISPOSAL, L.L.C.
C&D LANDFILL - PHASE 1**

**CQA MANUAL
APPENDIX A: REFERENCE LIST OF TEST METHODS**

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

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 2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 3017	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
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.

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Appendix B

Soil Liner CQA

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SOIL LINER CQA

1.0 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.

2.0 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.

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.

3.0 SUBGRADE APPROVAL

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

4.0 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.

4.1 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.

4.2 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.

4.3 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.

5.0 SOIL LINER CONSTRUCTION

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.

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.

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.

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.

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.

5.5 Perforations In Soil Liner

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

6.0 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 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 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

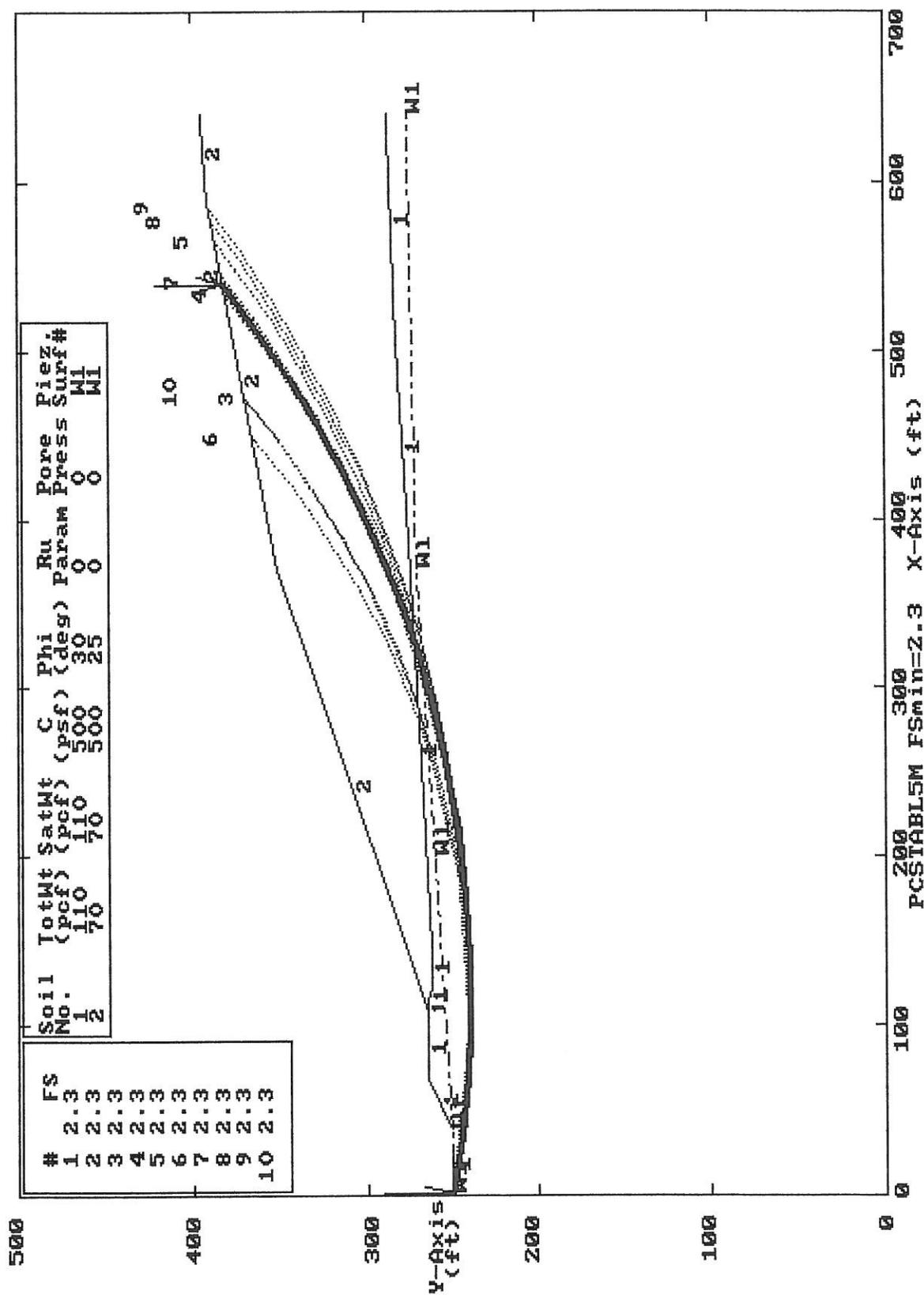
TABLE 3: CQA TESTING PROGRAM FOR SOIL LINER

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**.

Red Rock Disposal - Section B-B Global - Circular - Dynamic
 Ten Most Critical. C:RRBCCD.PLT By: PKS 05-18-01 11:38am



#	FS
1	2.3
2	2.3
3	2.3
4	2.3
5	2.3
6	2.3
7	2.3
8	2.3
9	2.3
10	2.3

Soil No.	TotMt (pcf)	SatMt (pcf)	C (psf)	Phi (deg)	Ru Param	Pore Press	Piez Surf #
1	110	110	500	30	0	0	M1
2	70	70	500	25	0	0	M1

Attachment H

Closure and Post Closure Plan

**Permit Renewal Application
Red Rock Disposal, LLC
NC Solid Waste Permit No. 92-28**

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Closure And Post-Closure Plan

**Red Rock Disposal, LLC
C&D Landfill - Phase 1
NC Solid Waste Permit No. 92-28**

Prepared for:



Red Rock Disposal, LLC
7130 New Landfill Drive
Holly Springs, North Carolina 27540

April 2008

PERMIT ISSUE DOCUMENTS

Prepared for:



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**RED ROCK DISPOSAL, LLC
C&D LANDFILL - PHASE 1**

CLOSURE AND POST-CLOSURE PLAN

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SECTION 1.0 CLOSURE PLAN

1.1 OVERVIEW

This plan is intended to serve as a guide for the proposed closure of the Red Rock Disposal C&D Landfill. A formalized Closure Plan for Phase 1 (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. E5**) is provided as **Appendix A** of this Plan as modified from the permit¹ drawings in accordance with 15A NCAC 13B .0543. for Phase 1 of the Red Rock Disposal C&D Landfill. Based on this drawing, the following are the estimated areas and capacity for each landfill unit to be closed under this plan.

Phase	Area (Ac.)	Operating Capacity (CY)		Life Expectancy ³
		Gross ¹	Net ²	
1 (Active)	30.8	2,546,488	2,279,064	3.3 Years
1C-2 (Future)	13.4	1,212,326	1,085,011	1.2 Years
Total:	44.2	3,758,814	3,364,076	4.5 Years

Notes:

- Gross capacity is based on final cover grades provided on **Drawing No. E5** and assumes subgrades as shown on **Drawing No. E4** as presented in current permit drawings¹.
- The net capacity is determined by pro-rated deductions for final cover soils from the gross capacity.
- The existing life expectancy assumes two hundred sixty (286) operating days a year accepting 2,000 tons per day with a unit weight of 0.625 tons per cubic yard.

1.3 FINAL COVER SYSTEM

The final cover system will consist of the following components (top-down):

¹ Red Rock Disposal, LLC Construction & Demolition Debris (C&D) Landfill Phase 1 Engineering Drawings dated May 2001 with revisions through April 2004 prepared by G.N. Richardson & Associates, Inc.

- 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 previously demonstrated in the Permit to Construct Application for Phase 1². This evaluation revealed a stable and safe configuration. A landfill gas (LFG) control (venting) system (as shown in **Detail 2** on **Drawing No. LFG1**) 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 **Appendices B and C**, respectively. Final cover system details are shown on **Drawings No. G1 and No. EC2** (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. LFG1** (Landfill Gas Management Plan).

1.5 SURFACE WATER SYSTEMS

Precipitation falling on the cover will infiltrate into the cover or run off the cover. Short-term the run-off runs down the surface of the intermediate cover. Long-term the run-off is collected in a series of drainage breaks built into the areas covered by final cover. These drainage breaks are in the form of “tack-on” berms provided along side slopes and near the upper edge of the side slopes (cap diversion berms). The “tack-on” berms are designed with a maximum slope length of approximately 150 feet (horizontally projected) such that side slope erosion potential is minimized. Water captured by the “tack-on” berms routed toward one of the down pipes. Flow in the down pipes is routed to the base of the landfill and to one of the site sediment basins.

The locations of berms, and down pipes are shown on **Drawing No. E5** (Phase 1 Final Grading

² Revised Permit to Construct Application, Red Rock Disposal, LLC C&D Landfill - Phase 1 dated October 2003 with revisions through June 2004 prepared by G.N. Richardson & Associates, Inc.

and Drainage Plan).

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 perimeter channels along the perimeter berms or to areas covered by final cover. 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.

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. Don Plessinger
Red Rock Disposal, LLC
7130 New Landfill Drive
Holly Springs, NC 27540
Phone: (919) 557-9583
Fax: (919) 557-9523.

2.3 POST-CLOSURE USE

After filling operations cease at the landfill and the it is officially closed in accordance with the Closure Plan, the landfill will be maintained as a grassy hill. Red Rock Disposal 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 re-seeded 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 Red Rock Disposal. Proper operation of the system is verified through periodic testing of the subsurface monitoring wells around the perimeter of the landfill.

If landfill gas wells/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 Landfill Gas Management Plan (**Drawing No. LFG1**).

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 Red Rock Disposal. 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 Red Rock Disposal 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 Red Rock Disposal'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 Phase 1 of the Red Rock Disposal C&D Landfill.

3.2 ESTIMATED CLOSURE COSTS

Table 3.1 summarizes the estimated costs for complete closure of Phase 1 (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
Red Rock Disposal C&D Landfill (NC SW Permit No. 92-28)
Engineer's Closure Construction Cost Estimate

Item No.	Item Description	Unit	Contractor			Comments
			Quantity	Unit Price	Total Price	
Closure Area (Horizontal Plan) ---->		AC	44.2			
1.0	Pre-Construction			Subtotal	\$37,100.00	
1.1	Construction Documents & Bidding	AC	44	\$15k + \$500/AC	\$37,100.00	RSG Estimate
2.0	Construction				\$2,225,470.00	References 1 and 2.
2.1	Surveys and Layout	AC	44	\$1,000.00	\$44,200.00	RSG Historical Estimate
2.2	Mobilization	AC	44	\$5,000.00	\$221,000.00	~4% of Construction Cost
2.3	Site Preparation (repairs to intermediate cover layer)	AC	44	\$500.00	\$22,100.00	Assumed estimate for repair of erosion rills.
2.4	18" On-site Low Permeability Soil	CY	106,964	\$8.00	\$855,712.00	RSG Estimate
2.5	18" Vegetative Support Layer	CY	106,964	\$4.50	\$481,338.00	Site Historical Estimate for On-Site Materials.
2.6	Landfill Gas Venting System	AC	44	\$3,500.00	\$154,700.00	RSG Estimate
2.7	Cap Drainage Structures (berms, piping, etc.)	AC	44	\$7,500.00	\$331,500.00	RSG Historical Estimate
2.8	Erosion & Sediment Control (grading, silt fence, maintenance, etc.)	AC	44	\$800.00	\$35,360.00	RSG Historical Estimate
2.9	Revegetation	AC	44	\$1,800.00	\$79,560.00	Site Historical Estimate
3.0	Quality Assurance, Certification, & Deed Notation				\$263,570.00	
3.1	Field Monitoring	AC	44	\$3,000.00	\$132,600.00	RSG Estimate
3.2	Laboratory Testing	AC	44	\$2,500.00	\$110,500.00	RSG Estimate
3.3	Engineering Certification	AC	44	\$5k + \$250/AC	\$16,050.00	RSG Estimate
3.4	Surveying and Deed Notation	AC	44	\$100.00	\$4,420.00	RSG Historical Estimate
4.0	Miscellaneous Costs to Close				\$55,250.00	
4.1	Erosion and Stormwater Control (outside landfill footprint)	AC	44	\$1,000.00	\$44,200.00	RSG Historical Estimate
4.2	Engineering and Reporting	AC	44	\$250.00	\$11,050.00	RSG Historical Estimate
5.0	Total Closure Costs					
Construction Estimate ---->					\$2,581,390	
Cost per Acre ---->					\$58,402	
Total Estimate ---->					\$2,581,390 (2008\$) (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:

- Red Rock Disposal, LLC - C&D Landfill - Phase 1 - Permit to Construct Application by G.N. Richardson & Associates, Inc. dated June 2001 with revisions through April 2004.
- Red Rock Disposal, LLC - C&D Landfill - Phase 1 - Revised Permit to Construct Application by G.N. Richardson & Associates, Inc. dated October 2003.

Denotes values calculated in spreadsheet.

TABLE 3.2
Red Rock Disposal C&D Landfill (NC SW Permit No. 92-28)
Engineer's Post Closure Estimate

Item	Quantity	Unit	Comments
Groundwater Monitoring			
Monitoring wells	15	wells	Reference 1
Surface water point	2	points	Reference 1
Sampling frequency	2	events	Reference 1
Field sampling, collection, and shipping	\$1,500	per event	Golden Proposal
Laboratory Analysis	\$200	per well	Golden Proposal
Data review, statistics, and reporting	\$1,500	per event	RSG estimate
Maintenance and repair	\$100	per well	RSG historical estimate
Subtotal Cost	\$14,300	per year	
Landfill Gas Management			
Control System Vents	22	vents	Assume one (1) well per two (2) acres.
Sub-Surface Monitoring Probes	12	probes	Assume one (1) per 500 LF along perimeter.
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	\$1,700	per year	Averaged over post-closure period
Final Cover Management			
Area of maintenance	44.2	acres	Extends to area immediately around landfill for Phase 1.
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	\$21,332	per year	
Administration, Inspections, and Reporting			
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	\$40,832	per year (2008\$)	
Number of Years for Post-Closure	30	years (see Note 1)	
Total Post Closure Costs	\$1,224,960	(2008\$) (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:

- Red Rock Disposal, LLC - Phase 1 Permit to Construct Application by G.N. Richardson & Associates, Inc. dated October 2003.

Denotes values calculated in spreadsheet.

Attachment L

Project Drawings (Provided Under Separate Cover)

**Permit Renewal Application
Red Rock Disposal, LLC
NC Solid Waste Permit No. 92-28**

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RED ROCK DISPOSAL, LLC
WAKE COUNTY, NORTH CAROLINA

CONSTRUCTION & DEMOLITION LANDFILL PHASE 1 ENGINEERING DRAWINGS

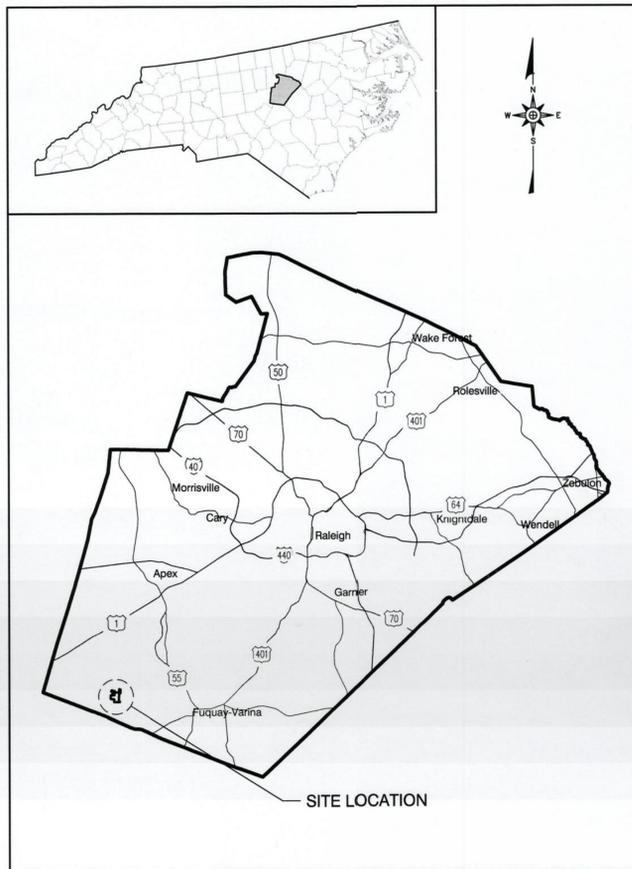
MAY 2001
REVISED APRIL 2013

SEAL

SEAL

REV.	DATE	DESCRIPTION

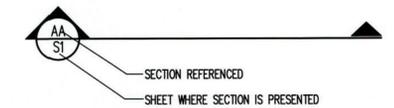
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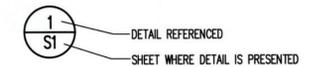
SITE LOCATION MAP
NOT TO SCALE

SHEET NO.	DRAWING NO.	TITLE	REVISION
1	1	TITLE/COVER SHEET	1 2 3 4
2	E1	EXISTING SITE CONDITIONS	1 2 5
3	E2	FACILITY PLAN - BASE GRADES	1 2 3
4	E3	FACILITY PLAN - FINAL COVER GRADES	1 2
5	E4	PHASE 1 - SUBGRADE (NOT INCLUDED IN REVISED DRAWING SET. REFER TO DRAWING EC8 FOR PHASE 1C SUBGRADE)	1 2
6	E5	PHASE 1 - FINAL GRADING AND DRAINAGE PLAN	1 2
7	G1	PHASE 1 - DETAILS (NO REVISIONS)	1 2 4
8	X1	PHASE 1 - ENGINEERING CROSS SECTIONS (SHEET 1 OF 2)	1 2 3 4 5
9	X2	PHASE 1 - ENGINEERING CROSS SECTIONS (SHEET 2 OF 2)	1 2 3 4 5
10	EC1	PHASE 1 - EROSION AND SEDIMENTATION CONTROL DETAILS (SHEET 1 OF 5)	1 2 4
11	EC2	PHASE 1 - EROSION AND SEDIMENTATION CONTROL DETAILS (SHEET 2 OF 5)	1 2 4
12	EC3	PHASE 1 - EROSION AND SEDIMENTATION CONTROL DETAILS (SHEET 3 OF 5)	1 2
13	EC4	PHASE 1 - EROSION AND SEDIMENTATION CONTROL DETAILS (SHEET 4 OF 5)	1 2
14	EC5	PHASE 1 - EROSION AND SEDIMENTATION CONTROL DETAILS (SHEET 5 OF 5)	1 2
15	EC6	PHASE 1C - INITIAL GRADING AND DRAINAGE PLAN	1 2
16	EC7	PHASE 1C-1 SUBGRADE AND DRAINAGE PLAN	1 2 3
17	EC8	PHASE 1C-2 SUBGRADE AND DRAINAGE PLAN	1 2 3 5 6
18	P1	PHASE 1 - FILLING SEQUENCE (NOT INCLUDED IN REVISED DRAWING SET.)	1 2 4 5 6
	LFG1	LANDFILL GAS MANAGEMENT PLAN	1 2 4 6

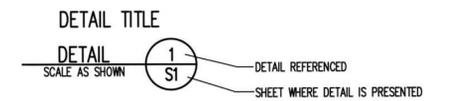
STANDARD SECTION LOCATION CALLOUT (SHEET AND DETAIL)



STANDARD DETAIL CALLOUT



STANDARD DETAIL LABEL AND CALLOUT



STANDARD REVISION CALLOUT (SHEET AND DETAIL)



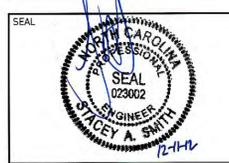
DATE	NO.	REVISION DESCRIPTION	REVISION

SAFETY NOTE:
Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

NC LIC. NO. C-0828 [ENGINEERING]

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



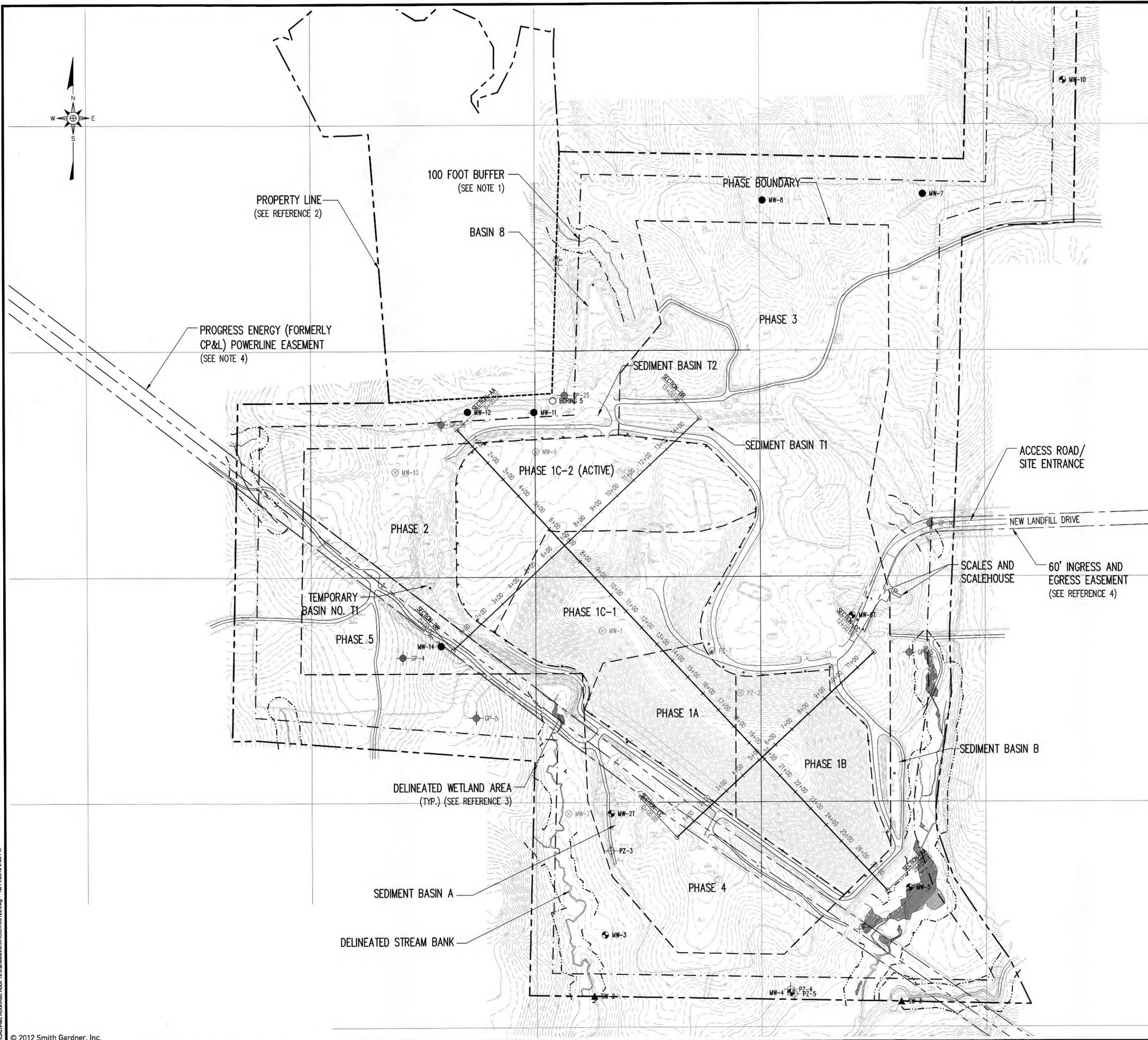
REV.	DATE	DESCRIPTION
5	12/12	UPDATED TOPOGRAPHY

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PROJECT TITLE:
**CONSTRUCTION & DEMOLITION
 LANDFILL
 PHASE 1
 ENGINEERING DRAWINGS**

DRAWING TITLE:
EXISTING SITE CONDITIONS

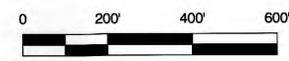
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DRAWN: J.A.L.	SCALE: AS SHOWN
APPROVED: 	DATE: NOV. 2012
FILENAME: REDROCK-D0122	DRAWING NUMBER:
SHEET NUMBER: 2	DRAWING NUMBER: E1



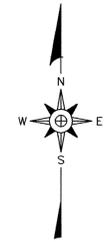
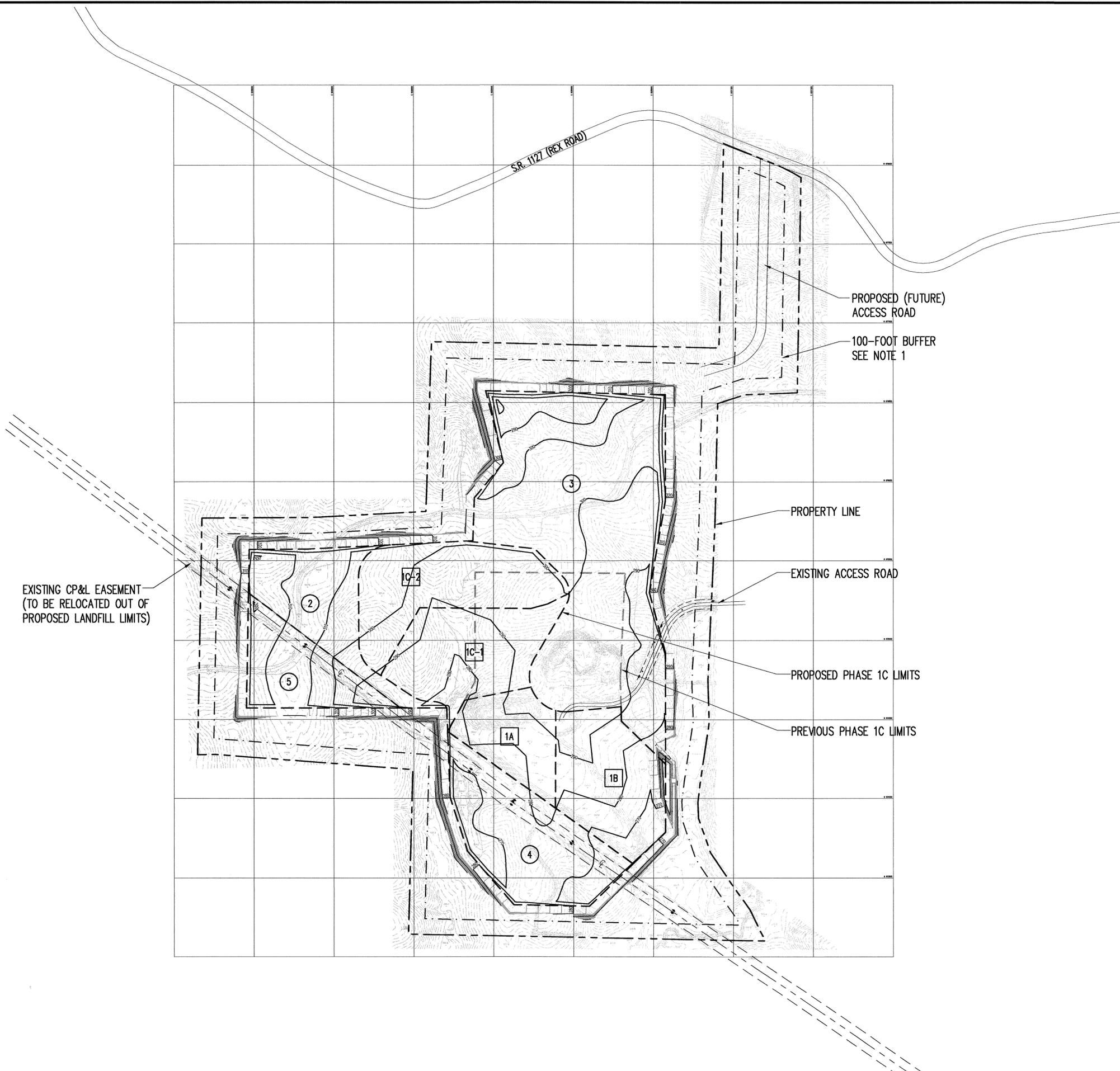
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- EXISTING 10' CONTOUR
 - EXISTING 2' CONTOUR
 - PROPERTY LINE (SEE REFERENCE 2)
 - 100' BUFFER (SEE NOTE 1)
 - PHASE LIMITS
 - 50' STREAM/WETLAND BUFFER
 - EASEMENTS (SEE REFERENCE 4)
 - DELINEATED WETLAND AREAS (SEE REFERENCE 3)
 - MW-1 MONITORING WELLS
 - PZ-2 PIEZOMETER
 - MW-7 WELLS NOT IN MONITORING NETWORK
 - SW-2 SURFACE WATER MONITORING POINT
 - BORING 5 BORING
 - GP-4 GAS PROBE
 - MW-1 ABANDONED WELL/PIEZOMETER

- NOTES**
- THIS BUFFER REPRESENTS A TYPE A BUFFER YARD AND A TRANSITIONAL BUFFER IN ACCORDANCE WITH WAKE COUNTY ZONING REQUIREMENTS. THIS 100-FOOT BUFFER ALSO INCLUDES, BUT DOES NOT SHOW, A 50-FOOT UNDISTURBED BUFFER ALSO PER WAKE COUNTY ZONING REQUIREMENTS.
 - ELEVATIONS REFERENCE U.S.G.S. VERTICAL DATUM (MSL).
 - GRID COORDINATES REFERENCE NC STATE PLANE SYSTEM (NAD 1983).
 - CP&L APPROVAL WILL BE RECEIVED PRIOR TO PLACEMENT OF ANY SOIL OR WASTE MATERIAL WITHIN THE 100' UTILITY EASEMENT.
 - SOME MONITORING WELLS WILL BE ABANDONED AND REPLACED AS DEVELOPMENT CONTINUES.
 - DISTURBANCE OF ANY AREA BEYOND PHASE 1 AND 2 IS CONTINGENT UPON OBTAINING THE NECESSARY EASEMENT ENCROACHMENT AGREEMENT FROM PROGRESS ENERGY, AND UPON WAKE COUNTY AUTHORIZATION.

- REFERENCES**
- OVERALL SITE TOPOGRAPHY PREPARED BY GEODATA DATA CORPORATION, BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 2, 2012 AND FEBRUARY 27, 2007.
 - THE PROPERTY LINE SHOWN REFERENCES DRAWING ENTITLED "BOUNDARY SURVEY FOR WASTE INDUSTRIES, INC.", PREPARED BY SURVEY SOLUTIONS, P.C. DATED 12/27/00.
 - DELINEATION PERFORMED BY SOIL & ENVIRONMENTAL CONSULTANTS; SURVEYED BY SURVEYING SOLUTIONS, P.C. DATED APRIL 2001.
 - 60' INGRESS AND EGRESS EASEMENT
 - DB 8104, PG 2753 CP&L DRAWING NO. RW-D-9327
 - BM 1988, PG 1316
 - 100' CP&L EASEMENT
 - DB 2585, PG 247 CP&L MAP NO. RW-A-6106.



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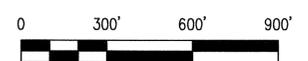
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- EXISTING 2' CONTOUR
- PROPERTY LINE (PER REFERENCE 2)
- PHASE BOUNDARY
- PHASE IDENTIFICATION
- SUBPHASE AND SUB-SUBPHASE IDENTIFICATION

NOTES:

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2. ELEVATIONS REFERENCE U.S.G.S. VERTICAL DATUM (MSL).
3. GRID COORDINATES REFERENCE NC STATE PLANE SYSTEM (NAD 1983).

REFERENCES:

1. OVERALL SITE TOPOGRAPHY PREPARED BY SPATIAL DATA CONSULTANTS, INC., BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 8, 2003.
2. THE PROPERTY LINE SHOWN REFERENCES DRAWING TITLED, "BOUNDARY SURVEY FOR WASTE INDUSTRIES, INC.", PREPARED BY SURVEY SOLUTIONS, P.C. DATED 12/27/00, SCALE 1"=400'
3. CP&L POWERLINE/EASEMENT REFERENCES THE BOUNDARY SURVEY.



NO.	DATE	REVISION
3	4/04	REVISED GRADING
2	10/03	PHASE 1C REVISIONS

G.N. RICHARDSON & ASSOCIATES, INC.
 Engineering and Geological Services
 14 N. BOYLAN AVENUE RALEIGH, N.C. 27603
 PHONE-919-828-0577 FAX-919-828-8889 WWW.GNRA.COM

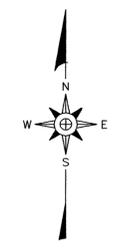
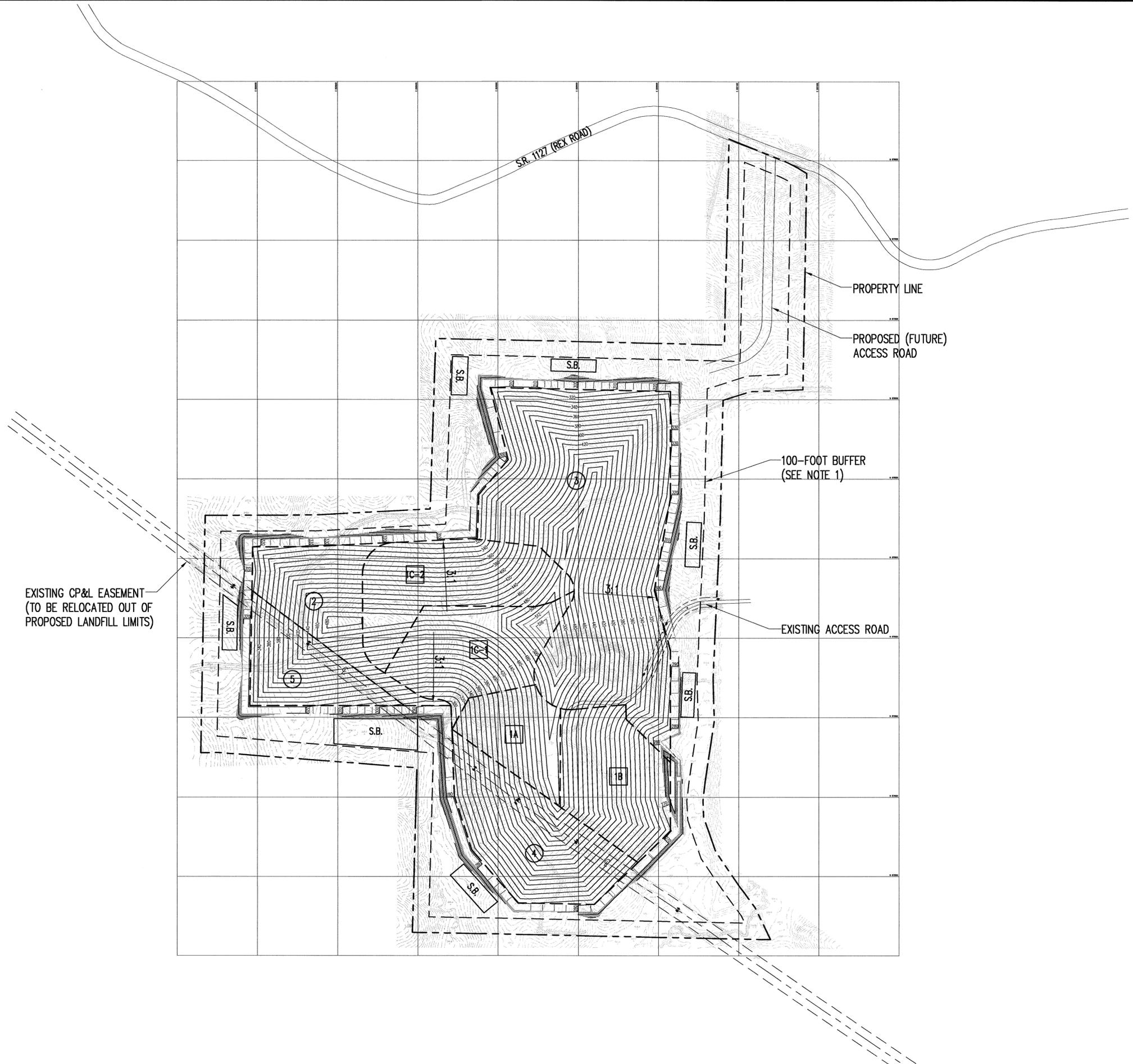


PROJECT TITLE:
**RED ROCK DISPOSAL, LLC
 CONSTRUCTION/DEMOLITION
 LANDFILL PHASE 1
 WAKE COUNTY, NC**

DRAWING TITLE:
**FACILITY PLAN
 BASE GRADES**

DESIGNED BY: T.B.M.	DRAWN BY: C.T.J.
CHECKED BY: J.M.G.	PROJECT NO.: RED ROCK-2
SCALE: AS SHOWN	DATE: OCT. 2003
FILE NAME: REDROCK-00022A	
SHEET NO. 3	DRAWING NO. E2

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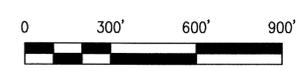
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- EXISTING 5' CONTOUR
- PROPERTY LINE (PER REFERENCE 2)
- PHASE BOUNDARY
- CONCEPTUAL SEDIMENT BASIN LOCATION (FINAL LOCATION TO BE DETERMINED)
- PHASE IDENTIFICATION
- SUBPHASE AND SUB-SUBPHASE IDENTIFICATION

NOTES:

1. THIS BUFFER REPRESENTS A TYPE A BUFFER YARD AND A TRANSITIONAL BUFFER IN ACCORDANCE WITH WAKE COUNTY ZONING REQUIREMENTS. THIS 100-FOOT BUFFER ALSO INCLUDES, BUT DOES NOT SHOW, A 50-FOOT UNDISTURBED BUFFER ALSO PER WAKE COUNTY ZONING REQUIREMENTS.
2. ELEVATIONS REFERENCE U.S.G.S. VERTICAL DATUM (MSL).
3. GRID COORDINATES REFERENCE NC STATE PLANE SYSTEM (NAD 1983).

REFERENCES:

1. OVERALL SITE TOPOGRAPHY PREPARED BY SPATIAL DATA CONSULTANTS, INC., BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 8, 2003.
2. THE PROPERTY LINE SHOWN REFERENCES DRAWING TITLED, "BOUNDARY SURVEY FOR WASTE INDUSTRIES, INC." PREPARED BY SURVEY SOLUTIONS, P.C. DATED 12/27/00, SCALE 1"=400'.
3. CP&L POWERLINE/EASEMENT REFERENCES THE BOUNDARY SURVEY.



NO.	DATE	PHASE	IC REVISIONS
2	10/03		

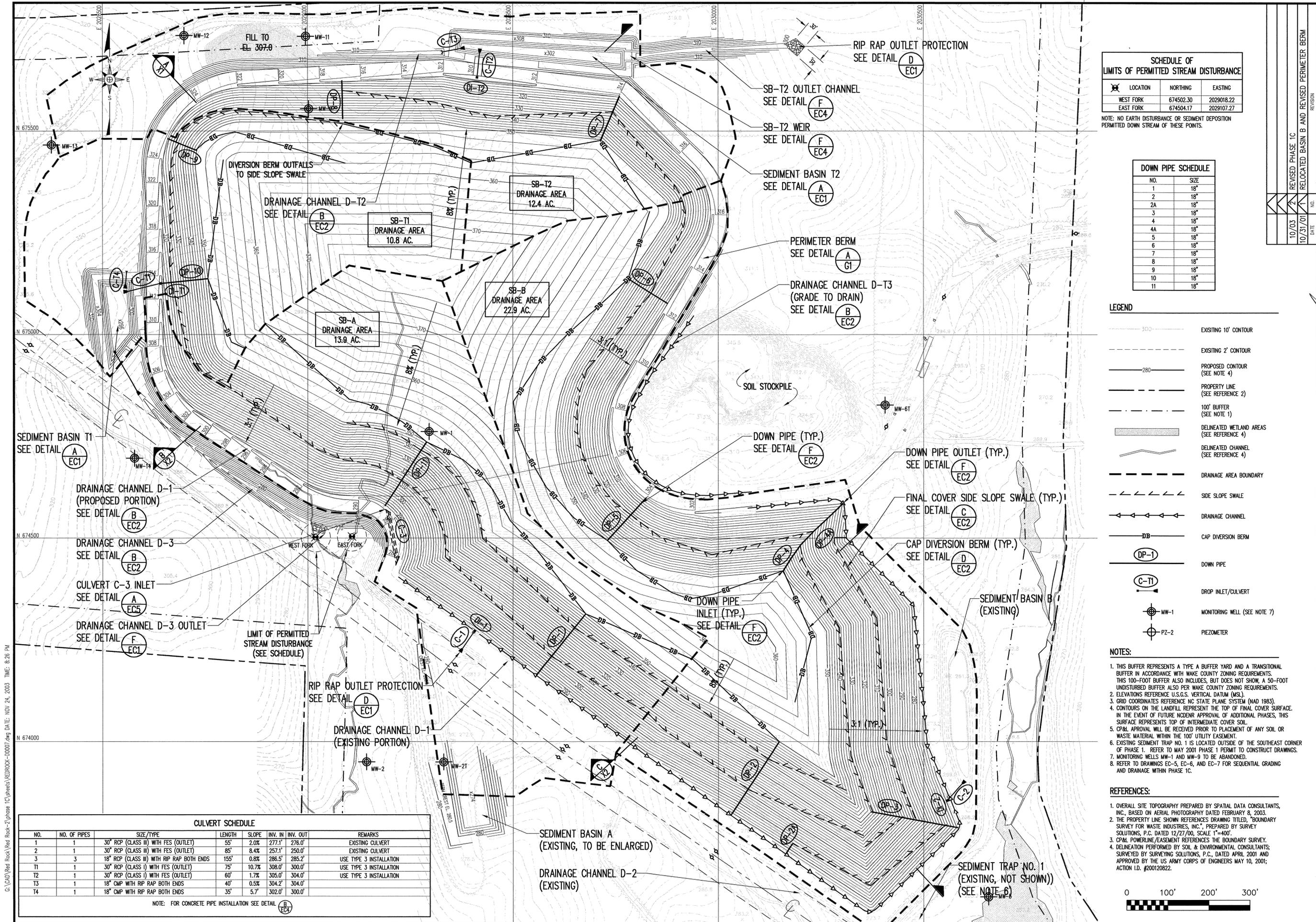
G.N. RICHARDSON & ASSOCIATES, INC.
 Engineering and Geological Services
 14 N. BOYLAN AVENUE RALEIGH, N.C. 27603
 PHONE-919-828-0677 FAX-919-828-3899 WWW.GNRA.COM



PROJECT TITLE:
**RED ROCK DISPOSAL, LLC
 CONSTRUCTION/DEMOLITION
 LANDFILL PHASE 1
 WAKE COUNTY, NC**

DRAWING TITLE:
**FACILITY PLAN
 FINAL COVER GRADES**

DESIGNED BY: T.B.M.	DRAWN BY: C.T.J.
CHECKED BY: J.M.G.	PROJECT NO.: RED ROCK-2
SCALE: AS SHOWN	DATE: OCT. 2003
FILE NAME: REDROCK-00023	
SHEET NO. 4	DRAWING NO. E3



SCHEDULE OF LIMITS OF PERMITTED STREAM DISTURBANCE

LOCATION	NORTHING	EASTING
WEST FORK	674502.30	2029018.22
EAST FORK	674504.17	2029107.27

NOTE: NO EARTH DISTURBANCE OR SEDIMENT DEPOSITION PERMITTED DOWN STREAM OF THESE POINTS.

DOWN PIPE SCHEDULE

NO.	SIZE
1	18"
2	18"
2A	18"
3	18"
4	18"
4A	18"
5	18"
6	18"
7	18"
8	18"
9	18"
10	18"
11	18"

LEGEND

- 500 --- EXISTING 10' CONTOUR
- 280 --- EXISTING 2' CONTOUR
- 280 --- PROPOSED CONTOUR (SEE NOTE 4)
- --- PROPERTY LINE (SEE REFERENCE 2)
- --- 100' BUFFER (SEE NOTE 1)
- --- DELINEATED WETLAND AREAS (SEE REFERENCE 4)
- --- DELINEATED CHANNEL (SEE REFERENCE 4)
- --- DRAINAGE AREA BOUNDARY
- --- SIDE SLOPE SWALE
- --- DRAINAGE CHANNEL
- DB --- CAP DIVERSION BERM
- DP-1 --- DOWN PIPE
- C-T1 --- DROP INLET/CULVERT
- MW-1 --- MONITORING WELL (SEE NOTE 7)
- PZ-2 --- PIEZOMETER

- NOTES:**
- THIS BUFFER REPRESENTS A TYPE A BUFFER YARD AND A TRANSITIONAL BUFFER IN ACCORDANCE WITH WAKE COUNTY ZONING REQUIREMENTS. THIS 100-FOOT BUFFER ALSO INCLUDES, BUT DOES NOT SHOW, A 50-FOOT UNDISTURBED BUFFER ALSO PER WAKE COUNTY ZONING REQUIREMENTS.
 - ELEVATIONS REFERENCE U.S.G.S. VERTICAL DATUM (MSL).
 - GRID COORDINATES REFERENCE NC STATE PLANE SYSTEM (NAD 1983).
 - CONTOURS ON THE LANDFILL REPRESENT THE TOP OF FINAL COVER SURFACE. IN THE EVENT OF FUTURE MODERN APPROVAL OF ADDITIONAL PHASES, THIS SURFACE REPRESENTS TOP OF INTERMEDIATE COVER SOIL.
 - CP&L APPROVAL WILL BE RECEIVED PRIOR TO PLACEMENT OF ANY SOIL OR WASTE MATERIAL WITHIN THE 100' UTILITY EASEMENT.
 - EXISTING SEDIMENT TRAP NO. 1 IS LOCATED OUTSIDE OF THE SOUTHEAST CORNER OF PHASE 1. REFER TO MAY 2001 PHASE 1 PERMIT TO CONSTRUCT DRAWINGS.
 - MONITORING WELLS MW-1 AND MW-9 TO BE ABANDONED.
 - REFER TO DRAWINGS EC-5, EC-6, AND EC-7 FOR SEQUENTIAL GRADING AND DRAINAGE WITHIN PHASE 1C.

- REFERENCES:**
- OVERALL SITE TOPOGRAPHY PREPARED BY SPATIAL DATA CONSULTANTS, INC., BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 8, 2003.
 - THE PROPERTY LINE SHOWN REFERENCES DRAWING TITLED, "BOUNDARY SURVEY FOR WASTE INDUSTRIES, INC.," PREPARED BY SURVEY SOLUTIONS, P.C. DATED 12/27/00, SCALE 1"=400'.
 - CP&L POWERLINE/EASEMENT REFERENCES THE BOUNDARY SURVEY.
 - DELINEATION PERFORMED BY SOIL & ENVIRONMENTAL CONSULTANTS; SURVEYED BY SURVEYING SOLUTIONS, P.C., DATED APRIL 2001 AND APPROVED BY THE US ARMY CORPS OF ENGINEERS MAY 10, 2001; ACTION ID. #200120822.

CULVERT SCHEDULE

NO.	NO. OF PIPES	SIZE/TYPE	LENGTH	SLOPE	INV. IN	INV. OUT	REMARKS
1	1	30" RCP (CLASS III) WITH FES (OUTLET)	55'	2.0%	277.1'	276.0'	EXISTING CULVERT
2	1	30" RCP (CLASS III) WITH FES (OUTLET)	85'	8.4%	257.1'	250.0'	EXISTING CULVERT
3	3	18" RCP (CLASS III) WITH RIP RAP BOTH ENDS	155'	0.8%	286.5'	285.2'	USE TYPE 3 INSTALLATION
T1	1	30" RCP (CLASS I) WITH FES (OUTLET)	75'	10.7%	308.0'	300.0'	USE TYPE 3 INSTALLATION
T2	1	30" RCP (CLASS I) WITH FES (OUTLET)	60'	1.7%	305.0'	304.0'	USE TYPE 3 INSTALLATION
T3	1	18" CMP WITH RIP RAP BOTH ENDS	40'	0.5%	304.2'	304.0'	
T4	1	18" CMP WITH RIP RAP BOTH ENDS	35'	5.7%	302.0'	300.0'	

NOTE: FOR CONCRETE PIPE INSTALLATION SEE DETAIL B EC4

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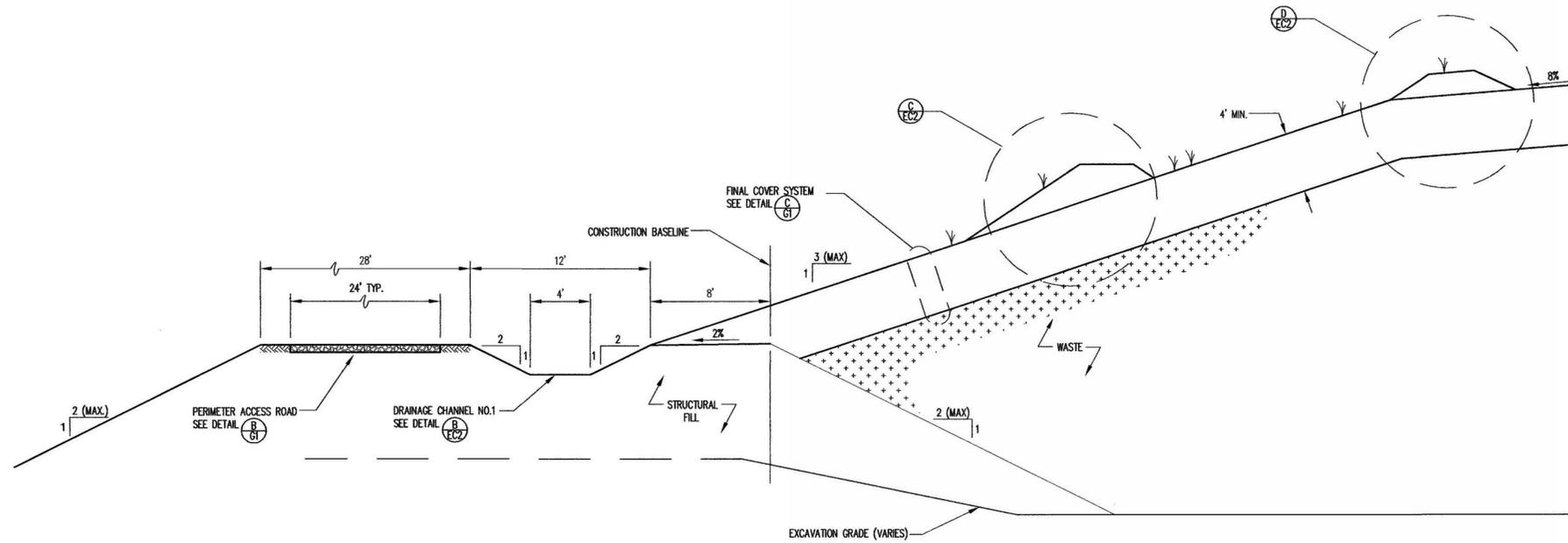


PROJECT TITLE:
**RED ROCK DISPOSAL, LLC
 CONSTRUCTION & DEMOLITION
 LANDFILL PHASE 1
 WAKE COUNTY, NC**

DRAWING TITLE:
**PHASE 1 FINAL
 GRADING AND
 DRAINAGE PLAN**

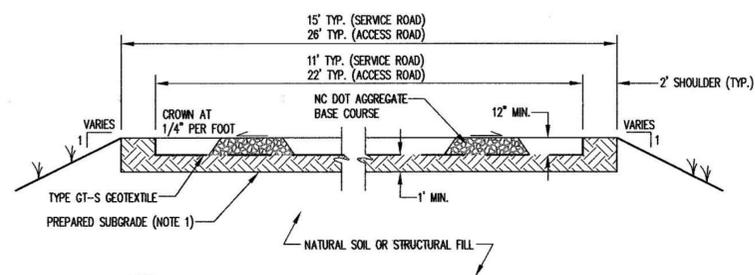
DESIGNED BY: T.B.M.	DRAWN BY: C.T.J.
CHECKED BY: J.M.G.	PROJECT NO.: RED ROCK-2
SCALE: AS SHOWN	DATE: OCT. 2003
FILE NAME: REDROCK-D0007	SHEET NO.: 6
	DRAWING NO.: E5

G:\CAD\Red Rock\Red Rock-2\Phase 1\Drawings\REDROCK-D0007.dwg DATE: NOV. 24, 2003. TIME: 8:26 PM



PERIMETER BERM CROSS SECTION (TYP.)

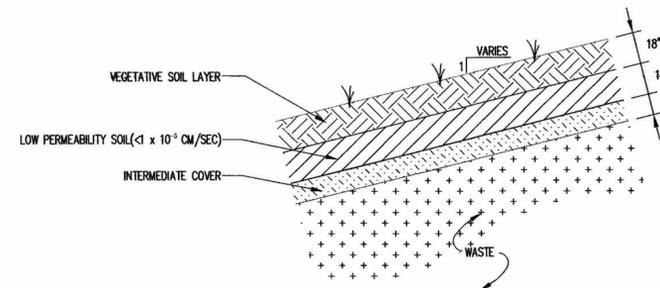
DETAIL (A/G1)
SCALE: 1" = 5'



NOTE:
1. IN FILL AREAS, PREPARED SUBGRADE IS EQUIVALENT TO STRUCTURAL FILL. FOR CUT AREAS, REMOVE AND REPLACE WITH STRUCTURAL FILL (SEE PROJECT SPECIFICATIONS).

TYPICAL ROADWAY CROSS SECTION

DETAIL (B/G1)
SCALE: 1" = 5'



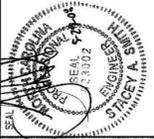
FINAL COVER SYSTEM

DETAIL (C/G1)
NOT TO SCALE

NO.	DATE	REVISION
4	5/08	REVISED FINAL COVER GRADING

RICHARDSON SMITH GARDNER & ASSOCIATES
www.rsgengineers.com
14 N. Boylan Ave., Raleigh, N.C. 27603
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fax: 919-828-4899

SEAL



PROJECT TITLE:
RED ROCK DISPOSAL, LLC
CONSTRUCTION/DEMOLITION
LANDFILL PHASE 1
WAKE COUNTY, NC

PHASE 1 - DETAILS

DRAWING TITLE:

DESIGNED BY: P.K.S.	DRAWN BY: C.T.J.
CHECKED BY: SM	PROJECT NO.: RED ROCK-2
SCALE: AS SHOWN	DATE: MAY 2001
FILE NAME: REDROCK-00031D	SHEET NO. DRAWING NO.
7	G1



RED ROCK DISPOSAL, LLC
NC PERMIT NO. 92-28

PREPARED BY:
NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER
ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



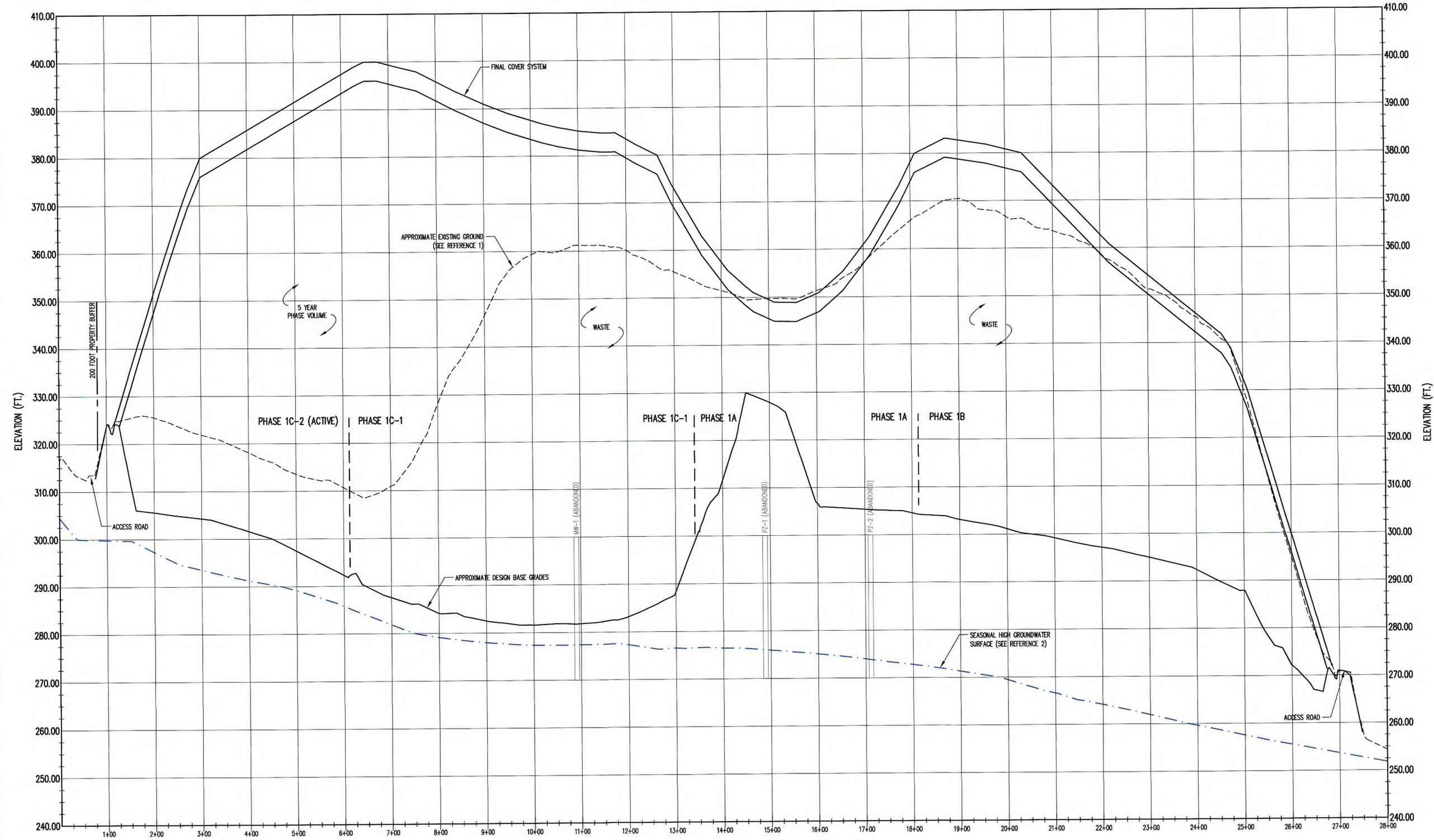
REV.	DATE	DESCRIPTION
5	12/12	UPDATED TOP/GRADING
4	5/08	REVISED FINAL COVER SYSTEM
3	4/04	GRADING REVISIONS;
		REVISED GROUNDWATER
2	10/03	PHASE 1C REVISIONS

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PROJECT TITLE:
**CONSTRUCTION & DEMOLITION
LANDFILL
PHASE 1
ENGINEERING DRAWINGS**

DRAWING TITLE:
**PHASE 1
ENGINEERING CROSS SECTIONS
(SHEET 1 OF 2)**

DESIGNED: J.W.C.	PROJECT NO: RED ROCK 12-2
DRAWN: J.A.L.	SCALE: AS SHOWN
APPROVED: 	DATE: NOV. 2012
FILE NAME: REDROCK-D0123	DRAWING NUMBER: X1
SHEET NUMBER: 8	

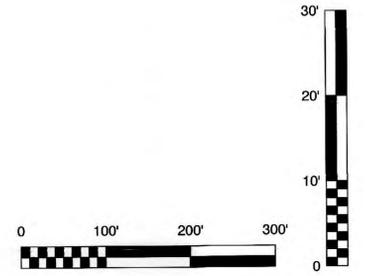


SECTION AA
SCALE: AS SHOWN X1

LEGEND

	DESIGN SURFACE
	EXISTING GROUND SURFACE
	SEASONAL HIGH GROUNDWATER SURFACE

- REFERENCES**
- OVERALL SITE TOPOGRAPHY PREPARED BY GEODATA DATA CORPORATION, BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 2, 2012 AND FEBRUARY 27, 2007.
 - GROUNDWATER SURFACE FROM APRIL 3, 2004 AS SHOWN IN PHASE 1 ENGINEERING DRAWINGS, DATED MAY 2008, PREPARED BY SMITH GARDNER, INC. FORMERLY RICHARDSON SMITH GARDNER & ASSOCIATES.





RED ROCK DISPOSAL, LLC
NC PERMIT NO. 92-28

PREPARED BY:
NC LIC. NO. C-0828 (ENGINEERING)

SMITH + GARDNER
ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



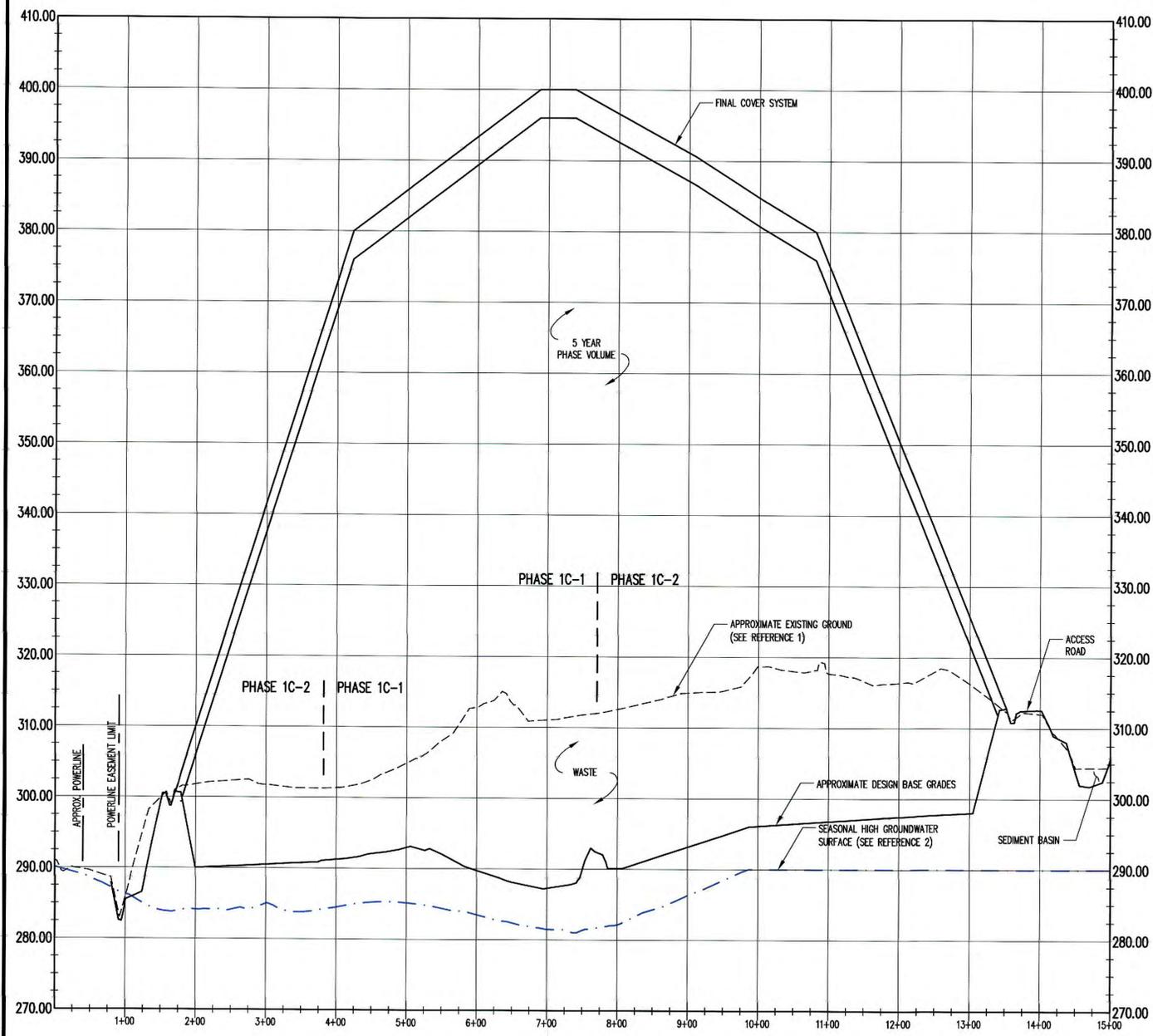
REV.	DATE	DESCRIPTION
5	12/12	UPDATED TOP/GRADING
4	5/08	REVISED FINAL COVER SYSTEM
3	4/04	GRADING REVISIONS; REVISED GROUNDWATER
2	10/03	PHASE 1C REVISIONS

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PROJECT TITLE:
**CONSTRUCTION & DEMOLITION
LANDFILL
PHASE 1
ENGINEERING DRAWINGS**

DRAWING TITLE:
**PHASE 1
ENGINEERING CROSS SECTIONS
(SHEET 2 OF 2)**

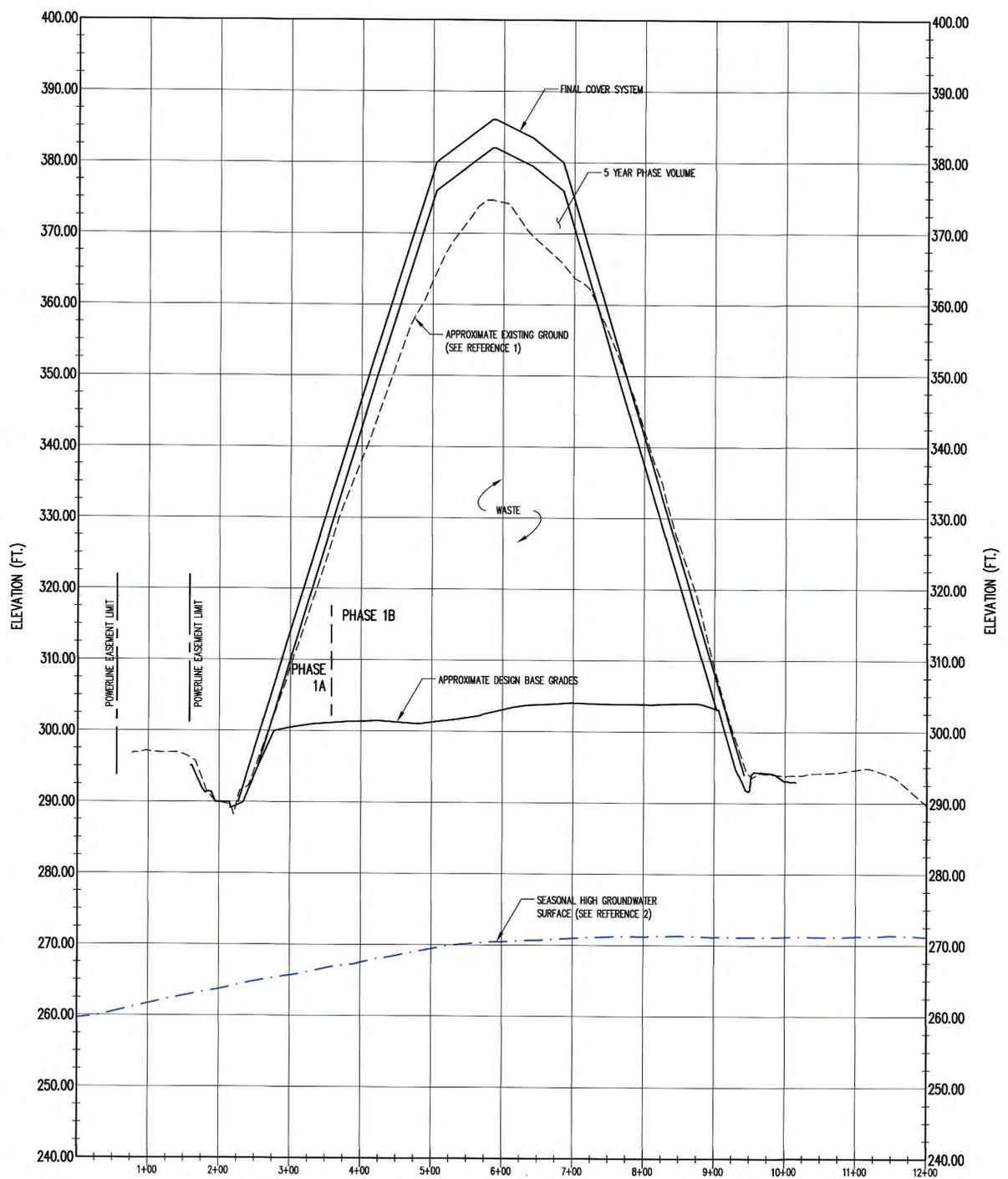
DESIGNED: J.W.C.	PROJECT NO: RED ROCK 12-2
DRAWN: J.A.L.	SCALE: AS SHOWN
APPROVED: [Signature]	DATE: NOV. 2012
FILENAME: REDROCK-D0124	
SHEET NUMBER: 9	DRAWING NUMBER: X2



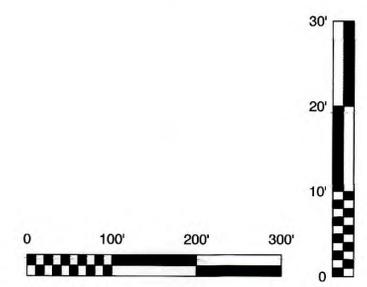
SECTION BB
SCALE: AS SHOWN

- LEGEND**
- DESIGN SURFACE
 - - - - - EXISTING GROUND SURFACE
 - · - · - SEASONAL HIGH GROUNDWATER SURFACE

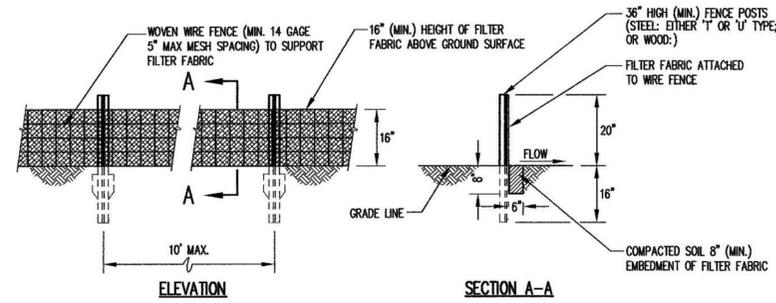
- REFERENCES**
- OVERALL SITE TOPOGRAPHY PREPARED BY GEODATA DATA CORPORATION BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 2, 2012 AND FEBRUARY 27, 2007.
 - GROUNDWATER SURFACE FROM APRIL 3, 2004 AS SHOWN IN PHASE 1 ENGINEERING DRAWINGS, DATED MAY 2008, PREPARED BY SMITH GARDNER, INC. FORMERLY RICHARDSON SMITH GARDNER & ASSOCIATES.



SECTION CC
SCALE: AS SHOWN



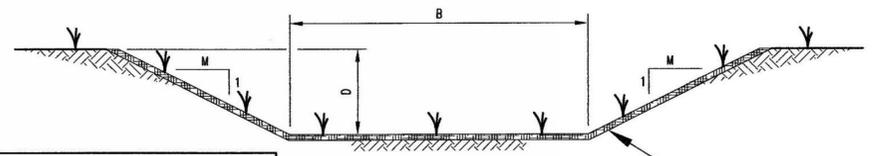
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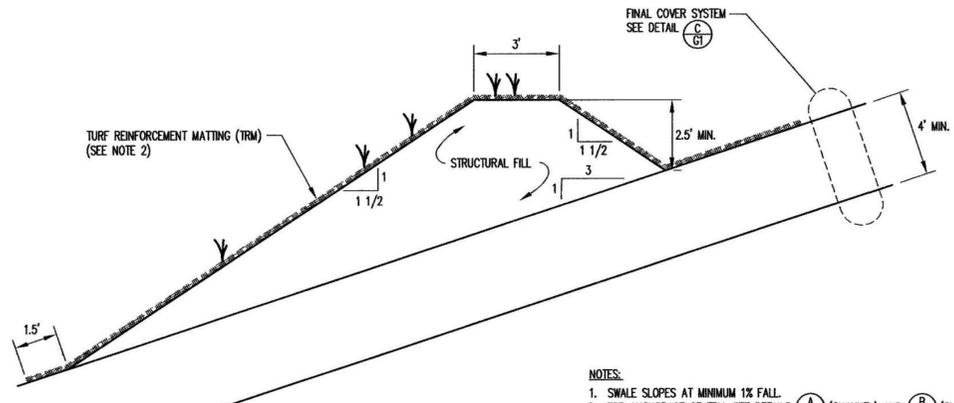
DRAINAGE CHANNEL SCHEDULE

DRAINAGE CHANNEL NO.	LINING	B	D	M
D-1	TRM*	4.0'	2.0'	2
D-2	TRM	0'	1.5'	2
D-3	TRM	4.0'	2.0'	2
D-T1	TRM	4.0'	2.0' MIN	2
D-T2	GRASS	3.0'	1.0' - 2.0'	2
D-T3	GRASS	0'	1.5'	2
SED. BASIN T1 OUTLET	TRM	4.0'	2.0'	2
SED. BASIN T2 OUTLET	TRM	4.0'	2.0'	2

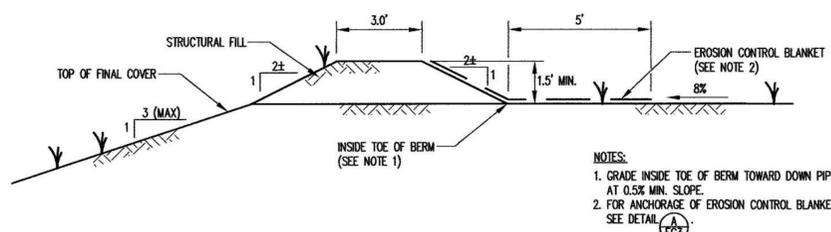
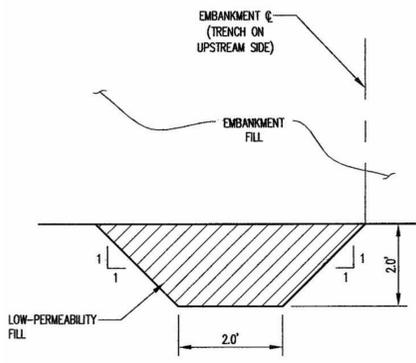
*TRM = TURF REINFORCEMENT MATTING



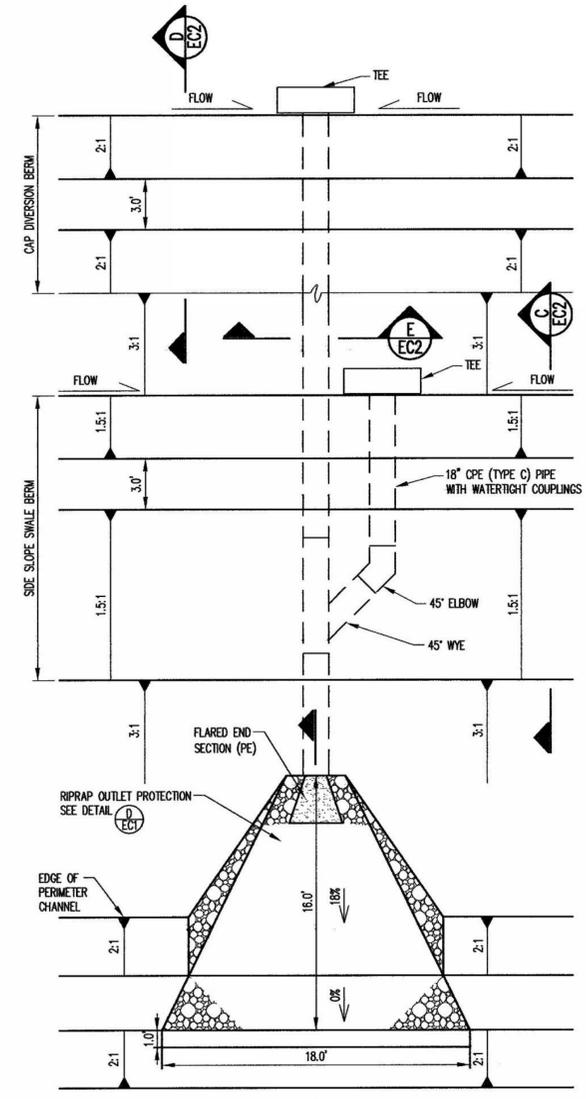
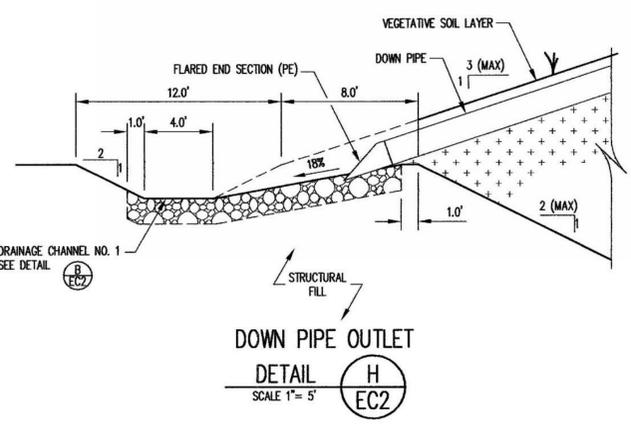
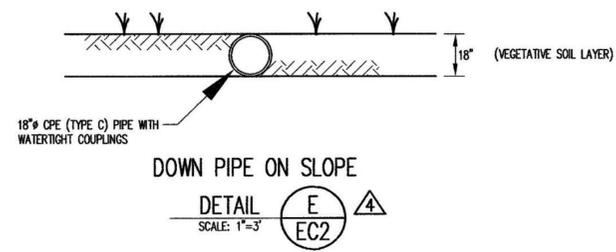
NOTES:
 1. FOR ANCHORAGE OF RECP, SEE DETAIL A.
 2. WHERE DEPTH OF CUT TO CHANNEL BOTTOM EXCEEDS 'D', INSTALL TRM TO HEIGHT 'D' ABOVE CHANNEL BOTTOM.



NOTES:
 1. SWALE SLOPES AT MINIMUM 1% FALL.
 2. FOR ANCHORAGE OF TRM, SEE DETAILS A (CHANNEL) AND B (SLOPE).



NOTES:
 1. GRADE INSIDE TOE OF BERM TOWARD DOWN PIPE AT 0.5% MIN. SLOPE.
 2. FOR ANCHORAGE OF EROSION CONTROL BLANKET, SEE DETAIL A.



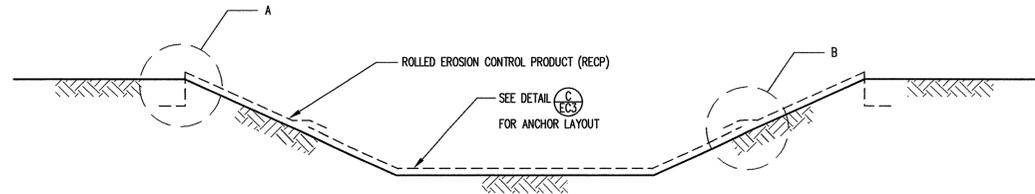
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NO.	DATE	REVISION
1	5/08	REVISED FINAL COVER GRADING
2	10/03	PHASE 1C REVISIONS

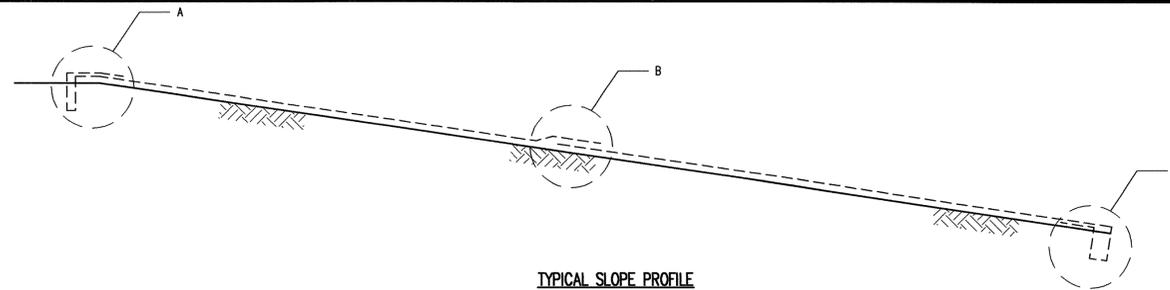
RED ROCK DISPOSAL, LLC
CONSTRUCTION/DEMOLITION
LANDFILL PHASE 1
WAKE COUNTY, NC

PHASE 1 - EROSION & SEDIMENTATION CONTROL DETAILS (SHEET 2 OF 5)

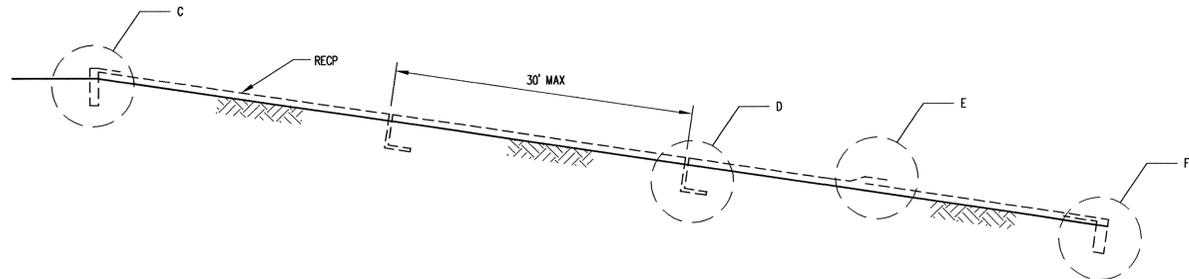
DESIGNED BY: T.B.M.	DRAWN BY: C.T.J.
CHECKED BY: SM	PROJECT NO.: RED ROCK-2
SCALE: AS SHOWN	DATE: OCT. 2003
FILE NAME: REDROCK-00011D	SHEET NO.: 11
DRAWING NO.: EC2	



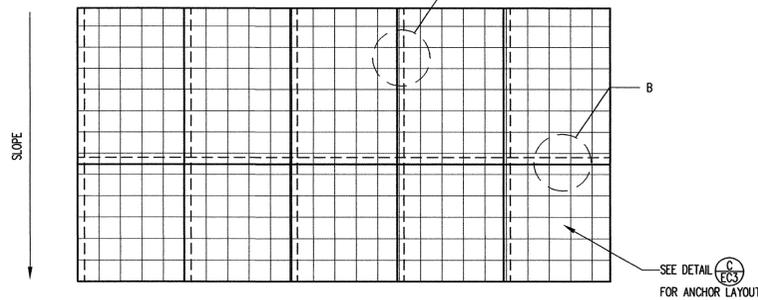
TYPICAL CHANNEL CROSS SECTION



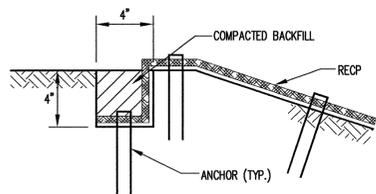
TYPICAL SLOPE PROFILE



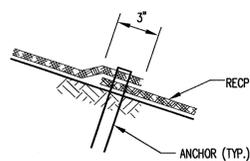
TYPICAL CHANNEL PROFILE



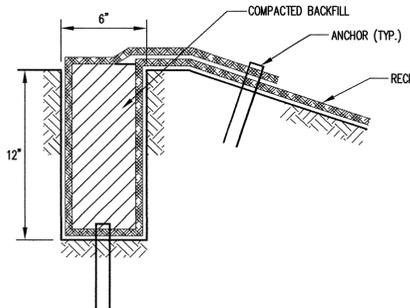
TYPICAL SLOPE PLAN VIEW



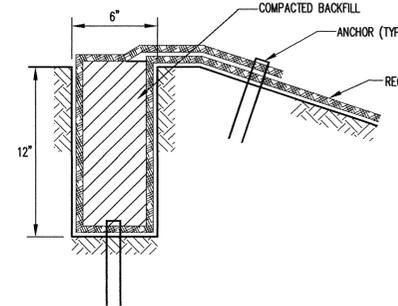
A. LONGITUDINAL ANCHOR TRENCH



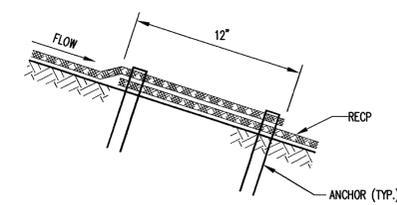
B. OVERLAP AT ADJACENT EDGES



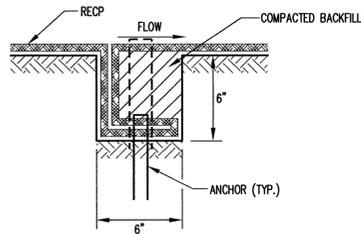
C. UPSTREAM TERMINAL ANCHOR TRENCH



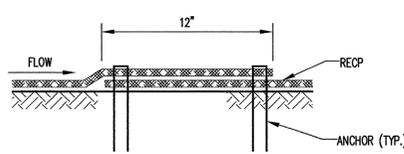
A. UPSLOPE TERMINAL ANCHOR TRENCH



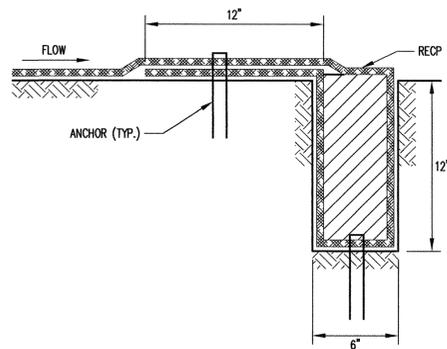
B. OVERLAP AT ROLL ENDS



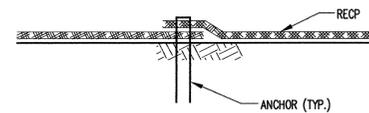
D. INTERMITTENT CHECK SLOT



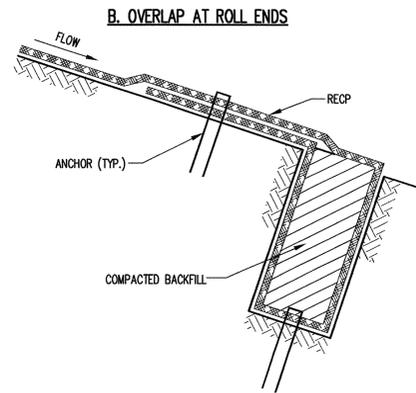
E. OVERLAP AT ROLL ENDS



C. DOWNSTREAM TERMINAL ANCHOR TRENCH



C. OVERLAP AT ADJACENT EDGES

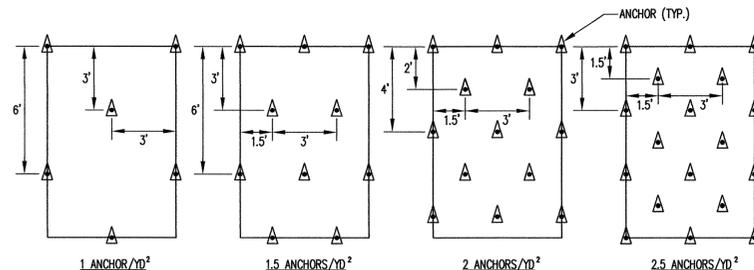


D. DOWNSLOPE TERMINAL ANCHOR TRENCH

NOTES:
1. PLACE ANCHORS AT ANCHOR TRENCHES, OVERLAPS, AND CHECK SLOTS ON 1 FOOT CENTERS.
IF APPLICABLE, STAGGER ANCHOR SPACING BETWEEN MULTIPLE ROWS OF ANCHORS.

INSTALLATION OF ROLLED EROSION CONTROL PRODUCTS (CHANNELS)

DETAIL A
N.T.S. EC3



ANCHOR LAYOUT

DETAIL C
N.T.S. EC3

INSTALLATION OF ROLLED EROSION CONTROL PRODUCTS (SLOPES)

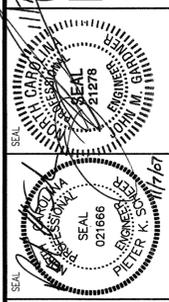
DETAIL B
N.T.S. EC3

ANCHOR SPACING SCHEDULE	
LOCATION	REQUIRED ANCHOR SPACING (ANCHORS/YD ²)
ALL CHANNELS	2.5
1.5H:1V SLOPES	2.0
2H:1V SLOPES	2.0
2.5H:1V SLOPES	1.5
3H:1V SLOPES	1.5
3.5H:1V SLOPES	1.0
4H:1V SLOPES	1.0

G:_cod\Curtis-James\Curtis-3\phase 1\sheet\CURTIS-D0039.dwg DATE: MAY 18, 2001 TIME: 5:02 PM

NO.	DATE	REVISION

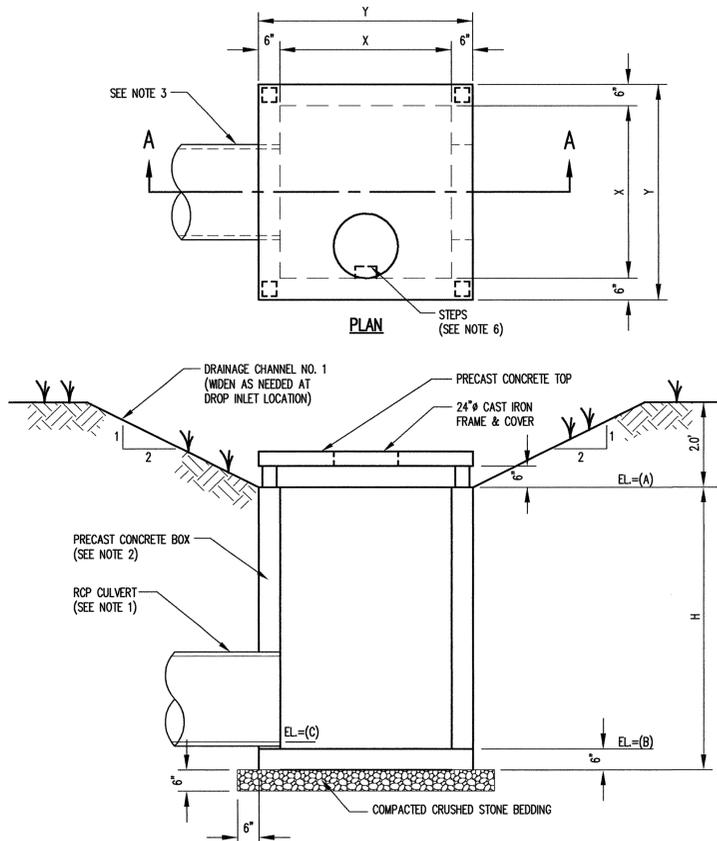
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Engineering and Geological Services
425 N. BOYLAN AVENUE RALEIGH, N.C. 27603
PHONE-919-828-0577 FAX-919-828-3898 WWW.GNRA.COM



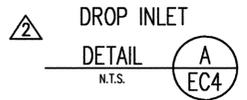
PROJECT TITLE:
RED ROCK DISPOSAL, LLC
CONSTRUCTION/DEMOLITION
LANDFILL PHASE 1
WAKE COUNTY, NC

DRAWING TITLE:
PHASE 1 - EROSION &
SEDIMENTATION CONTROL
DETAILS (SHEET 3 OF 4)

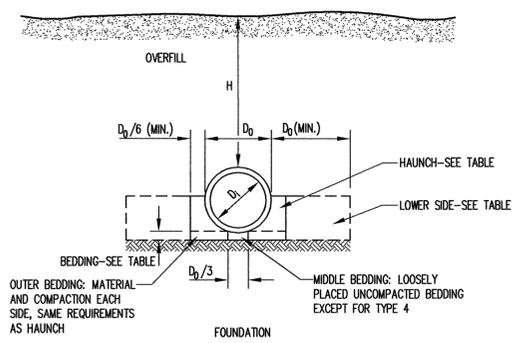
DESIGNED BY: P.K.S.	DRAWN BY: C.T.J.
CHECKED BY: J.M.G.	PROJECT NO.: CURTIS-3
SCALE: AS SHOWN	DATE: MAY 2001
FILE NAME: CURTIS-D0039	SHEET NO.: 12
SHEET NO.: 12	DRAWING NO.: EC3



DROP INLET SCHEDULE							
DROP INLET	CULVERT #	X	Y	A	B	C	H
1	30"	4.0'	5.0'	281.8'	276.8'	277.1'	5.5'
2	30"	4.0'	5.0'	261.8'	256.8'	257.1'	5.5'
T1	30"	4.0'	5.0'	311.7'	307.7'	308.0'	4.5'
T2	30"	4.0'	5.0'	307.7'	303.7'	304.0'	4.5'



- NOTES:**
- PROVIDE WATERTIGHT JOINTS ON ALL PIPING.
 - PRECAST CONCRETE BOXES SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:
 - A. CONCRETE: COMPRESSIVE STRENGTH 4000 PSI
 - B. REINFORCING: ASTM A-615, GRADE 60
 - C. MEETS H-20 LOADING.
 - PIPES MAY BE ORIENTED DIFFERENTLY WITH RESPECT TO THE CHANNEL THAN DISPLAYED HERE. SEE DRAWING ES FOR PROPER ORIENTATION.
 - THE CONTRACTOR SHALL PROVIDE ADEQUATE PROTECTION FROM SEDIMENTATION FOR ALL DROP INLETS USING GRAVEL AND WIRE MESH FILTERS OR OTHER METHOD AS APPROVED BY THE ENGINEER.
 - PROVIDE STEPS FOR DROP INLETS WITH H>4.5'. STEPS SHALL HAVE A 16" SPACING THE FULL HEIGHT OF THE DROP INLET. START FIRST STEP 6" BELOW TOP.

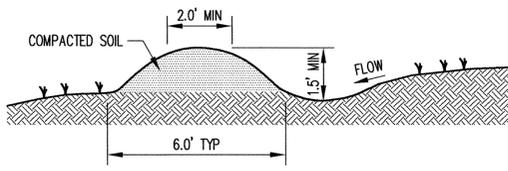


STANDARD EMBANKMENT INSTALLATIONS FOR CONCRETE PIPE
(BASED ON AMERICAN CONCRETE PIPE ASSOCIATION RECOMMENDATIONS)



STANDARD EMBANKMENT INSTALLATION SOILS AND MINIMUM COMPACTION REQUIREMENTS			
INSTALLATION TYPE	BEDDING THICKNESS	HAUNCH AND OUTER BEDDING	LOWER SIDE
TYPE 1	D ₀ /24" (600mm) MINIMUM, NOT LESS THAN 3" (75mm). IF ROCK FOUNDATION, USE D ₀ /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 ₀ /24" (600mm) MINIMUM, NOT LESS THAN 3" (75mm). IF ROCK FOUNDATION, USE D ₀ /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 ₀ /24" (600mm) MINIMUM, NOT LESS THAN 3" (75mm). IF ROCK FOUNDATION, USE D ₀ /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 ₀ /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%

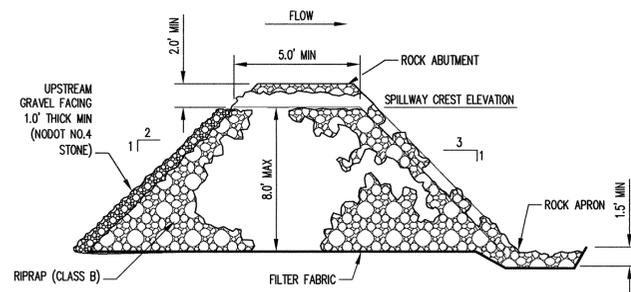
- NOTES:**
- COMPACTION AND SOIL SYMBOLS (95% SW) REFER TO SW SOIL MATERIAL (USCS CLASSIFICATION) WITH A MINIMUM STANDARD PROCTOR COMPACTION (ASTM D 698) OF 95%.
 - SOIL IN THE OUTER BEDDING, HAUNCH, AND LOWER SIDE ZONES, EXCEPT WITHIN D₀/3 FROM THE PIPE SPRINGLINE, SHALL BE COMPACTED TO AT LEAST THE SAME COMPACTION AS THE MAJORITY OF THE SOIL IN THE OVERFILL ZONE.
 - SUBTRENCHES:
 - 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.
 - THE MINIMUM WIDTH OF A SUBTRENCH SHALL BE 1.33 D₀, OR WIDER IF REQUIRED FOR ADEQUATE SPACE TO ATTAIN THE SPECIFIED COMPACTION IN THE HAUNCH AND BEDDING ZONES.
 - 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.



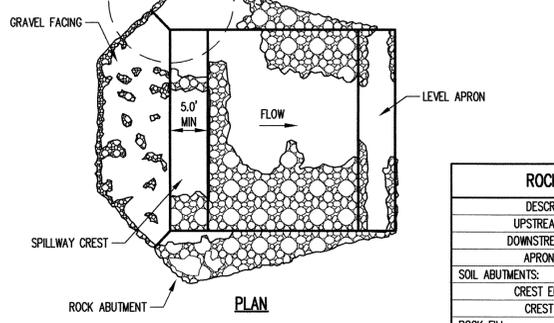
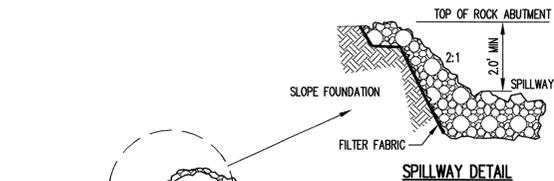
TEMPORARY DIVERSION



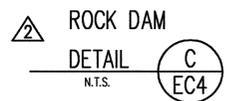
- NOTES:**
- THIS DETAIL APPLIES TO DIVERSION BERMS FOR WHICH CONTOURS ARE NOT SHOWN. CONTOURED DIVERSION BERMS HAVE A MINIMUM HEIGHT OF 2.0' AND CREST WIDTH OF 4.0'.



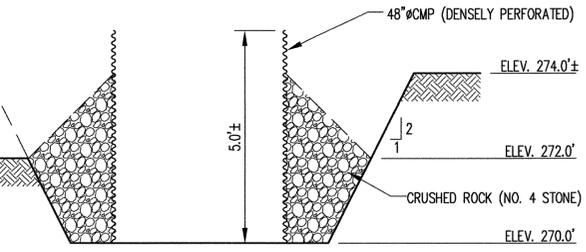
CROSS SECTION



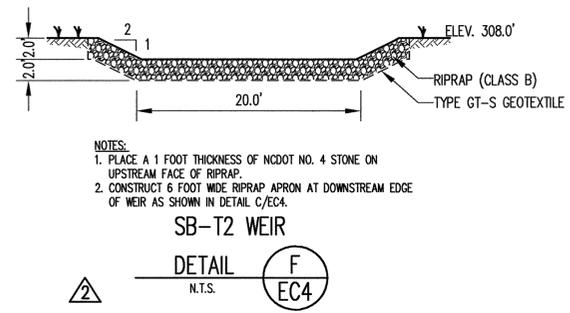
ROCK DAM GEOMETRY	
DESCRIPTION	VALUE
UPSTREAM SLOPE	2:1
DOWNSTREAM SLOPE	3:1
APRON WIDTH	6'
SOIL ABUTMENTS:	
CREST ELEVATION	276' MSL
CREST WIDTH	5'
ROCK FILL:	
CREST ELEVATION	274' MSL
CREST WIDTH	15'
WEIR LENGTH	20'



ROCK DAM



TEMPORARY PUMP STATION



SB-T2 WEIR



- NOTES:**
- PLACE A 1 FOOT THICKNESS OF NCDOT NO. 4 STONE ON UPSTREAM FACE OF RIPRAP.
 - CONSTRUCT 6 FOOT WIDE RIPRAP APRON AT DOWNSTREAM EDGE OF WEIR AS SHOWN IN DETAIL C/EC4.

G:\CAD\Red Rock\Red Rock-2\phase 1\sheet\REDROCK-D0012.dwg DATE: NOV 20, 2003 TIME: 2:24 PM

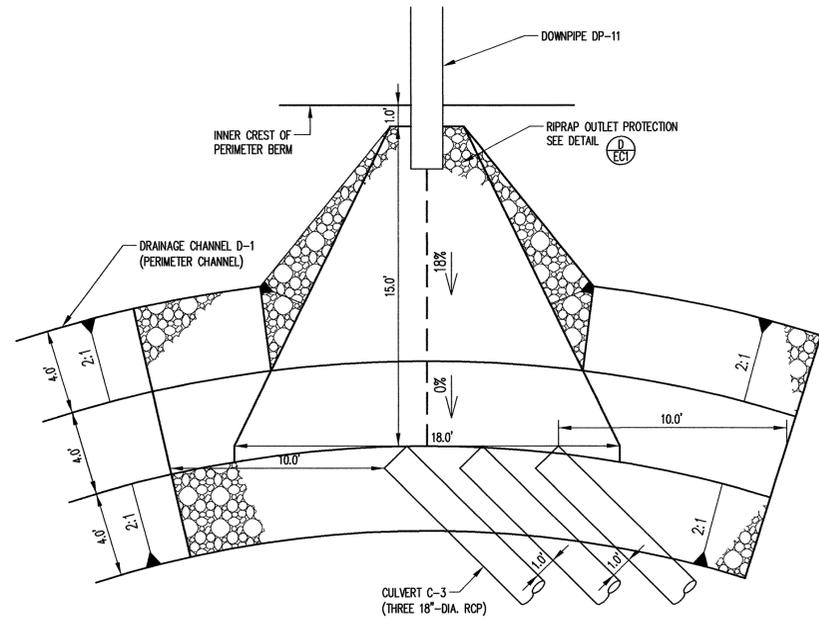
G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
14 N. BOYLAN AVENUE RALEIGH, N.C. 27603
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RED ROCK DISPOSAL, LLC
CONSTRUCTION/DEMOLITION
LANDFILL PHASE 1
WAKE COUNTY, NC

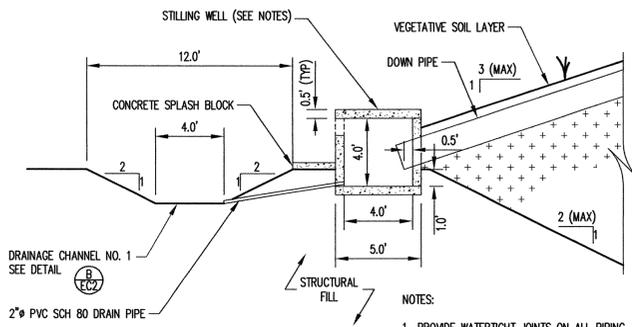
PHASE 1 - EROSION & SEDIMENTATION CONTROL
DETAILS (SHEET 4 OF 5)

DESIGNED BY: T.B.M. DRAWN BY: C.T.J.
CHECKED BY: J.M.G. PROJECT NO.: RED ROCK-2
SCALE: AS SHOWN DATE: OCT. 2003
FILE NAME: REDROCK-D0012
SHEET NO. 13 DRAWING NO. EC4

G:\CAD\Red Rock\Red Rock-2\phase 1\sheet\REDROCK-D0025.dwg DATE: NOV 24, 2003 TIME: 3:42 PM

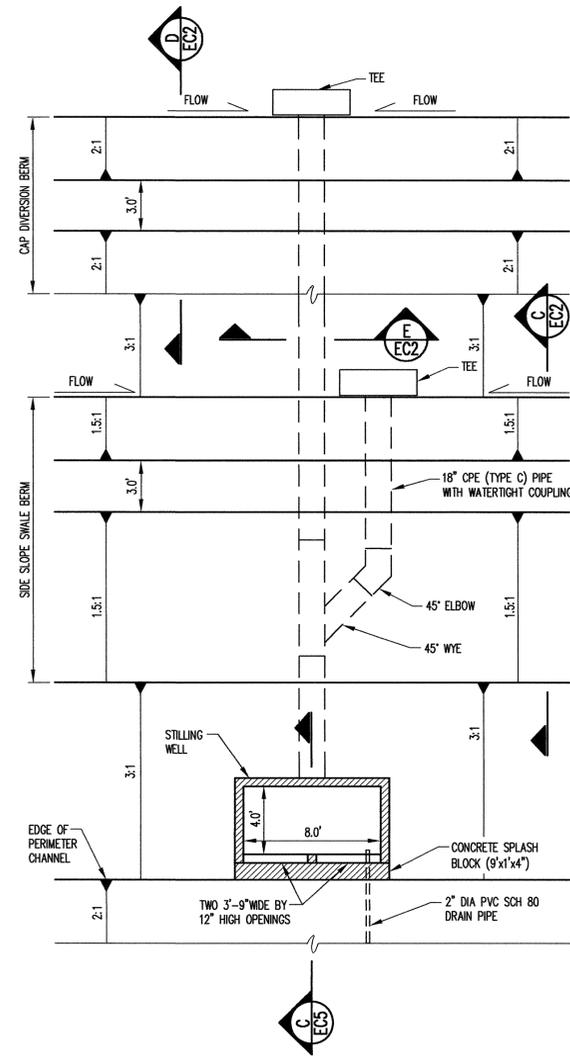


CULVERT C-3 INLET
DETAIL A
SCALE 1"=4'



STILLING WELL ALTERNATE
DETAIL C
SCALE 1"=5'

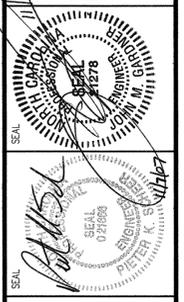
- NOTES:
1. PROVIDE WATERTIGHT JOINTS ON ALL PIPING.
 2. PRECAST CONCRETE BOXES SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:
A. CONCRETE, COMPRESSIVE STRENGTH 4000 PSI
B. REINFORCING: ASTM A-615, GRADE 60
C. MEETS H-20 LOADING.
 3. PIPES MAY BE ORIENTED DIFFERENTLY WITH RESPECT TO THE CHANNEL THAN DISPLAYED HERE. SEE DRAWING E5 FOR PROPER ORIENTATION.



DOWN PIPE WITH STILLING WELL ALTERNATE
DETAIL B
SCALE 1"=5'

NO.	DATE	REVISION
1	10/03	PHASE 1C REVISIONS

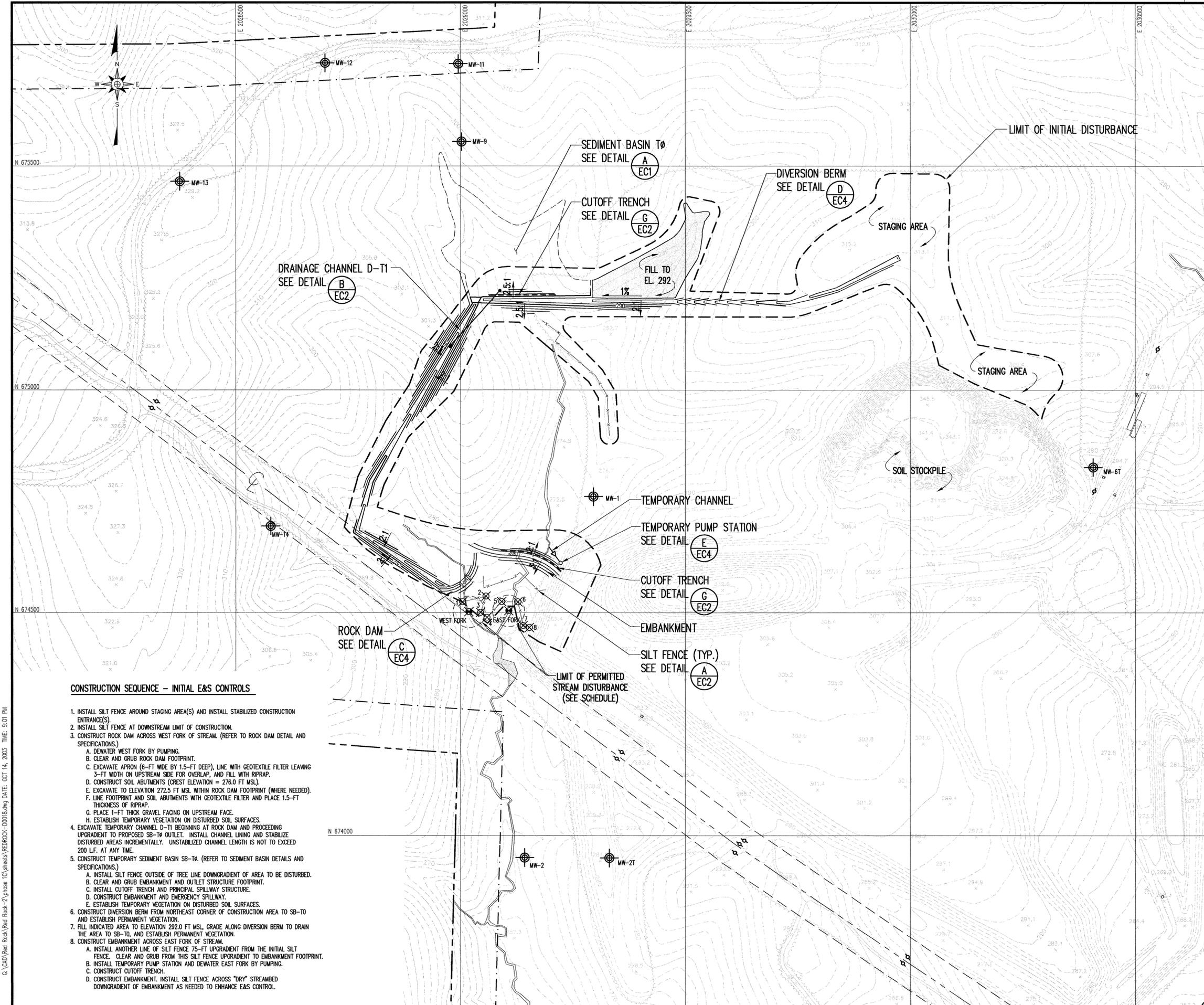
G.N. RICHARDSON & ASSOCIATES, INC.
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PROJECT TITLE:
RED ROCK DISPOSAL, LLC
CONSTRUCTION/DEMOLITION
LANDFILL PHASE 1
WAKE COUNTY, NC

DRAWING TITLE:
PHASE 1 - EROSION &
SEDIMENTATION CONTROL
DETAILS (SHEET 5 OF 5)

DESIGNED BY: T.B.M.	DRAWN BY: C.T.J.
CHECKED BY: J.M.G.	PROJECT NO.: RED ROCK-2
SCALE: AS SHOWN	DATE: OCT. 2003
FILE NAME: REDROCK-D0025	
SHEET NO. 14	DRAWING NO. EC5



SCHEDULE OF LIMITS OF PERMITTED STREAM DISTURBANCE

LOCATION	NORTHING	EASTING
WEST FORK	674502.30	2029018.22
EAST FORK	674504.17	2029107.27

NOTE: NO EARTH DISTURBANCE OR SEDIMENT DEPOSITION PERMITTED DOWN STREAM OF THESE POINTS.

SCHEDULE OF CONTROL POINTS FOR SILT FENCE NEAR LIMITS OF STREAM DISTURBANCE

CONTROL POINT NUMBER	NORTHING	EASTING
1	674524.49	2029004.56
2	674536.89	2029056.52
3	674500.62	2029044.34
4	674489.34	2029058.78
5	674524.64	2029091.50
6	674524.21	2029127.70
7	674470.60	2029139.04
8	674466.24	2029153.00

NOTE: THE LOCATION OF THE SILT FENCE WAS SELECTED TO PROVIDE APPROXIMATELY 20-FEET OF UNDISTURBED BUFFER UPSTREAM OF THE LIMITS OF PERMITTED STREAM DISTURBANCE.

LEGEND

- EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR
- PROPOSED SUBGRADE CONTOUR (BASE OF WASTE) (SEE NOTE 4)
- SILT FENCE
- LIMIT OF DISTURBANCE
- PROPERTY LINE (SEE REFERENCE 2)
- 100' BUFFER (SEE NOTE 1)
- DELINEATED WETLAND AREAS (SEE REFERENCE 4)
- DELINEATED CHANNEL (SEE REFERENCE 4)
- MW-1 MONITORING WELL (SEE NOTE 7)
- PZ-2 PIEZOMETER

NOTES:

- THIS BUFFER REPRESENTS A TYPE A BUFFER YARD AND A TRANSITIONAL BUFFER IN ACCORDANCE WITH WAKE COUNTY ZONING REQUIREMENTS. THIS 100-FOOT BUFFER ALSO INCLUDES, BUT DOES NOT SHOW, A 50-FOOT UNDISTURBED BUFFER ALSO PER WAKE COUNTY ZONING REQUIREMENTS.
- ELEVATIONS REFERENCE U.S.S. VERTICAL DATUM (M.S.L.)
- GRID COORDINATES REFERENCE NC STATE PLANE SYSTEM (NAD 1983).
- THE SUBGRADE ELEVATIONS IN PHASE 1C HAVE BEEN ESTABLISHED BASED ON A CONSERVATIVE ISOLATION DISTANCE ABOVE SEASONAL HIGH GROUND WATER LEVEL (I.E. 6 FEET).
- CP&E APPROVAL WILL BE RECEIVED PRIOR TO PLACEMENT OF ANY SOIL OR WASTE MATERIAL WITHIN THE 100' UTILITY EASEMENT.
- MONITORING WELLS MW-1 AND MW-9 TO BE ABANDONED.

REFERENCES:

- OVERALL SITE TOPOGRAPHY PREPARED BY SPATIAL DATA CONSULTANTS, INC., BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 8, 2003.
- THE PROPERTY LINE SHOWN REFERENCES DRAWING TITLED, "BOUNDARY SURVEY FOR WASTE INDUSTRIES, INC.", PREPARED BY SURVEY SOLUTIONS, P.C. DATED 12/27/00, SCALE 1"=40'.
- CP&E POWERLINE/EASEMENT REFERENCES THE BOUNDARY SURVEY.
- DELINEATION PERFORMED BY SOIL & ENVIRONMENTAL CONSULTANTS, SURVEYED BY SURVEYING SOLUTIONS, P.C., DATED APRIL 2001.



CONSTRUCTION SEQUENCE - INITIAL E&S CONTROLS

- INSTALL SILT FENCE AROUND STAGING AREA(S) AND INSTALL STABILIZED CONSTRUCTION ENTRANCE(S).
- INSTALL SILT FENCE AT DOWNSTREAM LIMIT OF CONSTRUCTION.
- CONSTRUCT ROCK DAM ACROSS WEST FORK OF STREAM. (REFER TO ROCK DAM DETAIL AND SPECIFICATIONS.)
 - DEWATER WEST FORK BY PUMPING.
 - CLEAR AND GRUB ROCK DAM FOOTPRINT.
 - EXCAVATE APRON (6-FT WIDE BY 1.5-FT DEEP), LINE WITH GEOTEXTILE FILTER LEAVING 3-FT WIDTH ON UPSTREAM SIDE FOR OVERLAP, AND FILL WITH RIPRAP.
 - CONSTRUCT SOIL ABUTMENTS (CREST ELEVATION = 276.0 FT MSL).
 - EXCAVATE TO ELEVATION 272.5 FT MSL WITHIN ROCK DAM FOOTPRINT (WHERE NEEDED).
 - LINE FOOTPRINT AND SOIL ABUTMENTS WITH GEOTEXTILE FILTER AND PLACE 1.5-FT THICKNESS OF RIPRAP.
 - PLACE 1-FT THICK GRAVEL FACING ON UPSTREAM FACE.
 - ESTABLISH TEMPORARY VEGETATION ON DISTURBED SOIL SURFACES.
- EXCAVATE TEMPORARY CHANNEL D-T1 BEGINNING AT ROCK DAM AND PROCEEDING UPSTREAM TO PROPOSED SB-T9 OUTLET. INSTALL CHANNEL LINING AND STABILIZE DISTURBED AREAS INCREMENTALLY. UNSTABILIZED CHANNEL LENGTH IS NOT TO EXCEED 200 L.F. AT ANY TIME.
- CONSTRUCT TEMPORARY SEDIMENT BASIN SB-T9. (REFER TO SEDIMENT BASIN DETAILS AND SPECIFICATIONS.)
 - INSTALL SILT FENCE OUTSIDE OF TREE LINE DOWNGRADIENT OF AREA TO BE DISTURBED.
 - CLEAR AND GRUB EMBANKMENT AND OUTLET STRUCTURE FOOTPRINT.
 - INSTALL CUTOFF TRENCH AND PRINCIPAL SPILLWAY STRUCTURE.
 - CONSTRUCT EMBANKMENT AND EMERGENCY SPILLWAY.
 - ESTABLISH TEMPORARY VEGETATION ON DISTURBED SOIL SURFACES.
- CONSTRUCT DIVERSION BERM FROM NORTHEAST CORNER OF CONSTRUCTION AREA TO SB-T9 AND ESTABLISH PERMANENT VEGETATION.
- FILL INDICATED AREA TO ELEVATION 292.0 FT MSL, GRADE ALONG DIVERSION BERM TO DRAIN THE AREA TO SB-T9, AND ESTABLISH PERMANENT VEGETATION.
- CONSTRUCT EMBANKMENT ACROSS EAST FORK OF STREAM.
 - INSTALL ANOTHER LINE OF SILT FENCE 75-FT UPSTREAM FROM THE INITIAL SILT FENCE. CLEAR AND GRUB FROM THIS SILT FENCE UPSTREAM TO EMBANKMENT FOOTPRINT.
 - INSTALL TEMPORARY PUMP STATION AND DEWATER EAST FORK BY PUMPING.
 - CONSTRUCT CUTOFF TRENCH.
 - CONSTRUCT EMBANKMENT. INSTALL SILT FENCE ACROSS "DRY" STREAMBED DOWNGRADIENT OF EMBANKMENT AS NEEDED TO ENHANCE E&S CONTROL.

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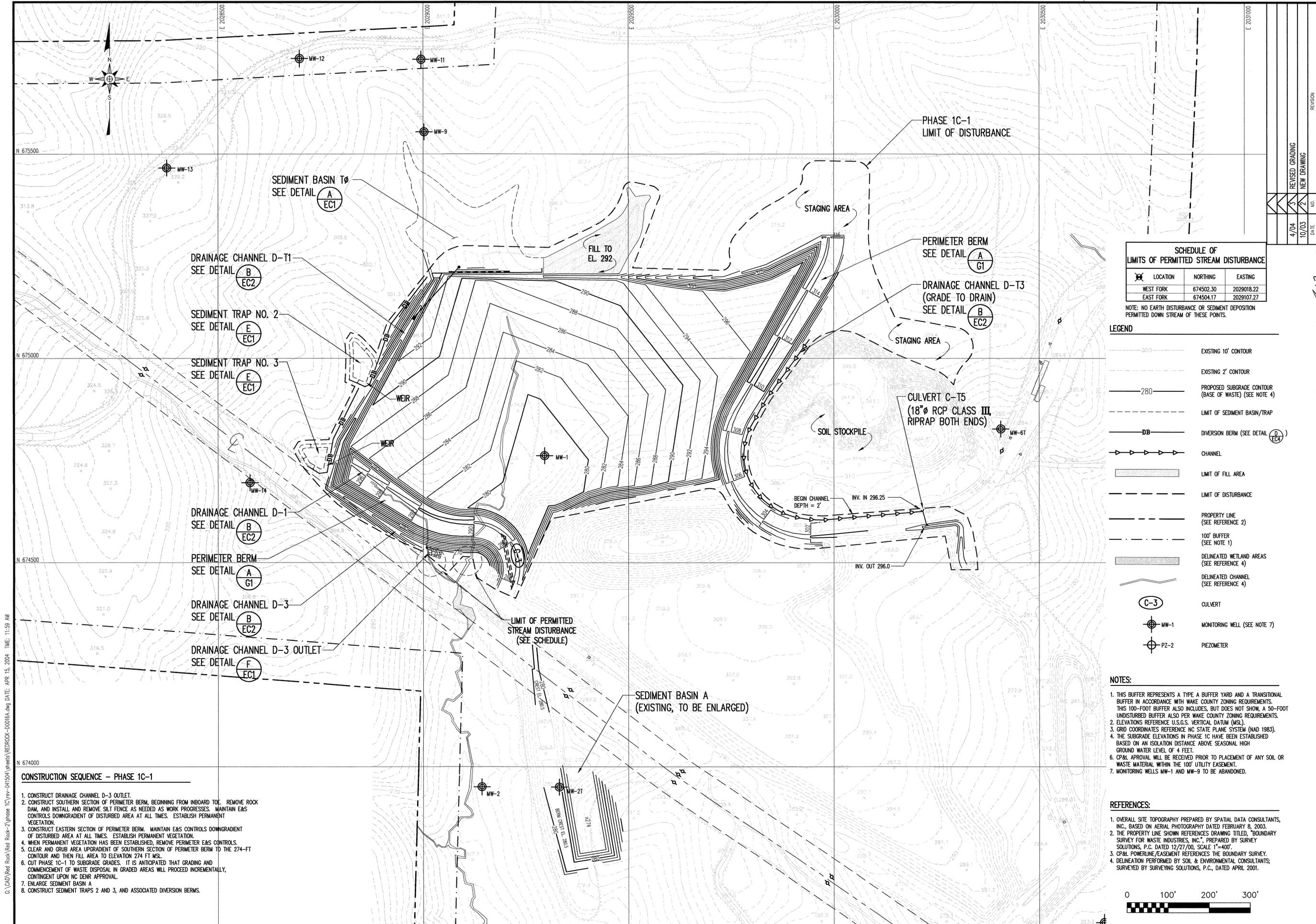
REVISION
NO. DATE
10/03 NEW DRAWING

PROJECT TITLE:
**RED ROCK DISPOSAL, LLC
CONSTRUCTION & DEMOLITION
LANDFILL PHASE 1C
WAKE COUNTY, NC**

DRAWING TITLE:
**PHASE 1C INITIAL
GRADING AND
DRAINAGE PLAN**

DESIGNED BY: T.B.M.	DRAWN BY: C.T.J.
CHECKED BY: J.M.G.	PROJECT NO.: RED ROCK-2
SCALE: AS SHOWN	DATE: OCT. 2003
FILE NAME: REDROCK-00018	DRAWING NO.:
SHEET NO.: 15	DRAWING NO.: EC6

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NO.	DATE	REVISION
3	4/04	REVISED GRADING
2	10/03	NEW DRAWING

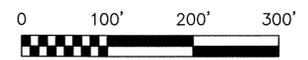
SCHEDULE OF LIMITS OF PERMITTED STREAM DISTURBANCE		
LOCATION	NORTHING	EASTING
WEST FORK	674502.30	2029018.22
EAST FORK	674504.17	2029107.27

NOTE: NO EARTH DISTURBANCE OR SEDIMENT DEPOSITION PERMITTED DOWN STREAM OF THESE POINTS.

LEGEND	
	EXISTING 10' CONTOUR
	EXISTING 2' CONTOUR
	PROPOSED SUBGRADE CONTOUR (BASE OF WASTE) (SEE NOTE 4)
	LIMIT OF SEDIMENT BASIN/TRAP
	DIVERSION BERM (SEE DETAIL (D EC4))
	CHANNEL
	LIMIT OF FILL AREA
	LIMIT OF DISTURBANCE
	PROPERTY LINE (SEE REFERENCE 2)
	100' BUFFER (SEE NOTE 1)
	DELINEATED WETLAND AREAS (SEE REFERENCE 4)
	DELINEATED CHANNEL (SEE REFERENCE 4)
	CULVERT
	MONITORING WELL (SEE NOTE 7)
	PIEZOMETER

- NOTES:**
- THIS BUFFER REPRESENTS A TYPE A BUFFER YARD AND A TRANSITIONAL BUFFER IN ACCORDANCE WITH WAKE COUNTY ZONING REQUIREMENTS. THIS 100-FOOT BUFFER ALSO INCLUDES, BUT DOES NOT SHOW, A 50-FOOT UNDISTURBED BUFFER ALSO PER WAKE COUNTY ZONING REQUIREMENTS.
 - ELEVATIONS REFERENCE U.S.G.S. VERTICAL DATUM (MSL).
 - GRID COORDINATES REFERENCE NC STATE PLANE SYSTEM (NAD 1983).
 - THE SUBGRADE ELEVATIONS IN PHASE 1C HAVE BEEN ESTABLISHED BASED ON AN ISOLATION DISTANCE ABOVE SEASONAL HIGH GROUND WATER LEVEL OF 4 FEET.
 - CP&E APPROVAL WILL BE RECEIVED PRIOR TO PLACEMENT OF ANY SOIL OR WASTE MATERIAL WITHIN THE 100' UTILITY EASEMENT.
 - MONITORING WELLS MW-1 AND MW-9 TO BE ABANDONED.

- REFERENCES:**
- OVERALL SITE TOPOGRAPHY PREPARED BY SPATIAL DATA CONSULTANTS, INC., BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 8, 2003.
 - THE PROPERTY LINE SHOWN REFERENCES DRAWING TITLED, "BOUNDARY SURVEY FOR WASTE INDUSTRIES, INC.", PREPARED BY SURVEY SOLUTIONS, P.C. DATED 12/27/00, SCALE 1"=400'.
 - CP&E POWERLINE/EASEMENT REFERENCES THE BOUNDARY SURVEY.
 - DELINEATION PERFORMED BY SOIL & ENVIRONMENTAL CONSULTANTS, SURVEYED BY SURVEYING SOLUTIONS, P.C., DATED APRIL 2001.



- CONSTRUCTION SEQUENCE - PHASE 1C-1**
- CONSTRUCT DRAINAGE CHANNEL D-3 OUTLET.
 - CONSTRUCT SOUTHERN SECTION OF PERIMETER BERM, BEGINNING FROM INBOARD TOE. REMOVE ROCK DAM, AND INSTALL AND REMOVE SILT FENCE AS NEEDED AS WORK PROGRESSES. MAINTAIN E&S CONTROLS DOWNGRADIENT OF DISTURBED AREA AT ALL TIMES. ESTABLISH PERMANENT VEGETATION.
 - CONSTRUCT EASTERN SECTION OF PERIMETER BERM. MAINTAIN E&S CONTROLS DOWNGRADIENT OF DISTURBED AREA AT ALL TIMES. ESTABLISH PERMANENT VEGETATION.
 - WHEN PERMANENT VEGETATION HAS BEEN ESTABLISHED, REMOVE PERIMETER E&S CONTROLS.
 - CLEAR AND GRUB AREA UPGRADIENT OF SOUTHERN SECTION OF PERIMETER BERM TO THE 274-FT CONTOUR AND THEN FILL AREA TO ELEVATION 274 FT MSL.
 - CUT PHASE 1C-1 TO SUBGRADE GRADES. IT IS ANTICIPATED THAT GRADING AND COMMENCEMENT OF WASTE DISPOSAL IN GRADED AREAS WILL PROCEED INCREMENTALLY, CONTINGENT UPON NC DENR APPROVAL.
 - ENLARGE SEDIMENT BASIN A
 - CONSTRUCT SEDIMENT TRAPS 2 AND 3, AND ASSOCIATED DIVERSION BERMS.

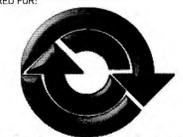
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 14 N. BOYLAN AVENUE RALEIGH, N.C. 27603
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RED ROCK DISPOSAL, LLC
 CONSTRUCTION & DEMOLITION
 LANDFILL PHASE 1C
 WAKE COUNTY, NC

PHASE 1C-1
 SUBGRADE AND
 DRAINAGE PLAN

DESIGNED BY: T.B.M. DRAWN BY: C.T.J.
 CHECKED BY: J.M.G. PROJECT NO.: RED ROCK-2
 SCALE: AS SHOWN DATE: OCT. 2003
 FILE NAME: REDROCK-00016A
 SHEET NO.: 16 DRAWING NO.: EC7

G:\CAD\Red Rock\Red Rock-2\Phase 1C\rev-041504\sheet REDROCK-00016A.dwg DATE: APR 15, 2004 TIME: 11:59 AM



RED ROCK DISPOSAL, LLC
NC PERMIT NO. 92-28

PREPARED BY:
NC LIC. NO. C-0828 (ENGINEERING)

**SMITH+
GARDNER**
ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



REV.	DATE	DESCRIPTION
5	12/12	REVISED GRADING

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PROJECT TITLE:
**CONSTRUCTION & DEMOLITION
LANDFILL
PHASE 1
ENGINEERING DRAWINGS**

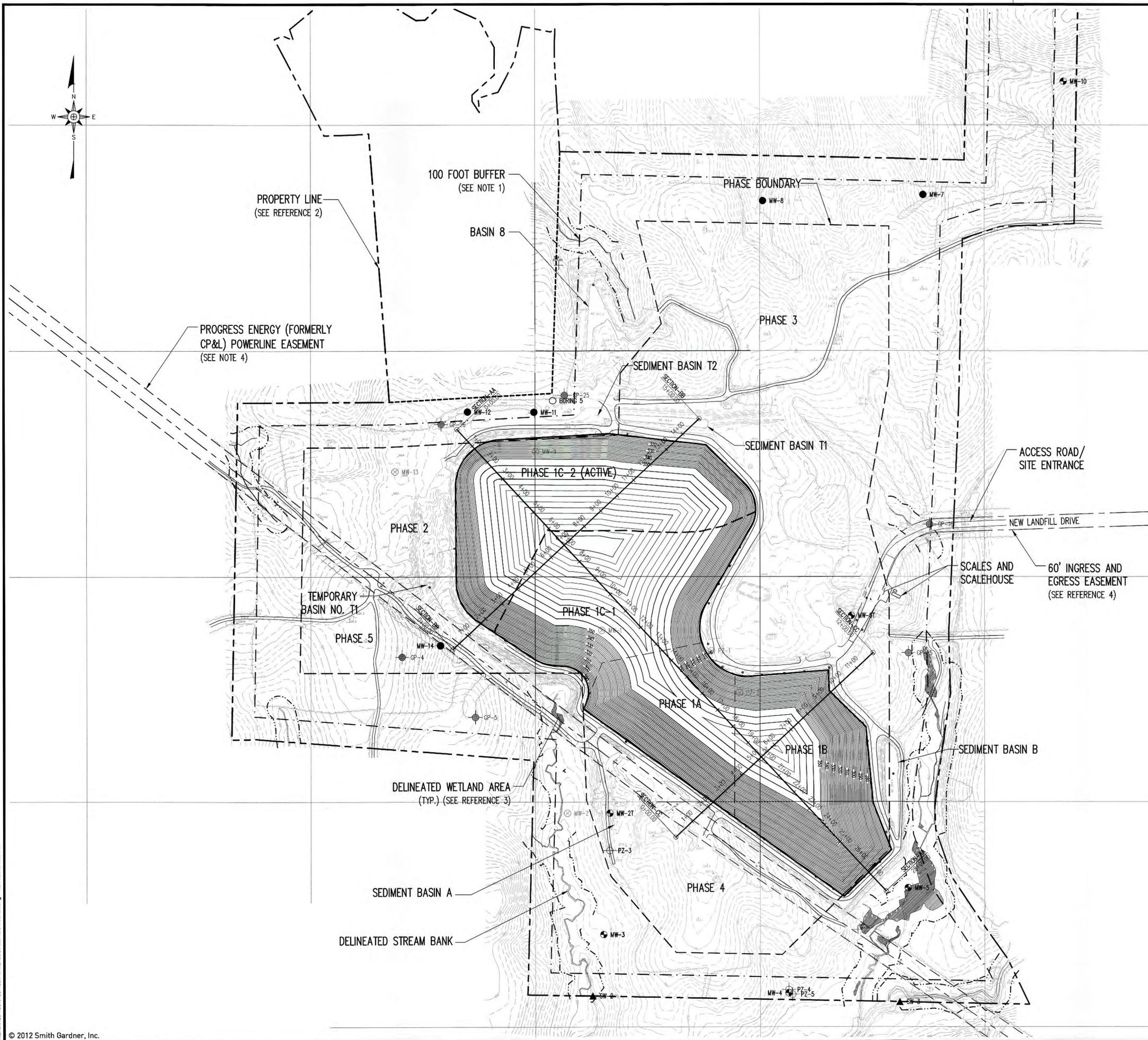
DRAWING TITLE:
**PHASE 1
FILLING SEQUENCE**

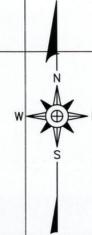
DESIGNED: J.W.C.	PROJECT NO. RED ROCK 12-2
DRAWN: J.A.L.	SCALE: AS SHOWN
APPROVED: 	DATE: NOV. 2012
FILENAME: REDROCK-D0126	DRAWING NUMBER: P1
SHEET NUMBER: 17	

- LEGEND**
- EXISTING 10' CONTOUR
 - EXISTING 2' CONTOUR
 - PROPERTY LINE (SEE REFERENCE 2)
 - 100' BUFFER (SEE NOTE 1)
 - PHASE LIMITS
 - 50' STREAM/WETLAND BUFFER
 - EASEMENTS (SEE REFERENCE 4)
 - DELINEATED WETLAND AREAS (SEE REFERENCE 3)
 - MONITORING WELLS
 - PIEZOMETER
 - WELLS NOT IN MONITORING NETWORK
 - SURFACE WATER MONITORING POINT
 - BORING
 - GAS PROBE
 - ABANDONED WELL/PIEZOMETER

- NOTES**
- THIS BUFFER REPRESENTS A TYPE A BUFFER YARD AND A TRANSITIONAL BUFFER IN ACCORDANCE WITH WAKE COUNTY ZONING REQUIREMENTS. THIS 100-FOOT BUFFER ALSO INCLUDES, BUT DOES NOT SHOW, A 50-FOOT UNDISTURBED BUFFER ALSO PER WAKE COUNTY ZONING REQUIREMENTS.
 - ELEVATIONS REFERENCE U.S.G.S. VERTICAL DATUM (MSL).
 - GRID COORDINATES REFERENCE NC STATE PLANE SYSTEM (NAD 1983).
 - CP&L APPROVAL WILL BE RECEIVED PRIOR TO PLACEMENT OF ANY SOIL OR WASTE MATERIAL WITHIN THE 100' UTILITY EASEMENT.
 - SOME MONITORING WELLS WILL BE ABANDONED AND REPLACED AS DEVELOPMENT CONTINUES.
 - DISTURBANCE OF ANY AREA BEYOND PHASE 1 AND 2 IS CONTINGENT UPON OBTAINING THE NECESSARY EASEMENT ENCROACHMENT AGREEMENT FROM PROGRESS ENERGY, AND UPON WAKE COUNTY AUTHORIZATION.

- REFERENCES**
- OVERALL SITE TOPOGRAPHY PREPARED BY GEODATA DATA CORPORATION, BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 2, 2012 AND FEBRUARY 27, 2007.
 - THE PROPERTY LINE SHOWN REFERENCES DRAWING ENTITLED "BOUNDARY SURVEY FOR WASTE INDUSTRIES, INC.", PREPARED BY SURVEY SOLUTIONS, P.C. DATED 12/27/00.
 - DELINEATION PERFORMED BY SOIL & ENVIRONMENTAL CONSULTANTS; SURVEYED BY SURVEYING SOLUTIONS, P.C. DATED APRIL 2001.
 - 60' INGRESS AND EGRESS EASEMENT
 - DB 8104, PG 2753 CP&L DRAWING NO. RW-D-9327
 - SM 1988, PG 1316
 - 100' CP&L EASEMENT
 - DB 2565, PG 247 CP&L MAP NO. RW-A-6106.





100 FOOT BUFFER
(SEE NOTE 1)

PROPERTY LINE

50-FOOT UNDISTURBED BUFFER

SEDIMENT BASIN NO. 8

SEDIMENT BASIN NO. 1

SEDIMENT BASIN NO. 2

SEDIMENT BASIN NO. 3

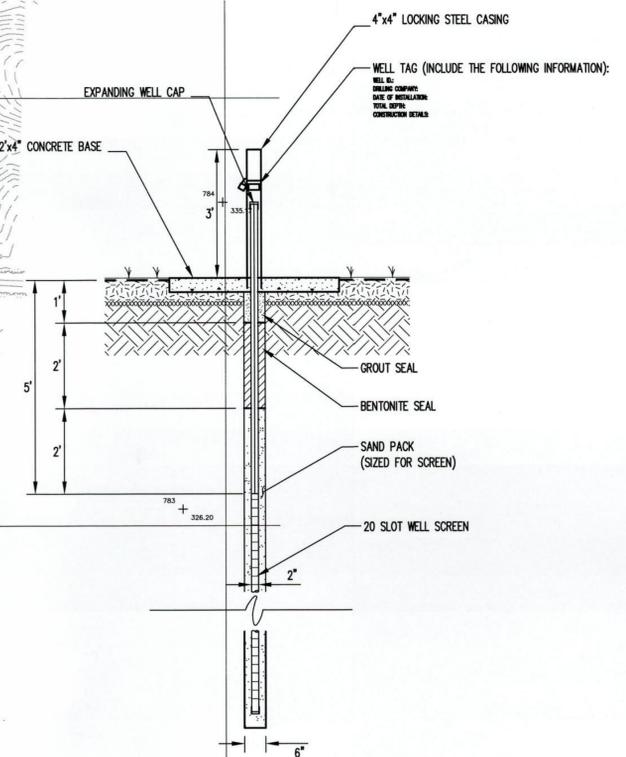
SEDIMENT BASIN NO. 4

SEDIMENT BASIN NO. 7

SEDIMENT BASIN NO. 6

SEDIMENT BASIN NO. 5

CP&L EASEMENT
(SEE NOTE 4)



NOTE:
1. DEPTH OF PROBE IS TO BE 5' BELOW LANDFILL OR TO GROUNDWATER OR TO BEDROCK, WHICHEVER IS FIRST.

GAS PROBE
DETAIL 1
NOT TO SCALE LFG1

LEGEND

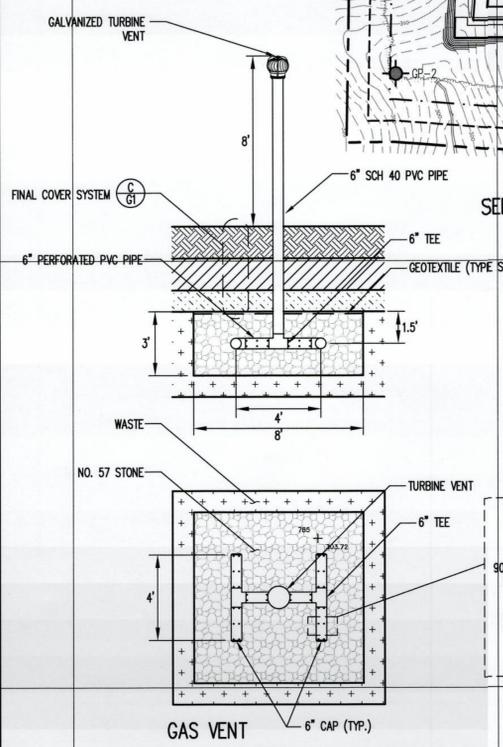
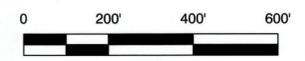
- 300 --- EXISTING 10' CONTOUR
- 280 --- EXISTING 2' CONTOUR
- 280 --- PROPOSED SUBGRADE CONTOUR
- --- CONSTRUCTION LIMITS
- --- PHASE/CELL LIMITS
- --- PROPERTY LINE (SEE REFERENCE 2)
- --- 50' UNDISTURBED BUFFER
- --- 100' BUFFER (SEE NOTE 1)
- --- DELINEATED WETLAND AREAS (SEE REFERENCE 3)
- /● MW-6T MONITORING WELL
- GP-4 PROPOSED GAS PROBE
- GV-7 PROPOSED METHANE GAS VENT

NOTES

1. THIS BUFFER REPRESENTS A TYPE A BUFFER YARD AND A TRANSITIONAL BUFFER IN ACCORDANCE WITH WAKE COUNTY ZONING REQUIREMENTS. THIS 100-FOOT BUFFER ALSO INCLUDES, BUT DOES NOT SHOW, A 50-FOOT UNDISTURBED BUFFER ALSO PER WAKE COUNTY ZONING REQUIREMENTS.
2. ELEVATIONS REFERENCE U.S.G.S. VERTICAL DATUM (MSL).
3. GRID COORDINATES REFERENCE NC STATE PLANE SYSTEM (NAD 1983).
4. CP&L APPROVAL WILL BE RECEIVED PRIOR TO PLACEMENT OF ANY SOIL OR WASTE MATERIAL WITHIN THE 100' UTILITY EASEMENT.

REFERENCES

1. OVERALL SITE TOPOGRAPHY PREPARED BY GEODATA DATA CORPORATION, BASED ON AERIAL PHOTOGRAPHY DATED FEBRUARY 15, 2007.
2. THE PROPERTY LINE SHOWN REFERENCES DRAWING ENTITLED "BOUNDARY SURVEY FOR WASTE INDUSTRIES, INC.", PREPARED BY SURVEYING SOLUTIONS, P.C. DATED 12/27/00.
3. DELINEATION PERFORMED BY SOIL & ENVIRONMENTAL CONSULTANTS; SURVEYED BY SURVEYING SOLUTIONS, P.C. DATED APRIL 2001.



GAS VENT
DETAIL 2
NOT TO SCALE LFG1

PREPARED FOR:

RED ROCK DISPOSAL, LLC
 NC PERMIT NO. 92-28

PREPARED BY:
 NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER ENGINEERS
 14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



REV.	DATE	DESCRIPTION
4	5/08	NEW SHEET
6	4/13	PROBE UPDATE

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PROJECT TITLE:
CONSTRUCTION & DEMOLITION LANDFILL PHASE 1 ENGINEERING DRAWINGS

DRAWING TITLE:
LANDFILL GAS MANAGEMENT PLAN

DESIGNED: S.A.S.	PROJECT NO: RED ROCK-2
DRAWN: K.C.B.	SCALE: AS SHOWN
APPROVED: [Signature]	DATE: MAY 2008
FILENAME: REDROCK-D0083A	SHEET NUMBER: 18
DRAWING NUMBER: LFG1	

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