

Fac/Perm/Co ID #	Date	Doc ID#
29-06	9/16/08	DIN 4979

*Carmen Johnson*

June 20, 2008

Mr. Edward F. Mussler, P.E.  
 Permitting Branch Supervisor  
 NC DENR - Division of Waste Management  
 401 Oberlin Road, Suite 150  
 Raleigh, North Carolina 27605



**RE: Davidson County C&D Landfill (Permit No. 29-06)  
 Application for Continued Operations**

Dear Ed:

On behalf of Davidson County, Richardson Smith Gardner & Associates, Inc. (RSG) would like to submit for your review information required for continued operations of Davidson County's construction and demolition debris (C&D) landfill unit (Phases 1 and 2) in accordance with 15A NCAC 13B .0547 for existing landfills as of January 1, 2007. As outlined in the aforementioned rule, the following must be submitted by July 1, 2008:

1. Closure and Post-Closure Plan {.0547 (2)(a)}
2. Financial Responsibility {.0547 (2)(b)}

Each of these requirements is described below:

**Closure and Post-Closure Plan**

Davidson County intends to install the prescriptive closure criteria in accordance with .0543(c)(1), a final cover system consisting of an 18-inch thick (min.) compacted soil barrier (permeability no greater than  $1 \times 10^{-5}$  cm/sec) with an overlying 18 inch thick (min.) vegetative soil layer. Technical specifications related to the compacted soil barrier (soil liner) and the vegetative soil layer along with construction quality assurance (CQA) requirements for the compacted soil barrier are provided in **Attachment A**.

A Closure and Post-Closure Plan has been prepared in accordance with .0543(d) and is provided in **Attachment B**. Note that this plan addresses both municipal solid waste (MSW) and C&D landfill units at the site. Affected permit drawings<sup>1</sup> have been revised as necessary to conform to the new closure requirements. The revised permit drawings are provided in **Attachment C**.

**Financial Responsibility**

As part of the Closure and Post-Closure Plan, estimates have been prepared for closure and post-closure costs (ref. Section 3.0 of the plan) as summarized below:

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<sup>1</sup> Permit to Construct Application, Davidson County C&D Landfill - Phase 2, Lexington, NC, prepared by G.N. Richardson & Associates, Inc., September 2005 (approved by NC DWM on 9/8/05).

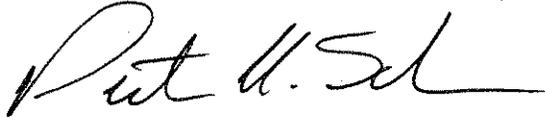
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MSW Phase 1 (Areas 1-3) - Closure Cost	\$2,008,680
MSW Phase 2 (Area 1) - Closure Cost	\$1,856,995
C&D (Phases 1-2) - Closure Cost	\$318,271
MSW Phase 1 (Areas 1-3) - Post-Closure Cost (30 Year)	\$3,134,571
MSW Phase 2 (Area 1) - Post-Closure Cost (30 Year)	\$2,614,623
C&D (Phases 1-2) - Post-Closure Cost (30 Year)	\$562,650
<b>Total:</b>	<b>\$10,495,790 (2008\$)</b>

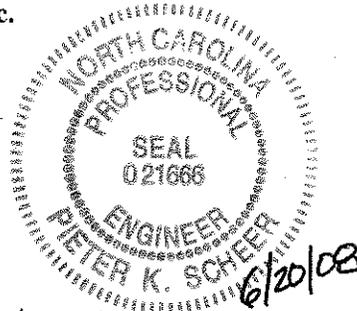
Davidson County intends to provide financial assurance for the above estimated costs in the form of a local government financial test upon approval of the estimates.

Should you have any questions or comments on this application, please contact us at your earliest convenience.

Sincerely,  
**Richardson Smith Gardner & Associates, Inc.**



Pieter K. Scheer, P.E.  
Principal, Project Manager



- Attachments:
- A. Specification and CQA Requirements
  - B. Closure and Post-Closure Plan
  - C. Revised Permit Drawings

cc: Charlie Brushwood, Davidson County

# Attachment A



Attachment A

Specification and CQA  
Requirements

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## SECTION 02250

### SOIL LINER

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

4. Quality Assurance:

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

B. MATERIALS

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

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Before approval is given to proceed with test fill construction, the Contractor shall submit descriptive information on compaction equipment to be used for construction of the Soil Liner.

2. Off-Site Borrow Sources (If Applicable):

a. For each off-site borrow source for Soil Liner soils, the Contractor shall provide the following information at least four weeks prior to placement of the Soil Liner:

(1) The name, location, and owner of proposed borrow site, including a topographic map and location map of the site.

(2) A certification submitted by an independent Registered Professional Engineer that the proposed borrow site contains a minimum of double the in-place volume of Soil Liner required to complete the work.

(3) A certification submitted by an independent Registered Professional Engineer that the proposed borrow soils meet the requirements for Soil Liner outlined in these Specifications. Certification shall include the following minimum testing and test frequency:

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

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

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

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

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

#### D. CONSTRUCTION

##### 1. General:

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

##### 2. Borrow Soils:

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

##### 3. Test Fill Construction:

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

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

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

4. Subgrade Preparation:

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

5. Placement and Compaction:

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

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

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

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

6. Surveying:

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

**TABLE 1: SOIL LINER MATERIAL REQUIREMENTS**

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

**TABLE 2: IN-PLACE SOIL LINER REQUIREMENTS**

PROPERTY	TEST METHOD	VALUE
Density	ASTM D 6938 <sup>1</sup>	≥ 95% maximum standard dry density <sup>4</sup>
Moisture Content	ASTM D 6938 <sup>2</sup>	≥ optimum moisture content <sup>4</sup>
Maximum Lift Thickness (Compacted):  (Compacted Soil Barrier)	-----	9 inches
Hydraulic Conductivity (Shelby Tube):  (Compacted Soil Barrier)	ASTM D 5084 <sup>3</sup>	≤ 1 x 10 <sup>-5</sup> 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 <sup>-5</sup> cm/s)	5	15

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

END OF SECTION

SECTION 02258

VEGETATIVE SOIL LAYER

Vegetative Soil Layer (VSL): The Vegetative Soil Layer (VSL) is placed in the final cover system in order to support permanent vegetative cover.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of the VSL 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>
Soil Liner	02250

3. Quality Assurance:

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

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 materials used in the VSL shall be reasonably free of gypsum, ferrous, and/or calcareous concretions and nodules, refuse, roots, or other deleterious substances.
2. 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.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

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

D. CONSTRUCTION

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

After completion of a segment of VSL, the VSL shall be surveyed (by test pit or hand auger) on a 100 foot grid to ensure the minimum specified thickness of VSL has been achieved.

END OF SECTION

## 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 disc'd 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: Recompaction 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**

<b>PROPERTY</b>	<b>TEST METHOD</b>	<b>MINIMUM TEST FREQUENCY</b>
<b>CONTROL TESTS:</b>		
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 <sup>3</sup>	10,000 CY per Each Soil

**TABLE 2: CQA TESTING PROGRAM FOR SOIL LINER TEST FILL**

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
<b>CONTROL TESTS: (See Table 1)</b>		
Moisture-Density Relationship	ASTM D 698 <sup>4</sup>	1 per lift
Hydraulic Conductivity - Lab Remolded	ASTM D 5084 <sup>3,4</sup>	1 per lift
<b>RECORD TESTS:</b>		
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 <sup>1</sup>	3 per lift
Moisture Content	ASTM D 6938 <sup>2</sup>	3 per lift
Hydraulic Conductivity - Undisturbed (Shelby Tube)	ASTM D 6938 <sup>3</sup>	1 per lift

**TABLE 3: CQA TESTING PROGRAM FOR SOIL LINER**

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

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# Attachment B



**Attachment B**

**Closure and Post-Closure Plan**

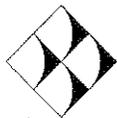
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# **Closure And Post-Closure Plan**

**Davidson County Landfill  
Davidson County, North Carolina**

Prepared for:  
**Davidson County Integrated Solid Waste Management Department  
Thomasville, NC**

**June 2008**



**RICHARDSON SMITH GARDNER & ASSOCIATES**  
**Engineering and Geological Services**  
14 N. Boylan Avenue  
Raleigh, North Carolina 27603

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**DAVIDSON COUNTY LANDFILL**  
**CLOSURE AND POST-CLOSURE PLAN**

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3.2	Estimated Closure Costs .....	3.0-1
3.3	Estimated Post-Closure Costs .....	3.0-1

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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. A formalized Closure Plan for each landfill unit (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

The following are the estimated areas and capacity for each landfill unit to be closed under this plan.

Landfill Unit	Closure Area (Acres)	Gross Capacity (CY) <sup>1</sup>	Net (Waste) Capacity (CY/Tons) <sup>1</sup>
<b>MSW Landfill Units</b>			
Phase 1 (Areas 1 - 3)	15.9 (See Note 2)	2,229,303	1,913,735 CY 1,332,605 Tons
Phase 1 (Areas 1 - 3) Vertical Expansion (See Note 3)	-----	62,100	55,890 CY 43,063 Tons
Phase 2 (Area 1)	14.7	903,896	803,343 CY 582,423 Tons
<b>Total (MSW):</b>	<b>30.6</b>	<b>3,195,299</b>	<b>2,772,968 CY 1,948,091 Tons</b>
<b>C&amp;D Landfill Units</b>			
Phases 1 & 2	5.9	217,563	197,489 CY 108,885 Tons

Notes:

1. With the exception of the Phase 1 Vertical Expansion (see Note 3), the volume and tonnage figures assumed for each landfill unit are based on the currently approved Facility Plan (reference: Permit to Construct Application for Phase 2 Area 1 (Vol. 1 of 2), prepared by Richardson Smith Gardner & Associates, Inc., dated February 2007). Note that the gross capacities reported are from bottom of waste (top of protective cover or subgrade as appropriate) to top of final cover.
2. The area shown for the Phase 1 MSW unit reflects the area remaining to be closed. Approximately 16 acres was closed in 2005 (reference: Partial Closure Construction CQA Certification Report, prepared by Joyce Engineering, Inc., dated November 2005).
3. The volumes shown for the Phase 1 vertical expansion are as reported in the currently pending permit modification request (reference: Request for Permit Modification, prepared by Richardson Smith Gardner & Associates, Inc., dated March 2008).

### 1.3 FINAL COVER SYSTEM

The final cover systems for the MSW and C&D landfill units will consist of the following components (top-down):

#### MSW Landfill Units:

- a 24-inch thick vegetative soil layer;
- a drainage geocomposite (with drainage breaks);
- a 30-mil textured LLDPE geomembrane; and
- a 12-inch thick intermediate cover layer.

#### C&D Landfill Units:

- an 18-inch thick vegetative soil layer; and
- an 18-inch thick soil liner with a hydraulic conductivity of no more than  $1 \times 10^{-5}$  cm/sec ("compacted soil barrier").

The final cover system will be placed on prepared intermediate cover at a maximum slope of 4H:1V. Surface water control devices and landfill gas (LFG) components will also be incorporated into the final cover of each landfill unit. The final cover surface will be vegetated upon completion of the final cover installation according to the project seeding specifications.

Where applicable, placement of the vegetative soil layer over the cover geosynthetics must be done with care to avoid damage to these materials. This soil layer should be placed from the bottom up using a small dozer equipped with low ground contact pressure (6 psi or less) tracks. A minimum of 12 inches of soil should be maintained between the dozer tracks and the underlying geosynthetics. The soil buffer 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.

Refer to the appropriate permit application for a detailed discussion and details related to the design of the final cover system for each landfill unit.

### 1.4 LANDFILL GAS SYSTEM

For the MSW landfill units and C&D landfill units, a landfill gas system is provided in the final cover design. This system includes a system of collection wells or vents placed within the waste to capture the gas and either passively vent or flare the gas via utility flares or, as required, actively collect and flare the gas via header piping and a blower/flare system. The collection wells should be placed before any geosynthetics are placed.

Refer to the appropriate permit application for a detailed discussion and details related to the design of the landfill gas system for each landfill unit.

## 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 provided along side slopes (rain gutters and/or diversion berms). Water captured by rain gutters or diversion berms is 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.

Refer to the appropriate permit application for a detailed discussion and details related to the design of surface water systems for each landfill unit.

### 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 diversion 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:

### MSW Landfill Units (15A NCAC 13B.1627(c)(5)):

- No later than 30 days after the date on which the MSWLF unit receives the known final receipt of wastes; or
- If the MSWLF unit has remaining capacity and there is a reasonable likelihood that the MSWLF unit will receive additional wastes, no later than one year after the most recent receipt of wastes.

### C&D Landfill Units (15A NCAC 13B.0543(c)(5)):

- No later than 30 days after the date on which the C&DLF unit receives the known final receipt of wastes;

- No later than 30 days after the date that a 10 acre or greater area of waste, is within in 15 feet of final design grades; or
- No later than one year after the most recent receipt of wastes, if the C&DLF 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.
- 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 landfill should be directed to:

Davidson County Integrated Solid Waste Management Department  
Attn: Charles Brushwood, Director  
1242 Old Highway 29  
Thomasville, NC 27360  
Phone: (336) 242-2284  
Fax: (336) 249-7524.

### 2.3 POST-CLOSURE USE

After filling operations cease at the landfill and the landfill is officially closed in accordance with the Closure Plan, each landfill unit will be maintained as a grassy hill. Davidson County will maintain control of the property and prevent public access to it during the post-closure period.

There may be (an) access road(s) on the final cover to allow proper maintenance during post-closure. Precise location of the access road(s) will be determined as a part of operations. Low ground pressure and rubber tire vehicles will be used for maintenance.

## 2.4 MAINTENANCE

### 2.4.1 Repair of Security Control Devices

All security control devices will be inspected and maintained as necessary to ensure access to the site is controlled. Locks, vehicular gates, and fencing will be replaced if functioning improperly. Warning signs will be kept legible at all times and will be replaced if damaged by inclement weather or vandalism.

### 2.4.2 Erosion Damage Repair

If erosion of the final cover occurs during post-closure, the affected area will be repaired and reseeded as necessary. If necessary, rolled erosion control products (RECPs) will be used to expedite rapid revegetation of slopes and to secure topsoil in place.

### 2.4.3 Correction of Settlement, Subsidence, and Displacement

Minimum slopes of 5 percent will be maintained after settlement in order to prevent ponding and allow for proper drainage without infiltration. If vertical or horizontal displacement occurs due to differential settlement, cracks will be filled with appropriate material and final cover will be reestablished. Excessive vertical displacement is not anticipated.

### 2.4.4 Leachate Management System (Lined Units)

In order to maintain the free flow in leachate collection piping, they will be cleared of debris using the manholes or cleanout locations for access. If pipes should crush or buckle within the landfill, leachate will flow through the gravel columns. The leachate collection system (LCS) includes a continuous blanket drain on the base of the landfill which will allow drainage of leachate even in the very unlikely event of total failure of the leachate collection pipes.

### 2.4.5 Closure of Leachate Storage Lagoon and Tanks

After closure of the Phase 1 and Phase 2 MSW landfill units have been achieved, the generation of leachate will eventually curtail. The flow rate immediately after closure should decrease to approximately 100 gallons/acre/day. Toward the end of the 30-year post-closure period, the flow should approach zero, at which time the storage lagoon (Phase 1) or the storage tanks (Phase 2) will not be required. The following procedures will be followed to properly close the leachate storage lagoon and tanks:

- Completely drain and remove all liquids, sludges, sediments, etc. from the storage lagoon or tanks.
- Disassemble the lagoon or tanks, piping, and appurtenances and dispose of

the contents in a manner approved by the DWM.

- Sample and analyze the underlying soil for appropriate constituents inherent to leachate. Assess the results for evidence of contaminant migration.
- If contamination of underlying soils is exhibited, perform an assessment as to the degree of contamination and develop remedial actions.
- Obtain approval of the DWM for the assessment and associated remedial measures.
- Perform the remedial actions as necessary to limit any threats to public, health, and the environment.
- Restore the area(s) to closely match pre-existing conditions in the vicinity of the containment area(s). Activities may include: filling, grading, topsoiling, and seeding.

#### **2.4.6 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.

#### **2.4.7 Landfill Gas System**

The landfill gas system will be maintained by the County and operated in accordance with any site air quality permits. Proper operation of the system is verified through testing at the landfill gas monitoring wells.

If 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 in accordance with the current Landfill Gas Management Plan.

#### **2.4.8 Groundwater Monitoring Wells**

Procedures outlined in the current Water Quality Monitoring 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 SAP 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 the County. 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 the County 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 the County'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 <sup>1</sup>	Quarterly
Surface Water Systems	Quarterly <sup>1</sup>	Quarterly
Erosion Damage	Quarterly <sup>1</sup>	Quarterly
Cover Drainage System	Quarterly <sup>1</sup>	Semi-Annually
Cover Settlement, Subsidence, and Displacement	Quarterly <sup>1</sup>	Semi-Annually
Leachate Management System	Quarterly	Semi-Annually
Landfill Gas System	Quarterly <sup>3</sup>	Semi-Annually <sup>3</sup>
Groundwater Monitoring System	Semi-Annually	Semi-Annually <sup>2</sup>
Benchmark Integrity	Annually	Annually
Leachate Collection Pipe Cleanout	Annually	Annually

Notes:

1. These items will be inspected after each large storm event (i.e.  $\geq 1$  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 or air quality permit(s).

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**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 costs associated with all activities specified in the written closure and post-closure plans which have been developed for the MSW (Phases 1 and 2) and the C&D (Phases 1 and 2) landfill units of the Davidson County Landfill.

**3.2 ESTIMATED CLOSURE COSTS**

**Tables 3.1A, 3.1B, and 3.1C** summarize the estimated costs for complete closure of the MSW Phase 1 (Areas 1 - 3), MSW Phase 2 (Area 1) and C&D (Phases 1 and 2) landfill units, respectively (the current maximum area to be closed). The cost estimate for each unit 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, increased costs in construction or materials, or any other adjustments to the Closure Plan.

**3.3 ESTIMATED POST-CLOSURE COSTS**

**Tables 3.2A, 3.2B, and 3.2C** summarize the estimated costs for the post-closure care maintenance activities for the MSW Phase 1 (Areas 1 - 3), MSW Phase 2 (Area 1) and C&D (Phases 1 and 2) landfill units, respectively. The cost estimate for each unit 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 3.1A: MSW - PHASE 1 - CLOSURE COST ESTIMATE<sup>1</sup>**

ITEM	QUANTITY	UNITS	UNIT COST	ITEM COST (2008 \$)
Surface Preparation	15.9	Acre	\$10,000	\$159,000
Landfill Gas System	15.9	Acre	\$15,000	\$238,500
30 mil Textured LLDPE Geomembrane	693,000	SF	\$0.45	\$311,850
Drainage Geocomposite	693,000	SF	\$0.55	\$381,150
Vegetative Soil Layer (24")	52,000	CY	\$5.00	\$260,000
Erosion Control (Rain Gutters, Diversion Berms, Down Pipes, Drainage Channels, Etc.)	15.9	Acre	\$15,000	\$238,500
Revegetation	15.9	Acre	\$1,500	\$23,850
Surveying	15.9	Acre	\$2,000	\$31,800
			Subtotal:	\$1,644,650
Bonds, Mobilization, & Insurance			(4% of Subtotal):	\$65,786
			Subtotal:	\$1,710,436
			Contingency (10%):	\$171,044
			<b>Construction Subtotal:</b>	<b>\$1,881,480</b>
Engineering	15.9	Acre	\$2,000	\$31,800
CQA	15.9	Acre	\$6,000	\$95,400
			<b>TOTAL:</b>	<b>\$2,008,680</b>

Notes:

1. Assumes closure of 15.9 acres (Phase 1 - Areas 1-3).

**TABLE 3.1 B: MSW - PHASE 2 - CLOSURE COST ESTIMATE<sup>1</sup>**

ITEM	QUANTITY	UNITS	UNIT COST	ITEM COST (2008 \$)
Surface Preparation	14.7	Acre	\$10,000	\$147,000
Landfill Gas System	14.7	Acre	\$15,000	\$220,500
30 mil Textured LLDPE Geomembrane	641,000	SF	\$0.45	\$288,450
Drainage Geocomposite	641,000	SF	\$0.55	\$352,550
Vegetative Soil Layer (24")	48,000	CY	\$5.00	\$240,000
Erosion Control (Rain Gutters, Diversion Berms, Down Pipes, Drainage Channels, Etc.)	14.7	Acre	\$15,000	\$220,500
Revegetation	14.7	Acre	\$1,500	\$22,050
Surveying	14.7	Acre	\$2,000	\$29,400
Subtotal:				\$1,520,450
Bonds, Mobilization, & Insurance	(4% of Subtotal):			\$60,818
Subtotal:				\$1,581,268
Contingency (10%):				\$158,127
<b>Construction Subtotal:</b>				<b>\$1,739,395</b>
Engineering	14.7	Acre	\$2,000	\$29,400
CQA	14.7	Acre	\$6,000	\$88,200
<b>TOTAL:</b>				<b>\$1,856,995</b>

Notes:

1. Assumes closure of 14.7 acres (Phase 2 - Area 1).

TABLE 3.1C: C&D UNIT - CLOSURE COST ESTIMATE<sup>1</sup>

ITEM	QUANTITY	UNITS	UNIT COST	ITEM COST (2008 \$)
Surface Preparation	5.9	Acre	\$2,000	\$11,800
Landfill Gas System	5.9	Acre	\$3,000	\$17,700
Compacted Soil Barrier (18")	14,300	CY	\$7.00	\$100,100
Vegetative Soil Layer (18")	14,300	CY	\$4.00	\$57,200
Erosion Control (Diversion Berms, Down Pipes, Drainage Channels, Etc.)	5.9	Acre	\$5,000	\$29,500
Revegetation	5.9	Acre	\$1,500	\$8,850
Surveying	5.9	Acre	\$2,000	\$11,800
Subtotal:				\$236,950
Bonds, Mobilization, & Insurance	(4% of Subtotal):			\$9,478
Subtotal:				\$246,428
Contingency (10%):				\$24,643
<b>Construction Subtotal:</b>				<b>\$271,071</b>
Engineering	5.9	Acre	\$2,000	\$11,800
CQA	5.9	Acre	\$6,000	\$35,400
<b>TOTAL:</b>				<b>\$318,271</b>

Notes:

1. Assumes closure of 5.9 acres (Phases 1 and 2).

**TABLE 3.2A: MSW - PHASE 1 - POST-CLOSURE COST ESTIMATE<sup>1</sup>**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL (2008 \$)
Site Inspection And Record Keeping	60	HR	\$75	\$4,500
Revegetation (5% Total Area)	2	Acre	\$1,500	\$3,000
Mowing (once per year)	32	Acre	\$100	\$3,200
Erosion Control	1	LS	\$5,000	\$5,000
Gates/Fences	1	LS	\$1,000	\$1,000
Groundwater/Surface Water Monitoring & Reporting (15 Long- Term Wells/Points - Semi-Annual)	15	Each	\$1,000	\$30,000
Methane Monitoring & Reporting (Semi-Annual After Year 1)	2	Each	\$2,500	\$5,000
Leachate Management <sup>2</sup>	1	LS	\$43,287	\$43,287
Subtotal:				\$94,987
Contingency (10%):				\$9,499
<b>ANNUAL TOTAL:</b>				<b>\$104,486</b>
<b>30-YEAR TOTAL:</b>				<b>\$3,134,571</b>

Notes:

1. Assumes post-closure of MSW Phase 1 (Areas 1 - 3) (31.9 Ac.).
2. Leachate treatment based on 100 gal/ac/day x 31.9 acres lined x 365 x \$20/1,000 gal. (\$23,287/year) plus \$5,000/year staff cost plus \$3,000/year lab cost plus \$2,000/year leachate collection line cleanout costs. Also include \$10,000 per year to account for decommissioning leachate facilities (leachate storage lagoon) (\$300,000 assumed) at the end of the post-closure period.

**TABLE 3.2B: MSW - PHASE 2 - POST-CLOSURE COST ESTIMATE<sup>1</sup>**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL (2008 \$)
Site Inspection And Record Keeping	60	HR	\$75	\$4,500
Revegetation (5% Total Area)	1	Acre	\$1,500	\$1,500
Mowing (once per year)	15	Acre	\$100	\$1,500
Erosion Control	1	LS	\$5,000	\$5,000
Gates/Fences	1	LS	\$1,000	\$1,000
Groundwater/Surface Water Monitoring & Reporting (15 Long- Term Wells/Points - Semi-Annual)	15	Each	\$1,000	\$30,000
Methane Monitoring & Reporting (Semi-Annual After Year 1)	2	Each	\$2,500	\$5,000
Leachate Management <sup>2</sup>	1	LS	\$64,018	\$30,731
Subtotal:				\$79,231
Contingency (10%):				\$7,923
<b>ANNUAL TOTAL:</b>				<b>\$87,154</b>
<b>30-YEAR TOTAL:</b>				<b>\$2,614,623</b>

Notes:

1. Assumes post-closure of MSW Phase 2 (Area 1) (14.7 Ac.)
2. Leachate treatment based on 100 gal/ac/day x 14.7 acres lined x 365 x \$20/1,000 gal. (\$10,731/year) plus \$5,000/year staff cost plus \$3,000/year lab cost plus \$2,000/year leachate collection line cleanout costs. Also include \$10,000 per year to account for decommissioning leachate facilities (leachate storage lagoon) (\$300,000 assumed) at the end of the post-closure period.

**TABLE 3.2C: C&D UNIT - POST-CLOSURE COST ESTIMATE<sup>1</sup>**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL (2008 \$)
Site Inspection And Record Keeping	20	HR	\$75	\$1,500
Revegetation (5% Total Area)	0.3	Acre	\$1,500	\$450
Mowing (once per year)	6	Acre	\$100	\$600
Erosion Control	1	LS	\$2,000	\$2,000
Gates/Fences	1	LS	\$500	\$500
Groundwater/Surface Water Monitoring & Reporting (5 Long-Term Wells/Points (Estimated) - Semi- Annual)	5	Each	\$1,000	\$10,000
Methane Monitoring & Reporting (Semi-Annual After Year 1)	2	Each	\$1,000	\$2,000
Subtotal:				\$17,050
Contingency (10%):				\$1,705
<b>ANNUAL TOTAL:</b>				<b>\$18,755</b>
<b>30-YEAR TOTAL:</b>				<b>\$562,650</b>

Notes:

1. Assumes post-closure of C&D Phases 1 and 2 (5.9 Ac.).

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# Attachment C



Attachment C

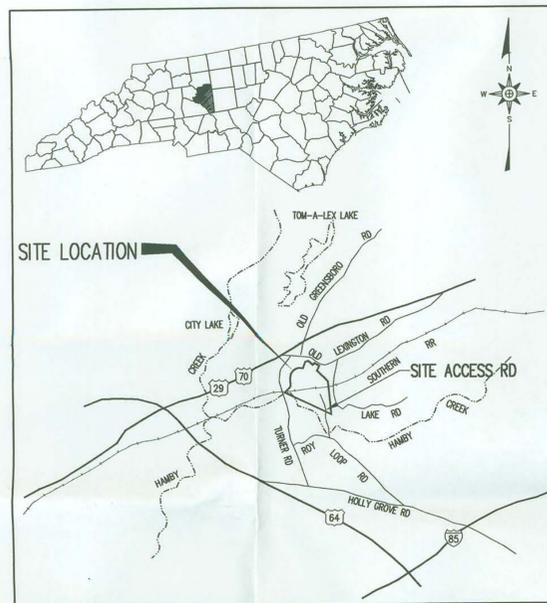
Revised Permit Drawings

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DAVIDSON COUNTY INTEGRATED  
SOLID WASTE MANAGEMENT  
LEXINGTON, NORTH CAROLINA

CONSTRUCTION & DEMOLITION DEBRIS  
(C&D) LANDFILL - PHASE 2  
ENGINEERING DRAWINGS

APRIL 2005  
REVISED: JUNE 2008



VICINITY MAP  
NOT TO SCALE

SHEET	DRAWING	TITLE	REVISION
1	--	TITLE/COVER SHEET	△
2	S1	EXISTING SITE CONDITIONS	
3	S2	SITE DEVELOPMENT PLAN - BASE GRADES	
4	S3	SITE DEVELOPMENT PLAN - FINAL COVER GRADES	
5	S4	PHASE 2 - SUBGRADE GRADING AND DRAINAGE PLAN	
6	S5	PHASE 2 - FINAL COVER GRADING AND DRAINAGE PLAN	△
7	D1	DETAILS (SHEET 1 OF 3)	
8	D2	DETAILS (SHEET 2 OF 3)	△
9	D3	DETAILS (SHEET 3 OF 3)	
10	X1	ENGINEERING CROSS SECTIONS	△
11	P1	PHASNG PLAN	

**RICHARDSON SMITH GARDNER**  
& ASSOCIATES

14 N. Boylan Ave.  
Raleigh, N.C. 27603

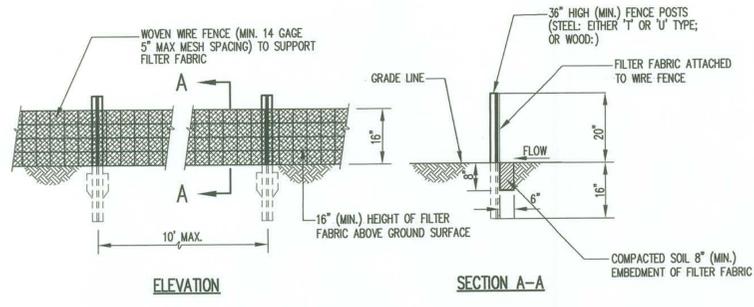
www.rsgengineers.com

ph: 919-828-0577  
fax: 919-828-3899

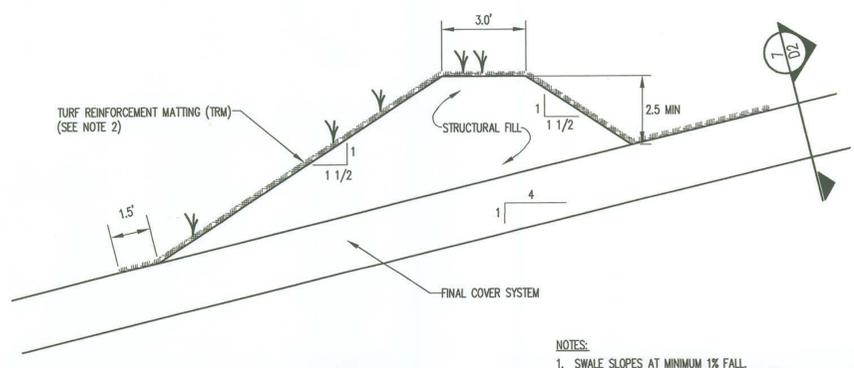


NO.	DATE	REVISION
1	6/08	FINAL COVER REVISIONS

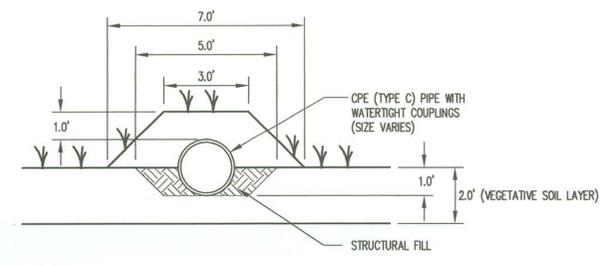
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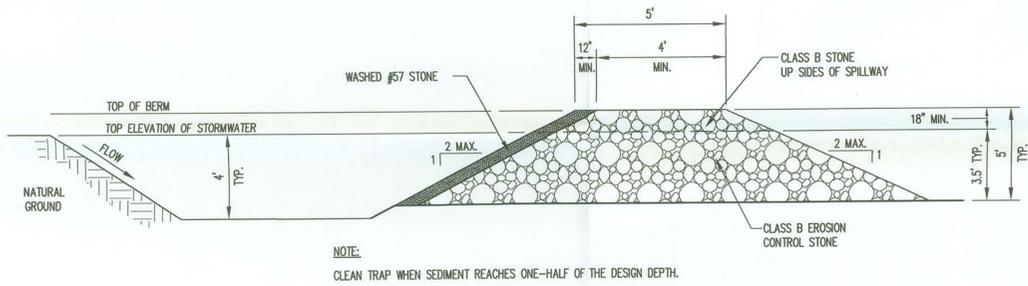
**SILT FENCE**  
 DETAIL 1  
 NOT TO SCALE D2



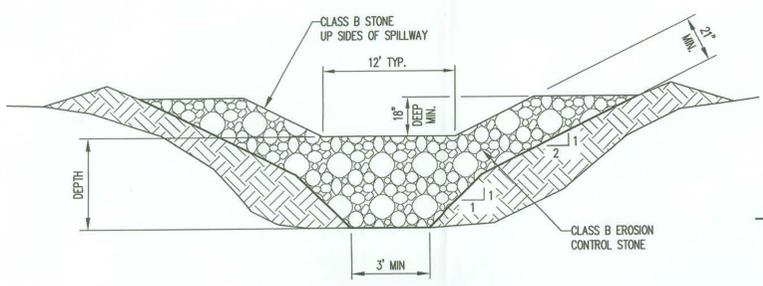
**FINAL COVER - SIDE SLOPE SWALE**  
 DETAIL 4  
 SCALE 1" = 3'-0" D2



**DOWN PIPE ON SLOPE**  
 DETAIL 6  
 SCALE 1" = 3' D2

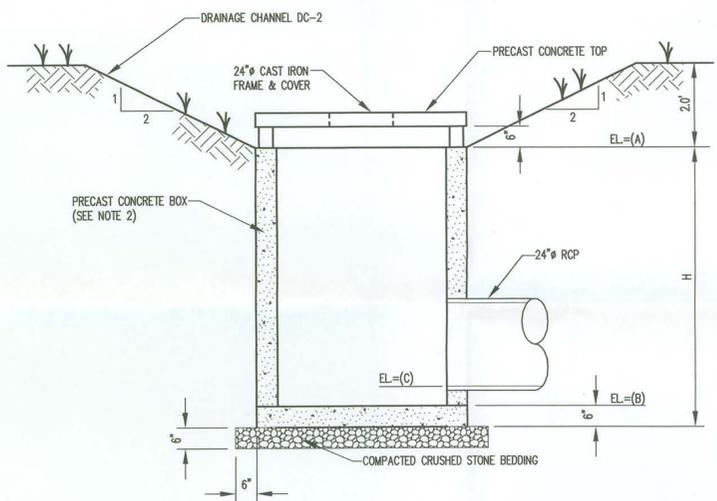
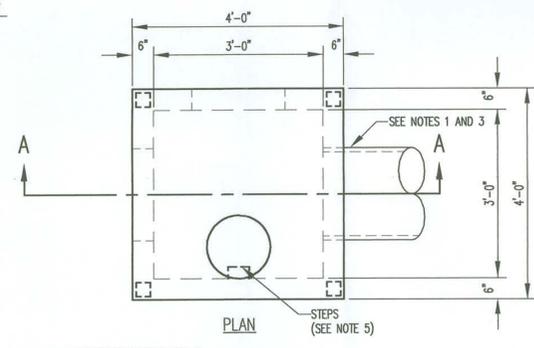


**SECTION THRU TRAP AND OUTLET**  
 NOTE:  
 CLEAN TRAP WHEN SEDIMENT REACHES ONE-HALF OF THE DESIGN DEPTH.



**SECTION THRU BERM AND OUTLET**

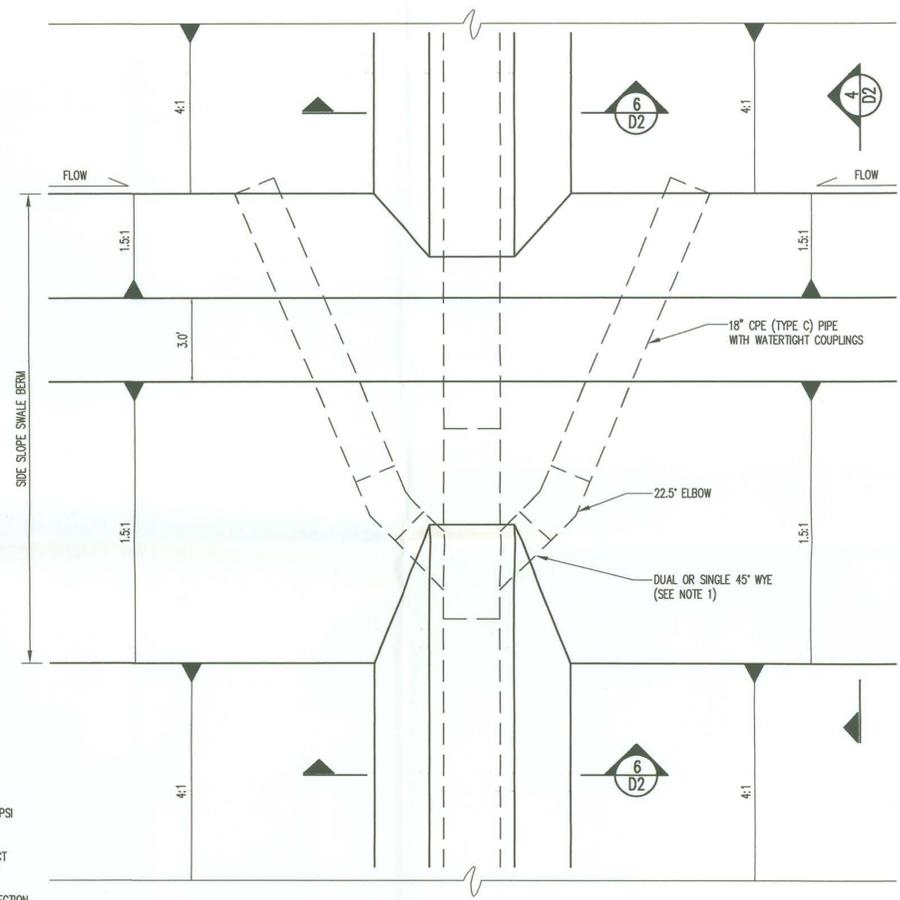
**TYPICAL EXISTING SEDIMENT TRAP**  
 DETAIL 2  
 NOT TO SCALE D2



DROP INLET SCHEDULE				
DROP INLET	A	B	C	H
DI-1	692.3'	685.6'	685.8'	7.2'

**DROP INLET DETAIL**  
 DETAIL 3  
 NOT TO SCALE D2

- 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 EC1 FOR PROPER ORIENTATION.
  4. 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.
  5. 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.



**DOWN PIPE**  
 DETAIL 5  
 SCALE 1" = 3' D2

- NOTES:**
1. DEPENDING ON LOCATION AND SIZE OF DOWN PIPE, WYE FITTING MAY BE SINGLE OR DUAL AND MAY BE A REDUCING WYE.

NO.	DATE	REVISION
1	6/08	FINAL COVER REVISIONS

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**DAVIDSON COUNTY  
 C&D LANDFILL  
 PHASE 2  
 LEXINGTON, NORTH CAROLINA**

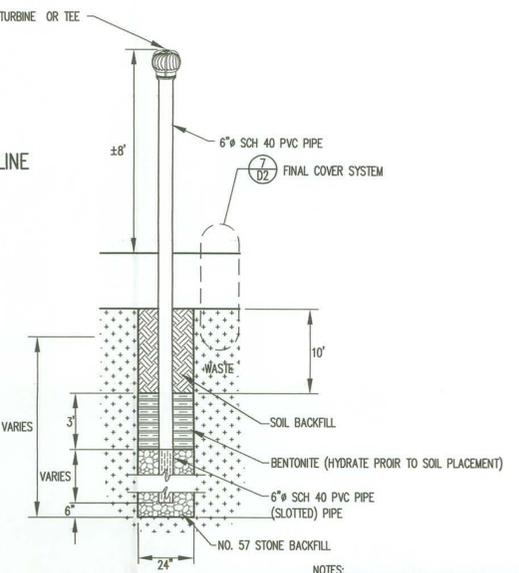
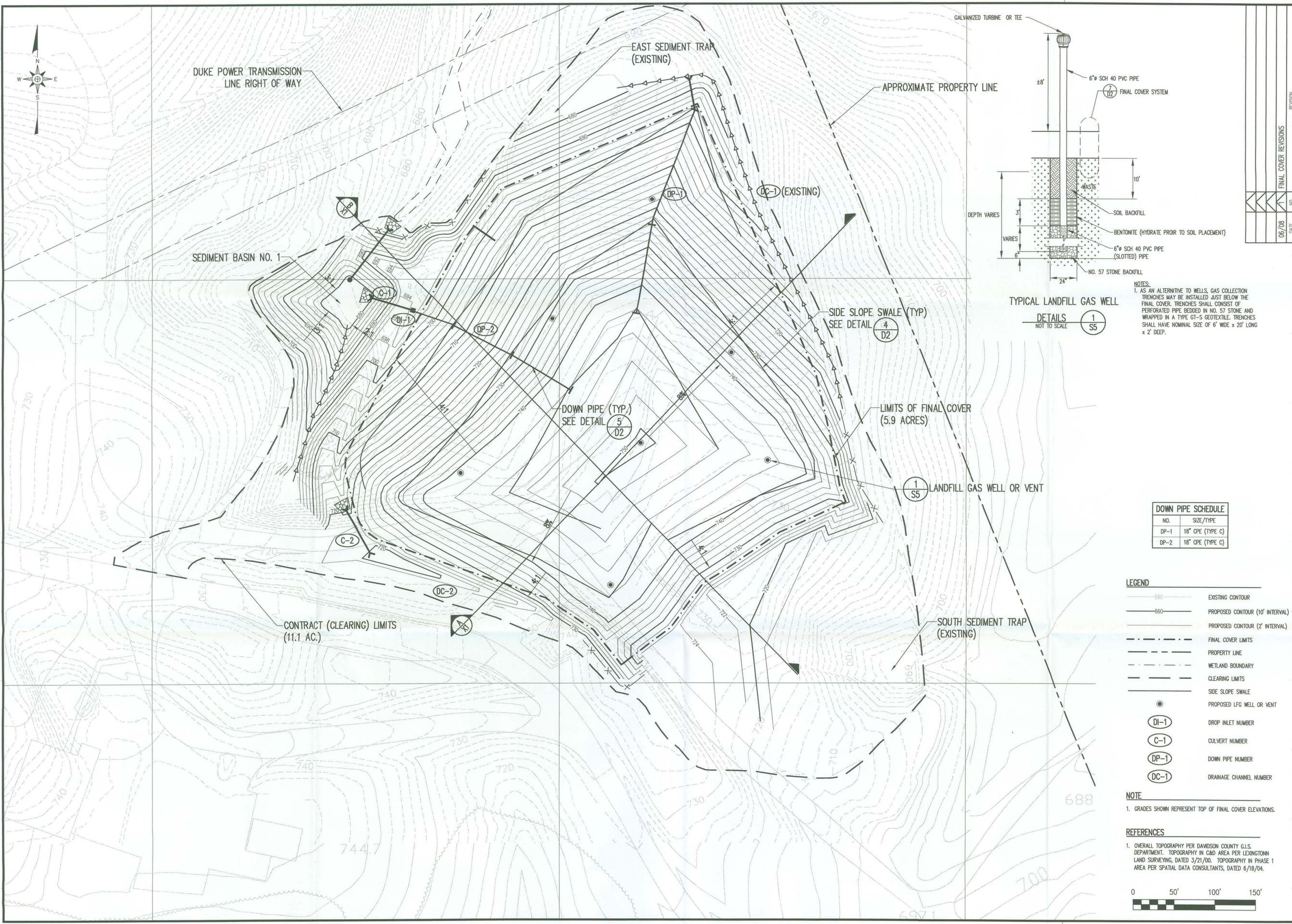
PROJECT TITLE:

**DETAILS  
 (SHEET 2 OF 3)**

DESIGNED BY: P.K.S.	DRAWN BY: W.E.E.
CHECKED BY:	PROJECT NO.: DAVDCO-13
SCALE: AS SHOWN	DATE: APRIL 2005
FILE NAME: DAVDCO-D0251A	SHEET NO.: 7
DRAWING NO.: D2	

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**TYPICAL LANDFILL GAS WELL**  
 DETAILS 1 S5  
 NOT TO SCALE

**NOTES:**  
 1. AS AN ALTERNATIVE TO WELLS, GAS COLLECTION TRENCHES MAY BE INSTALLED JUST BELOW THE FINAL COVER. TRENCHES SHALL CONSIST OF PERFORATED PIPE BEDDED IN NO. 57 STONE AND WRAPPED IN A TYPE G1-S GEOTEXTILE. TRENCHES SHALL HAVE NOMINAL SIZE OF 6' WIDE x 20' LONG x 2' DEEP.

DOWN PIPE SCHEDULE	
NO.	SIZE/TYPE
DP-1	18" CPE (TYPE C)
DP-2	18" CPE (TYPE C)

- LEGEND**
- 680 --- EXISTING CONTOUR
  - 660 --- PROPOSED CONTOUR (10' INTERVAL)
  - 660 --- PROPOSED CONTOUR (2' INTERVAL)
  - - - - - FINAL COVER LIMITS
  - - - - - PROPERTY LINE
  - - - - - WETLAND BOUNDARY
  - - - - - CLEARING LIMITS
  - - - - - SIDE SLOPE SWALE
  - PROPOSED LFG WELL OR VENT
  - DI-1 DROP INLET NUMBER
  - C-1 CULVERT NUMBER
  - DP-1 DOWN PIPE NUMBER
  - DC-1 DRAINAGE CHANNEL NUMBER

**NOTE**  
 1. GRADES SHOWN REPRESENT TOP OF FINAL COVER ELEVATIONS.

**REFERENCES**  
 1. OVERALL TOPOGRAPHY PER DAVIDSON COUNTY G.I.S. DEPARTMENT. TOPOGRAPHY IN C&D AREA PER LEXINGTON LAND SURVEYING, DATED 3/21/00. TOPOGRAPHY IN PHASE 1 AREA PER SPATIAL DATA CONSULTANTS, DATED 6/18/04.



REVISION	
NO.	DATE
1	06/08

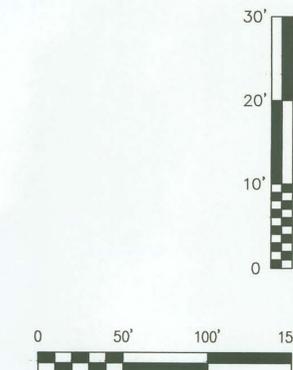
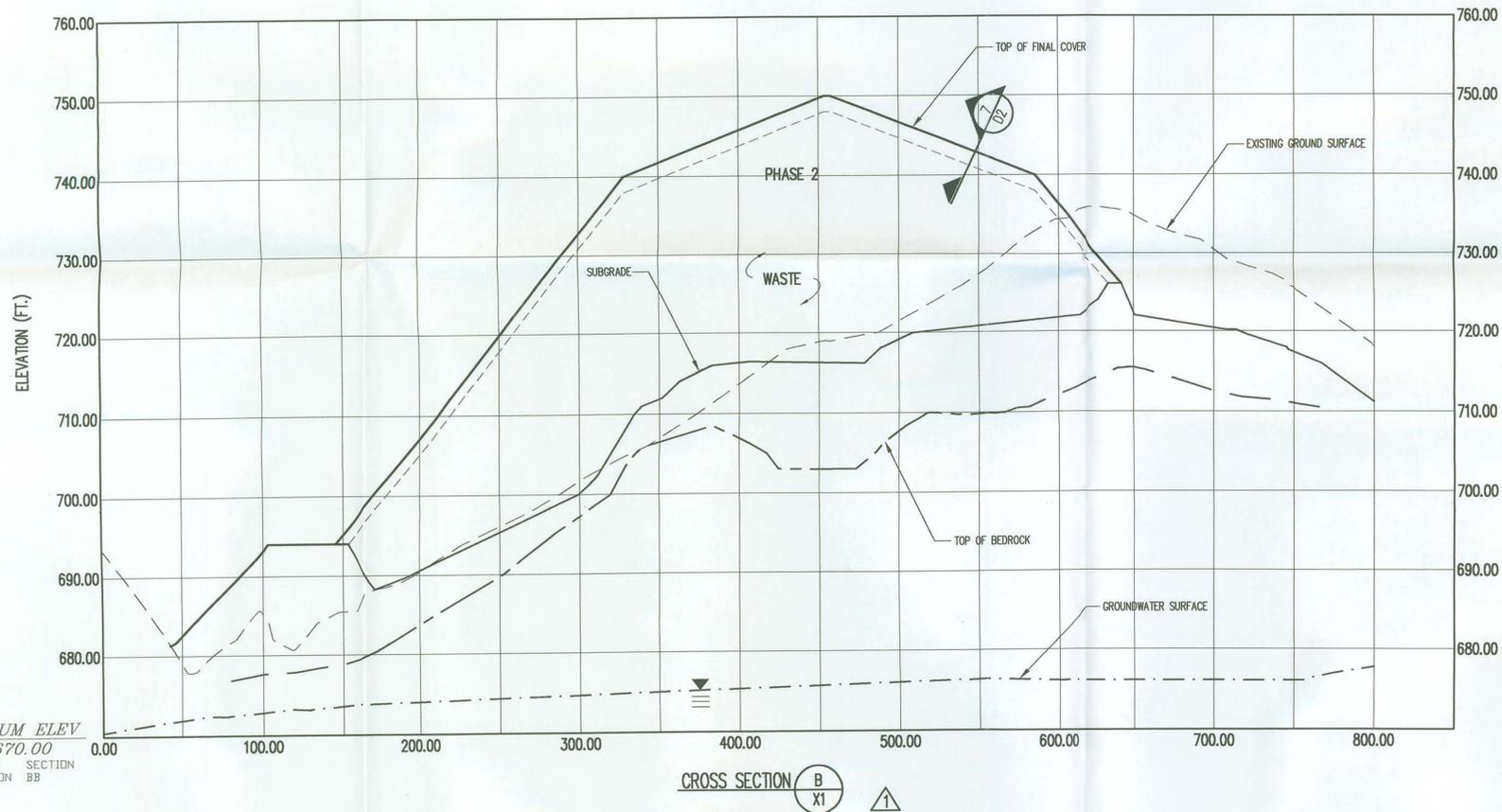
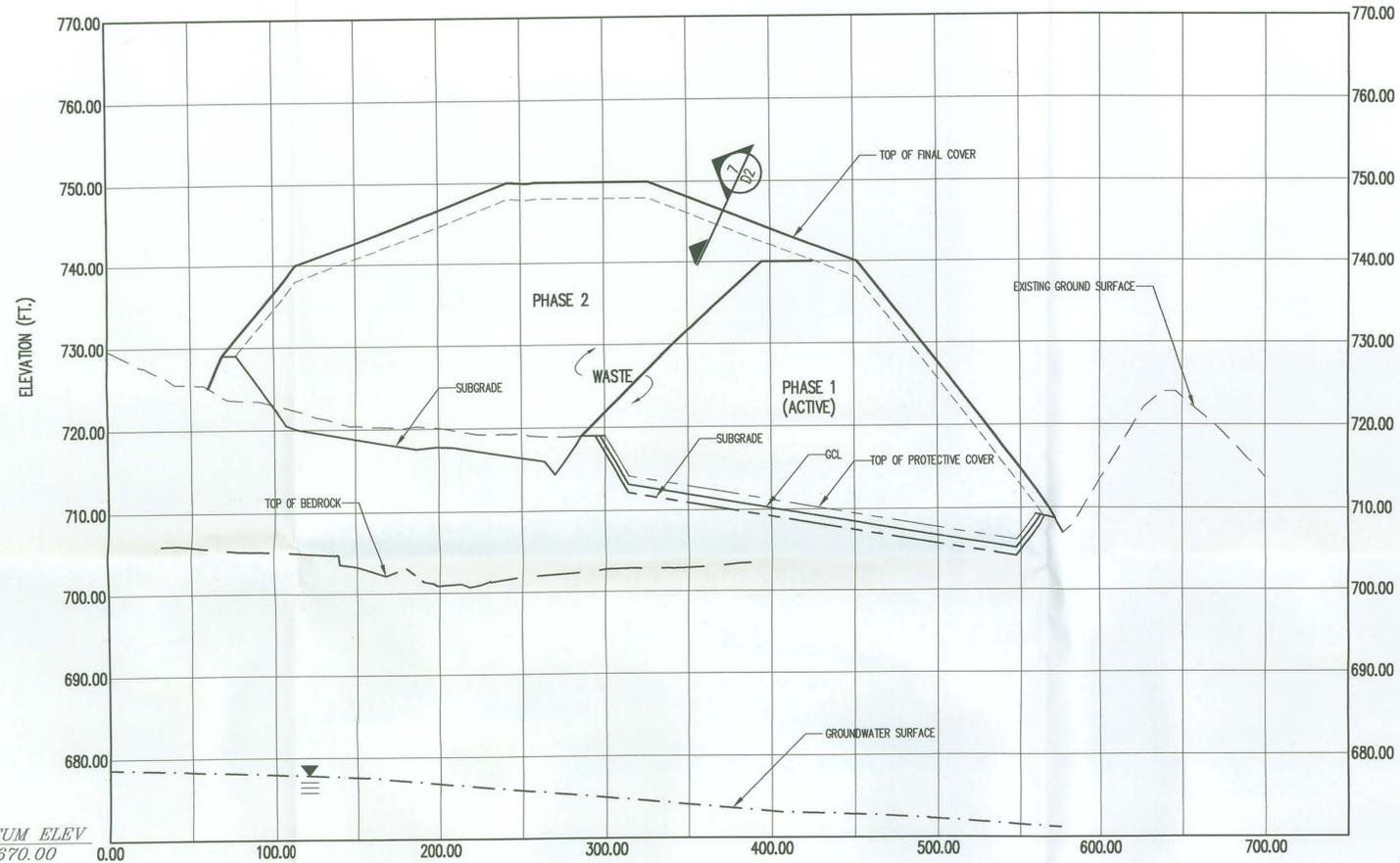
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Professional Engineer Seal for Peter K. S. 06/18/05

DAVIDSON COUNTY  
 C&D LANDFILL  
 PHASE 2  
 LEXINGTON, NORTH CAROLINA

PHASE 2 - FINAL COVER GRADING AND DRAINAGE PLAN

DESIGNED BY: P.K.S. DRAWN BY: W.E.E.  
 CHECKED BY: PROJECT NO.: DAVDCO-13  
 SCALE: AS SHOWN DATE: APRIL 2005  
 FILE NAME: DAVDCO-D0259A  
 SHEET NO.: 6 DRAWING NO.: S5



**LEGEND**

- EXISTING GROUND (SEE REFERENCE 1)
- PROPOSED GRADES
- - - TOP OF BEDROCK (BASED ON AUGER REFUSAL)
- SUBGRADE
- - - MAXIMUM SEASONAL HIGH GROUND WATER SURFACE

**REFERENCES**

1. OVERALL TOPOGRAPHY PER DAVIDSON COUNTY G.I.S. DEPARTMENT. TOPOGRAPHY IN C&D AREA PER LEXINGTON LAND SURVEYING, DATED 3/21/00. TOPOGRAPHY IN PHASE 1 AREA PER SPATIAL DATA CONSULTANTS, DATED 6/18/04.

REVISION	NO.	DATE
1	FINAL COVER	6/08

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DAVIDSON COUNTY  
C&D LANDFILL  
PHASE 2  
LEXINGTON, NORTH CAROLINA

ENGINEERING CROSS SECTIONS

DESIGNED BY: P.K.S.	DRAWN BY: C.T.J.
CHECKED BY:	PROJECT NO.: DAVDCO-13
SCALE: AS SHOWN	DATE: APRIL 2005
FILE NAME: DAVDCO-D061B	
SHEET NO. 9	DRAWING NO. X1

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