

DOCUMENT RECEIVED IN ELECTRONIC FORMAT FOLLOWS:

Letter of Transmittal with Received Date Stamp, Copy of check, Receipt for check, History sheet, Page 1 of book with 2 date stamps, Copies of pages with seals, 1 missing page

Attention: Tom Lubozynski, PE

Date: August 26, 2010

Job No: 139929-002

To: Florida Department of Environmental Protection
Central Florida District
3319 Maguire Blvd, Suite 232
Orlando, Florida 32803-3767

Phone:

RECEIVED
AUG 27 2010
Central Dist.

Regarding: Volusia County – Tomoka Farms Road Landfill
Closure Permit Intermediate Modification Application

We are sending you:

☒ **Attached**

☒ **Under separate cover via FedEx Ground the following items**

☐ Shop drawings

☐ Prints

☒ Plans

☐ Samples

☐ Specifications

☐ Copy of letter

☐ Change Order

☒ Other Report & CD

Copies	Date	No.	Description
4	8/25/10	1	Closure Permit Intermediate Modification Application report
4	8/25/10	2	Closure Permit Intermediate Modification Application drawings

These are transmitted as checked below:

☒ For approval

☐ Approved as submitted

☐ Resubmit _____ copies for approval

☐ For your use

☐ Approved as noted

☐ Submit _____ copies for distribution

☐ As requested

☐ Returned for corrections

☐ Return _____ corrected prints

☐ For review/comment

☐ Other

☐ For bids due _____

☐ Prints returned after loan to us

Remarks Please find enclosed four (4) copies of the closure permit intermediate modification application report and drawings for your review and approval.

Copy to Leonard Marion, Director, Volusia County Signed Ashley V. Evans, PE
Solid Waste Division

If enclosures are not as noted, please notify us at once

C:\Documents and Settings\cdaigle\My Documents\Work Files\Project Management\Forms\Transmittal.doc

PERMIT DATA FORM

CHECK IF NEW: 0078767

MOD ☒ NEW ☐ RENEWAL

SITE WAFR # AIR #

SITE/WAFER/FACILITY NAME: TOMOKA FARMS ROAD LANDFILL - NORTH CELL, CLASS I

PROJECT NAME: Volusia County Solid Waste Division

DESC: _____

TYPE CODE: SF

SUBCODE: IM

CHECK IF GP ☐ EXEMPT ☐ NPDES ☐

CORRECT FEE: \$ 3750 -

PROCESSOR: He AMOUNT RCV'D: 3750 -

AMOUNT REFUND: _____

MONIES DUE: _____

RED ___ YELLOW ___ GREEN ___ NO PERMIT REQ ___

HISTORY SHEET

SITE/WAFR/AIR#: 64-007871-027 TYPE: sf SUBTYPE: lm

SITE/WAFR/AID:
NAME: Lonoka Farm Rd off

PROJECT

NAME: _____

[illegible]



ONE COMPANY *Many Solutions*

August 25, 2010

Mr. Tom Lubozynski, PE
Waste Program Manager
Central Florida District
Florida Department of Environmental Protection
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

RECEIVED

AUG 27 2010

DEP Central Dist.

SEP 14 2010

**RE: FDEP Application for Intermediate Modification of the Existing Closure Permit
North Cell Class I Solid Waste Disposal Areas
FDEP Permit No. SF64-0078737-020
Tomoka Farms Road Landfill**

Dear Mr. Lubozynski:

On behalf of the Volusia County Public Works Solid Waste Division (County), HDR Engineering, Inc. (HDR) is hereby submitting four (4) copies of the Florida Department of Environmental Protection (FDEP) application for an intermediate modification to the existing Closure Permit for the North Cell Class I landfill at the Tomoka Farms Road Landfill.

To be consistent with the existing Operations Permit, the North Cell, East Cell Phase I, and East Cell Phase II disposal areas are to be considered one contiguous cell and referred to as the North Cell from here to forward.

The original Closure Permit Application was submitted in November 2006 and the permit (SF64-0078737-20) was issued May 30, 2007 by the FDEP. The County submitted a closure permit application for a phased closure of the North Cell that included interim closure of the south slope of the North Cell with an exposed geomembrane cover. The County intended to infill the valley between the South Cell and the North Cell following the completion of filling of the North Cell.

The County no longer intends to infill the valley, therefore this intermediate modification provides the necessary requirements to replace the exposed geomembrane cap (EGC) on the south slope with a traditional Subtitle D cover. Subsequently, the components of the EGC have been removed from the Construction Quality Assurance (CQA) Plan and Construction Specifications. Drainage design and calculations that are consistent with the original permit application and Environmental Resource Permit (ERP64-020632-002EI) methods have been provided for the terraces, downdrains, and perimeter ditches.

In the original Closure Permit Application, the Closure Plan consisted of the Engineering Report Sections P.3, P.4, P.5, Q, R, and S. Further revisions were made during the Request for Additional Information (RAI) process. A separate Closure and Long Term Care Plan which incorporates the original application submittal, RAI responses, and proposed modifications has been prepared and provided within this application. Since the original Closure Permit's Engineering Report was the Closure Plan, the Engineering



ONE COMPANY | *Many Solutions*

Enclosures: Permit Application
North Cell Closure Permit Drawings
Volusia County Check – Permit Application Fee

cc: Mr. Leonard Marion, Director, Volusia County Solid Waste Division
Mr. Patrick McCormack, Capital Improvements Coordinator, Volusia County Solid Waste Division
Mr. Chet Purves, Landfill Manager, Volusia County Solid Waste Division
Ms. Jennifer Stirk, Permit Compliance, Volusia County Solid Waste Division



Volusia County
Solid Waste Division

Tomoka Farms Road Landfill
North Cell Class I Closure
Intermediate Modification Permit Application

Prepared for:

Volusia County – Solid Waste Division
3151 East New York Avenue
DeLand, Florida 32724

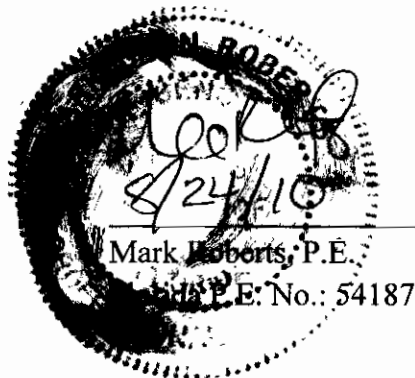
Submitted by:

SCS Engineers
504 North Grandview Avenue, Ste. 400
Daytona Beach, Florida 32118
Date: November 15, 2006

Revised by:

HDR Engineering, Inc.
200 W. Forsyth Street, Ste. 800
Jacksonville, Florida 32202
Date: August 25, 2010

HDR Project No. 0195-139929-002



PART S. CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

Applicant:

The undersigned applicant or authorized representative of Volusia County

_____ is aware that statements made in this form and attached information are an application for a _____ Closure _____ Permit from the Florida Department of Environmental Protection and certifies that the information in this application is true, correct and complete to the best of his/her knowledge and belief. Further, the undersigned agrees to comply with the provisions of Chapter 403, Florida Statutes, and all rules and regulations of the Department. It is understood that the Permit is not transferable, and the Department will be notified prior to the sale or legal transfer of the permitted facility.

Paul J. Murphy
Signature of Applicant or Agent

Leonard Marion, Director
Name and Title (please type)

Imarion@co.volusia.fl.us
E-Mail address (if available)

3151 East New York Avenue
Mailing Address

DeLand, FL 32724
City, State, Zip Code

(386) 943-7889
Telephone Number

Date: 8/22/2010

Attach letter of authorization if agent is not a governmental official, owner, or corporate officer.

Professional Engineer registered in Florida (or Public Officer if authorized under Sections 403.707 and 403.7075, Florida Statutes):

This is to certify that the engineering features of this solid waste management facility have been designed/examined by me and found to conform to engineering principles applicable to such facilities. In my professional judgment, this facility, when properly maintained and operated, will comply with all applicable statutes of the State of Florida and rules of the Department. It is agreed that the undersigned will provide the applicant with a set of instructions of proper maintenance and operation of the facility.

Handwritten signature: Mark 8/24/10
Signature

Mark Roberson, Vice President
(Name and title, please type)

200 W. Forsyth St., Ste. 800
Mailing Address

Jacksonville, FL 32202-4321

Mark.Roberts@hdrinc.com
E-Mail address (if available)

54187
Florida Registration Number
(please affix seal)

(904) 598-8979
Telephone Number

Date: _____



Volusia County
Solid Waste Division

Tomoka Farms Road Landfill
North Cell Class I Closure
Intermediate Modification Permit Application

Prepared for:

Volusia County – Solid Waste Division
3151 East New York Avenue
DeLand, Florida 32724

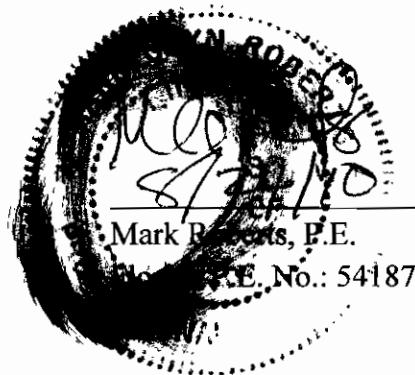
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Jacksonville, Florida 32202
Date: August 25, 2010

HDR Project No. 0195-139929-002



Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Terrace Capacity	Date	7/7/2010

Terrace for Top Deck Area

Contributing final cover area of the terrace = 0.98 ac

(Attachment A)

Maximum Discharge (100-yr) = $Q = CiA$

Q = Maximum Discharge, cfs

C = Runoff Coefficient → Steep Slopes, Sandy Soils, Bare Earth = 0.50

(Attachment B-1)

Adjust by 1.25 for 100-yr return period

$C = 0.625$

(Attachment B-2)

i = rainfall intensity for 100-yr storm = 10.4 in/hr

(Attachment C)

Q (100-yr) = 6.37 cfs

Terrace for Intermediate Top Deck Area

Contributing final cover area of the terrace = 1.43 ac

(Attachment A)

Maximum Discharge (100-yr) = $Q = CiA$

Q = Maximum Discharge, cfs

C = Runoff Coefficient → Steep Slopes, Sandy Soils, Bare Earth = 0.50

(Attachment B-1)

Adjust by 1.25 for 100-yr return period

$C = 0.625$

(Attachment B-2)

i = rainfall intensity for 100-yr storm = 10.4 in/hr

(Attachment C)

Q (100-yr) = 9.30 cfs

Step 2 - Determine Maximum Capacity of Terrace

The maximum flow capacity of the terrace is determined using the Manning's equation for open channel flow. The geometry of the terrace is shown in Attachment D.

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

Q = Flow Rate, cfs

n = Roughness Coefficient → maintained grass ditches 0.200

(Attachment E)

Decrease 30% for flows > 0.7 ft

$n = 0.140$

A = Flow Area of Terrace (Assume Flowing Full)

Left Side (H:1V)	Bottom Width	Right Side (H:1V)	Depth
3	5	3	2

$A = 22$ sf

R_h = Hydraulic Radius = A/W (W = Wetted Perimeter)

$W = 17.65$ ft

$R_h = 1.25$ ft

$S = 1\% = 0.01$ ft/ft

Volusia County
Solid Waste Division

Tomoka Farms Road Landfill Class I Closure and Long Term Care Plan

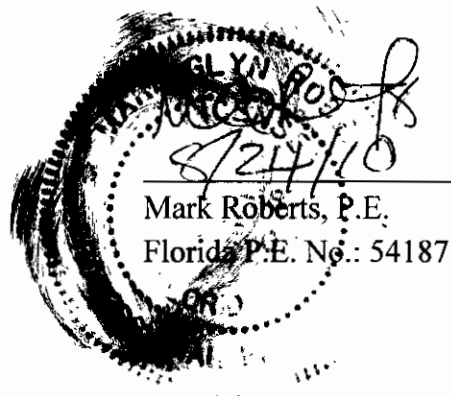
Prepared for:

Volusia County – Solid Waste Division
3151 East New York Avenue
DeLand, Florida 32724

Submitted by:

HDR Engineering, Inc.
200 W. Forsyth Street, Ste. 800
Jacksonville, Florida 32202
Date: August 25, 2010

HDR Project No. 0195-139929-002



Volusia County
Solid Waste Division

Tomoka Farms Road Landfill
North Cell Closure CQA Plan

Prepared for:

Volusia County – Solid Waste Division
3151 East New York Avenue
DeLand, Florida 32724

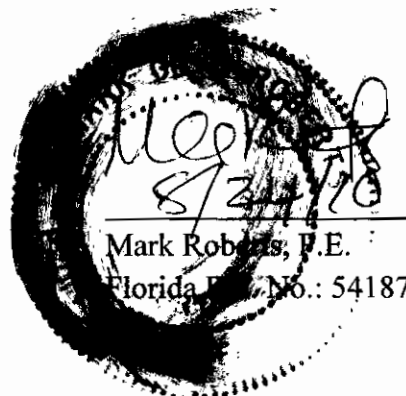
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504 North Grandview Avenue, Ste. 400
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Revised by:

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200 W. Forsyth Street, Ste. 800
Jacksonville, Florida 32202
Date: August 25, 2010

HDR Project No. 0195-139929-002





August 25, 2010

Mr. Tom Lubozynski, PE
Waste Program Manager
Central Florida District
Florida Department of Environmental Protection
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

**RE: FDEP Application for Intermediate Modification of the Existing Closure Permit
North Cell Class I Solid Waste Disposal Areas
FDEP Permit No. SF64-0078737-020
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Report for this submittal uses the ~~strike through~~/underline methods to document proposed modifications to ease FDEP's review.

The Long Term Care Plan for the North and South Cells were combined due to the potential infill in the original Closure Permit. The County no longer intends to construct an infill combining these Class I cells into a single cell. Modifications to the Long Term Care Plan are incorporated to allow monitoring of the South Cell separately from the North Cell. No revisions were made to the start date of the Long Term Care of the North or South Cells but additional details and requirements have been addressed that were not included in the original Closure Permit have been included in this modification.

The proposed closure modification also incorporates the updated Fill Sequence Plan, originally submitted August 2009 to the FDEP. The Fill Sequence Plan provides revised final grades due to the permanent landfill access road relocation. Details of the permanent landfill access road have been provided and the closure sequencing has been modified to reflect the Fill Sequence Plan.

Minor changes to the Environmental Monitoring Plan and Closure and Long Term Care Plan have been included in order to comply with the revised Chapter 62-701, F.A.C. rules promulgated on January 6, 2010. Per discussions with FDEP, it is our understanding that these modifications can be incorporated via a modification letter and that an entire submittal of the plans would not be necessary. Hence the Monitoring Plan is not provided in this submittal.

The application for an intermediate modification closure permit, a supporting engineering report, and attachments are structured according to the Chapter 62-701.900, F.A.C. checklist format. The drawings provided within this application include an updated aerial photograph, a combined North Cell site plan, and a well inventory. The attached full size signed and sealed set of engineering drawings for the North Cell Closure are based on the previously submitted Closure Drawings submitted with the original Closure Permit.

The application fee of \$3,750 for this Closure Permit modification application is being submitted in the form of a check from Volusia County to FDEP along with this application package.

If you have any questions or require additional information, please contact Ashley Evans at 904-598-8941.

Sincerely,
HDR Engineering, Inc.



Ashley Evans, PE, LEED AP
Project Engineer
PE No. 71640



Mark Roberts, PE
Vice President
PE No. 54187



ONE COMPANY | *Many Solutions*

Enclosures: Permit Application
North Cell Closure Permit Drawings
Volusia County Check – Permit Application Fee

cc: Mr. Leonard Marion, Director, Volusia County Solid Waste Division
Mr. Patrick McCormack, Capital Improvements Coordinator, Volusia County Solid Waste Division
Mr. Chet Purves, Landfill Manager, Volusia County Solid Waste Division
Ms. Jennifer Stirk, Permit Compliance, Volusia County Solid Waste Division

Mark
8/24/10



Volusia County
Solid Waste Division

Tomoka Farms Road Landfill
North Cell Class I Closure
Intermediate Modification Permit Application

Prepared for:

Volusia County – Solid Waste Division
3151 East New York Avenue
DeLand, Florida 32724

Submitted by:

SCS Engineers
504 North Grandview Avenue, Ste. 400
Daytona Beach, Florida 32118
Date: November 15, 2006

Revised by:

HDR Engineering, Inc.
200 W. Forsyth Street, Ste. 800
Jacksonville, Florida 32202
Date: August 25, 2010

A handwritten signature in blue ink, which appears to read "Mark Roberts", is written over the date "8/24/10". The signature and date are written in a cursive, slanted style.

Mark Roberts, P.E.
Florida P.E. No.: 54187

HDR Project No. 0195-139929-002

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APPENDICES

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APPENDIX C CQA PLAN
APPENDIX D TECHNICAL SPECIFICATIONS



Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

DEP Form #: 62-701.900(1), F.A.C.

Form Title: Application to Construct, Operate, Modify, or
Close a Solid Waste Management Facility

Effective Date: January 6, 2010

Incorporated in Rule: 62-701.330(3), F.A.C.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

APPLICATION TO CONSTRUCT, OPERATE, MODIFY, OR CLOSE A SOLID WASTE MANAGEMENT FACILITY

APPLICATION INSTRUCTIONS AND FORMS

Northwest District
160 Governmental Center
Pensacola, FL 32502-5794
850-595-8360

Northeast District
7825 Baymeadows Way, Ste. B200
Jacksonville, FL 32256-7590
904-807-3300

Central District
3319 Maguire Blvd., Ste. 232
Orlando, FL 32803-3767
407-894-7555

Southwest District
13051 N. Telecom Pkwy
Temple Terrace, FL 33637
813-632-7600

South District
2295 Victoria Ave., Ste. 364
Fort Myers, FL 33901-3881
239-332-6975

Southeast District
400 North Congress Ave.
West Palm Beach, FL 33401
561-681-6600

INSTRUCTIONS TO APPLY FOR A SOLID WASTE MANAGEMENT FACILITY PERMIT

I. General

Solid Waste Management Facilities shall be permitted pursuant to Section 403.707, Florida Statutes,(FS) and in accordance with Florida Administrative Code (FAC) Chapter 62-701. A minimum of four copies of the application shall be submitted to the Department's District Office having jurisdiction over the facility. The appropriate fee in accordance with Rule 62-701.315, FAC, shall be submitted with the application by check made payable to the Department of Environmental Protection (DEP).

Complete appropriate sections for the type of facility for which application is made. Entries shall be typed or printed in ink. All blanks shall be filled in or marked "not applicable" or "no substantial change". Information provided in support of the application shall be marked "submitted" and the location of this information in the application package indicated. The application shall include all information, drawings, and reports necessary to evaluate the facility. Information required to complete the application is listed on the attached pages of this form.

II. Application Parts Required for Construction and Operation Permits

- A. Landfills and Ash Monofills - Submit Parts A through S
- B. Asbestos Monofills - Submit Parts A,B,C,D,E,F,I,K,M, O through S
- C. Industrial Solid Waste Disposal Facilities - Submit Parts A through S

NOTE: Portions of some Parts may not be applicable.

NOTE: For facilities that have been satisfactorily constructed in accordance with their construction permit, the information required for A, B and C type facilities does not have to be resubmitted for an operation permit if the information has not substantially changed during the construction period. The appropriate portion of the form should be marked "no substantial change".

III. Application Parts Required for Closure Permits

- A. Landfills and Ash Monofills - Submit Parts A,B,L, N through S
- B. Asbestos Monofills - Submit Parts A,B,M, O through S
- C. Industrial Solid Waste Disposal Facilities - Submit Parts A,B, L through S

NOTE: Portions of some Parts may not be applicable.

IV. Permit Renewals

The above information shall be submitted at time of permit renewal in support of the new permit. However, facility information that was submitted to the Department to support the expiring permit, and which is still valid, does not need to be re-submitted for permit renewal. Portions of the application not re-submitted shall be marked "no substantial change" on the application form.

V. Application Codes

S	-	Submitted
LOCATION	-	Physical location of information in application
N/A	-	Not Applicable
N/C	-	No Substantial Change

VI. LISTING OF APPLICATION PARTS

PART A:	GENERAL INFORMATION
PART B:	DISPOSAL FACILITY GENERAL INFORMATION
PART C:	PROHIBITIONS
PART D:	SOLID WASTE MANAGEMENT FACILITY PERMIT REQUIREMENTS, GENERAL
PART E:	LANDFILL PERMIT REQUIREMENTS
PART F:	GENERAL CRITERIA FOR LANDFILLS
PART G:	LANDFILL CONSTRUCTION REQUIREMENTS
PART H:	HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS
PART I:	GEOTECHNICAL INVESTIGATION REQUIREMENTS
PART J:	VERTICAL EXPANSION OF LANDFILLS
PART K:	LANDFILL OPERATION REQUIREMENTS
PART L:	WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS
PART M:	SPECIAL WASTE HANDLING REQUIREMENTS
PART N:	GAS MANAGEMENT SYSTEM REQUIREMENTS
PART O:	LANDFILL CLOSURE REQUIREMENTS
PART P:	OTHER CLOSURE PROCEDURES
PART Q:	LONG-TERM CARE
PART R:	FINANCIAL ASSURANCE
PART S:	CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

**STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
APPLICATION FOR A PERMIT TO CONSTRUCT, OPERATE, MODIFY OR CLOSE
A SOLID WASTE MANAGEMENT FACILITY**

Please Type or Print

PART A. GENERAL INFORMATION

1. Type of disposal facility (check all that apply):

- | | |
|--|--|
| <input checked="" type="checkbox"/> Class I Landfill | <input type="checkbox"/> Ash Monofill |
| <input type="checkbox"/> Class III Landfill | <input type="checkbox"/> Asbestos Monofill |
| <input type="checkbox"/> Industrial Solid Waste | |
| <input type="checkbox"/> Other Describe: | |

NOTE: Waste Processing Facilities should apply on Form 62-701.900(4), FAC;
Land Clearing Disposal Facilities should notify on Form 62-701.900(3), FAC;
Compost Facilities should apply on Form 62-701.900(10), FAC; and
C&D Disposal Facilities should apply on Form 62-701.900(6), FAC

2. Type of application:

- ☐ Construction
☐ Operation
☐ Construction/Operation
☒ Closure
☐ Long-term Care Only

3. Classification of application:

- | | |
|----------------------------------|---|
| <input type="checkbox"/> New | <input type="checkbox"/> Substantial Modification |
| <input type="checkbox"/> Renewal | <input checked="" type="checkbox"/> Intermediate Modification |
| | <input type="checkbox"/> Minor Modification |

4. Facility name: Tomoka Farms Road Landfill - North Cell Class I Solid Waste Disposal Area

5. DEP ID number: _____ County: Volusia

6. Facility location (main entrance):
1990 Tomoka Farms Road, Port Orange, FL 32128

7. Location coordinates:

Section: 9 Township: 16S Range: 32E

Latitude: 29° 7' 50" Longitude: 81° 6' 2"

Datum: NAD 1983/90 (east) Coordinate Method: AutoCAD/GPS

Collected by: J.E. Zapert Company/Affiliation: Sliger & Associates, Inc.

PART B. DISPOSAL FACILITY GENERAL INFORMATION

1. Provide brief description of disposal facility design and operations planned under this application:

This application is for a permit to close the North Class I cell at the Volusia County, Tomoka Farms Road Landfill as portions of this cell reach permitted final grade, and to provide a post-closure care plan that includes the closed South Class I Cell. See Section B in the Engineering Report for a more detailed description.

2. Facility site supervisor: Chester Purves

Title: Supervisor Telephone: (386) 947-2952

cpurves@co.volusia.fl.us

E-Mail address (if available)

3. Disposal area: Total 90 acres; Used 69 acres; Available 21 acres.

4. Weighing scales used: ☒ Yes ☐ No

5. Security to prevent unauthorized use: ☒ Yes ☐ No

6. Charge for waste received: _____ \$/yds³ 34 \$/ton

7. Surrounding land use, zoning:

☐ Residential

☐ Industrial

☒ Agricultural

☐ None

☐ Commercial

☐ Other Describe:

8. Types of waste received:

☒ Household

☐ C & D debris

☒ Commercial

☐ Shredded/cut tires

☐ Incinerator/WTE ash

☐ Yard trash

☐ Treated biomedical

☒ Septic tank

☐ Water treatment sludge

☒ Industrial

-
-
-
-
-
-

Operands

21. Leachate collection method:

- | | |
|--|---|
| <input checked="" type="checkbox"/> Collection pipes | <input type="checkbox"/> Sand layer |
| <input checked="" type="checkbox"/> Geonets | <input type="checkbox"/> Gravel layer |
| <input type="checkbox"/> Well points | <input type="checkbox"/> Interceptor trench |
| <input type="checkbox"/> Perimeter ditch | <input type="checkbox"/> None |

☒ Other Describe:

Sump/pump station-leachate collection for onsite treatment

22. Leachate storage method:

- | | |
|--|--|
| <input type="checkbox"/> Tanks | <input checked="" type="checkbox"/> Surface impoundments |
| <input type="checkbox"/> Other Describe: | |

23. Leachate treatment method:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Oxidation | <input type="checkbox"/> Chemical treatment |
| <input type="checkbox"/> Secondary | <input checked="" type="checkbox"/> Settling |
| <input type="checkbox"/> Advanced | <input type="checkbox"/> None |
| <input type="checkbox"/> Other | |

24. Leachate disposal method:

- | | |
|---|--|
| <input type="checkbox"/> Recirculated | <input checked="" type="checkbox"/> Pumped to WWTP |
| <input checked="" type="checkbox"/> Transported to WWTP | <input type="checkbox"/> Discharged to surface water/wetland |
| <input type="checkbox"/> Injection well | <input type="checkbox"/> Percolation ponds |
| <input checked="" type="checkbox"/> Evaporation | <input checked="" type="checkbox"/> Spray Irrigation |
| <input type="checkbox"/> Other | |

25. For leachate discharged to surface waters:

Name and Class of receiving water:

N/A

26. Storm Water:

Collected: ☒ Yes ☐ No

Type of treatment:

Wetland detention and natural treatment

Name and Class of receiving water:

Unnamed Class III headwaters of Tomoka River

27. Environmental Resources Permit (ERP) number or status:

ERP 64-020632-002EI issued June 30, 2003

PART C. PROHIBITIONS (62-701.300, FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. Provide documentation that each of the siting criteria will be satisfied for the facility; (62-701.300(2), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. If the facility qualifies for any of the exemptions contained in Rules 62-701.300(12) through (18), FAC, then document this qualification(s).
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. Provide documentation that the facility will be in compliance with the burning restrictions; (62-701.300(3), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 4. Provide documentation that the facility will be in compliance with the hazardous waste restrictions; (62-701.300(4), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 5. Provide documentation that the facility will be in compliance with the PCB disposal restrictions; (62-701.300(5), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 6. Provide documentation that the facility will be in compliance with the biomedical waste restrictions; (62-701.300(6), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 7. Provide documentation that the facility will be in compliance with the Class I surface water restrictions; (62-701.300(7), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 8. Provide documentation that the facility will be in compliance with the special waste for landfills restrictions; (62-701.300(8), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 9. Provide documentation that the facility will be in compliance with the liquid restrictions; (62-701.300(10), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/> 10. Provide documentation that the facility will be in compliance with the used oil and oily waste restrictions; (62-701.300(11), FAC)

PART D. SOLID WASTE MANAGEMENT FACILITY PERMIT REQUIREMENTS, GENERAL (62-701.320, FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>
<input checked="" type="checkbox"/>	Section D.1	<input type="checkbox"/>	<input type="checkbox"/> 1. Four copies, at minimum, of the completed application form, all supporting data and reports; (62-701.320(5)(a), FAC)

S	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART D CONTINUED
<input checked="" type="checkbox"/>	Section D.2	<input type="checkbox"/>	<input type="checkbox"/>	2. Engineering and/or professional certification (signature, date and seal) provided on the applications and all engineering plans, reports and supporting information for the application; (62-701.320(6),FAC)
<input checked="" type="checkbox"/>	Section D.3	<input type="checkbox"/>	<input type="checkbox"/>	3. A letter of transmittal to the Department; (62-701.320(7)(a),FAC)
<input checked="" type="checkbox"/>	Section D.4	<input type="checkbox"/>	<input type="checkbox"/>	4. A completed application form dated and signed by the applicant; (62-701.320(7)(b),FAC)
<input checked="" type="checkbox"/>	Section D.5	<input type="checkbox"/>	<input type="checkbox"/>	5. Permit fee specified in Rule 62-701.315, FAC in check or money order, payable to the Department; (62-701.320(7)(c),FAC)
<input checked="" type="checkbox"/>	Section D.6	<input type="checkbox"/>	<input type="checkbox"/>	6. An engineering report addressing the requirements of this rule and with the following format: a cover sheet, text printed on 8 1/2 inch by 11 inch consecutively numbered pages, a table of contents or index, the body of the report and all appendices including an operation plan, contingency plan, illustrative charts and graphs, records or logs of tests and investigations, engineering calculations; (62-701.320(7)(d),FAC)
<input checked="" type="checkbox"/>	Section D.7	<input type="checkbox"/>	<input type="checkbox"/>	7.Operation Plan and Closure Plan; (62-701.320(7)(e)1,FAC)
<input type="checkbox"/>	Section D.8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	8. Contingency Plan; (62-701.320(7)(e)2,FAC)
<input checked="" type="checkbox"/>	Section D.9	<input type="checkbox"/>	<input type="checkbox"/>	9. Plans or drawings for the solid waste management facilities in appropriate format (including sheet size restrictions, cover sheet, legends, north arrow, horizontal and vertical scales, elevations referenced to NGVD 1929) showing; (62-701.320(7)(f),FAC)
<input checked="" type="checkbox"/>	Section D.9	<input type="checkbox"/>	<input type="checkbox"/>	a. A regional map or plan with the project location in relation to major roadways and population centers;
<input checked="" type="checkbox"/>	Section D.9	<input type="checkbox"/>	<input type="checkbox"/>	b. A vicinity map or aerial photograph no more than 1 year old showing the facility site and relevant surface features located within 1000 feet of the facility;
<input type="checkbox"/>	Section D.9	<input type="checkbox"/>	<input checked="" type="checkbox"/>	c. A site plan showing all property boundaries certified by a Florida Licensed Professional Surveyor and Mapper; and
<input checked="" type="checkbox"/>	Section D.9	<input type="checkbox"/>	<input type="checkbox"/>	d. Other necessary details to support the engineering report, including referencing elevations to a consistent, nationally recognized datum and identifying the method used for collecting latitude and longitude data.

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART D CONTINUED
<input type="checkbox"/>	Section D.10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10. Documentation that the applicant either owns the property or has legal authority from the property owner to use the site; (62-701.320(7)(g),FAC)
<input type="checkbox"/>	Section D.11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	11. For facilities owned or operated by a county, provide a description of how, if any, the facilities covered in this application will contribute to the county's achievement of the waste reduction and recycling goals contained in Section 403.706,FS; (62-701.320(7)(h),FAC)
<input type="checkbox"/>	Section D.12	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12. Provide a history and description of any enforcement actions taken by the Department against the applicant for violations of applicable statutes, rules, orders or permit conditions relating to the operation of any solid waste management facility in this state; (62-701.320(7)(i),FAC)
<input type="checkbox"/>	Section D.13	<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. Proof of publication in a newspaper of general circulation of notice of application for a permit to construct or substantially modify a solid waste management facility; (62-702.320(8),FAC)
<input type="checkbox"/>	Section D.14	<input type="checkbox"/>	<input checked="" type="checkbox"/>	14. Provide a description of how the requirements for airport safety will be achieved including proof of required notices if applicable. If exempt, explain how the exemption applies; (62-701.320(13),FAC)
<input type="checkbox"/>	Section D.15	<input type="checkbox"/>	<input checked="" type="checkbox"/>	15. Explain how the operator and spotter training requirements and special criteria will be satisfied for the facility; (62-701.320(15), FAC)

PART E. LANDFILL PERMIT REQUIREMENTS (62-701.330, FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. Regional map or aerial photograph no more than 5 years old showing all airports that are located within five miles of the proposed landfill; (62-701.330(3)(a),FAC)
<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Plot plan with a scale not greater than 200 feet to the inch showing; (62-701.330(3)(b),FAC)
<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Dimensions;
<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Locations of proposed and existing water quality monitoring wells;
<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Locations of soil borings;

S **LOCATION** **N/A** **N/C**

PART E CONTINUED

☐ _____ ☒ ☐

d. Proposed plan of trenching or disposal areas;

☐ _____ ☒ ☐

e. Cross sections showing original elevations and proposed final contours which shall be included either on the plot plan or on separate sheets;

☐ _____ ☒ ☐

f. Any previously filled waste disposal areas;

☐ _____ ☒ ☐

g. Fencing or other measures to restrict access.

☐ _____ ☒ ☐

3. Topographic maps with a scale not greater than 200 feet to the inch with 5-foot contour intervals showing; (62-701.330(3)(c),FAC):

☐ _____ ☒ ☐

a. Proposed fill areas;

☐ _____ ☒ ☐

b. Borrow areas;

☐ _____ ☒ ☐

c. Access roads;

☐ _____ ☒ ☐

d. Grades required for proper drainage;

☐ _____ ☒ ☐

e. Cross sections of lifts;

☐ _____ ☒ ☐

f. Special drainage devices if necessary;

☐ _____ ☒ ☐

g. Fencing;

☐ _____ ☒ ☐

h. Equipment facilities.

☐ _____ ☒ ☐

4. A report on the landfill describing the following; (62-701.330(3)(d),FAC)

☐ _____ ☒ ☐

a. The current and projected population and area to be served by the proposed site;

☐ _____ ☒ ☐

b. The anticipated type, annual quantity, and source of solid waste, expressed in tons;

☐ _____ ☒ ☐

c. Planned active life of the facility, the final design height of the facility and the maximum height of the facility during its operation;

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART E CONTINUED
-----------------	------------------------	-------------------	-------------------	-------------------------

- | | | | | |
|--------------------------|-------|-------------------------------------|--------------------------|---|
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | d. The source and type of cover material used for the landfill. |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. Provide evidence that an approved laboratory shall conduct water quality monitoring for the facility in accordance with Chapter 62-160,FAC; (62-701.330(3)(g),FAC) |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 6. Provide a statement of how the applicant will demonstrate financial responsibility for the closing and long-term care of the landfill; (62-701.330(3)(h),FAC) |

PART F. GENERAL CRITERIA FOR LANDFILLS (62-701.340,FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>
-----------------	------------------------	-------------------	-------------------

- | | | | | |
|--------------------------|-------|-------------------------------------|--------------------------|--|
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. Describe (and show on a Federal Insurance Administration flood map, if available) how the landfill or solid waste disposal unit shall not be located in the 100-year floodplain where it will restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain unless compensating storage is provided, or result in a washout of solid waste; (62-701.340(3)(b),FAC) |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. Describe how the minimum horizontal separation between waste deposits in the landfill and the landfill property boundary shall be 100 feet, measured from the toe of the proposed final cover slope; (62-701.340(3)(c),FAC) |

PART G. LANDFILL CONSTRUCTION REQUIREMENTS (62-701.400,FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>
-----------------	------------------------	-------------------	-------------------

- | | | | | |
|--------------------------|-------|-------------------------------------|--------------------------|---|
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. Describe how the landfill shall be designed so that solid waste disposal units will be constructed and closed at planned intervals throughout the design period of the landfill and shall be designed to achieve a minimum factor of safety of 1.5 using peak strength values to prevent failures of side slopes and deep-seated failures; (62-701.400(2),FAC) |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. Landfill liner requirements; (62-701.400(3),FAC) |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | a. General construction requirements; (62-701.400(3)(a),FAC): |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (1) Provide test information and documentation to ensure the liner will be constructed of materials that have appropriate physical, chemical, and mechanical properties to prevent failure; |

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART G CONTINUED
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Document foundation is adequate to prevent liner failure;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Constructed so bottom liner will not be adversely impacted by fluctuations of the ground water;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Designed to resist hydrostatic uplift if bottom liner located below seasonal high ground water table;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(5) Installed to cover all surrounding earth which could come into contact with the waste or leachate.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Composite liners; (62-701.400(3)(b),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Upper geomembrane thickness and properties;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Design leachate head for primary LCRS including leachate recirculation if appropriate;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Design thickness in accordance with Table A and number of lifts planned for lower soil component.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Double liners; (62-701.400(3)(c),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Upper and lower geomembrane thicknesses and properties;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Design leachate head for primary LCRS to limit the head to one foot above the liner;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Lower geomembrane sub-base design;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Leak detection and secondary leachate collection system minimum design criteria ($k \geq 10$ cm/sec, head on lower liner ≤ 1 inch, head not to exceed thickness of drainage layer);
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Standards for geosynthetic components; (62-701.400(3)(d),FAC)

S **LOCATION** **N/A** **N/C**

PART G CONTINUED

- | | | | | | |
|--------------------------|-------|-------------------------------------|--------------------------|-----|--|
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (1) | Factory and field seam test methods to ensure all geomembrane seams achieve the minimum specifications; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (2) | Geomembranes to be used shall pass a continuous spark test by the manufacturer; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (3) | Design of 24-inch-thick protective layer above upper geomembrane liner; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (4) | Describe operational plans to protect the liner and leachate collection system when placing the first layer of waste above 24-inch-thick protective layer. |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (5) | HDPE geomembranes, if used, meet the specifications in GRI GM13 and LLDPE geomembranes, if used, meet the specifications in GRI GM17; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (6) | PVC geomembranes, if used, meet the specifications in PGI 1104; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (7) | Interface shear strength testing results of the actual components which will be used in the liner system; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (8) | Transmissivity testing results of geonets if they are used in the liner system; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (9) | Hydraulic conductivity testing results of geosynthetic clay liners if they are used in the liner system; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | e. Geosynthetic specification requirements; (62-701.400(3)(e),FAC) |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (1) | Definition and qualifications of the designer, manufacturer, installer, QA consultant and laboratory, and QA program; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (2) | Material specifications for geomembranes, geocomposites, geotextiles, geogrids, and geonets; |

S **LOCATION** **N/A** **N/C**

PART G CONTINUED

☐ _____ ☒ ☐

- (3) Manufacturing and fabrication specifications including geomembrane raw material and roll QA, fabrication personnel qualifications, seaming equipment and procedures, overlaps, trial seams, destructive and nondestructive seam testing, seam testing location, frequency, procedure, sample size and geomembrane repairs;

☐ _____ ☒ ☐

- (4) Geomembrane installation specifications including earthwork, conformance testing, geomembrane placement, installation personnel qualifications, field seaming and testing, overlapping and repairs, materials in contact with geomembrane and procedures for lining system acceptance;

☐ _____ ☒ ☐

- (5) Geotextile and geogrid specifications including handling and placement, conformance testing, seams and overlaps, repair, and placement of soil materials and any overlying materials;

☐ _____ ☒ ☐

- (6) Geonet and geocomposite specifications including handling and placement, conformance testing, stacking and joining, repair, and placement of soil materials and any overlying materials;

☐ _____ ☒ ☐

- (7) Geosynthetic clay liner specifications including handling and placement, conformance testing, seams and overlaps, repair, and placement of soil material and any overlying materials;

☐ _____ ☒ ☐

f. Standards for soil liner components (62-710.400(3)(f),FAC):

☐ _____ ☒ ☐

- (1) Description of construction procedures including overexcavation and backfilling to preclude structural inconsistencies and procedures for placing and compacting soil component in layers;

☐ _____ ☒ ☐

- (2) Demonstration of compatibility of the soil component with actual or simulated leachate in accordance with EPA Test Method 9100 or an equivalent test method;

☐ _____ ☒ ☐

- (3) Procedures for testing in-situ soils to demonstrate they meet the specifications for soil liners;

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART G CONTINUED
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Specifications for soil component of liner including at a minimum:
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(a) Allowable particle size distribution, Atterberg limits, shrinkage limit;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(b) Placement moisture and dry density criteria;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(c) Maximum laboratory-determined saturated hydraulic conductivity using simulated leachate;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(d) Minimum thickness of soil liner;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(e) Lift thickness;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(f) Surface preparation (scarification);
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(g) Type and percentage of clay mineral within the soil component;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(5) Procedures for constructing and using a field test section to document the desired saturated hydraulic conductivity and thickness can be achieved in the field.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	g. If a Class III landfill is to be constructed with a bottom liner system, provide a description of how the minimum requirements for the liner will be achieved.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. Leachate collection and removal system (LCRS); (62-701.400(4),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. The primary and secondary LCRS requirements; (62-701.400(4)(a),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Constructed of materials chemically resistant to the waste and leachate;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Have sufficient mechanical properties to prevent collapse under pressure;

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART G CONTINUED
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Have granular material or synthetic geotextile to prevent clogging;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Have method for testing and cleaning clogged pipes or contingent designs for rerouting leachate around failed areas;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Other LCRS requirements; (62-701.400(4)(b) and (c),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Bottom 12 inches having hydraulic conductivity $\geq 1 \times 10^{-3}$ cm/sec;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Total thickness of 24 inches of material chemically resistant to the waste and leachate;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Bottom slope design to accommodate for predicted settlement and still meet minimum slope requirements;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Demonstration that synthetic drainage material, if used, is equivalent or better than granular material in chemical compatibility, flow under load and protection of geomembrane liner.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. Leachate recirculation; (62-701.400(5),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Describe general procedures for recirculating leachate;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Describe procedures for controlling leachate runoff and minimizing mixing of leachate runoff with storm water;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Describe procedures for preventing perched water conditions and gas buildup;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Describe alternate methods for leachate management when it cannot be recirculated due to weather or runoff conditions, surface seeps, wind-blown spray, or elevated levels of leachate head on the liner;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	e. Describe methods of gas management in accordance with Rule 62-701.530, FAC;

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART G CONTINUED
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	f. If leachate irrigation is proposed, describe treatment methods and standards for leachate treatment prior to irrigation over final cover and provide documentation that irrigation does not contribute significantly to leachate generation.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. Leachate storage tanks and leachate surface impoundments; (62-701.400(6), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Surface impoundment requirements; (62-701.400(6)(b), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Documentation that the design of the bottom liner will not be adversely impacted by fluctuations of the ground water;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Designed in segments to allow for inspection and repair as needed without interruption of service;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) General design requirements;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(a) Double liner system consisting of an upper and lower 60-mil minimum thickness geomembrane;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(b) Leak detection and collection system with hydraulic conductivity ≥ 1 cm/sec;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(c) Lower geomembrane placed on subbase ≥ 6 inches thick with $k \leq 1 \times 10^{-5}$ cm/sec or on an approved geosynthetic clay liner with $k \leq 1 \times 10^{-7}$ cm/sec;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(d) Design calculation to predict potential leakage through the upper liner;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(e) Daily inspection requirements and notification and corrective action requirements if leakage rates exceed that predicted by design calculations;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Description of procedures to prevent uplift, if applicable;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(5) Design calculations to demonstrate minimum two feet of freeboard will be maintained;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(6) Procedures for controlling vectors and off-site odors.

S **LOCATION** **N/A** **N/C**

PART G CONTINUED

<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Above-ground leachate storage tanks; (62-701.400(6)(c),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Describe tank materials of construction and ensure foundation is sufficient to support tank;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Describe procedures for cathodic protection if needed for the tank;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Describe exterior painting and interior lining of the tank to protect it from the weather and the leachate stored;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Describe secondary containment design to ensure adequate capacity will be provided and compatibility of materials of construction;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(5) Describe design to remove and dispose of stormwater from the secondary containment system;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(6) Describe an overfill prevention system such as level sensors, gauges, alarms and shutoff controls to prevent overfilling;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(7) Inspections, corrective action and reporting requirements;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(a) Overfill prevention system weekly;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(b) Exposed tank exteriors weekly;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(c) Tank interiors when tank is drained or at least every three years;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(d) Procedures for immediate corrective action if failures detected;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(e) Inspection reports available for department review.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Underground leachate storage tanks; (62-701.400(6)(d),FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART G CONTINUED
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Describe materials of construction;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) A double-walled tank design system to be used with the following requirements;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(a) Interstitial space monitoring at least weekly;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(b) Corrosion protection provided for primary tank interior and external surface of outer shell;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(c) Interior tank coatings compatible with stored leachate;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(d) Cathodic protection inspected weekly and repaired as needed;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Describe an overfill prevention system such as level sensors, gauges, alarms and shutoff controls to prevent overfilling and provide for weekly inspections;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Inspection reports available for department review.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Schedule provided for routine maintenance of LCRS; (62-701.400(6)(e), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. Liner systems construction quality assurance (CQA); (62-701.400(7), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Provide CQA Plan including:
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Specifications and construction requirements for liner system;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Detailed description of quality control testing procedures and frequencies;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Identification of supervising professional engineer;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Identify responsibility and authority of all appropriate organizations and key personnel involved in the construction project;

LOCATION**N/A****N/C****PART G CONTINUED**

- | | | | | |
|--------------------------|-------|-------------------------------------|--------------------------|--|
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (5) State qualifications of CQA professional engineer and support personnel; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | (6) Description of CQA reporting forms and documents; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | b. An independent laboratory experienced in the testing of geosynthetics to perform required testing; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. Soil Liner CQA (62-701.400(8)FAC) |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | a. Documentation that an adequate borrow source has been located with test results or description of the field exploration and laboratory testing program to define a suitable borrow source; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | b. Description of field test section construction and test methods to be implemented prior to liner installation; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | c. Description of field test methods including rejection criteria and corrective measures to insure proper liner installation. |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. Surface water management systems; (62-701.400(9),FAC) |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | a. Provide a copy of a Department permit for stormwater control or documentation that no such permit is required; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | b. Design of surface water management system to isolate surface water from waste filled areas and to control stormwater run-off; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | c. Details of stormwater control design including retention ponds, detention ponds, and drainage ways; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. Gas control systems; (62-701.400(10),FAC) |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | a. Provide documentation that if the landfill is receiving degradable wastes, it will have a gas control system complying with the requirements of Rule 62-701.530, FAC; |
| <input type="checkbox"/> | _____ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 10. For landfills designed in ground water, provide documentation that the landfill will provide a degree of protection equivalent to landfills designed with bottom liners not in contact with ground water; (62-701.400(11),FAC) |

PART H. HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS (62-701.410(1), FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. Submit a hydrogeological investigation and site report including at least the following information:
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Regional and site specific geology and hydrogeology;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Direction and rate of ground water and surface water flow including seasonal variations;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Background quality of ground water and surface water;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Any on-site hydraulic connections between aquifers;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	e. Site stratigraphy and aquifer characteristics for confining layers, semi-confining layers, and all aquifers below the landfill site that may be affected by the landfill;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	f. Description of topography, soil types and surface water drainage systems;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	g. Inventory of all public and private water wells within a one-mile radius of the landfill including, where available, well top of casing and bottom elevations, name of owner, age and usage of each well, stratigraphic unit screened, well construction technique and static water level;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	h. Identify and locate any existing contaminated areas on the site;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	i. Include a map showing the locations of all potable wells within 500 feet of the waste storage and disposal areas;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Report signed, sealed and dated by PE and/or PG.

PART I. GEOTECHNICAL INVESTIGATION REQUIREMENTS (62-701.410(2),FAC)

	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. Submit a geotechnical site investigation report defining the engineering properties of the site including at least the following:
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Description of subsurface conditions including soil stratigraphy and ground water table conditions;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Investigate for the presence of muck, previously filled areas, soft ground, lineaments and sink holes;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Estimates of average and maximum high water table across the site;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Foundation analysis including:
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Foundation bearing capacity analysis;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Total and differential subgrade settlement analysis;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Slope stability analysis;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	e. Description of methods used in the investigation and includes soil boring logs, laboratory results, analytical calculations, cross sections, interpretations and conclusions;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	f. An evaluation of fault areas, seismic impact zones, and unstable areas as described in 40 CFR 258.13, 40 CFR 258.14 and 40 CFR 258.15.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Report signed, sealed and dated by PE and/or PG.

PART J. VERTICAL EXPANSION OF LANDFILLS (62-701.430,FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. Describe how the vertical expansion shall not cause or contribute to leachate leakage from the existing landfill, shall not cause objectionable odors, or adversely affect the closure design of the existing landfill;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Describe how the vertical expansion over unlined landfills will meet the requirements of Rule 62-701.400, FAC with the exceptions of Rule 62-701.430(1)(c),FAC;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. Provide foundation and settlement analysis for the vertical expansion;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. Provide total settlement calculations demonstrating that the final elevations of the lining system, that gravity drainage, and that no other component of the design will be adversely affected;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. Minimum stability safety factor of 1.5 for the lining system component interface stability and deep stability;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. Provide documentation to show the surface water management system will not be adversely affected by the vertical expansion;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. Provide gas control designs to prevent accumulation of gas under the new liner for the vertical expansion.

PART K. LANDFILL OPERATION REQUIREMENTS (62-701.500,FAC)

<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. Provide documentation that landfill will have at least one trained operator during operation and at least one trained spotter at each working face; (62-701.500(1),FAC)
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Provide a landfill operation plan including procedures for: (62-701.500(2), FAC)
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Designating responsible operating and maintenance personnel;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Emergency preparedness and response, as required in subsection 62-701.320(16), FAC;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Controlling types of waste received at the landfill;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Weighing incoming waste;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	e. Vehicle traffic control and unloading;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	f. Method and sequence of filling waste;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	g. Waste compaction and application of cover;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	h. Operations of gas, leachate, and stormwater controls;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	i. Water quality monitoring.
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	j. Maintaining and cleaning the leachate collection system;
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. Provide a description of the landfill operation record to be used at the landfill; details as to location of where various operational records will be kept (i.e. FDEP permit, engineering drawings, water quality records, etc.) (62-701.500(3),FAC)
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. Describe the waste records that will be compiled monthly and provided to the Department annually; (62-701.500(4),FAC)
<input type="checkbox"/> _____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. Describe methods of access control; (62-701.500(5),FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART K CONTINUED
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. Describe load checking program to be implemented at the landfill to discourage disposal of unauthorized wastes at the landfill; (62-701.500(6),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. Describe procedures for spreading and compacting waste at the landfill that include: (62-701.500(7),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Waste layer thickness and compaction frequencies;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Special considerations for first layer of waste placed above liner and leachate collection system;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Slopes of cell working face and side grades above land surface, planned lift depths during operation;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Maximum width of working face;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	e. Description of type of initial cover to be used at the facility that controls:
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(1) Vector breeding/animal attraction
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(2) Fires
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(3) Odors
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(4) Blowing litter
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(5) Moisture infiltration
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	f. Procedures for applying initial cover including minimum cover frequencies;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	g. Procedures for applying intermediate cover;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	h. Time frames for applying final cover;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	i. Procedures for controlling scavenging and salvaging.

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART K CONTINUED
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	j. Description of litter policing methods;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	k. Erosion control procedures.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. Describe operational procedures for leachate management including; (62-701.500(8),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Leachate level monitoring, sampling, analysis and data results submitted to the Department;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Operation and maintenance of leachate collection and removal system, and treatment as required;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Procedures for managing leachate if it becomes regulated as a hazardous waste;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Identification of treatment or disposal facilities that may be used for off-site discharge and treatment of leachate;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	e. Contingency plan for managing leachate during emergencies or equipment problems;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	f. Procedures for recording quantities of leachate generated in gal/day and including this in the operating record;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	g. Procedures for comparing precipitation experienced at the landfill with leachate generation rates and including this information in the operating record;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	h. Procedures for water pressure cleaning or video inspecting leachate collection systems.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. Describe how the landfill receiving degradable wastes shall implement a gas management system meeting the requirements of Rule 62-701.530, FAC; (62-701.500(9),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. Describe procedures for operating and maintaining the landfill stormwater management system to comply with the requirements of Rule 62-701.400(9); (62-701.500(10),FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART K CONTINUED
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. Equipment and operation feature requirements; (62-701.500(11),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Sufficient equipment for excavating, spreading, compacting and covering waste;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Reserve equipment or arrangements to obtain additional equipment within 24 hours of breakdown;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Communications equipment;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Dust control methods;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	e. Fire protection capabilities and procedures for notifying local fire department authorities in emergencies;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	f. Litter control devices;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	g. Signs indicating operating authority, traffic flow, hours of operation, disposal restrictions.
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. Provide a description of all-weather access road, inside perimeter road and other roads necessary for access which shall be provided at the landfill; (62-701.500(12),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. Additional record keeping and reporting requirements; (62-701.500(13),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Records used for developing permit applications and supplemental information maintained for the design period of the landfill;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	b. Monitoring information, calibration and maintenance records, copies of reports required by permit maintained for at least 10 years;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	c. Maintain annual estimates of the remaining life of constructed landfills and of other permitted areas not yet constructed and submit this estimate annually to the Department;
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	d. Procedures for archiving and retrieving records which are more than five year old.

PART L. WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS (62-701.510, FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input checked="" type="checkbox"/>	<u>Section L.1</u>	<input type="checkbox"/>	<input type="checkbox"/>	1. Water quality and leachate monitoring plan shall be submitted describing the proposed ground water, surface water and leachate monitoring systems and shall meet at least the following requirements;
<input type="checkbox"/>	<u>Section L.1.a</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	a. Based on the information obtained in the hydrogeological investigation and signed, dated and sealed by the PG or PE who prepared it; (62-701.510(2)(a),FAC)
<input type="checkbox"/>	<u>Section L.1.b</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	b. All sampling and analysis performed in accordance with Chapter 62-160, FAC; (62-701.510(2)(b),FAC)
<input checked="" type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input type="checkbox"/>	c. Ground water monitoring requirements; (62-701.510(3),FAC)
<input type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(1) Detection wells located downgradient from and within 50 feet of disposal units;
<input type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(2) Downgradient compliance wells as required;
<input type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(3) Background wells screened in all aquifers below the landfill that may be affected by the landfill;
<input type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(4) Location information for each monitoring well;
<input type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(5) Well spacing no greater than 500 feet apart for downgradient wells and no greater than 1500 feet apart for upgradient wells unless site specific conditions justify alternate well spacings;
<input type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(6) Well screen locations properly selected;
<input checked="" type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input type="checkbox"/>	(7) Monitoring wells constructed to provide representative ground water samples;
<input type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(8) Procedures for properly abandoning monitoring wells;
<input type="checkbox"/>	<u>Section L.1.c</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(9) Detailed description of detection sensors if proposed.
<input checked="" type="checkbox"/>	<u>Section L.1.d</u>	<input type="checkbox"/>	<input type="checkbox"/>	d. Surface water monitoring requirements; (62-701.510(4),FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART L CONTINUED
<input type="checkbox"/>	Section L.1.d	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(1) Location of and justification for all proposed surface water monitoring points;
<input type="checkbox"/>	Section L.1.d	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(2) Each monitoring location to be marked and its position determined by a registered Florida land surveyor;
<input type="checkbox"/>	Section L.1.e	<input type="checkbox"/>	<input checked="" type="checkbox"/>	e. Leachate sampling locations proposed; (62-701.510(5),FAC)
<input type="checkbox"/>	Section L.1.f	<input type="checkbox"/>	<input checked="" type="checkbox"/>	f. Initial and routine sampling frequency and requirements; (62-701.510(6),FAC)
<input type="checkbox"/>	Section L.1.f	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(1) Initial background ground water and surface water sampling and analysis requirements;
<input type="checkbox"/>	Section L.1.f	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(2) Routine leachate sampling and analysis requirements;
<input type="checkbox"/>	Section L.1.f	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(3) Routine monitoring well sampling and analysis requirements;
<input type="checkbox"/>	Section L.1.f	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(4) Routine surface water sampling and analysis requirements.
<input checked="" type="checkbox"/>	Section L.1.g	<input type="checkbox"/>	<input type="checkbox"/>	g. Describe procedures for implementing evaluation monitoring, prevention measures and corrective action as required; (62-701.510(7),FAC)
<input checked="" type="checkbox"/>	Section L.1.h	<input type="checkbox"/>	<input type="checkbox"/>	h. Water quality monitoring report requirements;(62-701.510(9),FAC)
<input type="checkbox"/>	Section L.1.h	<input type="checkbox"/>	<input checked="" type="checkbox"/>	(1) Semi-annual report requirements (see paragraphs 62 701.510(6)(c),(d)and (e) for sampling frequencies);
<input checked="" type="checkbox"/>	Section L.1.h	<input type="checkbox"/>	<input type="checkbox"/>	(2) Documentation that the water quality data shall be provided to the Department in an electronic format consistent with requirements for importing into Department databases, unless an alternate form of submittal is specified in the permit.
<input checked="" type="checkbox"/>	Section L.1.h	<input type="checkbox"/>	<input type="checkbox"/>	(3) Two and one-half year report requirements, or every five years if in long-term care, signed, dated and sealed by PG or PE.

PART M. SPECIAL WASTE HANDLING REQUIREMENTS (62-701.520, FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. Describe procedures for managing motor vehicles; (62-701.520(1),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Describe procedures for landfilling shredded waste; (62-701.520(2),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. Describe procedures for asbestos waste disposal; (62-701.520(3),FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. Describe procedures for disposal or management of contaminated soil; (62-701.520(4), FAC)
<input type="checkbox"/>	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. Describe procedures for disposal of biological wastes; (62-701.520(5), FAC)

PART N. GAS MANAGEMENT SYSTEM REQUIREMENTS (62-701.530,FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input type="checkbox"/>	Section N.1 _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1. Provide the design for a gas management system that will (62-701.530(1), FAC):
<input type="checkbox"/>	Section N.1 _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	a. Be designed to prevent concentrations of combustible gases from exceeding 25% the LEL in structures and 100% the LEL at the property boundary;
<input type="checkbox"/>	Section N.1 _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	b. Be designed for site-specific conditions;
<input type="checkbox"/>	Section N.1 _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	c. Be designed to reduce gas pressure in the interior of the landfill;
<input type="checkbox"/>	Section N.1 _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	d. Be designed to not interfere with the liner, leachate control system or final cover.
<input type="checkbox"/>	Section N.2 _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2. Provide documentation that will describe locations, construction details and procedures for monitoring gas at ambient monitoring points and with soil monitoring probes; (62-701.530(2), FAC):
<input type="checkbox"/>	Section N.3 _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	3. Provide documentation describing how the gas remediation plan and odor remediation plan will be implemented; (62-701.530(3), FAC):
<input type="checkbox"/>	Section N.4 _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>	4. Landfill gas recovery facilities; (62-701.530(5), FAC):

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART N CONTINUED
* <input type="checkbox"/>	Section N.4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	a. Information required in Rules 62-701.320(7) and 62-701.330(3), FAC supplied;
<input type="checkbox"/>	Section N.4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	b. Information required in Rule 62-701.600(4), FAC supplied where relevant and practical;
* <input type="checkbox"/>	Section N.4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	c. Estimate of current and expected gas generation rates and description of condensate disposal methods provided;
* <input type="checkbox"/>	Section N.4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	d. Description of procedures for condensate sampling, analyzing and data reporting provided;
<input type="checkbox"/>	Section N.4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	e. Closure plan provided describing methods to control gas after recovery facility ceases operation and any other requirements contained in Rule 62-701.400(10), FAC;
<input type="checkbox"/>	Section N.4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	f. Performance bond provided to cover closure costs if not already included in other landfill closure costs.

PART O. LANDFILL FINAL CLOSURE REQUIREMENTS (62-701.600,FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input checked="" type="checkbox"/>	Section O.1	<input type="checkbox"/>	<input type="checkbox"/>	1. Closure permit requirements; (62-701.600(2),FAC)
<input checked="" type="checkbox"/>	Section O.1a	<input type="checkbox"/>	<input type="checkbox"/>	a. Application submitted to Department at least 90 days prior to final receipt of wastes;
<input checked="" type="checkbox"/>	Section O.1b	<input type="checkbox"/>	<input type="checkbox"/>	b. Closure plan shall include the following:
<input checked="" type="checkbox"/>	Section O.2	<input type="checkbox"/>	<input type="checkbox"/>	(1) Closure design plan;
<input checked="" type="checkbox"/>	Section O.3	<input type="checkbox"/>	<input type="checkbox"/>	(2) Closure operation plan;
<input checked="" type="checkbox"/>	Section Q	<input type="checkbox"/>	<input type="checkbox"/>	(3) Plan for long-term care;
<input checked="" type="checkbox"/>	Section R	<input type="checkbox"/>	<input type="checkbox"/>	(4) A demonstration that proof of financial responsibility for long-term care will be provided.

	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART O CONTINUED
<input checked="" type="checkbox"/>	Section O.2	<input type="checkbox"/>	<input type="checkbox"/>	2. Closure design plan including the following requirements: (62-701.600(3),FAC)
<input checked="" type="checkbox"/>	Section O.2.a	<input type="checkbox"/>	<input type="checkbox"/>	a. Plan sheet showing phases of site closing;
<input checked="" type="checkbox"/>	Section O.2.b	<input type="checkbox"/>	<input type="checkbox"/>	b. Drawings showing existing topography and proposed final grades;
<input checked="" type="checkbox"/>	Section O.2.c	<input type="checkbox"/>	<input type="checkbox"/>	c. Provisions to close units when they reach approved design dimensions;
<input checked="" type="checkbox"/>	Section O.2.d	<input type="checkbox"/>	<input type="checkbox"/>	d. Final elevations before settlement;
<input checked="" type="checkbox"/>	Section O.2.e	<input type="checkbox"/>	<input type="checkbox"/>	e. Side slope design including benches, terraces, down slope drainage ways, energy dissipaters and discussion of expected precipitation effects;
<input checked="" type="checkbox"/>	Section O.2.f	<input type="checkbox"/>	<input type="checkbox"/>	f. Final cover installation plans including:
<input checked="" type="checkbox"/>	Section O.2.f	<input type="checkbox"/>	<input type="checkbox"/>	(1) CQA plan for installing and testing final cover;
<input checked="" type="checkbox"/>	Section O.2.f	<input type="checkbox"/>	<input type="checkbox"/>	(2) Schedule for installing final cover after final receipt of waste;
<input checked="" type="checkbox"/>	Section O.2.f	<input type="checkbox"/>	<input type="checkbox"/>	(3) Description of drought-resistant species to be used in the vegetative cover;
<input checked="" type="checkbox"/>	Section O.2.f	<input type="checkbox"/>	<input type="checkbox"/>	(4) Top gradient design to maximize runoff and minimize erosion;
<input checked="" type="checkbox"/>	Section O.2.f	<input type="checkbox"/>	<input type="checkbox"/>	(5) Provisions for cover material to be used for final cover maintenance.
<input checked="" type="checkbox"/>	Section O.2.g	<input type="checkbox"/>	<input type="checkbox"/>	g. Final cover design requirements:
<input checked="" type="checkbox"/>	Section O.2.g	<input type="checkbox"/>	<input type="checkbox"/>	(1) Protective soil layer design;
<input checked="" type="checkbox"/>	Section O.2.g	<input type="checkbox"/>	<input type="checkbox"/>	(2) Barrier soil layer design;

S	LOCATION	N/A	N/C	PART O CONTINUED
<input checked="" type="checkbox"/>	Section O.2.g	<input type="checkbox"/>	<input type="checkbox"/>	(3) Erosion control vegetation;
<input checked="" type="checkbox"/>	Section O.2.g	<input type="checkbox"/>	<input type="checkbox"/>	(4) Geomembrane barrier layer design;
<input checked="" type="checkbox"/>	Section O.2.g	<input type="checkbox"/>	<input type="checkbox"/>	(5) Geosynthetic clay liner design if used;
<input checked="" type="checkbox"/>	Section O.2.g	<input type="checkbox"/>	<input type="checkbox"/>	(6) Stability analysis of the cover system and the disposed waste.
<input checked="" type="checkbox"/>	Section O.2.h	<input type="checkbox"/>	<input type="checkbox"/>	h. Proposed method of stormwater control;
<input checked="" type="checkbox"/>	Section O.2.i	<input type="checkbox"/>	<input type="checkbox"/>	i. Proposed method of access control;
<input checked="" type="checkbox"/>	Section O.2.j	<input type="checkbox"/>	<input type="checkbox"/>	j. Description of the proposed or existing gas management system which complies with Rule 62-701.530, FAC.
<input checked="" type="checkbox"/>	Section O.3	<input type="checkbox"/>	<input type="checkbox"/>	3. Closure operation plan shall include:(62-701.600(4),FAC)
<input checked="" type="checkbox"/>	Section O.3.a	<input type="checkbox"/>	<input type="checkbox"/>	a. Detailed description of actions which will be taken to close the landfill;
<input checked="" type="checkbox"/>	Section O.3.b	<input type="checkbox"/>	<input type="checkbox"/>	b. Time schedule for completion of closing and long-term care;
<input checked="" type="checkbox"/>	Section O.3.c	<input type="checkbox"/>	<input type="checkbox"/>	c. Describe proposed method for demonstrating financial assurance for long-term care;
<input checked="" type="checkbox"/>	Section O.3.d	<input type="checkbox"/>	<input type="checkbox"/>	d. Operation of the water quality monitoring plan required in Rule 62-701.510, FAC.
<input checked="" type="checkbox"/>	Section O.3.e	<input type="checkbox"/>	<input type="checkbox"/>	e. Development and implementation of gas management system required in Rule 62-701.530, FAC.
<input checked="" type="checkbox"/>	Section O.4	<input type="checkbox"/>	<input type="checkbox"/>	4. Certification of closure construction completion including: (62-701.600(6),FAC)
<input checked="" type="checkbox"/>	Section O.4.a	<input type="checkbox"/>	<input type="checkbox"/>	a. Survey monuments; (62-701.600(6)(a),FAC)
<input checked="" type="checkbox"/>	Section O.4.b	<input type="checkbox"/>	<input type="checkbox"/>	b. Final survey report; (62-701.600(6)(b),FAC)

	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	PART O CONTINUED
<input checked="" type="checkbox"/>	Section O.5	<input type="checkbox"/>	<input type="checkbox"/>	5. Declaration to the public; (62-701.600(7),FAC)
<input checked="" type="checkbox"/>	Section O.6	<input type="checkbox"/>	<input type="checkbox"/>	6. Official date of closing; (62-701.600(8),FAC)
<input type="checkbox"/>	Section O.7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. Justification for and detailed description of procedures to be followed for temporary closure of the landfill, if desired; (62-701.600(9),FAC)

PART P. OTHER CLOSURE PROCEDURES (62-701.610,FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input checked="" type="checkbox"/>	Section P.1	<input type="checkbox"/>	<input type="checkbox"/>	1. Describe how the requirements for use of closed solid waste disposal areas will be achieved;(62-701.610(1),FAC)
<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Describe how the requirements for relocation of wastes will be achieved; (62-701.610(2), FAC)

PART Q. LONG-TERM CARE (62-701.620,FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input checked="" type="checkbox"/>	Section Q.1	<input type="checkbox"/>	<input type="checkbox"/>	1. Maintaining the gas collection and monitoring system; (62-701.620(5), FAC)
<input checked="" type="checkbox"/>	Section Q.2	<input type="checkbox"/>	<input type="checkbox"/>	2. Stabilization report requirements; (62-701.620(6),FAC)
<input checked="" type="checkbox"/>	Section Q.3	<input type="checkbox"/>	<input type="checkbox"/>	3. Right of access;(62-701.620(7),FAC)
<input checked="" type="checkbox"/>	Section Q.4	<input type="checkbox"/>	<input type="checkbox"/>	4. Requirements for replacement of monitoring devices; (62-701.620(8),FAC)
<input checked="" type="checkbox"/>	Section Q.5	<input type="checkbox"/>	<input type="checkbox"/>	5. Completion of long-term care signed and sealed by professional engineer (62-701.620(9), FAC).

PART R. FINANCIAL ASSURANCE (62-701.630,FAC)

<u>S</u>	<u>LOCATION</u>	<u>N/A</u>	<u>N/C</u>	
<input checked="" type="checkbox"/>	<u>Section R.1</u>	<input type="checkbox"/>	<input type="checkbox"/>	1. Provide cost estimates for closing, long-term care, and corrective action costs estimated by a PE for a third party performing the work, on a per unit basis, with the source of estimates indicated; (62-701.630(3)&(7), FAC).
<input checked="" type="checkbox"/>	<u>Section R.2</u>	<input type="checkbox"/>	<input type="checkbox"/>	2. Describe procedures for providing annual cost adjustments to the Department based on inflation and changes in the closing, long-term care, and corrective action plans; (62-701.630(4)&(8), FAC).
<input checked="" type="checkbox"/>	<u>Section R.3</u>	<input type="checkbox"/>	<input type="checkbox"/>	3. Describe funding mechanisms for providing proof of financial assurance and include appropriate financial assurance forms; (62-701.630(5),(6),&(9), FAC).
<input type="checkbox"/>	<u>Section R.3</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. Provide documentation and the appropriate forms for delaying submitting proof of financial assurance for solid waste disposal units that qualify; (62-701.630(2)(c), FAC).

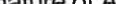
PART S.

Applicant:

The undersigned applicant or authorized representative of Volusia County

_____ is aware that statements made in this form and attached

information are an application for a Closure Permit from the Florida Department of Environmental Protection and certifies that the information in this application is true, correct and complete to the best of his/her knowledge and belief. Further, the undersigned agrees to comply with the provisions of Chapter 403, Florida Statutes, and all rules and regulations of the Department. It is understood that the Permit is not transferable, and the Department will be notified prior to the sale or legal transfer of the permitted facility.


Signature of Applicant or Agent

Leonard Marion, Director
Name and Title (please type)

Imarion@co.volusia.fl.us
E-Mail address (if available)

3151 East New York Avenue

Mailing Address

DeLand, FL 32724

City, State, Zip Code

(386) 943-7889

Telephone Number

Date: 8/28/2010

Attach letter of authorization if agent is not a governmental official, owner, or corporate officer.

Professional Engineer registered in Florida (or Public Officer if authorized under Sections 403.707 and 403.7075, Florida Statutes):

This is to certify that the engineering features of this solid waste management facility have been designed/examined by me and found to conform to engineering principles applicable to such facilities. In my professional judgment, this facility, when properly maintained and operated, will comply with all applicable statutes of the State of Florida and rules of the Department. It is agreed that the undersigned will provide the applicant with a set of instructions of proper maintenance and operation of the facility.

Signature

Mark Roberts P.E., Vice President
Name and Title (please type)

200 W. Forsyth St., Ste. 800

Mailing Address

Jacksonville, FL 32202-4321

City, State, Zip Code

Mark.Roberts@hdrinc.com

E-Mail address (if available)

54187

Florida Registration Number
(please affix seal)

(904) 598-8979

Telephone Number

Date:



Volusia County
Solid Waste Division

Tomoka Farms Road Landfill
North Cell Class I Closure
Intermediate Modification Permit Application

Prepared for:

Volusia County – Solid Waste Division
3151 East New York Avenue
DeLand, Florida 32724

Submitted by:

SCS Engineers
504 North Grandview Avenue, Ste. 400
Daytona Beach, Florida 32118
Date: November 15, 2006

Revised by:

HDR Engineering, Inc.
200 W. Forsyth Street, Ste. 800
Jacksonville, Florida 32202
Date: August 25, 2010

A handwritten signature in blue ink, which appears to read "Mark Roberts", is written over a horizontal line. Below the signature, the date "8/24/10" is handwritten in blue ink.

Mark Roberts, P.E.
Florida P.E. No.: 54187

HDR Project No. 0195-139929-002

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APPENDICES

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APPENDIX C	CQA PLAN
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SECTION A

GENERAL INFORMATION

The information required for Part A of the permit application is included on the application form.

The following documents are incorporated by reference into this permit application:

1. Application to Renew Existing Operations Permit, North Class I Cell, Tomoka Farms Road Landfill dated July 8, 2002.
2. Construction Permit Application/Operation Permit Modification Tomoka Farms Road Landfill, East Cell Expansion dated April 3, 2002. Received and stamped May 28, 2002, DEP – Central District.
3. Tomoka Farms Road Landfill, East Cell Expansion Geotechnical Report, dated November 14, 2000. Received and stamped May 28, 2002, Central District – DEP.
4. January 2002 Drawings: Volusia County Tomoka Farms Road Landfill East Cell Expansion. Included with the April 3, 2002 Application. Received and stamped May 28, 2002, DEP – Central District.
5. Volusia County, Tomoka Farms Road Landfill, Environmental Resource Permit Modification, dated January 22, 2003, prepared by SCS Engineers.
6. November 2005 Record Drawings: Volusia County Tomoka Farms Road Landfill East Cell Expansion (included with Construction Certification Report). Received and stamped December 19, 2005, Central District – DEP.
7. Construction Certification Report, Volusia County Tomoka Farms Road Landfill East Cell Expansion, submitted to FDEP December 19, 2005. Received and stamped December 19, 2005, Central District – DEP.
8. Application for Intermediate Modification of Operation Permit to Construct and Operate a Landfill Gas Collection and Control System, dated October 2003. Received and stamped October 15, 2003, Central District – DEP.
9. Closure Permit Application, Tomoka Farms Road Landfill – North and East Class I Cell, November 15, 2006. Received and stamped December 1, 2006, Central District – DEP.
10. Tomoka Farms Road Landfill, North and East Cell Closure Permit Drawings dated October 2006. Received and stamped December 1, 2006, Central District – DEP.
11. FDEP Application for Renewal of Operations Permit North Cell Class I Landfill, Tomoka Farms Road Landfill dated June 2007, Prepared by Neel-Schaffer, Maitland, Florida. Received and stamped July 2, 2007, DEP – Central District
12. Updated Operations Plan and Fill Sequence dated September 5, 2008. Received and stamped September 8, 2008, DEP – Central District.
13. August 2009 Drawings: Volusia County Tomoka Farms Road Landfill Class I Cell Fill Sequence Plan. Received and stamped August 14, 2009, DEP – Central District.
14. Financial Responsibility Closure & Long-Term Care Cost Estimates FY 2009, dated August 2009.

15. Updated Monitoring Plan Implementation Schedule (MPIS) approved as part of the Solid Waste Operating Permit, Class III. Permit Issued December 10, 2009, DEP – Central District.
16. Updated Operations Plan dated July 1, 2010. Received and stamped July 1, 2010, DEP – Central District.

SECTION B

DISPOSAL FACILITY GENERAL INFORMATION

Volusia County (County) operates the North Class I disposal cell at the Tomoka Farms Road Landfill under Permit No SO64-0078767-016023, issued by the Florida Department of Environmental Protection (FDEP) on ~~November 8, 2002~~ June 2, 2008. Prior to the current Operations Permit, the North Class I disposal cell was divided into two cells, the North and East cells. However, these cells are now considered one and referred to as the North Cell. On December 9, 2002, the FDEP issued Permit No. SC64-0078767-014 and SO64-0078767-015 to construct and operate the East Class I disposal cell, a lateral expansion of the North Cell. The County intends to install final cover over portions of the combined North and East Cell that have reached final permitted elevation. This closure permit application describes the County's plan of closure for the combined North and East Cell.

The construction permits for the North and East Cell describe the final cover, in descending order, to consist of six inches of topsoil, 18 inches of compacted protective soil layer, double sided geocomposite, 40-mil linear low density polyethylene (LLDPE) flexible geomembrane liner, and 12 inches grading layer of granular fill (intermediate cover) to protect the geomembrane from the underlying solid waste. This A closure permit application was submitted in November 2006 that included the constructing construction of an exposed geomembrane cover (EGC) on the south slope of the North and East Cell; however, the County is now applying to modify that closure permit in order to remove the EGC plans and use a traditional soil final cover in its place. The County no longer intends to construct an infill between the south slope of the North and East Cell and the closed South Class I Cell in the next 15 years, at which time the EGC will be covered and incorporated into the design of the infill. Construction of the infill is not included in this permit application; therefore, the closure intermediate permit modification reflects this change.

The closure contours provided in the intermediate permit modification were submitted in August of 2009 to the FDEP in the Fill Sequence Plan for the North Cell. The Fill Sequence Plan provided design contours for the top of final closure grades and access road grades. The grades provided in the Fill Sequence Plan reflected the eastern expansion as-built location and relocation of the access road and downdrains. The closure intermediate permit modification does not modify the submitted Fill Sequence Plan's top of final closure grades or access road grades.

The South Cell was closed under permit SF64-0078767-011, issued March 8, 2001 and expiring on January 30, 2006. The County has been performing post closure care for the South Cell, including water quality monitoring, landfill gas monitoring, maintenance of the final cover, stormwater management facilities, and monitoring devices, as part of on-going landfill activities. Because the South Cell is physically adjacent to the North and East Cell, and because the County intended to construct an infill combining these Class I cells into a single cell, the County is requesting by this permit application that was approved to include the post closure care of the South Cell be included in the closure permit for with the North and East Cell. There are no

longer any plans to infill the area between the South and North Cells but the post closure care for the two cells are still combined. A Closure and Post Closure Care Plan is provided with the permit modification which includes post closure care for both the South and North Cells.

~~SECTION C~~

~~NON-DISPOSAL FACILITY GENERAL INFORMATION~~

~~Part C of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form.~~

~~SECTION F~~SECTION C

PROHIBITIONS

Part ~~D~~C of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form. Volusia County does not seek any exemptions to the prohibitions of 62-701.300.

~~SECTION G~~SECTION D

GENERAL PERMIT REQUIREMENTS

~~Part E of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form.~~

D.1 PERMIT APPLICATION COPIES

Four (4) copies of the completed application form, supporting data and reports have been submitted herewith.

D.2 CERTIFICATION

Appropriate professional certifications are provided on all applicable submittals herewith.

D.3 TRANSMITTAL LETTER

A letter of transmittal to FDEP is submitted herewith.

D.4 FDEP FORM

A completed, dated, signed and sealed application form is included in this closure intermediate modification permit application.

D.5 PERMIT APPLICATION FEE

A check in the amount of \$7,500.00 for the closure intermediate modification permit application is submitted herewith.

D.6 ENGINEERING REPORT

The Engineering Report is contained herewith. The Engineering Report submitted with the original permit application in 2006 is used and references existing information where needed and includes information that has changed since the original closure permit. A "strikeout/underline" system has been used to ease the Department's review.

D.7 OPERATIONS PLAN AND CLOSURE PLAN

A Closure and Long Term Care Plan has been provided with this permit application. The Operations Plan was submitted with the Operations Permit Renewal in June 2007 and is not being revised as part of this application.

D.8 CONTINGENCY PLAN

The Contingency Plan has been provided as part of the previously submitted Operations Plan and is not being revised as part of this application.

D.9 DRAWINGS FOR THE SOLID WASTE MANAGEMENT FACILITIES

The Closure Design Drawings are provided in Appendix A and meet the requirements of 62-701.320(7)(f), FAC.

D.10 PROOF OF PROPERTY OWNERSHIP

Please refer to the documents submitted/referenced in Part A. There have been no changes to this information.

D.11 RECYCLING GOAL ACHIEVEMENT

Please refer to the documents submitted/referenced in Part A. There have been no changes to this information.

D.12 HISTORY OF FDEP ENFORCEMENT ACTIVITIES

Please refer to the documents submitted/referenced in Part A. There have been no changes to this information.

D.13 PROOF OF PUBLICATION OF LANDFILL PERMIT APPLICATIONS

The proof of publication in a newspaper of general circulation is not applicable for an intermediate modification application.

D.14 AIRPORT SAFETY REQUIREMENTS

Please refer to the documents submitted/referenced in Part A. There have been no changes to this information.

D.15 CERTIFIED OPERATORS

Please refer to the documents submitted/referenced in Part A. There have been no changes to this information.

~~SECTION H~~SECTION E

LANDFILL PERMIT REQUIREMENTS

Part ~~F-E~~ of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form.

~~SECTION I~~ SECTION F

GENERAL CRITERIA FOR LANDFILLS

Part ~~G~~F of the permit application does not apply to this closure permit application and is designated as “Not Applicable” on the application form.

~~SECTION J~~SECTION G

LANDFILL CONSTRUCTION REQUIREMENTS

Part ~~H~~G of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form.

~~SECTION K~~ SECTION H

HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS

| Part ~~H~~H of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form.

~~SECTION L~~SECTION I

GEOTECHNICAL INVESTIGATION REQUIREMENTS

Part ~~J~~I of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form.

~~SECTION M~~SECTION J

VERTICAL EXPANSION REQUIREMENTS

| Part ~~K~~J of the permit application does not apply to this closure permit application and is designated as “Not Applicable” on the application form.

~~SECTION N~~SECTION K

LANDFILL OPERATION REQUIREMENTS

Part ~~L~~K of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form.

~~SECTION O~~SECTION L

WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS

ML.1 WATER QUALITY AND LEACHATE MONITORING

The groundwater, surface water, and leachate monitoring requirements were proposed in the Tomoka Farms Road Landfill Groundwater Monitoring Plan Modification, Class I East Cell dated July 18, 2000. These changes have been fully integrated into the current Monitoring Plan Implementation Schedule (MPIS), as part of the February 15, 2007 operations permit modification/closure permit and further updated in November 2009 to comply with the revised Chapter 62-701, F.A.C. rules promulgated in January 2010. The application for this modification was submitted in December 2006.

~~Minor~~No changes to the ground water monitoring plan are proposed in this application in order as it is compliant with the revised 62-701 rules promulgated in January 2010.

0.1.aL.1.a Hydrogeological Investigation

A summary of the previous hydrogeological reports for the North and East Cell was included in Attachment I-1 in the 2002 Application for a Construction Permit and Operation Permit Modification for the Tomoka Farms Road East Cell Expansion permit application report.

0.1.bL.1.b Sampling and Analysis

All sampling and analysis is performed in accordance with Chapter 62-160, Florida Administrative Code (FAC), as required by 62-701.510(2)(b) FAC. The County contracts with ~~Elab, Inc.~~, a certified environmental laboratory, to collect and analyze ground and surface water samples.

0.1.cL.1.c Ground Water Monitoring

The groundwater monitoring system is described in the Monitoring Plan Implementation Schedule WACS 27540, attached as Exhibit I to the North and East Cell operating permit, updated in November 2009s. Groundwater is monitored through Background and Compliance wells in the surficial and Floridan aquifers.

The monitoring wells for ~~each monitored zone~~the surficial aquifer are summarized in Table ~~ML-~~1:

**TABLE ML-1. GROUNDWATER MONITORING WELLS
TOMOKA FARMS ROAD LANDFILL**

<u>WELL SITE NUMBER</u>	<u>ZONE</u>
<u>B1-B</u>	<u>4</u>
<u>B2</u>	<u>4</u>
<u>B5</u>	<u>4</u>
<u>B8</u>	<u>6</u>
<u>B8-2</u>	<u>4</u>
<u>B11</u>	<u>1-2</u>
<u>B-32</u>	<u>4</u>
<u>B33-1</u>	<u>4</u>
<u>B33-2</u>	<u>1-2</u>
<u>B34-1</u>	<u>4</u>
<u>B34-2</u>	<u>1-2</u>
<u>B35-1</u>	<u>4</u>
<u>B35-2</u>	<u>1-2</u>
<u>B36</u>	<u>4</u>
<u>B37-1</u>	<u>4</u>
<u>B37-2</u>	<u>1-2</u>
<u>B38-1</u>	<u>4</u>
<u>B38-2</u>	<u>1-2</u>
<u>B39</u>	<u>1-2</u>
<u>B40-1</u>	<u>4</u>
<u>B40-2</u>	<u>1-2</u>
<u>B41-1</u>	<u>4</u>
<u>B41-2</u>	<u>1-2</u>
<u>B42-1</u>	<u>4</u>
<u>B42-2</u>	<u>1-2</u>
<u>B43-1</u>	<u>3-4</u>
<u>B43-2</u>	<u>1-2</u>
<u>B44</u>	<u>1-2</u>
<u>B45-1</u>	<u>4</u>
<u>B45-2</u>	<u>1-2</u>
<u>B59-1R</u>	<u>4</u>
<u>B59-2R</u>	<u>1-2</u>
<u>B60</u>	<u>4</u>
<u>B61R</u>	<u>1-2</u>
<u>B62-1R</u>	<u>4</u>
<u>B62-2R</u>	<u>1-2</u>
<u>B63-1</u>	<u>4</u>
<u>B63-2</u>	<u>1-2</u>
<u>B64</u>	<u>1-2</u>

<u>B65</u>	<u>1-2</u>
<u>B66</u>	<u>1-2</u>
<u>B68</u>	<u>4</u>
<u>B70-1</u>	<u>4</u>
<u>B70-2</u>	<u>1-2</u>
<u>B71</u>	<u>1-2</u>
<u>B72</u>	<u>1-2</u>
<u>B73-1</u>	<u>4</u>
<u>B73-2</u>	<u>1-2</u>
<u>B74</u>	<u>1-2</u>
<u>B75</u>	<u>1-2</u>
<u>FA-1B</u>	<u>FLORIDAN</u>
<u>FA-2C</u>	<u>FLORIDAN</u>
<u>F-MB</u>	<u>FLORIDAN</u>
<u>MO5-B</u>	<u>4</u>

There are two Floridan monitoring wells at the site. The Floridan wells are identified as follows:

- FA-1B
- FA-2C

No changes to the ground water monitoring plan are proposed in this application as it complies with the revised 62-701 rules promulgated in January 2010.

The monitoring wells constructed provide representative ground water samples as required in 62-701.510(3), F.A.C.

Groundwater samples are collected semi-annually and analyzed by an approved environmental laboratory for the parameters identified in 62-701.510(8)(a) and (8)(d), F.A.C.

0.1.dL.1.d Surface Water Monitoring

The surface water monitoring system is described in the Monitoring Plan Implementation Schedule MPIS WACS 27540, attached as Exhibit I to the North and East Cell operating permits, updated in November 2009. Surface water is monitored through the collection of surface water samples from the following eight-seven sampling locations:

- SW-1
- SW-2
- SW-3
- SW-4
- SW-5
- SW-6
- SW-9

- SW-10SW-11
- SW-12

No changes to the surface water monitoring plan are proposed in this application as it complies with the revised 62-701, F.A.C. rules promulgated in January 2010.

Surface water samples are collected semi-annually and analyzed by an approved environmental laboratory for the parameters identified in 62-701.501(8)(b).

0.1.eL.1.e Leachate Sampling

Leachate monitoring is described in the ~~Monitoring Plan Implementation Schedule~~MPIS WACS 27540, attached as Exhibit I to the North and East Cell operating permits, updated in November 2009. Leachate is monitored through the collection of leachate samples from the North Leachate Pond.

No changes to the leachate monitoring plan are proposed in this application as it complies with the revised 62-701 rules promulgated in January 2010.

Leachate samples are collected annually and analyzed by an approved environmental laboratory for the parameters listed in 62-701.510(8)(c) and (8)(d), F.A.C.

0.1.fL.1.f Sampling Frequency

Sampling frequency is described in the Monitoring Plan Implementation Schedule WACS 27540, attached as Exhibit I to the North and East Cell operating permits, updated in November 2009.

No changes to the sampling frequency are proposed in this application.

0.1.gL.1.g Procedures for Implementing Evaluation Monitoring

Requirements for evaluation monitoring are described in Rule 62-701.510(7) FAC. If monitoring parameters are detected in detection wells in concentrations which are significantly above background water quality, or which are at levels above the FDEP water quality standards or criteria specified in Chapter 62-520, F.A.C., the County will resample the wells within 30 days after the sampling data is received, to confirm the data. If the data is confirmed, the County will notify the FDEP in writing within 14 days of this finding. Upon notification by the FDEP, the County will initiate evaluation monitoring as follows:

1. Routine monitoring of all monitoring wells, surface water monitoring locations and leachate sampling locations will continue according to the water quality monitoring permit requirements.
2. Within 90 days of notification from the FDEP to initiate~~ing~~ evaluation monitoring and annually thereafter, the County will sample and analyze a representative sample of the

background wells and all affected detection wells for the parameters listed in Rule 62-701.510(8)(d) FAC. Any new parameters detected and confirmed in the affected downgradient wells will be added to the routine ground water monitoring parameter lists, required in Rule 62-701.510(6) FAC for the affected wells. However, if the parameters detected in the detection wells consist only of Iron, Aluminum, Manganese, Sulfates, or Total Dissolved Solids (TDS), either individually or in any combination, then only the detected parameters will be monitored in the representative background wells, affected detection wells, and downgradient compliance wells rather than the parameters listed in 62-701.510(8)(a) and (8)(d), F.A.C.

3. Within 90 days of notification from the FDEP to initiateing evaluation monitoring, the County will install and sample compliance monitoring wells at the compliance line of the zone of discharge and downgradient from the affected detection monitoring wells. These wells will be installed according to the requirements of Rule 62-701.510(3)(d) FAC, and samples from these wells and the affected detection wells will be analyzed quarterly for the parameters listed in Rule 62-701.510(8)(a), F.A.C. and annually for the parameters listed in 62-701.510(8) (d) F.A.C.

4. Within 180 days of notification from the FDEP to initiateing evaluation monitoring, the County will submit a contamination evaluation plan to the FDEP. This plan will be designed to delineate the extent and cause of the contamination, in order to predict the likelihood that FDEP water quality standards will be violated outside the zone of discharge, and to evaluate methods to prevent any such violations. After the plan is accepted by the FDEP, the County will implement the plan and submit a contamination evaluation report in accordance with the plan. All reasonable efforts will be made by the County to prevent further degradation of water quality from landfill activities.

5. The County may request a permit modification to use an alternate monitoring frequency, for repeated sampling during evaluation monitoring, based upon site specific lithology of the aquifer and unsaturated zone, hydraulic conductivity of the aquifer and unsaturated zone, ground water flow rates, minimum distance of travel and the fate and transport of parameters detected.

6. The County may request a permit modification to delete specific monitoring parameters or field parameters from evaluation analyses of detection or compliance wells if these parameters are not reasonably expected to be in or derived from the waste contained in the unit.

7. The County will continue evaluation monitoring, until authorized to return to routine monitoring only by the FDEP based upon the results of the contamination evaluation report and other relevant water quality data.

If the contamination evaluation report indicates that water quality standards are likely to be violated outside the zone of discharge, the County will, within 90 days, submit a prevention measures plan to the FDEP. Upon approval, the County will initiate measures to prevent such violations.

If any contaminants are detected and confirmed in compliance wells in concentrations which exceed both background levels and FDEP water quality standards or criteria, or are detected and

confirmed in detection wells in concentrations which are above FDEP water quality minimum criteria, the County will notify the FDEP within 14 days of this finding and will initiate corrective actions. Evaluation monitoring will continue according to the requirements of Rule 62-701.510(7)(a) FAC.

0.1.h L.1.h Water Quality Report Requirements

Water quality reporting requirements are described in the Monitoring Plan Implementation Schedule WACS 27540, attached as Exhibit I to the North and East Cell operating permits, updated in November 2009.

No changes to the sampling frequency is water quality report requirements are proposed in this application as they comply with the revised 62-701, F.A.C. rules.

Electronic water quality data will be submitted to the Department in a format consistent with importing into the Department database or as specified in the permit.

A technical report analyzing the appropriateness of the groundwater monitoring well and surface water sampling locations to intercept any potential contaminant plume that may generate from the landfill will be submitted to the FDEP every two and half years and at the landfill's permit renewal during the active life of the landfill. The report should be submitted once every five years during the long-term care period of the facility.

~~SECTION P~~SECTION M

SPECIAL WASTE HANDLING REQUIREMENTS

Part ~~N~~M of the permit application does not apply to this closure permit application and is designated as "Not Applicable" on the application form.

~~SECTION Q~~ SECTION N

GAS MANAGEMENT SYSTEM REQUIREMENTS

N.1 ~~0.1~~ GAS MANAGEMENT SYSTEM

The County installed a comprehensive landfill gas (LFG) collection and control system in the closed Class I South Cell disposal area. This system includes a series of vertical wells, lateral and header piping, and condensate management facilities. Collected LFG is piped through a transmission line to a gas recovery facility operated by ~~Minnesota Methane, LLC~~ Fortistar Methane Group. At the gas recovery facility, the LFG is either combusted in the LFG-to-energy system consisting of four Caterpillar 3516 SITA engines ~~or, the enclosed flare, or the utility flare station~~. Each of these control scenarios complies with the control requirements of the New Source Performance Standards (NSPS).

The County has completed installation of a LFG collection and control system in the North Cell ~~and now operates it, as authorized by permit SO64-0078767-018 in accordance with the requirements of the FDEP Title V Air Permit for the landfill~~. The LFG collected from the North Cell is either sent to a ~~new~~ blower/utility flare station located southwest of the North Cell or conveyed by a pipeline to the existing LFG recovery facility. The gas management system is designed to reduce gas pressure in the interior of the landfill without interfering with the bottom liner or final cover.

The County intends to expand this LFG collection system as the North Cell is developed further. Horizontal and vertical wells will be installed as needed to control odors and to meet existing and future permit requirements.

No changes to the gas management system are proposed for this closure intermediate modification permit.

N.2 ~~0.2~~ GAS MONITORING

Florida Administrative Code (FAC) 62-701.530(1)(a)1.b requires that combustible gases at the property line not exceed the lower explosive limit (LEL). There are seven landfill gas monitoring wells at the site, numbered MW-1 through MW-5, MW-7, and MW-8. Monitoring well MW-6 was deleted from the monitoring plan, as described in the SCS letter dated February 6, 2003.

Each well is tested on a quarterly basis for Methane (CH₄), Oxygen (O₂), Carbon Dioxide (CO₂), and for the Lower Explosive Limit (LEL).

Surface emissions monitoring (SEM) is conducted at the closed South Class I disposal cell, as specified in County's Title V permit, and the requirements of 40 CFR 60.755 (c) and (d), and 40 CFR 60, Appendix A, Method 21.

Florida Administrative Code (FAC) 62-701.530(1)(a)1.a requires that the concentration of combustible gases generated by the landfill not exceed twenty-five percent of the LEL for combustible gases in structures on- or off-site. To demonstrate that air quality in the maintenance building does not exceed the requirements of Rule 62-701.530(1)(a)1.b FAC, the County installed two methane detectors, model GD-21, manufactured by the Macurco Corporation, inside the maintenance building.

Methane concentrations in the ambient air in the scale house, the administration building, and the maintenance building are measured quarterly in conjunction with the perimeter gas monitoring.

No changes to the gas monitoring are proposed for this closure intermediate modification permit.

N.3 ~~O.3~~—GAS REMEDIATION PLAN

If the results of gas monitoring show that combustible gas concentrations exceed 100 percent of the LEL at the property boundary or 25 percent of the LEL in structures, the County will notify the FDEP and take all necessary steps to ensure protection of human health. Within 7 days of detection, the County will submit a gas remediation plan to the FDEP for approval. The plan will describe the nature and extent of the problem and the proposed remedy. The remedy may include installation of additional passive gas vents, active gas vents, cut-off trenches or other methods appropriate to the situation. The remedy will be completed within 60 days of detection unless otherwise approved by the FDEP.

If gas concentrations cause objectionable odors at or beyond the landfill property boundary, the County will implement a routine odor monitoring program to determine the timing and extent of any off-site odors. Immediate steps to reduce the objectionable odors will be implemented which include applying increasing initial cover, reducing the size of the working face, or ceasing operations in areas where odors have been detected. If the monitoring program confirms the existence of objectionable odors, the County will prepare and submit to the FDEP an odor remediation plan for the gas releases. The plan will describe the nature and extent of the problem and the proposed remedy. The remedy will be initiated within 30 days of approval.

No changes to the gas remediation plan are proposed for this closure intermediate modification permit.

N.4 ~~O.4~~—LANDFILL GAS RECOVERY FACILITIES

The County has completed installation of a LFG collection and control system in the North Cell. Collected LFG will be piped through a transmission line to the gas recovery facility constructed for the closed South Class I disposal cell. At the gas recovery facility, the LFG is either combusted in the LFG-to-energy system consisting of four Caterpillar 3516 SITA engines ~~or, in the enclosed flare, or the utility flare station.~~

The landfill gas recovery system will be operated as long as landfill gas is being generated at a sufficient rate to support the LFG to energy system.- When gas production in the closed landfill drops below that level, the gas will continue to be collected and destroyed in the flare. When gas production drops below the level required to operate the flare, a smaller flare will be installed to continue burn gas on an intermittent basis as it is generated. At some point, gas production will be sufficiently low that passive gravity vents will be sufficient to control gas without causing odor problems.

No changes to the gas recovery facilities are proposed for this closure intermediate modification permit.

~~SECTION R~~SECTION O

LANDFILL FINAL CLOSURE REQUIREMENTS

~~P.1~~ CLOSURE SCHEDULE REQUIREMENTS

~~The County will notify the FDEP in writing at least one year prior to final receipt of waste in the North and East Cell. This notice will include a schedule for completion of the required closure tasks. Rules 62-701.600(2)(b) and (c) FAC require the County to notify users of the facility of the planned closure of the facility within 120 days of final receipt of wastes, and the general public within 10 days of final receipt of wastes. The County anticipates that the North and East Cell will continue to receive waste for disposal for the next ten years. After the North and East Cell is complete, the County intends to develop additional disposal cells, including an infill between the North and East Cell and the closed South Class I cell, to allow the County to continue utilizing the Tomoka Farms Road site for Class I waste disposal. The notification requirements of Rule 62-701.600(2) FAC therefore are not expected to apply at this time the North and East Cell is closed.~~

~~An intermediate cover consisting of twelve inches of compacted soil cover is placed over areas that have reached final permit elevations in accordance with Specific Condition 34 of the East Cell operating permit and Condition 20 of the North Cell operating permit. By this permit application, the County is applying for a permit to construct final cover over closed areas to control side slope erosion and to prevent odors.~~

~~The planned sequence of construction and closure is shown on the attached permit drawings.~~

~~P.2~~ O.1 CLOSURE PERMIT GENERAL REQUIREMENTS

~~P.2 O.1.a~~ Closure Permit Application

~~This application is for a intermediate modification to the existing permit to close the North and East Cell at the Tomoka Farms Road Landfill. Although the North and East Cell is anticipated to have an operating life in excess of ten-six years, portions of the cell have reached the permitted final elevations and the County is proposing to construct the final cover over the completed areas.~~

~~P.2 O.1.b~~ Closure Plan

~~The Closure and Long Term Care Plan is provided in Appendix B.~~

~~The complete closure plan includes Section P.3, the closure report, Section P.4O.2, the closure design plan, Section ~~P.5~~O.3, the closure operation plan, Section ~~Q~~P, closure procedures, and Section ~~R~~Q, the long-term care plan, and Section ~~SR~~, proof of financial responsibility.~~

P.3—CLOSURE REPORT

P.3.a—General information:

P.3.a.1 Identification of the Landfill

~~Volusia County operates the North Cell at the Tomoka Farms Road Landfill under Permit No SO64-0078767-016, issued by the FDEP on November 8, 2002, and the East Cell, a lateral expansion of the North Cell, under Permit No. SC64-0078767-014 and SO64-0078767-015 issued by the FDEP on December 9, 2002.~~

P.3.a.2 Location of the Landfill

~~The landfill is located at 1990 Tomoka Farms Road, approximately three miles south of International Speedway Boulevard, in Daytona Beach, Florida.~~

P.3.a.3 Site Acreage and Disposal Area Acreage

~~The total Tomoka Farms Road Landfill site includes over 3,500 acres. This area includes buffer area, wetlands, an industrial park, and waste processing and disposal areas. The North Cell waste disposal area occupies approximately 43.2 acres. The County has recently completed construction of the first phase of the East Cell, a 47-acre lateral expansion of the North Cell.~~

P.3.a.4 Legal Property Description

~~A legal property description is included in Attachment P-1.~~

P.3.a.5 History of the Landfill

~~Construction of the North Cell began in 1999. The cell was constructed in a former borrow pit, with the average excavation approximately 12 to 15 feet below original grade. The landfill bottom liner system consists of a prepared subgrade, a secondary geosynthetic clay liner (GCL), a secondary 60-mil high density polyethylene (HDPE) geomembrane, a geocomposite leak detection drainage layer, a primary GCL, a primary 60-mil HDPE geomembrane, a geocomposite leak collection drainage layer, overlaid by two feet of drainage sand.~~

~~A portion of the East Cell has been constructed but the County has not placed waste in the East Cell at the time of this application.~~

P.3.a.6 Types of Waste

~~The North Cell accepts municipal Class I solid waste. No waste has been placed in the East Cell at the time of this permit application. The combined North and East Cell will accept municipal Class I solid waste.~~

P.3.b—Geotechnical Investigation and Water Quality Monitoring

A geotechnical investigation was performed by SCS for the design of the North Cell. The report of this investigation, dated June 25, 1997, was submitted with the original North Cell construction permit application. A geotechnical investigation was performed by SCS for the design of the East Cell. The report of this investigation, dated November 14, 2000, was submitted with the East Cell construction permit application.

The County proposes to use linear low density polyethylene (LLDPE) liner covered with soil on the West, North, and East slopes and an exposed geomembrane Cover (EGC) on the south slope.

The LLDPE final cover system includes a double-sided geocomposite drainage net on top of the geomembrane, 18 inches of compacted protective soil cover, and 6 inches of soil cover capable of supporting vegetative growth.

To reduce the saturation of the cover soil on the side slopes over LLDPE, toe drains will be installed at the terraces and at the toe of slope in areas where LLDPE is used on side slopes. The interface shear strength of the final cover system components, including the cover soil, will be tested prior to construction after material suppliers and borrow sources are identified. The testing will demonstrate the stability of the weakest interface of the final cover system.

The landfill hydrogeology is described in the "Tomoka Landfill Hydrogeologic Summary and Groundwater Monitoring Plan", dated May 1992, prepared by Dr. David Gomberg, P.G. This report was superseded by the March 8, 1993 response to the FDEP's request for additional information, also prepared by Dr. David N. Gomberg. The only known contamination on the site is the area adjacent to the southwest corner of the old landfill where vinyl chloride has been reported near monitoring wells B-5 and B37.

P.3.c Land use

The North and East Cell is located at the 3,500-acre Volusia County's Tomoka Farms Road Landfill site. The cell is north of the closed South Cell Class I disposal cell. The Class III disposal cell is located east of the South Cell. The area around the landfill property is zoned as agricultural. A private construction and demolition debris facility is located northeast of the landfill property.

P.3.d Gas Migration

The active gas extraction system is designed to prevent the subsurface migration of LFG. Active extraction of the LFG from the North and East Cell minimizes the potential for concentrations of combustible gases to exceed 25 percent of the lower explosive limit (LEL) of methane in structures and 100 percent of the LEL at the property boundary.

The County monitors the Tomoka Farms Road Landfill site for landfill gas under the current operating permits. No landfill gas migration has been observed at the site.

P.3.e—Effectiveness Assessment

Geotechnical Investigation

The geotechnical reports previously discussed indicated that the bearing capacity of the underlying geologic formations are adequate to support the weight of the landfill with little risk of shear failure or bearing capacity failure. The landfill site is not in an area that is known for sinkhole formation or seismic activity.

Surface Water Runoff

On the sides closed with LLDPE and cover soil, terraces are provided after every 40 feet of vertical rise. The terraces drain at a one percent slope to down pipes, located every 400 feet. On the north side, the down pipes drain to the flooded borrow pit located north of the cell. On the east and west sides, the down pipes drain to perimeter channels that convey the runoff to the flooded borrow pit.

On the south side, surface runoff sheet flows down the exposed geomembrane cover to the channel located near the toe of slope. The channel drains the runoff to the channels located east and west of the cell, which drain to the flooded borrow pit.

The flooded borrow pit is kept at elevation 26.0 National Geodetic Vertical Datum (NGVD). The rim elevation of the flooded borrow pit is at elevation 30.0 NGVD, allowing four feet of storage. The water pumped from the flooded borrow pit flows to the onsite wetland located north of the flooded borrow pit.

Gas Migration

The active gas extraction system is designed to prevent the subsurface migration of LFG. Active extraction of the LFG will minimize the potential for concentrations of combustible gases exceeding 25 percent of the LEL of methane in structures and 100 percent of the LEL at the property boundary.

The County monitors the Tomoka Farms Road Landfill site for landfill gas under the current operating permits. No landfill gas migration has been observed at the site.

The County proposes no changes to the monitoring of LFG migration at the property boundary or in on-site structures.

Existing Cover

Portions of the cell that have reached permitted final grade have received 12 inches of soil cover.

Nature of Waste

The North Cell has been used for the disposal of Class I municipal solid waste since 2001.

P-4 O.2 CLOSURE DESIGN PLAN

The Closure Design Plan consists of the Closure Design Drawings included within Appendix A and a report on closing procedures that apply to the final closing of the North Cell included in the Closure and Long Term Care Plan (Appendix B). The references below indicate where the requested information is provided within the Closure Design Drawings and Closure and Long Term Care Plan.

P-4 O.2.a Closure Phases

The final cover will be constructed in phases three sequences, to allow the County to install final cover over areas that have reached final permitted elevation. The proposed phased development of the North and East Cell; and the associated phases-sequences of closure; are shown on the permit drawings. Additional information is provided in Section 2.4.1 of the Closure and Long Term Care Plan.

P-4 O.2.b Existing Topography and Proposed Final Grades

The existing grades and the proposed-permitted final grades for the North and East Cell are shown on the permit closure design drawings provided in Appendix A.

P-4 O.2.c Phased Closure

The County intends to construct final cover over the portions of the North and East Cell that have reached the maximum permitted elevation.

P-4 O.2.d Final Elevations Before Settlement

Proposed final elevations before settlement for the North and East Cell are shown on the permit drawings.

P-4 O.2.e Side Slope Design

The side slope design is provided in the Closure Design Drawings provided in Appendix A and is addressed within Section 2.4.5 of the Closure and Long Term Care Plan provided in Appendix B.

The side slopes are designed with terraces after every 40 feet of vertical rise. These terraces are constructed at approximate elevations 69, 107, 145, and 185 feet NGVD. The maximum elevation of the completed cell is 193.0 NGVD. The terraces are approximately 19 feet wide. The side slopes are at a slope of 3 horizontal to 1 vertical.

On the south, west, north, and east sides, the terraces drain at a slope of one percent to a series of down pipes down drains, constructed at approximately 400-foot centers. The down pipes down drains are designed to handle the peak runoff from the 100-year, 24-hour design storm of 11 inches, using the SCS Type II distribution event.

The terraces on the south slopes are flat to allow sheet flow over the exposed geomembrane cover (EGC). Horizontal anchor trenches for the EGC are constructed at the 107-foot terrace and 185-foot terrace.

P.4 O.2.f Final Cover Installation

P.4 O.2.f.1 Construction Quality Assurance

The Construction Quality Assurance Plan for the closure construction is included in Appendix AC.

P.4 O.2.f.2 Final Cover Installation Schedule

The County intends to place final cover over each phase within 180 days of reaching final permitted elevations and is addressed within Section 2.4.7 of the Closure and Long Term Care Plan.

P.4 O.2.f.3 Final Vegetative Cover

Volusia County uses rolled sod for landfill closure and is addressed in Section 2.4.7 of the Closure and Long Term Care Plan. This grass has been very successful at the Tomoka Farms Road Landfill and has proven to be drought resistant. The County intends to continue using rolled sod for final vegetative cover.

P.4 O.2.f.4 Top Gradient Design

The top portion of the North and East Cell is designed to have a 4 percent slope to promote good positive drainage after settlement. Additional information is provided in Section 2.4.7 of the Closure and Long Term Care Plan.

P.4 O.2.f.5 Final Cover Maintenance Material

There are currently two permitted borrow pits at the Tomoka Farms Road Landfill site. The County is committed to developing and maintaining sources for cover soil to support the on-going landfill operations. It is anticipated that additional on-site borrow pits will be developed within the 3500-acre landfill property. Off-site sources may also be used to provide cover soil for long term cover maintenance. Additional information is provided in Section 2.4.7 of the Closure and Long Term Care Plan.

The County intends to keep a small quantity of 60-mil textured white HDPE on site for repairs if the EGC is damaged.

P.4 O.2.g Final Cover Design

The final cover system for the west, north, and east sides of the North and East Cell consists of a minimum of twelve inches of initial soil cover (grading layer), a LLDPE geomembrane, a bi-

planar geocomposite drainage net, and 24 inches of protective cover soil, including six inches of top soil capable of supporting vegetative growth. Rolled-sod will be placed on top of the protective soil cover. Additional information is provided in Section 2.4.6 of the Closure and Long Term Care Plan.

~~The County intends to use an exposed geomembrane cover on the south slope of the North and East Cell. This cover system consists of a minimum of twelve inches of initial soil cover overlaid with a 60-mil, textured, white HDPE geomembrane.~~

P.4 O.2.h Stormwater Control

Surface water management in the North and East Cell is designed to prevent intrusion of stormwater runoff into areas with municipal solid waste. Surface runoff from the landfill on the south, west and east sides is directed through down-pipes/drainage to the perimeter ditch that surrounds the landfill. On the north side, the down-pipes/drainage discharge directly into the flooded borrow pit that provides detention and treatment of stormwater runoff. On the south side, surface runoff is allowed to sheet flow over the EGC into a channel that directs the runoff to the flooded borrow pit. Stormwater control for the North Cell is addressed in Sections 2.4.5 and 2.4.8 of the Closure and Long Term Care Plan. Drainage calculations for the closure are provided with Attachment O.2.h.

P.4 O.2.i Access Control

The North and East Cell is part of the County's Tomoka Farms Road Landfill site. This site is open and staffed seven days per week. The site is fenced to prevent unauthorized access and the gates are locked during the hours when the site is not open. Security personnel are at the site during the hours that the landfill is closed to assist in preventing unauthorized entry. Access controls for the Tomoka Farms Road Landfill are addressed in Section 2.4.9 of the Closure and Long Term Care Plan.

P.4.j Final End Use

The County intends to continue operating the Tomoka Farms Road Landfill as a waste disposal site for the foreseeable future.

P.4.k O.2.j Gas Management

The County installed a comprehensive LFG collection and control system in the closed Class I South Cell disposal area. This system includes a series of vertical wells, lateral and header piping, and condensate management features. Collected LFG is piped through a transmission line to the gas recovery facility. At the gas recovery facility, the LFG is either combusted in the LFG-to-energy system, or in the enclosed flare, and or the utility flare.

The County has completed installation of a LFG collection and control system in the North Cell, as authorized by permit SO64-0078767-018. The LFG collected from the North Cell is either sent to a new blower/ and utility flare station located southwest of the North Cell or conveyed by a pipeline to the existing LFG recovery facility. The County intends to expand this LFG collection system eastward as the East-North Cell is developed.

The LFG collection and control system is discussed in Section 2.4.11 of the Closure and Long Term Care Plan.

P.5 O.3 CLOSURE OPERATION PLAN

P.5 O.3.a Actions Needed to Close the Landfill

The County will construct the landfill to the grades shown on the permit drawings, with a minimum of 12 inches of soil cover (i.e. grading layer), compacted to a minimum of 95 percent of Standard Proctor maximum density.

The County will receive bids for the furnishing and installing of the final cover, including the liner materials, geocomposites, grout-filled fabric revetment, piping, soil, and other materials required for closure.

When the soil cover/grading layer has been accepted for depth of cover, maximum particle size, compaction, and grade, panels of LLDPE or HDPE geomembrane will be placed over the cover soil followed by geocomposite. Final cover construction, including down pipes/downdrains and other drainage structures, as well as protective soil, vegetative support soil, and sod placement, will be completed. An as-built survey of the completed closure will be prepared and submitted to the FDEP along with the certificate of completion of closure construction for the portion of the landfill that has been closed.

Section 2.5.1 of the Closure and Long Term Care Plan provides details on the actions required to close the landfill.

PO.53.b Time Schedule

The County intends to install final cover including the low permeability geomembrane over portions of the North and East Cell that have reached final grade after receiving FDEP approval of this closure permit application. Final cover will be installed over the remaining portion of the North and East Cell as indicated on the fill sequence plan included in the permit drawings submitted in August 2009. The County anticipates constructing an infill between the North and East Cell and the closed South Class I Cell. The thirty-year long-term care period is not expected to begin for the North and East Cell until after the infill is complete/entire cell receives final cover.

The closure schedule is provided in Section 2.5.2 of the Closure and Long Term Care Plan.

PO.53.c Financial Responsibility

See Please refer to Appendix B Section 2.5.4 and Section Part QR.

PO.5.d Additional Equipment and Personnel

~~The County intends to receive bids for the furnishing and installing of the final cover, including the liner materials, geocomposites, grout filled concrete revetment, and piping. No additional equipment or personnel are anticipated to be required for the County to perform the earthwork required for final closure of the North and East Cell disposal area.~~

PO.53.ed Water Quality Monitoring Plan

The groundwater monitoring system is described in the Monitoring Plan Implementation Schedule WACS 27540, attached as Exhibit I to the North and East Cell operating permits, updated in November 2009. No changes to this monitoring plan are proposed, as they are compliant with the revised 62-701, F.A.C. rules promulgated in January 2010.

Additional information is provided in Section 2.3.3 and 2.5.5 of the Closure and Long Term Care Plan.

PO.53.fe Gas Monitoring Plan

The landfill gas monitoring plan is described in Section ~~QN~~. No changes to this plan are proposed at this time.

Additional information is provided in Section 2.3.5 and 2.5.6 of the Closure and Long Term Care Plan.

Q.30.4 CERTIFICATION OF CLOSURE CONSTRUCTION COMPLETION

The County will submit a Certification of Closure Construction completion, signed, dated and sealed by a professional engineer to the FDEP after completion of closure of the North and East Cell. All substantial deviations from the permitted closure plans will be noted. Additional information is provided in Section 3.0 and 3.3 of the Closure and Post Closure Care Plan.

~~Q.1~~ O.4.a Survey Monuments

Concrete monuments will be installed to mark the boundaries of the landfill property and other permanent markers will be installed to outline the general location of the waste disposal areas after the Tomoka Farms Road Landfill is closed. These markers will be tied to one or more of the boundary markers by a survey performed by a registered land surveyor. The location and elevation of all markers will be shown on a site plan filed with the "Declaration to the Public" described in paragraph ~~P.4~~ O.5. Additional information is provided in Section 3.1 of the Closure and Post Closure Care Plan.

Q.2 O.4.b **Final Survey Report**

A final survey using aerial mapping techniques will be performed after the North Cell is closed to verify that final contours and elevations of the facility are in accordance with the plans as approved in the permit. The aerial mapping information will be included in the report along with information reflecting the conditions of the landfill as constructed. Contours shall be shown at no greater than five-foot intervals. The County will submit this report to the FDEP in accordance with the closing schedule. Additional information is provided in Section 3.2 of the Closure and Post Closure Care Plan.

Q.40.5 **DECLARATION TO THE PUBLIC**

After closing operations for the Tomoka Farms Road Landfill site are approved by the FDEP, the County will file a declaration to the public in the deed records in the office of the County Clerk. The declaration will include a legal description of the property on which the landfill is located and a site plan specifying the area actually filled with solid waste. The declaration to the public will not be filed until the entire site is closed. Additional information is provided in Section 3.4 of the Closure and Post Closure Care Plan.

Q.50.6 **OFFICAL DATE OF CLOSING**

The FDEP will acknowledge by letter to the County that notice of termination of operations and closing of the Class I disposal facility has been received. The date of this letter will be the official date of landfill closing for the purpose of determining the long-term care period. Additional information is provided in Section 3.5 of the Closure and Post Closure Care Plan.

PO.67 ~~TEMPORARY CLOSURE~~ **TEMPORY CLOSURE**

No temporary closure of the landfill will be required. See Section 3.8 of the Closure and Long Term Care Plan.

~~SECTION~~ SECTION P

CLOSURE PROCEDURES

Q-6P.1 USE OF CLOSED LANDFILL AREAS

Consultation with the FDEP is required prior to conducting activities at closed landfills in accordance with Rule 62-701.610(7), F.A.C.

Closed landfill areas, if disturbed, are a potential hazard to public health, ground water and the environment. The FDEP retains regulatory control over activities which may affect the integrity of the environmental protection measures such as the landfill cover, drainage, liners, monitoring system, or leachate and stormwater controls. The County will consult with the FDEP prior to conducting activities over the closed landfill area.

Q-7P.2 RELOCATION OF WASTES

This section is not applicable to this application.

~~SECTION T~~SECTION Q

LONG TERM CARE REQUIREMENTS

The Tomoka Farms Road Landfill will continue to be used for solid waste disposal after the North and East Cell is closed. Site access will continue to be monitored by on-site personnel. Fencing, on-site roads, and monitoring devices will be kept in working order to support the active landfill operations. Inspections of the closed landfill cell will include daily, monthly, and quarterly inspections as discussed below.

Daily Inspections

During on-going landfill operations, County staff will observe the South Cell and closed portions of the North Cell. If unusual conditions such as the following are observed, a report will be made to the site superintendent:

- Erosion or seepage through the soil cover
- Damage or blockage of drainage structures, including ~~downchutes~~downdrains
- Damage to the vegetative cover
- ~~Damage to the exposed geomembrane liner~~
- Unusual odors
- Smoke or flames
- Damage to groundwater monitoring wells
- Damage to gas collection wells
- Damage to gas header or condensate pipelines
- Damage to the gas flare

No specific procedure or checklist is used for daily observations of the closed cell and no record of daily observations is maintained except for reports of unusual conditions. Corrective actions or repairs that are undertaken as a result of an unusual condition report should be described a separate report attached to the unusual condition report.

Weekly Inspections

The site supervisor should ensure that the closed cell is inspected at least once each week for each of the conditions discussed above. In addition, the weekly inspection should check for the following:

- Damage to the perimeter or service roads
- High or unusually low water levels in the drainage facilities
- Water levels in the leachate ponds
- Low spots retaining water after rain events
- ~~Uplift of the exposed geomembrane liner~~

- Leachate pump operation
- Approximate height of grass on closed landfill exceeding 18 inches
- Litter

No specific form is used for weekly inspections of the closed cell and no record of weekly inspections is maintained except for reports of unusual conditions. Corrective actions or repairs that are undertaken as a result of an unusual condition report should be described a separate report attached to the unusual condition report.

Quarterly Inspections

The closed cell should be inspected on a quarterly basis for each of the conditions discussed above. In addition, the quarterly inspection should include the following:

- Condition of signage
- Condition of caps and locks on perimeter gas probes and groundwater monitor wells
- Condition of gas collection wells
- Growth of vegetation or accumulation of silt or debris around culverts
- Growth of vegetation around wells, and other structures
- Evidence of siltation in the stormwater channels
- ~~Condition of exposed geomembrane liner at terraces and penetrations~~

The date of the quarterly inspection and the name of the individual conducting the inspection should be recorded and a record kept of any insufficiencies noted. Corrective actions or repairs that are undertaken as a result of a quarterly inspection should be described a report attached to the quarterly inspection report.

Additional information is provided in Section 4.0 of the Closure and Long Term Care Plan.

RQ.1 GAS COLLECTION AND MONITORING SYSTEMS

Monitoring for LFG migration will continue through the long-term care period of the landfill cells, unless FDEP approves any future County request to reduce the long-term care schedule. The NSPS requires that the gas collection and control system be in operation for at least 15 years. After this time, if gas generation rates and emission potential have diminished per the requirements of 40 CFR 60.752(b)(2)(iv), the system may be taken offline.

Additional information is provided in Section 4.7.2 of the Closure and Long Term Care Plan.

Q.2 STABILIZATION REPORTS

Since only portions of the North Cell are receiving final cover and the remaining North Cell landfill is active, the North Cell will not enter the long-term care period in accordance with the official date of closing requirements (Rule 62-701.600(8), F.A.C.), therefore, the stabilization

report will not be required until the facility enters the long-term care period. Stabilization reports will be submitted every five years after issuance of the long-term care permit. Stabilization reports are addressed in Section 4.9 of the Closure and Long Term Care Plan.

The final cover will be maintained during this time in accordance with Section 4.0 of the Closure and Long Term Care Plan provided in Appendix B.

RQ.23 RIGHT OF PROPERTY ACCESS

The County will continue to make the site available for inspection by the FDEP after closure. Additional information is provided in Section 4.6 of the Closure and Long Term Care Plan.

RQ.3 SUCCESSORS OF INTEREST

~~The County has no plans for selling the property, but recognizes that any future property owner would be required to abide by permit and other regulatory requirements.~~

RQ.4 REPLACEMENT OF MONITORING DEVICES

If a monitoring well or other device required by the approved monitoring plan is destroyed or damaged, the County will notify the FDEP in writing and repair or replace the monitoring device with a functioning device. Additional information is provided in Section 4.0 and 4.7 of the Closure and Long Term Care Plan.

RQ.5 COMPLETION OF LONG TERM CARE

After the FDEP acknowledges that the facility has been closed, the County will continue to monitor and maintain the facility for at least 30 years, unless specific release from all or part of these requirements is granted by the FDEP. Monitoring activities will include inspection of the side slopes, soil cover, and drainage facilities, monitoring for gas formation, ground and surface water monitoring, and checking for unauthorized use of the site for debris disposal. ~~The County anticipates constructing an infill between the North and East Cell and the closed South Class I Cell. The thirty-year long-term care period is not expected to begin for the North and East Cell until after all closure sequences are complete.~~ the infill is complete.

Long-term maintenance consists of periodic inspection, repairing erosion damage to the side slopes, maintaining and re-establishing the vegetative cover, mowing, repair and replacement of groundwater monitor wells, and cleaning and maintenance of the stormwater control structures. The County will conduct these activities with County forces and equipment in

conjunction with the other maintenance and repair activities required at the Tomoka Farms Road Landfill site.

Following completion of the long-term care period, the County will submit a certification, signed and sealed by a professional engineer, verifying that long-term care has been completed in accordance with the closure plan has been placed in the operating record.

Completion of long term care is provided in Section 4.10 of the Closure and Long Term Care Plan provided in Appendix B.

SECTION R

FINANCIAL RESPONSIBILITY REQUIREMENTS

SR.1 PROBABLE ESTIMATED COSTS

An estimate of probable final closure costs was prepared based on having a contractor brought in to construct the final cover over the entire North and East Cell. The estimate assumes that the County will have placed the waste and the initial soil cover. The remaining closure costs would include site preparation, geomembrane, geocomposite drainage net, piping, grout-filled fabric revetment, drainage facilities, and the gas management facilities. Protective soil cover, topsoil, and sod is included for areas to be closed with LLDPE. The costs also include survey, administrative, and engineering costs. Approximately 57-90 acres of the North and East Cell will be closed using LLDPE and soil cover. This closure method is expected to cost approximately \$220,000-\$160,000 per acre based on values provided in the Financial Responsibility Closure & Long-Term Care Cost Estimates FY 2009. Approximately 33 acres of the North and East Cell will be closed using an exposed geomembrane cover. This method of closure is expected to cost approximately \$110,000 per acre. The estimate assumes that sufficient cover soil and topsoil is available on-site, and that the County will have this material stockpiled for use by the closure contractor.

The total expected closure cost is shown in Table SR-1.

TABLE SR-1. ESTIMATE OF PROBABLE CLOSURE COST, AUGUST 31, 2006, JULY 2010.

Closure Method	Acres	Cost per Acre	Closure Cost
LLDPE with soil cover	57	\$220,000	\$12,540,000
	90	\$160,000	\$14,440,000
Exposed geomembrane cover	33	\$200,000	\$6,600,000
Total	90	-	\$19,140,000

This estimate includes constructing final cover for the entire North and East Cell, even though portions of the East Cell have not been constructed and no waste has been placed in the East Cell within portions of the constructed cell at the time of this application. The County intends to construct the final cover in phases, so that at the time of closure only a portion of the final cover would remain to be constructed.

Long-term care is expected to cost approximately \$2000 per acre per year. The long-term care cost for the entire 90 acres would be \$180,000 per year.

SR.2 ANNUAL COST ADJUSTMENTS

Volusia County provides the FDEP with annual estimates of probable closure and long-term care, in accordance with Rule 62-701.630(4), FAC. The statement addresses closure and long-term care costs. ~~The eastern portion of the East Cell~~The North Cell Phase 2 Expansion Area has not yet been constructed and no waste has been placed in the recently constructed western portion of the North Cell Phase 1 Expansion Area, therefore, these areas are not included in the annual cost estimate adjustments.

Upon approval of this closure permit modification, the annual Financial Responsibility Closure and Long-Term Care Cost Estimates Report submitted in August of each year will be revised to reflect the annual cost adjustments based on the proposed modifications.

SR.3 FUNDING MECHANISMS

The County has established an escrow account to provide funding for closure and long-term care.

R.4 FINANCIAL ASSURANCE DELAY

The County has established an escrow account to provide funding for closure and long-term care. This section is not applicable to this application.

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Terrace Capacity	Date	7/7/2010

Purpose

Confirm the proposed terrace for the final cover is sufficient to contain the 100-yr design storm.

Methodology

The terrace design is checked for the critical terrace (i.e. the terrace with the maximum discharge). In order to determine the location of the critical terrace, the peak discharge from the largest subareas are determined during a 100-yr storm using the Rational Method. The location of the critical terrace is determined as the terrace with the highest peak discharge. The capacity, flow velocity and pipe inlet capacity of the critical terrace are verified.

Assumptions

- 1) Per the Closure Permit Application dated November 15, 2006, pg. P-5, the sideslopes are designed with terraces after every 40-feet of vertical rise. The terraces are constructed at approximate elevations 69, 107, 145 and 185 feet NGVD. The maximum elevation of the completed cell is 193.0 NGVD. The terraces are approximately 19 feet wide. The sideslopes are at a slope of 3H:1V.

The terraces drain at a slope of one percent to a series of downdrains constructed at approximately 400-foot centers. The downdrains are designed to handle the peak runoff from the 100 year storm.

- 2) Use procedures in the FDOT Drainage Manual.
- 3) The time of concentration (Tc) for each drainage area is assumed to be 8 minutes. This is the most conservative value using the FDOT Drainage Manual procedures.

Calculation

Step 1 - Determine Maximum Discharge

The location of the critical terrace is estimated as the bench with the largest contributing cover area. The locations for the terrace on sideslope area, the terrace for top deck area, and the terrace for the intermediate top deck area used to determine the critical terrace are shown in Attachment A. The 100-yr maximum discharge is determined using the Rational Method provided in the FDOT Drainage Manual.

Terrace for Sideslope Area

Contributing final cover area of the terrace = 0.62 ac (Attachment A)

Maximum Discharge (100-yr) = $Q = CiA$

Q = Maximum Discharge, cfs

C = Runoff Coefficient → Steep Slopes, Sandy Soils, Bare Earth = 0.60 (Attachment B-1)

Adjust by 1.25 for 100-yr return period

$C = 0.75$ (Attachment B-2)

i = rainfall intensity for 100-yr storm = 10.4 in/hr (Attachment C)

Q (100-yr) = 4.84 cfs

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Terrace Capacity	Date	7/7/2010

$Q_{max} = 27.12 \text{ cfs}$ Check: $Q_{max} > Q_{(100\text{-yr})} \rightarrow \underline{OK}$
 At design discharge,
 $\text{Flow Depth} = 1.2 \text{ ft} \rightarrow \text{Freeboard} = 0.8 \text{ ft} = 9.8 \text{ in}$

Step 3 - Check Flow Velocity in Terrace

Verify velocity in channel does not exceed the allowable velocity for the terrace lining.

$$V = Q/A$$

$V = \text{Velocity, fps}$

$V = 1.23 \text{ fps}$ (conservatively assumed to be flowing full)

Maximum Allowable Velocity for Sod = 4 fps $\rightarrow \underline{OK}$

(Attachment F)

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Downdrain Pipe Sizing	Date	7/7/2010

Purpose

Determine the maximum drainage area to maintain desired flow depth in downdrains for the final cover. Determine the appropriate downdrain sizes based on drainage subareas.

Methodology

The highest flow rate from a subarea to a downdrain is obtained using the Rational Method procedures in the FDOT Drainage Manual. Using conservative assumptions consistent for each subarea, a linear relationship is obtained between flow and the subarea. Therefore the highest flow rate is produced from the subarea with the maximum area. Using this same relationship, determine the maximum drainage area to maintain a desired flow depth in both 18-in ADS and 24-in ADS pipes. Determine the appropriate incremental downdrain sizes so that the maximum drainage area for each pipe size is not exceeded.

Assumptions

- 1) Per the Closure Permit Application dated November 15, 2006, pg. P-5, the sideslopes are designed with terraces after every 40-feet of vertical rise. The terraces are constructed at approximate elevations 69, 107, 145 and 185 feet NGVD. The maximum elevation of the completed cell is 193.0 NGVD. The terraces are approximately 19 feet wide. The sideslopes are at a slope of 3H:1V.

The terraces drain at a slope of one percent to a series of downdrains constructed at approximately 400-foot centers. The downdrains are designed to handle the peak runoff from the 100 year storm.

- 2) Use procedures in the FDOT Drainage Manual.
- 3) The time of concentration (T_c) for each subarea is assumed to be 8 minutes. This is the most conservative value using the FDOT Drainage Manual procedures.

Calculation

Step 1 - Determine the maximum drainage area to maintain desired flow depth in downdrains.

Using the manning's equation for circular pipes, the maximum allowable flow and drainage area for both 18-in ADS and 24-in ADS pipes is determined using the Rational Method. Normal depth flow is assumed in pipe.

Surface Flow Equations and Known Variables

Rational Method $\rightarrow Q = CiA$ (design storm 100-yr)

Q (surf) = Maximum Discharge, cfs

C = Runoff Coefficient \rightarrow Steep Slopes, Sandy Soils, Bare Earth = 0.60 (Attachment B-1)

Adjust by 1.25 for 100-yr return period

$C = 0.75$ (Attachment B-2)

i = rainfall intensity for 100-yr storm = 10.4 in/hr (Attachment C)

A = Maximum Drainage Area

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Downdrain Pipe Sizing	Date	7/7/2010

Pipe Flow Equations and Known Variables

$$\text{Manning's Equation} \rightarrow Q = \frac{1.49 A R_h^{2/3} S^{1/2}}{n}$$

Q (pipe) = Flow Rate, cfs

n = Roughness Coefficient → ADS Pipe = 0.020

(Attachment G)

A = Flow Area of Pipe (Assume Normal Flow Depth)

R_h = Hydraulic Radius = A/W (W = Wetted Perimeter)

S = Slope = 33% = 0.33 ft/ft

18-in ADS Pipe Maximum Capacity (assuming normal depth flow)

The two equations above are solved using an iterative process. Modify maximum drainage area so that surface flow equals pipe flow (i.e. $Q(\text{surf}) = Q(\text{pipe})$).

Surface Flow	Pipe Flow	Calculated Pipe Flow Data
A = 5.11 ac	Pipe ID = 18 in = 1.5 ft	Top Flow Width = 1.12 ft
Q (surf) = 39.89 cfs	Pipe Radius = 0.75 ft	Flow Velocity = 25.35 fps
	Normal Depth = 1.25 ft	Hydraulic Depth = 1.41 ft
	A = 1.57 sf	Froude Number = 3.77
	W = 3.45 ft	
	R_h = 0.46 ft	
	Q (pipe) = 39.89 cfs	

24-in ADS Pipe Maximum Capacity (assuming normal depth flow)

The two equations above are solved using an iterative process. Modify maximum drainage area so that surface flow equals pipe flow (i.e. $Q(\text{surf}) = Q(\text{pipe})$).

Surface Flow	Pipe Flow	Calculated Pipe Flow Data
A = 11.41 ac	Pipe ID = 24 in = 2 ft	Top Flow Width = 1.32 ft
Q (surf) = 88.98 cfs	Pipe Radius = 1 ft	Flow Velocity = 30.53 fps
	Normal Depth = 1.75 ft	Hydraulic Depth = 2.20 ft
	A = 2.91 sf	Froude Number = 3.62
	W = 4.84 ft	
	R_h = 0.60 ft	
	Q (pipe) = 88.98 cfs	

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Downdrain Pipe Sizing	Date	7/7/2010

Step 2 - Determine the critical downdrain subareas

The location of the critical downdrain subarea is estimated as the area with the largest contributing cover area based on the methodology explained above. The locations for the critical downdrain subareas are shown in *Attachment H*. Due to the uniform spacing and drainage basin structure, only a few drainage basin areas are shown.

Based on maximum drainage areas for each pipe size calculated above, when a downdrain collects runoff from a subarea greater than 5.11 ac the pipe size should be increased from 18-in ADS pipe to 24-in ADS pipe. The table below summarizes the downdrain pipe sizes. Downdrain IDs are shown in *Attachment H*.

Downdrain ID	Pipe Size (inches) and Type				
	Top Deck	Terrace 3	Terrace 2	Terrace 1	Toe of Slope
DD-1	18 ADS	18 ADS	18 ADS	24 ADS	19 x 30 RCP
DD-2	18 ADS	18 ADS	18 ADS	24 ADS	19 x 30 RCP
DD-3	18 ADS	18 ADS	18 ADS	24 ADS	19 x 30 RCP
DD-4	18 ADS	18 ADS	18 ADS	24 ADS	19 x 30 RCP
DD-5			18 ADS	18 ADS	18 ADS
DD-6	18 ADS	18 ADS	18 ADS	18 ADS	18 ADS
DD-7			18 ADS	18 ADS	18 ADS
DD-8		18 ADS	18 ADS	18 ADS	18 ADS
DD-9			18 ADS	18 ADS	18 ADS
DD-10	18 ADS	18 ADS	18 ADS	18 ADS	18 ADS
DD-11	18 ADS	18 ADS	18 ADS	24 ADS	24 ADS
DD-12	18 ADS	18 ADS	18 ADS	24 ADS	24 ADS
DD-13	18 ADS	18 ADS	18 ADS	24 ADS	24 ADS
DD-14	18 ADS	18 ADS	18 ADS	24 ADS	24 ADS
DD-15			18 ADS	18 ADS	18 ADS
DD-16		18 ADS	18 ADS	18 ADS	18 ADS
DD-17		18 ADS	18 ADS	18 ADS	18 ADS
DD-18			18 ADS	18 ADS	18 ADS

Note: 1) Pipe size shown represents the size required between the given terrace and the terrace downgradient.

2) Downdrains crossing under the perimeter access road shall be concrete elliptical pipe with the equivalent design pipe diameter.

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Downdrain Inlet Capacity	Date	7/7/2010

Purpose Verify 18-in downdrain inlets are adequately sized for 100-yr 24-hr design flow.

Methodology The highest flow rate from a subarea to a downdrain inlet is obtained using the Rational Method procedures in the FDOT Drainage Manual. Using conservative assumptions consistent for each subarea, a linear relationship is obtained between flow and the subarea. Therefore the highest flow rate is produced from the subarea with the maximum area. Once the maximum flow rate to the "Critical Inlet" is determined it is compared to the inlet's maximum capacity to evaluate if the inlet is properly sized. If the inlet is insufficient then the inlet size or quantity should be increased.

- Assumptions**
- 1) Inlet design utilizes an 18-in HDPE inlet with trash screen. *See Attachment I*
 - 2) Largest contributing basin area is 1.43 ac from the intermediate top deck area (prior to closure sequence 3). The largest contributing basin after final closure is 0.98 ac. *See Attachment A*
 - 3) Use procedures in the FDOT Drainage Manual.

Calculation **Step 1 - Determine Flow to Critical Inlet**

Flow from Final Closure Top Deck Area

Contributing final cover area of the terrace = 0.98 ac *(Attachment A)*

Maximum Discharge (100-yr) = $Q = CiA$

Q = Maximum Discharge, cfs

C = Runoff Coefficient \rightarrow Steep Slopes, Sandy Soils, Bare Earth = 0.50 *(Attachment B-1)*

Adjust by 1.25 for 100-yr return period

$C = 0.625$ *(Attachment B-2)*

i = rainfall intensity for 100-yr storm = 10.4 in/hr *(Attachment C)*

Q (100-yr) = 6.37 cfs

Flow From Intermediate Top Deck Area

Contributing final cover area of the terrace = 1.43 ac *(Attachment A)*

Maximum Discharge (100-yr) = $Q = CiA$

Q = Maximum Discharge, cfs

C = Runoff Coefficient \rightarrow Steep Slopes, Sandy Soils, Bare Earth = 0.50 *(Attachment B-1)*

Adjust by 1.25 for 100-yr return period

$C = 0.625$ *(Attachment B-2)*

i = rainfall intensity for 100-yr storm = 10.4 in/hr *(Attachment C)*

Q (100-yr) = 9.30 cfs

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Downdrain Inlet Capacity	Date	7/7/2010

Step 2 - Verify Inlet Pipe Size

Verify 18-in diameter ADS inlet has sufficient capacity. Conservatively assume inlet characteristics are similar to concrete pipe with groove end with headwall. Since pipe slopes 3:1 after inlet, inlet controls flow, assume headwater (HW) is allowed to come to top of pipe (HW/D = 1). *Attachment I* provides a section of the terrace/downdrain section.

$$Q_{\text{pipe}} = 7 \text{ cfs} \quad \text{for diameter} = 18\text{-in and HW/D} = 1$$

(Attachment J)

$$Q_{100\text{-yr critical final closure area}} = 6.37 \text{ cfs} < Q_{\text{pipe}} \rightarrow \text{OK}$$

$$\text{Factor of Safety} = 1.1$$

$$Q_{100\text{-yr critical intermediate closure area}} = 9.30 \text{ cfs} > Q_{\text{pipe}} \rightarrow \text{NOT OK}$$

$$\text{Factor of Safety} = 0.0$$

Design flows for the critical intermediate top deck area exceed the minimum inlet pipe flow; therefore a third inlet will be installed to handle the additional flow demand.

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Downdrain Discharge Structure	Date	7/7/2010

Purpose

Determine the appropriate energy dissipater sizes based on outfall flow of the downdrains.

Methodology

Using the FDOT Design Standards the appropriate energy dissipater is selected. The FDOT standards for energy dissipaters are based on pipe size and rate of slope.

Assumptions

- Per the Closure Permit Application dated November 15, 2006, pg. P-5, the sideslopes are designed with terraces after every 40-feet of vertical rise. The terraces are constructed at approximate elevations 69, 107, 145 and 185 feet NGVD. The maximum elevation of the completed cell is 193.0 NGVD. The terraces are approximately 19 feet wide. The sideslopes are at a slope of 3H:1V. A baffled endwall FDOT Index 261 is used for energy dissipaters.

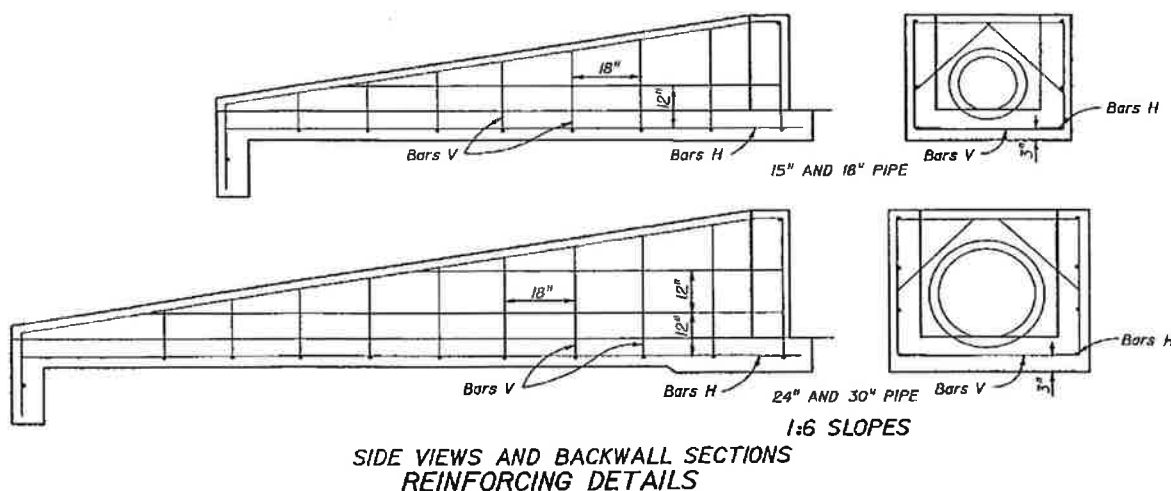
The terraces drain at a slope of one percent to a series of downdrains constructed at approximately 400-foot centers. The downdrains are designed to handle the peak runoff from the 100 year storm.

- Use the FDOT Design Standards.

Calculation

Step 1 - Determine the dimensions and quantities for energy dissipaters need for the 18-in and 24-in downdrains.

Consistent with the previous Closure Permit Application, FDOT Index No. 261 for Baffled Endwalls will be used for the energy dissipater design. Using the pipe sizing results from downdrain calculations, it was determined that both 18-in and 24-in downdrains were needed. The downdrains transition from a 3H:1V slope to a relatively flat slope. Therefore, the FDOT Rate of Slope used for selecting the proper energy dissipaters is 1:6. The tables and figures provided below are from the FDOT Design Standards and provide the details, dimensions and quantities for the energy dissipaters.

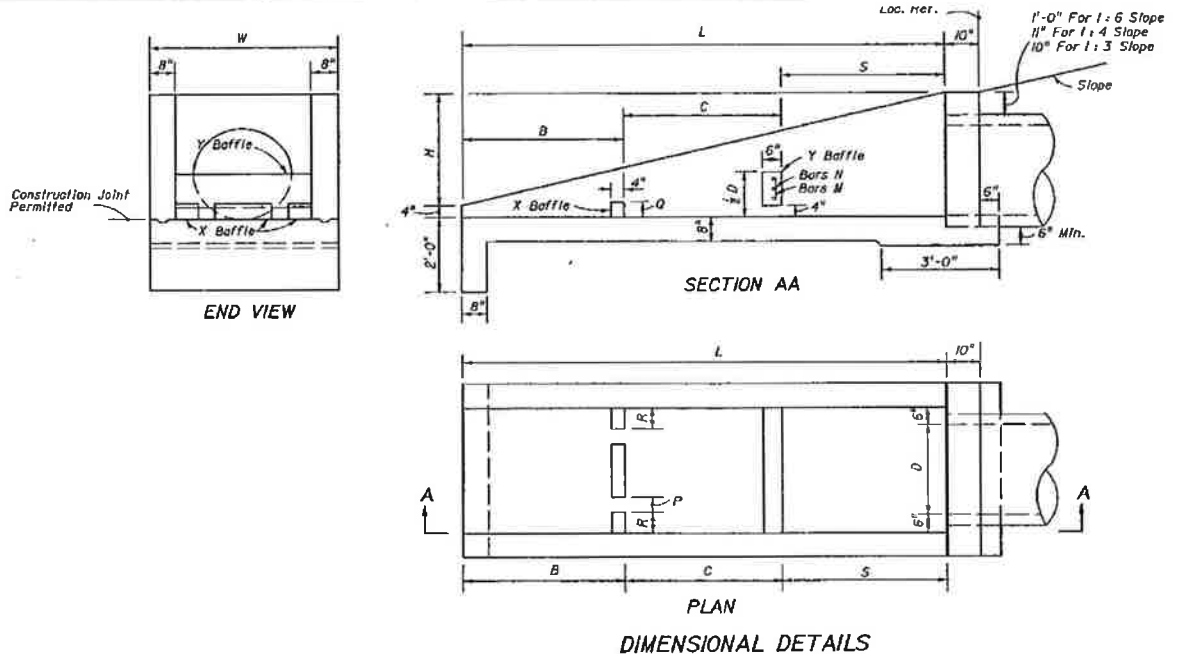


1:6 Slope

Computation

HDR

Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Downdrain Discharge Structure	Date	7/7/2010



DIMENSIONS AND QUANTITIES FOR ONE U-ENDWALL										
Rate Of Slope	Pipe Size		L	H	W	Baffle Locations (When Required)			Concrete Class I Cu. Yd.	Reinf. Steel Lbs.
	D	Area Sq. Ft.				S	B	C		
1:3	15"	1.23	5'-3"	1'-9"	3'-7"	1'-9"	1'-9"	1'-9"	1.19	51
	18"	1.77	6'-0"	2'-0"	3'-10"	2'-0"	2'-0"	2'-0"	1.42	56
	24"	3.14	7'-6"	2'-6"	4'-4"	2'-6"	2'-6"	2'-6"	1.94	77
	30"	4.91	9'-0"	3'-0"	4'-10"	3'-0"	3'-0"	3'-0"	2.54	96
1:4	15"	1.23	7'-4"	1'-10"	3'-7"	2'-6"	2'-6"	2'-4"	1.54	64
	18"	1.77	8'-4"	2'-1"	3'-10"	2'-10"	2'-10"	2'-8"	1.84	71
	24"	3.14	10'-4"	2'-7"	4'-4"	3'-6"	3'-6"	3'-4"	2.53	92
	30"	4.91	12'-4"	3'-1"	4'-10"	4'-2"	4'-2"	4'-0"	3.34	124
1:6	15"	1.23	11'-6"	1'-11"	3'-7"	3'-10"	3'-10"	3'-10"	2.19	89
	18"	1.77	13'-0"	2'-2"	3'-10"	4'-4"	4'-4"	4'-4"	2.63	103
	24"	3.14	16'-0"	2'-8"	4'-4"	5'-4"	5'-4"	5'-4"	3.59	143
	30"	4.91	19'-0"	3'-2"	4'-10"	6'-4"	6'-4"	6'-4"	4.81	180

DIMENSIONS AND QUANTITIES FOR BAFFLES							
Pipe Size D	X Baffle			Y Baffle Reinf. Steel		Concrete Class I Cu. Yd.	Reinf. Steel Lbs.
	P Width	Q Height	R Length	Bar M	Bar N		
15"	4"	4"	4"	2-#4	1-#4	0.10	4
18"	4"	4"	5"	3-#4	2-#4		8
24"	5"	5"	6"	4-#4	3-#4		12
30"	5"	5"	7"	4-#4	4-#4		16

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Sideslope Design	Reviewed	T. Yanoschak
Task	Downrain Discharge Structure	Date	7/7/2010

The table below provides a summary of the downdrains requiring energy dissipaters. See *Attachment H* for downrain locations.

Downrain ID	Pipe Size and Type
DD-5	18 ADS
DD-6	18 ADS
DD-7	18 ADS
DD-8	18 ADS
DD-9	18 ADS
DD-10	18 ADS
DD-11	24 ADS

Downrain ID	Pipe Size and Type
DD-12	24 ADS
DD-13	24 ADS
DD-14	24 ADS
DD-15	18 ADS
DD-16	18 ADS
DD-17	18 ADS
DD-18	18 ADS

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Perimeter Ditch Design	Reviewed	T.Yanoschak
Task	Southwest, West, Southeast, East and North Ditch Design	Date	7/7/2010

Purpose

Determine the appropriate dimensions for the North Cell's Southwest, West, Southeast, East and North perimeter ditches.

Methodology

Using the Rational Method procedures in the FDOT Drainage Manual and Manning's Equation for flow in open channels the dimensions for the perimeter ditches is determined. The equations are used in an iterative process where the assumed depth of channel flow is modified until it is equal to the calculated depth of channel flow.

Assumptions

- 1) The perimeter ditches are to be designed for the 100-yr storm.
- 2) Use procedures in the FDOT Drainage Manual.
- 3) The time of concentration (Tc) for each subarea is assumed to be 8 minutes. This is the most conservative value using the FDOT Drainage Manual procedures.

Calculation

Surface Flow Equations and Known Variables

Rational Method $\rightarrow Q = CiA$ (design storm 100-yr)

Q (100-yr) = Flow Rate, cfs

C = Runoff Coefficient \rightarrow Flat, Sandy Soils, Grass = 0.15

(Attachment B-1)

Adjust by 1.25 for 100-yr return period

C = 0.19

(Attachment B-2)

C = Runoff Coefficient \rightarrow Steep Slopes, Sandy Soils, Bare Earth = 0.60

(Attachment B-1)

Adjust by 1.25 for 100-yr return period

C = 0.75

(Attachment B-2)

i = rainfall intensity for 100-yr storm = 10.4 in/hr

(Attachment C)

A = Drainage Area

Open Channel Equations and Known Variables

Manning's Equation $\rightarrow Q = \frac{1.49 A R_h^{2/3} S^{1/2}}{n}$

Q (100-yr) = Flow Rate, cfs

n = Roughness Coefficient \rightarrow maintained grass ditches = 0.060

(Attachment E)

Decrease 30% for flows > 0.7 ft

n = 0.042

n = Roughness Coefficient \rightarrow roughened concrete ditches = 0.020

(Attachment E)

A = Area of Flow

R_h = Hydraulic Radius

S = Slope of Channel

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Perimeter Ditch Design	Reviewed	T.Yanoschak
Task	Southwest, West, Southeast, East and North Ditch Design	Date	7/7/2010

Southwest and West Perimeter Ditches

Location of Upper End	Segment Length (ft)	Rational Method			Manning's Equation										
		Landfill Drainage Area (ac)	Overland Drainage Area (ac)	Total Flow (cfs)	Assumed Depth of Flow (ft)	Calculated Depth of Flow (ft)	Flow Line El.		Slope (%)	Velocity (fps)	Bottom Width (ft)	Left Slope (H:1)	Right Slope (H:1)	Rh (ft)	Area of Flow (sf)
							Up (ft)	Low (ft)							
HP	98	1.21	0.97	11.33	0.19	0.35	29.0	28.9	0.1	0.37	86	3	3	0.2	16.4
DD-12	388	6.13	2.06	51.83	0.69	0.69	28.9	28.5	0.1	0.86	86	3	3	0.7	60.8
DD-13	400	6.27	2.31	64.74	0.75	0.81	28.5	28.1	0.1	0.91	86	3	3	0.7	66.2
DD-14	683	5.94	3.74	118.4	1.10	1.14	28.1	27.4	0.1	1.16	86	3	3	1.1	97.8
DD-15	610	2.18	2.58	140.4	1.22	1.26	27.4	26.8	0.1	1.24	86	3	3	1.2	109.4
DD-16	364	4.10	1.52	175.3	1.40	1.44	26.8	26.5	0.1	1.35	86	3	3	1.3	125.8
DD-17	500	5.14	1.88	219.1	1.60	1.64	26.5	26.0	0.1	1.47	86	3	3	1.5	145.3
Trans	60	0.00	0.35	219.8	2.86	2.91	26.0	25.9	0.1	1.95	30	3	3	2.3	110.3

Note: "Trans" indicates the location ditch transition from a 86 ft bottom to a 30 ft bottom to promote drainage to the existing drainage pipes.

North Perimeter Ditch

Location of Upper End	Segment Length (ft)	Rational Method			Manning's Equation										
		Landfill Area (ac)	Overland Drainage Area (ac)	Total Flow (cfs)	Assumed Depth of Flow (ft)	Calculated Depth of Flow (ft)	Flow Line El.		Slope (%)	Velocity (fps)	Bottom Width (ft)	Left Slope (H:1)	Right Slope (H:1)	Rth (ft)	Area of Flow (sf)
							Up (ft)	Low (ft)							
DD-18	421	1.66	0.00	12.95	1.14	0.73	29.0	28.2	0.2	1.46	10	3	3	0.9	15.3
DD-1	400	1.52	0.00	11.86	1.09	0.69	29.0	28.2	0.2	1.43	10	3	3	0.9	14.5
DD-2	400	1.52	0.00	11.86	1.09	0.69	29.0	28.2	0.2	1.43	10	3	3	0.9	14.5
DD-3	400	1.55	0.00	12.09	1.10	0.70	29.0	28.2	0.2	1.43	10	3	3	0.9	14.6
DD-4	460	1.73	0.00	13.49	1.16	0.74	29.0	28.1	0.2	1.48	10	3	3	0.9	15.7

Note: Assumed all stormwater flows in the same direction to one point for each drainage area. This is a conservative assumption since the stormwater will be directed into multiple stormdrains.

Drainage Area Basins provided in Attachment K.

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Perimeter Ditch Design	Reviewed	T.Yanoschak
Task	Southwest, West, Southeast, East and North Ditch Design	Date	7/7/2010

Southeast and East Perimeter Ditch

Location of Upper End	Segment Length (ft)	Rational Method			Manning's Equation										
		Downdrain Drainage Area (ac)	Overland Drainage Area (ac)	Total Flow (cfs)	Assumed Depth of Flow (ft)	Calculated Depth of Flow (ft)	Flow Line El.		Slope (%)	Velocity (fps)	Bottom Width (ft)	Left Slope (H:1)	Right Slope (H:1)	Rh (ft)	Area of Flow (sf)
							Up (ft)	Low (ft)							
HP	152	0.39	0.71	4.43	0.16	0.16	29.0	28.8	0.1	0.33	86	3	3	0.2	13.8
DD-11	396	6.34	1.81	57.41	0.73	0.73	28.8	28.5	0.1	0.89	86	3	3	0.7	64.4
DD-10	638	5.48	3.07	106.1	1.05	1.05	28.5	27.8	0.1	1.13	86	3	3	1	94.0
DD-9	559	2.58	2.55	131.2	1.20	1.20	27.8	27.3	0.1	1.22	86	3	3	1.1	107.1
DD-8	354	3.86	1.67	164.6	1.37	1.37	27.3	26.9	0.1	1.34	86	3	3	1.3	123.5
DD-7	373	2.00	1.61	183.3	1.46	1.46	26.9	26.5	0.1	1.39	86	3	3	1.4	132.0
DD-6	270	0.87	1.61	193.3	1.51	1.51	26.5	26.3	0.1	1.42	86	3	3	1.4	136.2
Trans	60	0.00	0.33	184	2.62	2.62	26.5	26.5	0.1	1.85	30	3	3	2.1	99.2

Note: "Trans" indicates the location ditch transition from a 60 ft bottom to a 30 ft bottom.
This is done to promote drainage to the existing drainage pipes.

Drainage Area Basins provided in Attachment K.

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	7/17/2010
Component	Access Road Drop Inlet	Reviewed	
Task	Design Drop Inlet	Date	

Purpose

Determine the appropriate dimensions for the drop inlets located along the landfill access road.

Methodology

Using the Rational Method procedures in the FDOT Drainage Manual and Manning's Equation for flow in open channels, the dimensions for the drop inlet and outlet pipe are determined. The equations are used in an iterative process where the assumed depth of channel flow is modified until it is equal to the calculated depth of channel flow. This will provide flow conditions in the access road ditch. The pipe size is then determined by calculating the maximum flow rate and drainage area for a standard size pipe that exceeds the worst case drainage basin conditions calculated in Step 1.

Assumptions

- 1) The access road ditch and piping are to be designed for the 25-yr storm.
- 2) Use procedures in the FDOT Drainage Manual.
- 3) The time of concentration (Tc) for each subarea is assumed to be 8 minutes. This is the most conservative value using the FDOT Drainage Manual procedures.

Calculation

Step 1 - Calculate runoff flow for worst case drainage basin and determine flow conditions in ditch.

Surface Flow Equations and Known Variables

Rational Method → $Q = CiA$ (design storm 25-yr)

Q (25-yr) = Flow Rate, cfs

C = Runoff Coefficient → Steep Slopes, Sandy Soils, Bare Earth = 0.60 (Attachment B-1)

Adjust by 1.1 for 25-yr return period

$C = 0.66$ (Attachment B-2)

i = rainfall intensity for 25-yr storm = 8.0 in/hr (Attachment C)

A = Drainage Area

Open Channel Equations and Known Variables

Manning's Equation → $Q = \frac{1.49 A R_h^{2/3} S^{1/2}}{n}$

Q (100-yr) = Flow Rate, cfs

n = Roughness Coefficient → maintained grass ditches = 0.060 (Attachment E)

A = Area of Flow

R_h = Hydraulic Radius

S = Slope of Channel

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	7/17/2010
Component	Access Road Drop Inlet	Reviewed	
Task	Design Drop Inlet	Date	

Landfill Access Road Ditch - Worse Case

Segment Length (ft)	Rational		Manning's Equation										
	Landfill Drainage Area (ac)	Total Flow (cfs)	Assumed Depth of Flow (ft)	Calculated Depth of Flow (ft)	Flow Line El.		Slope (%)	Velocity (fps)	Bottom Width (ft)	Left Slope (H:1)	Right Slope (H:1)	Rh (ft)	Area of Flow (sf)
					Up (ft)	Low (ft)							
705	0.93	4.91	0.28	0.28	135.0	64.5	10.0	3.04	5	3	3	0.2	1.6

Drainage Area Basins provided in Attachment L.

Step 2 - Determine the maximum drainage area to maintain desired flow depth in collection pipe.

Using the manning's equation for circular pipes, the maximum allowable flow and drainage area for both 18-in ADS and 24-in ADS pipes is determined using the Rational Method. Normal depth flow is assumed in pipe.

Surface Flow Equations and Known Variables

Rational Method → $Q = CiA$ (design storm 25-yr)

Q (surf) = Maximum Discharge, cfs

C = Runoff Coefficient → Steep Slopes, Sandy Soils, Bare Earth = 0.60 (Attachment B-1)

Adjust by 1.1 for 25-yr return period

$C = 0.66$

(Attachment B-2)

i = rainfall intensity for 25-yr storm = 8.0 in/hr

(Attachment C)

A = Maximum Drainage Area

Pipe Flow Equations and Known Variables

Manning's Equation → $Q = \frac{1.49}{n} A R_h^{2/3} S^{1/2}$

Q (pipe) = Flow Rate, cfs

n = Roughness Coefficient → ADS Pipe = 0.020

(Attachment G)

A = Flow Area of Pipe (Assume Normal Flow Depth)

R_h = Hydraulic Radius = A/W (W = Wetted Perimeter)

S = Slope = 10% = 0.10 ft/ft

12-in ADS Pipe Maximum Capacity (assuming normal depth flow)

The two equations above are solved using an iterative process. Modify maximum drainage area so

Surface Flow	Pipe Flow	Calculated Pipe Flow Data
$A = 1.27$ ac	Pipe ID = 12 in = 1 ft	Top Flow Width = 0.87 ft
Q (surf) = 6.69 cfs	Pipe Radius = 0.5 ft	Flow Velocity = 10.59 fps
	Normal Depth = 0.75 ft	Hydraulic Depth = 0.73 ft
	$A = 0.63$ sf	Froude Number = 2.19
	$W = 2.09$ ft	
	$R_h = 0.30$ ft	

Job No. 139929

Calc No.

Computation



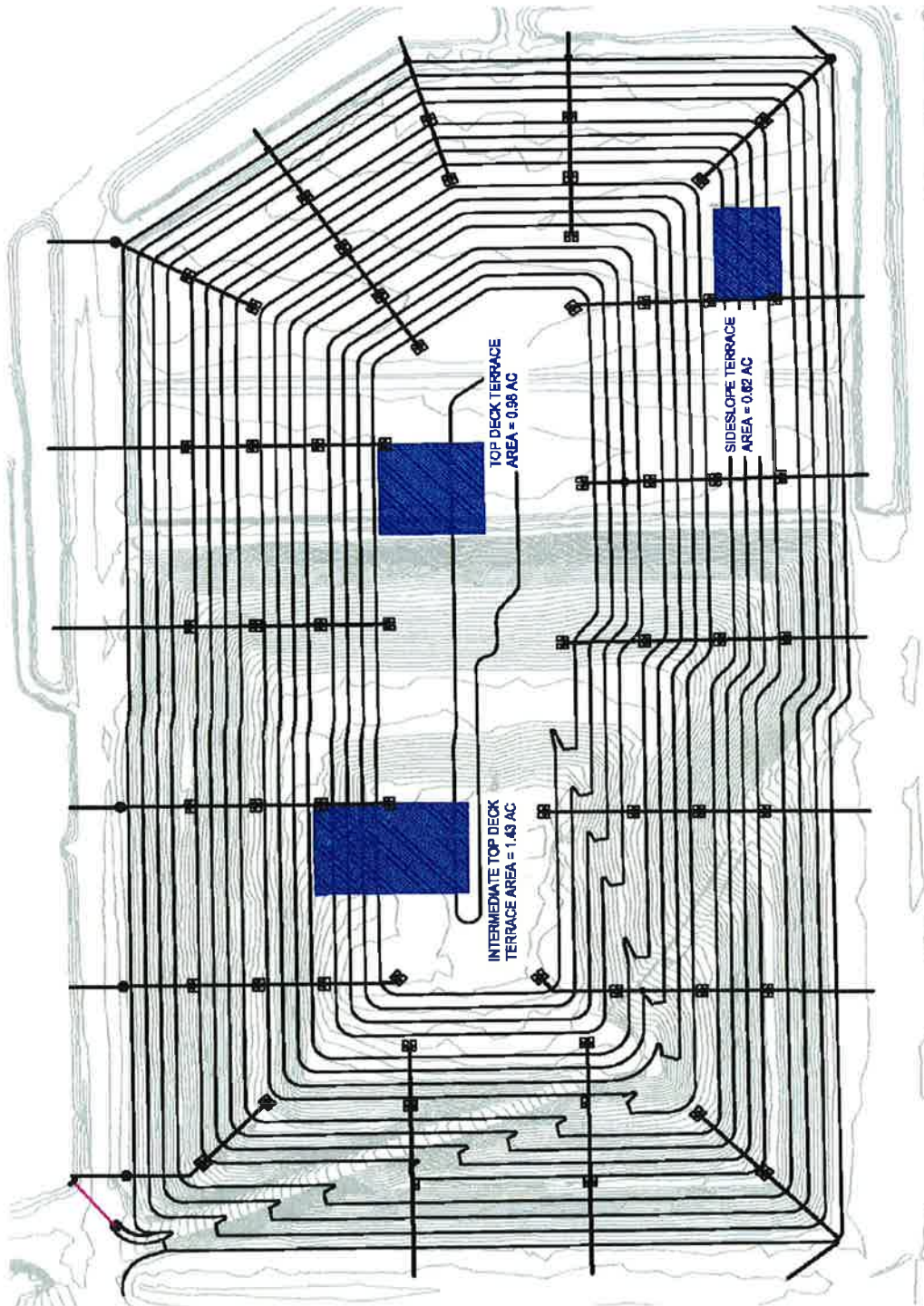
Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	7/17/2010
Component	Access Road Drop Inlet	Reviewed	
Task	Design Drop Inlet	Date	
	Q (pipe) = 6.69 cfs		

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment A	Reviewed	T.Yanoschak
Task		Date	7/7/2010

Attachment A Estimated Critical Terrace Drainage Basins



Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment B	Reviewed	T.Yanoschak
Task		Date	7/7/2010

Attachment B.1 Source: FDOT Drainage Handbook Hydrology

Hydrology Handbook
January 2004

Table T-4
Runoff Coefficients For A Design Storm Return
Period Of 10 Years Or Less^a

Slope	Land Use	Sandy Soils			Clay Soils	
		Min.	Max.		Min.	Max.
Flat (0-2%)	Woodlands	0.10	0.15	Use 0.15	0.15	0.20
	Pasture, grass, and farmland ^b	0.15	0.20		0.20	0.25
	Bare Earth	0.30	0.50		0.50	0.60
	Rooftops and pavement	0.95	0.95		0.95	0.95
	Pervious pavements ^c	0.75	0.95		0.90	0.95
	SFR: 1/2-acre lots and larger	0.30	0.35		0.35	0.45
	Smaller lots	0.35	0.45		0.40	0.50
	Duplexes	0.35	0.45		0.40	0.50
	MFR: Apartments, townhouses, and condominiums	0.45	0.60		0.50	0.70
	Commercial and Industrial	0.50	0.95		0.50	0.95
Rolling (2-7%)	Woodlands	0.15	0.20	Use 0.50	0.20	0.25
	Pasture, grass, and farmland ^b	0.20	0.25		0.25	0.30
	Bare Earth	0.40	0.60		0.60	0.70
	Rooftops and pavement	0.95	0.95		0.95	0.95
	Pervious pavements ^c	0.80	0.95		0.90	0.95
	SFR: 1/2-acre lots and larger	0.35	0.50		0.40	0.55
	Smaller lots	0.40	0.55		0.45	0.60
	Duplexes	0.40	0.55		0.45	0.60
	MFR: Apartments, townhouses, and condominiums	0.50	0.70		0.60	0.80
	Commercial and Industrial	0.50	0.95		0.50	0.95
Steep (7%+)	Woodlands	0.20	0.25	Use 0.60	0.25	0.30
	Pasture, grass, and farmland ^b	0.25	0.35		0.30	0.40
	Bare Earth	0.50	0.70		0.70	0.80
	Rooftops and pavement	0.95	0.95		0.95	0.95
	Pervious pavements ^c	0.85	0.95		0.90	0.95
	SFR: 1/2-acre lots and larger	0.40	0.55		0.50	0.65
	Smaller lots	0.45	0.60		0.55	0.70
	Duplexes	0.45	0.60		0.55	0.70
	MFR: Apartments, townhouses, and condominiums	0.60	0.75		0.65	0.85
	Commercial and Industrial	0.60	0.95		0.65	0.95

^a Weighted coefficient based on percentage of impervious surfaces and green areas must be selected for each site.

^b Coefficients assume good ground cover and conservation treatment.

^c Depends on depth and degree of permeability of underlying strata.

Note: SFR = Single Family Residential
MFR = Multi-Family Residential

Computation



<i>Project</i>	Tomoka Farms Road Landfill - Closure Permit Modification	<i>Computed</i>	A. Evans
<i>System</i>	North Cell Landfill Drainage Calculations	<i>Date</i>	6/30/2010
<i>Component</i>	Attachment B	<i>Reviewed</i>	T.Yanoschak
<i>Task</i>		<i>Date</i>	7/7/2010

Attachment B.2 Source: FDOT Drainage Handbook Hydrology

Hydrology Handbook
January 2004

Table T-5
Design Storm Frequency Factors For Pervious Area
Runoff Coefficients *

<u>Return Period (years)</u>	<u>Design Storm Frequency Factor, X_T</u>
2 to 10	1.0
25	1.1
50	1.2
100	1.25

Reference: Wright-McLaughlin Engineers (1969).

- * DUE TO THE INCREASE IN THE DURATION TIME THAT THE PEAK OR NEAR PEAK DISCHARGE RATE IS RELEASED FROM STORMWATER MANAGEMENT SYSTEMS, THE USE OF THESE SHORT DURATION PEAK RATE DISCHARGE ADJUSTMENT FACTORS IS NOT APPROPRIATE FOR FLOOD ROUTING COMPUTATIONS.

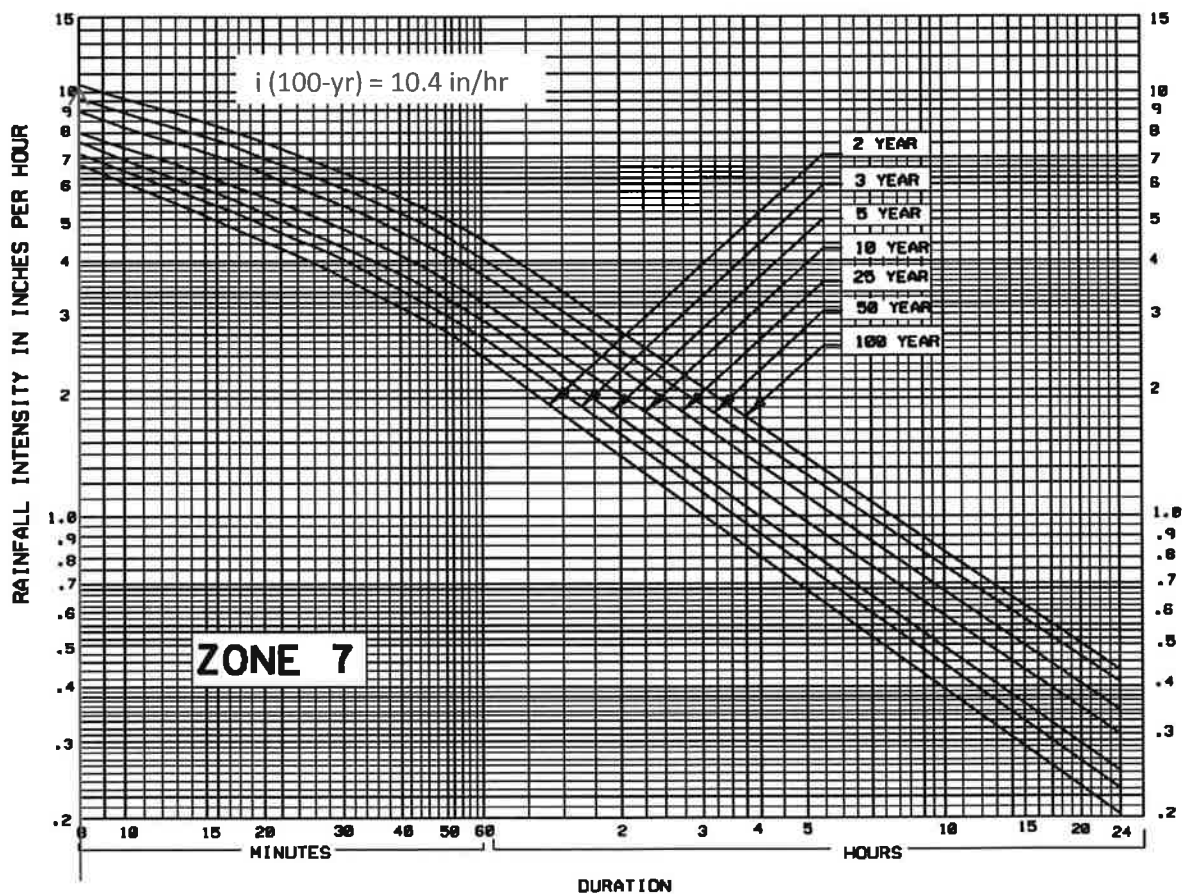
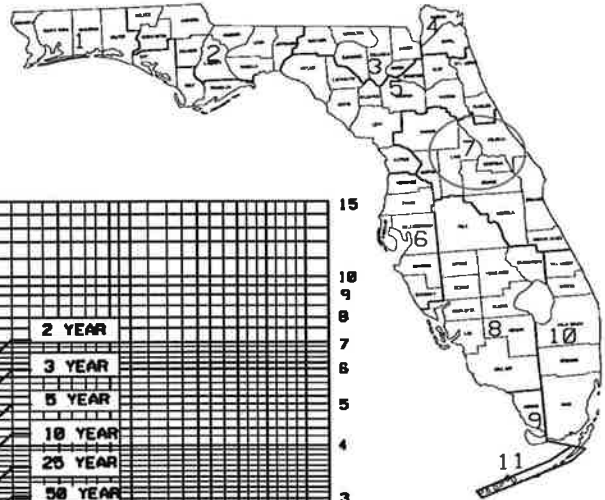
Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment C	Reviewed	T.Yanoschak
Task		Date	7/7/2010

Attachment C

Source: FDOT Drainage Handbook Hydrology



Assume worst case

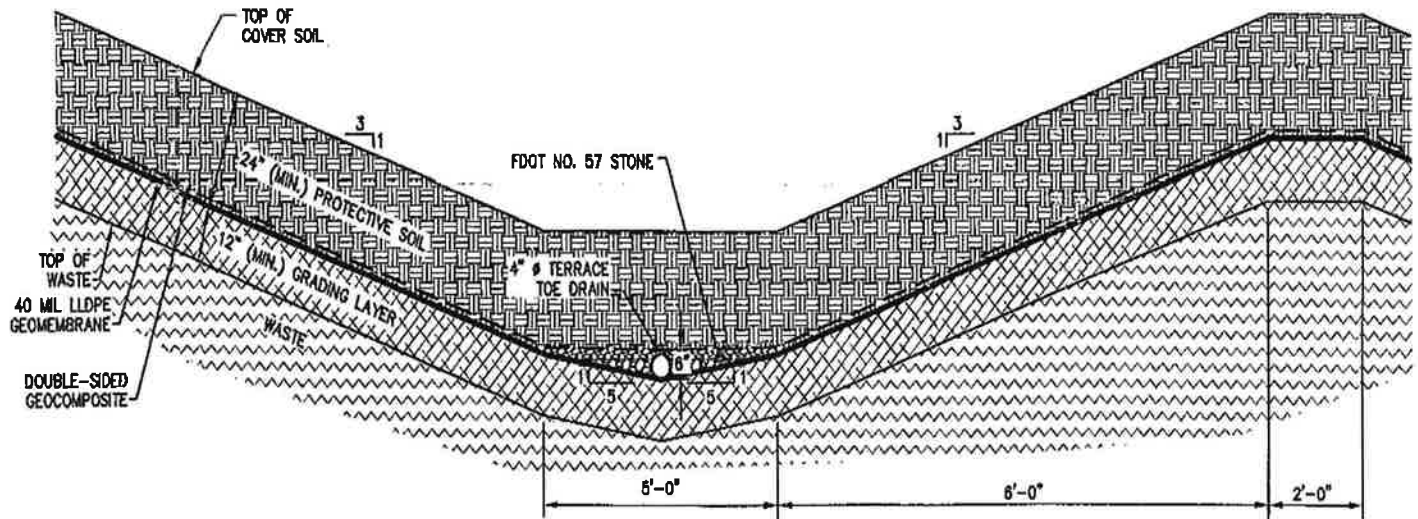
 $T_c = 8 \text{ min}$

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment D	Reviewed	T. Yanoschak
Task		Date	7/7/2010

Attachment D Terrace Geometry



TERRACE CROSS SECTION (TYPICAL) (2)

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment E	Reviewed	T.Yanoschak
Task		Date	7/7/2010

Attachment E Roughness Coefficients for Channels

Hydrology Handbook
January 2004

Table T-3
Recommended Manning's n Values for Artificial
Channels with Various Linings

<u>Channel Lining</u>	<u>Lining Description</u>	<u>Design Manning's n Value</u>
<u>Bare Earth or Vegetative Linings</u>		
Bare earth, fairly uniform	Clean, recently completed	0.022
Bare earth, fairly uniform	Short grass and some weeds	0.028
Dragline excavated	No vegetation	0.030
Dragline excavated	Light brush	0.040
Channels not maintained	Dense weeds to flow depth	0.100
Channels not maintained	Clear bottom, brush sides	0.080
Maintained grass or sodded ditches	Good stand, well maintained 2" - 6"	0.060*
Maintained grass or sodded ditches	Fair stand, length 12" - 24"	0.200*
<u>Rigid Linings</u>		
Concrete paved	Broomed**	0.016
Concrete paved	"Roughened" - standard	0.020
Concrete paved	Gunite	0.020
Concrete paved	Over rubble	0.023
Asphalt concrete	Smooth	0.013
Asphalt concrete	Rough	0.016

* Decrease 30% for flows > 0.7' (maximum flow depth 1.5').

** Because this is not the standard finish, it must be specified.

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment F	Reviewed	T. Yanoschak
Task		Date	7/7/2010

Attachment F Recommended Maximum Velocities

605-040-207-a

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Table 7-1
MAXIMUM SHEAR STRESS VALUES
AND ALLOWABLE VELOCITIES FOR DIFFERENT SOILS

Soil Type	Shear Stress (lb/ft ²)	Allowable Velocity for a Flow Depth of About 3 ft (ft/sec)
Silt or Fine Sand	0.027	1.50
Sandy Loam	0.037	1.75
Silt Loam	0.048	2.00
Firm Loam	0.075	2.50
Stiff Clay	0.260	3.75
Hardpans	0.670	6.00

Reference: University of Florida (1972)

Table 7-2
RECOMMENDED MAXIMUM VELOCITIES FOR VARIOUS LINING TYPES

Lining Type	Maximum Velocity (ft/sec)
Grass with Mulch	Bare Soil (see Table 17-1)
Sod	4
Lapped Sod	5.5
Geotextile Grid	4-8*
Flexible	Design in Accordance with HEC-15
Rigid	10**

*Varies with grid.

**Higher velocities are acceptable if energy dissipation is accomplished.

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment G	Reviewed	T. Yanoschak
Task		Date	7/7/2010

Attachment G Manning's n Value for Pipes (source: Advanced Drainage Systems Catalog)

TABLE 1

Manning's "n" Value For Design
(Storm & Sanitary Sewer and Culverts)

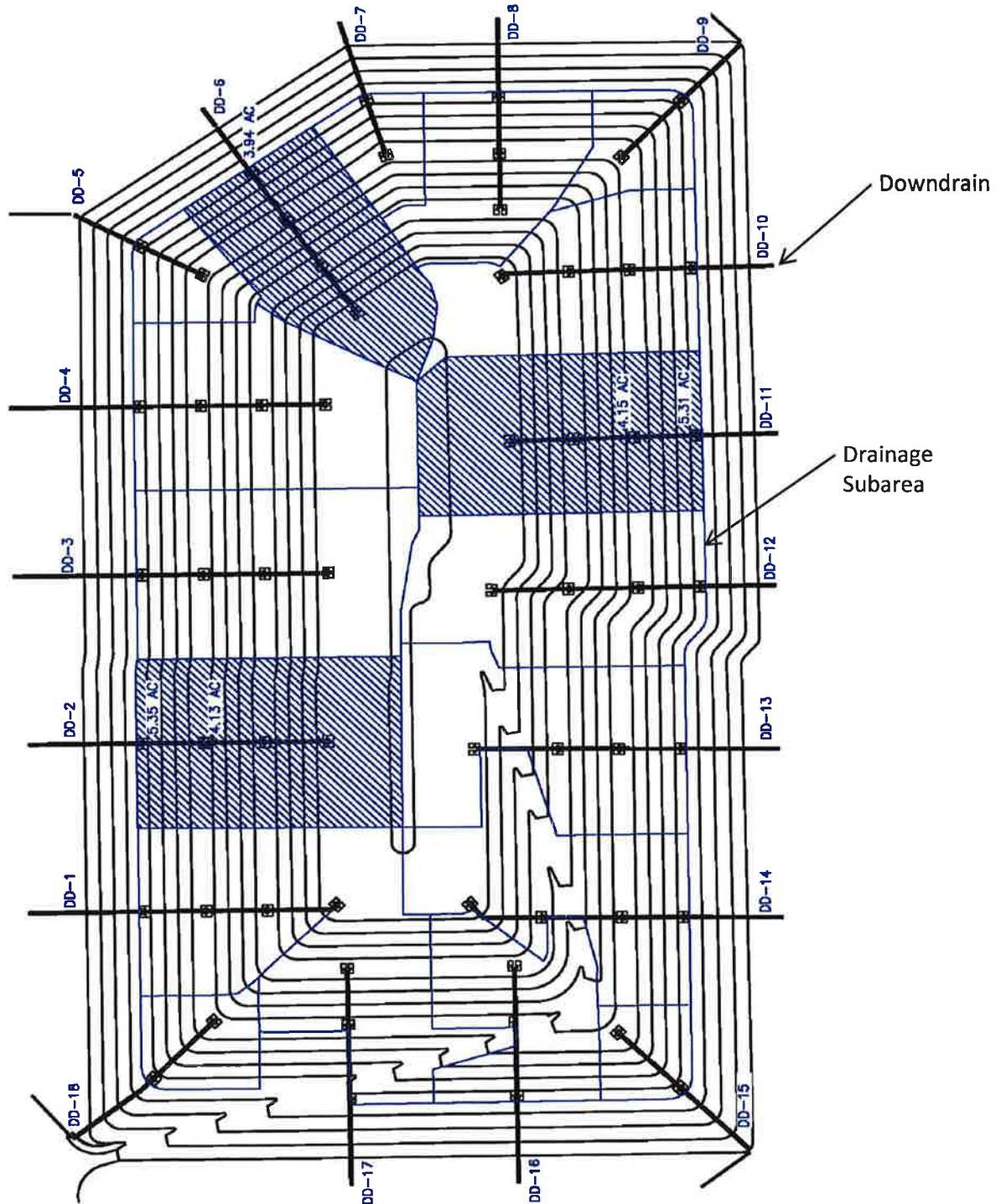
Pipe Type	"n"
A.D.S. Corrugated Polyethylene Pipe	
3 - 6" Diameter	0.015
8" Diameter	0.016
10" Diameter	0.017
12 - 15" Diameter	0.018
18 - 36" Diameter	0.020
A.D.S. N-12	0.012
Concrete Pipe	0.013
Corrugated Metal Pipe (2 2/3" x 1/2" corrugation)	
Annular	
Plain	0.024
Paved Invert	0.020
Fully Paved (smooth lined)	0.013
Helical	
Plain 15" Diameter	0.013
18" Diameter	0.015
24" Diameter	0.018
36" Diameter	0.021
Spiral-Rib	0.012
Plastic Pipe (SDR, S&D, Etc.)	0.011
Vitrified Clay	0.013

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment H	Reviewed	T. Yanoschak
Task		Date	7/7/2010

Attachment H Downdrain Criteria Subareas

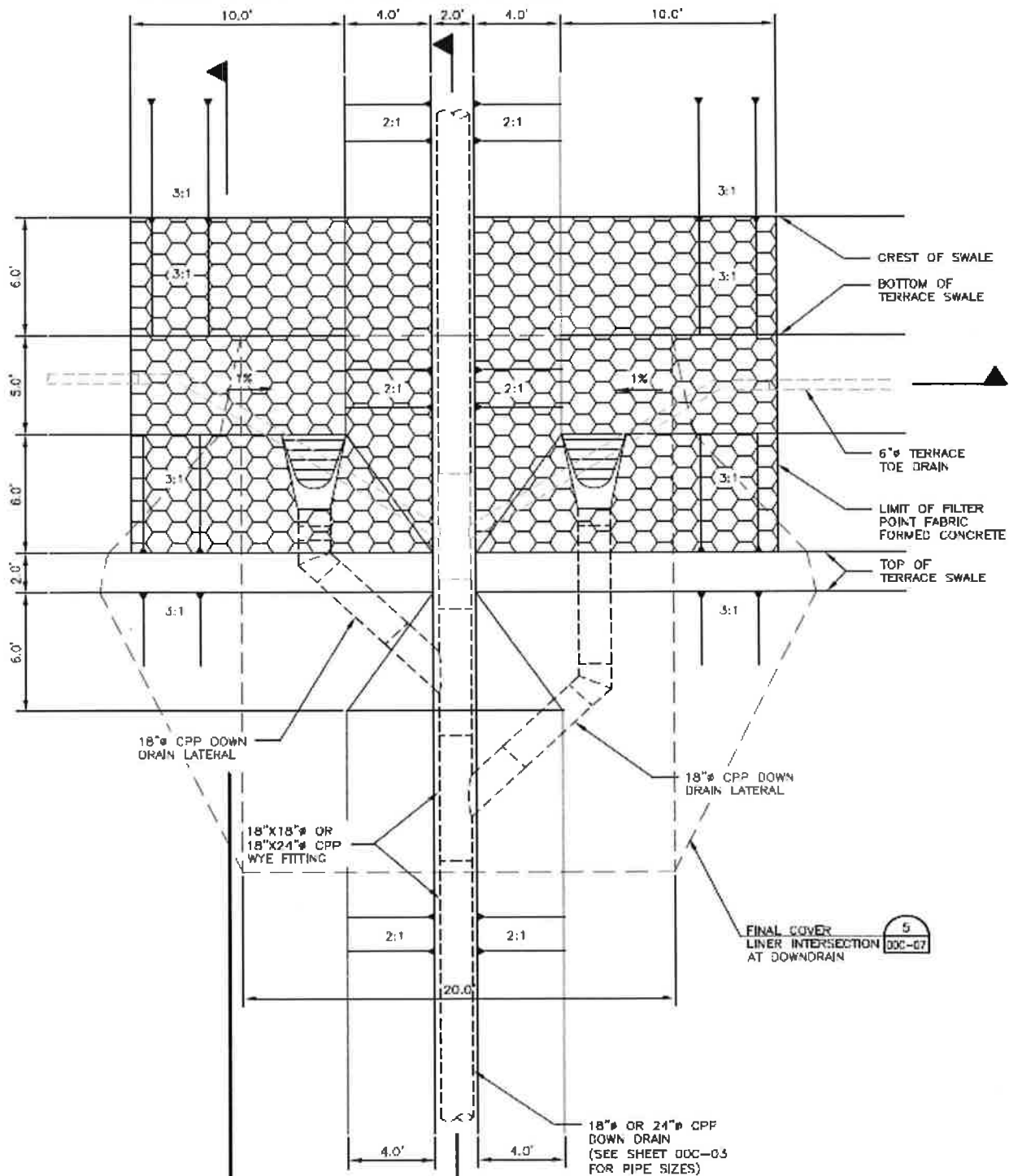


Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment I	Reviewed	T. Yanoschak
Task		Date	7/7/2010

Attachment I DOWNDRAIN INLET DESIGN



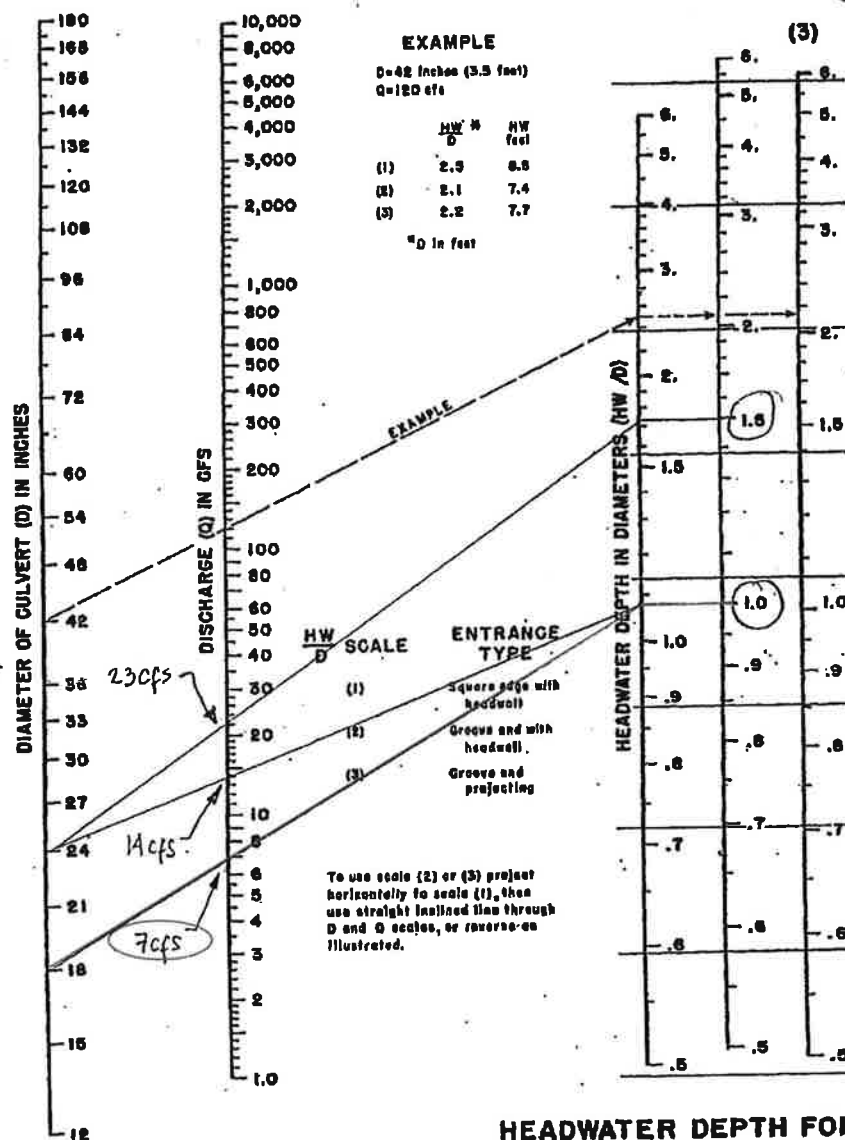
Computation

HDR

Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment J	Reviewed	T. Yanoschak
Task		Date	7/7/2010

Attachment J Culverts with Inlet Control Chart

CHART 1B



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2 & 3
 REVISED MAY 1964

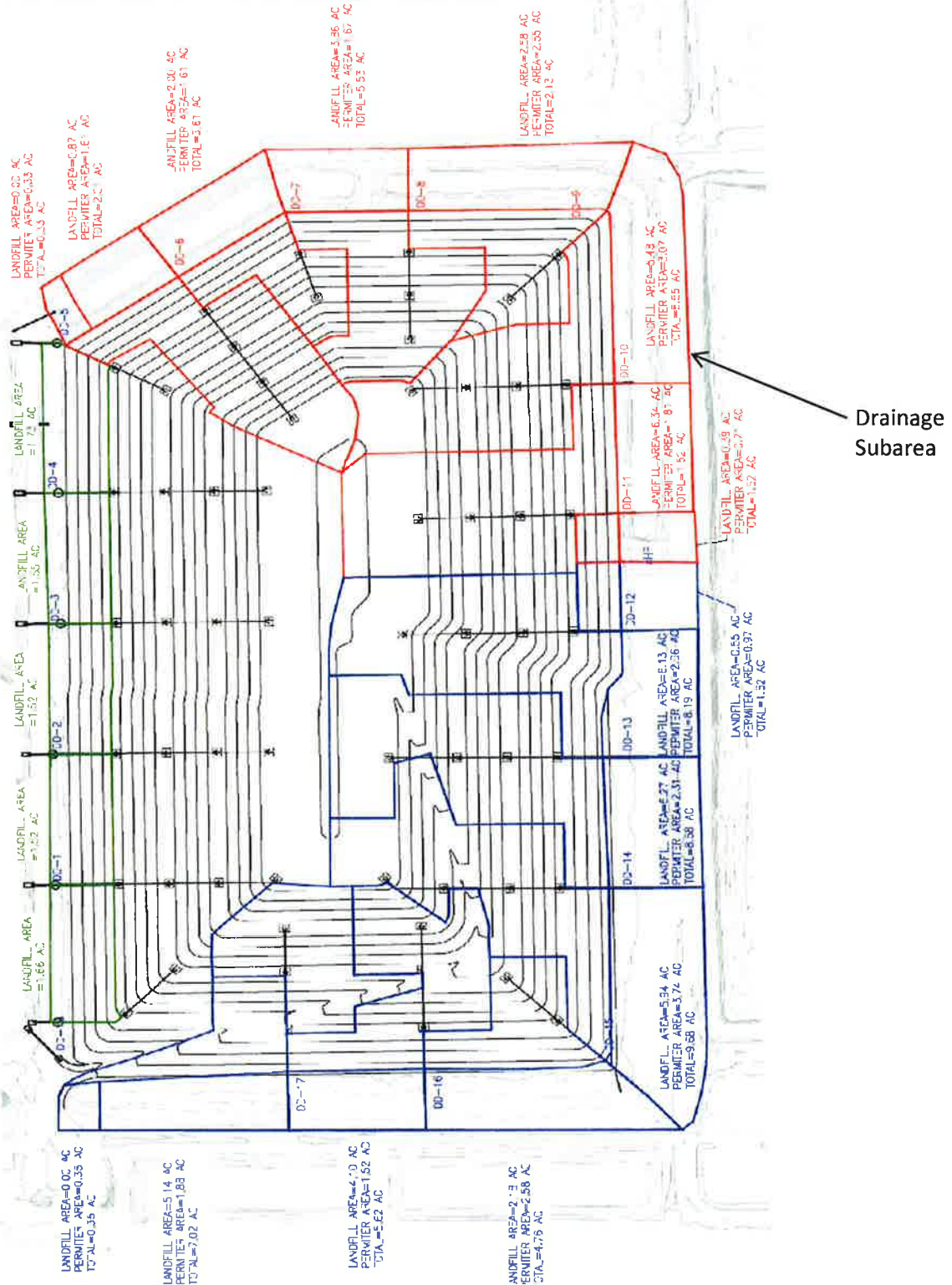
BUREAU OF PUBLIC ROADS JAN. 1963

Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	6/30/2010
Component	Attachment K	Reviewed	T.Yanoschak
Task		Date	7/7/2010

Attachment K Ditch Drainage Basin Areas

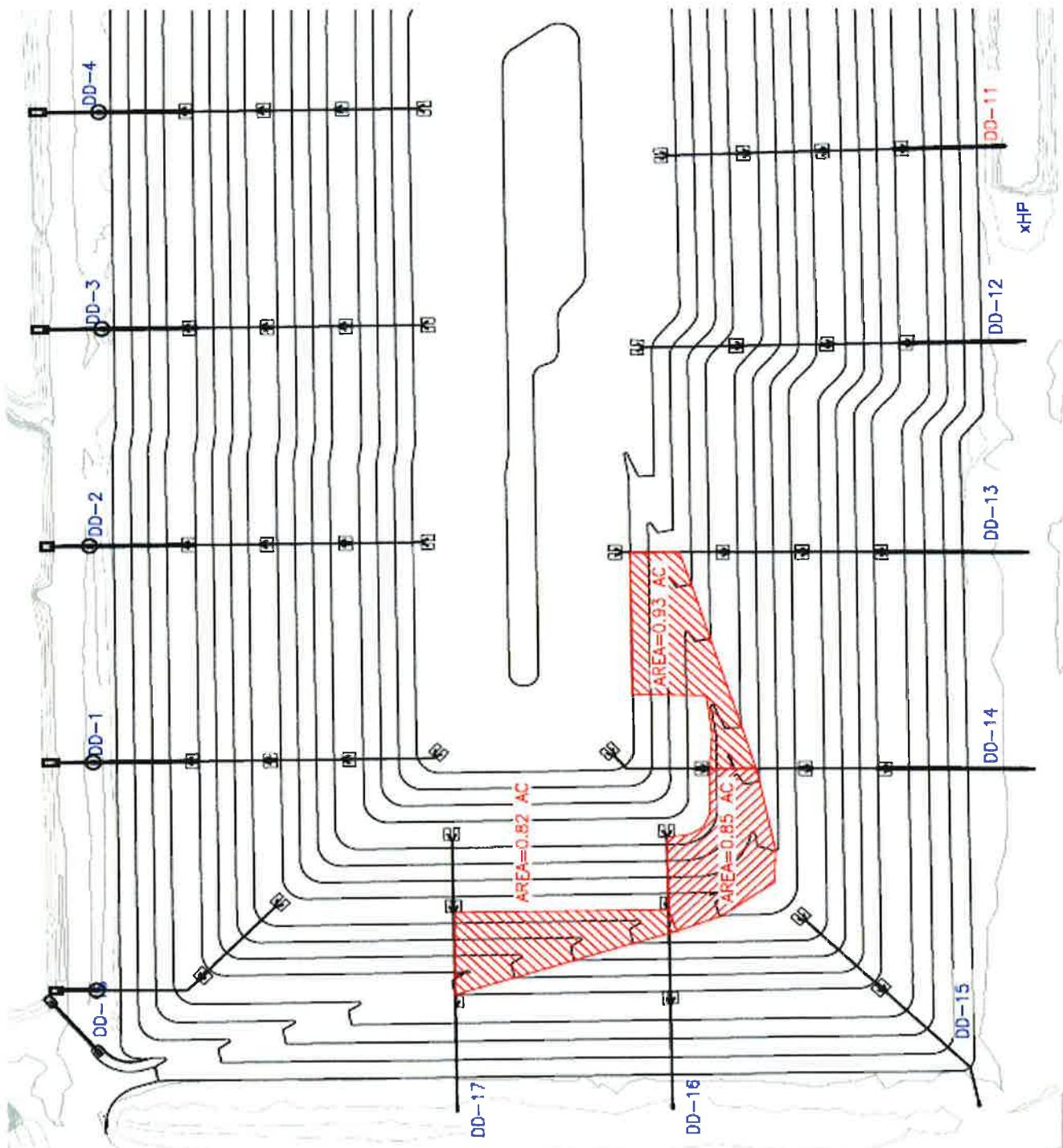


Computation



Project	Tomoka Farms Road Landfill - Closure Permit Modification	Computed	A. Evans
System	North Cell Landfill Drainage Calculations	Date	7/16/2010
Component	Attachment L	Reviewed	
Task		Date	

Attachment L Access Road Ditch Drainage Basin for Worst Case Drop Inlet



APPENDIX A

Closure Design Drawings

(Under Separate Cover)



Volusia County
Solid Waste Division

Tomoka Farms Road Landfill Class I Closure and Long Term Care Plan

Prepared for:

Volusia County – Solid Waste Division
3151 East New York Avenue
DeLand, Florida 32724

Submitted by:

HDR Engineering, Inc.
200 W. Forsyth Street, Ste. 800
Jacksonville, Florida 32202
Date: August 25, 2010

A handwritten signature in blue ink, which appears to read "Mark Roberts", is written over the date "8/24/10". The signature and date are positioned above a horizontal line.

Mark Roberts, P.E.

Florida P.E. No.: 54187

HDR Project No. 0195-139929-002

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this Closure and Long-Term Care Plan (Plan) is to provide general guidelines and procedures for the closure requirements, closure construction, inspection, maintenance, repairs, monitoring, and record keeping for the South Cell and North Cell Class I Landfills located at the Tomoka Farms Road Landfill (TFRL) located in Port Orange, Florida. This Plan is being submitted in support of the North Cell Class I Closure Intermediate Modification Permit Application.

This Plan provides a combination of recommendations and Florida Department of Environmental Protection (FDEP) requirements. Only those permit items pertinent to the closure and routine maintenance and/or operation of the North Cell landfill and the stormwater system as well as the long term care of the South Cell and North Cell landfills have been identified and discussed.

The Plan contains a general discussion of the following: (1) closure requirements specified in 62-701.600, F.A.C., and (2) long-term care requirements specified in 62-701.620(2), F.A.C., which include a description of the procedures for erosion control; filling areas of subsidence or other depressions; maintenance of stormwater management system; leachate collection and management; groundwater monitoring and monitor well maintenance; maintenance of vegetative cover; general maintenance of the facility; and provisions and anticipated source of cover material for long term care, consistent with the information provided in support of the financial assurance long-term care estimates required by Rule 62-701.630, F.A.C.

An overall site plan of the TFRL is provided on Sheet C-01 of the Closure Design Drawings located in Appendix A of the North Cell Class I Closure Intermediate Modification Permit Application. The site plan shows the locations of the various components of the TFRL including existing South Cell, North Cell and future phases of the Class I landfills.

1.2 General Information

The TFRL currently operates the North Cell – Phase I, Class I, under FDEP permit number SO64-0078767-023 dated June 2, 2008 which expires on March 3, 2013.

The TFRL is a 3,400 acre waste management facility located at 1990 Tomoka Farms Road, Port Orange, Florida, 2 miles south of US 92. The TFRL has accepted waste since 1969 and is owned and operated by Volusia County and includes a closed Class I landfill (South Cell), an active Class I landfill (North Cell), and an active Class III landfill. The South Cell and Class III landfill are not included as part of this closure permit; however to be consistent with the original closure permit, the long term care of the South Cell is included in this Plan. The active North Cell Class I landfill is approximately 69.2 acres in size and is permitted to be filled to an elevation of 192 feet. The County will soon be moving east into a lined, permitted, and constructed cell (North Cell - Phase II) covering 21.0 acres. Ultimately, the North Cell Class I landfill will be expanded to include two additional Phases of Class I landfill for a total of 90 acres. A vicinity map showing the location of the TFRL site is provided on the cover sheet of the Closure Design Drawings contained in Appendix A of this permit application.

The legal description of the property on which the Class I landfill is located is Section 9, Township 16 South, and Range 32 East. The TFRL services Flagler and Volusia Counties and only the wastes allowed by the operation permit are disposed of within the TFRL Class I landfill. These include residential, commercial, industrial, and agricultural wastes.

2.0 CLOSURE REQUIREMENTS

In accordance with the requirements of 62-701.600, F.A.C., the following describes the procedures that will be followed and the information that is required for the closure of the North Cell Class I landfill at TFRL.

This Closure and Long Term Care Plan is being prepared for the closure of the North Cell Class I landfill and long term care of the South Cell and North Cell Class 1 landfills. The North Cell will be closed in three phases as shown in the Closure Design Drawings provided in Appendix A of the Intermediate Modification Permit Application. It is anticipated that the expansion areas or upgradient terraces will be in operation at the time of the first and second closure sequence.

2.2 Closure Permit Requirements

This Plan is part of a closure intermediate modification permit application for the North Cell Class I landfill which is being submitted to the FDEP at least 90 days before final receipt of waste within the North Cell in accordance with FAC 62-701.600(3).

This Plan includes the following items:

- Closure design plan.
- Closure operation plan.
- Plan for long-term care.
- Demonstration of financial responsibility.

2.3 Closure Report Requirements

Section omitted for compliance with the revised 62-701 rules promulgated in January 2010.

2.4 Closure Design Plan

The Closure Design Plan for the North Cell consists of the Closure Design Drawings provided in Appendix A and the discussions provided within the following subsections.

2.4.1 Closure Sequencing

The final cover will be constructed in three sequences, to allow the County to install final cover over areas that have reached final permitted elevation. The proposed phased development of the North Cell and the associated phases of closure are shown on the permit drawings.

2.4.2 Drawings Showing Existing Topography and Final Grades

The existing grades and the permitted final grades for the North Cell are shown on the permit drawings. The final closure shown on Sheet C-03 of the Closure Design Drawings are consistent with the FDEP approved design dimensions for the North Cell submitted in August of 2009.

2.4.3 Approved Design Dimensions

The County intends to construct final cover over the portions of the North Cell once they reach the maximum permitted elevation.

2.4.4 Final Elevations

Final elevations of the final cover for the North Cell are shown on Sheet C-05. The maximum permitted elevation of the final cover is 192 feet NGVD.

2.4.5 Side Slope Design

The proposed side slope design for the North Cell closure is provided on Sheet C-05 of the Closure Design Drawings and detail sheets C-06 through C-09. The maximum side slope is 3H:1V which is consistent with FAC 62-701.600(3)(e). A series of 19-foot wide drainage terraces are located at approximate elevations of 69, 107, 145, and 185 feet NVGD, as a means of collecting stormwater from the slopes. Terraces drain at a slope of one percent to direct stormwater to a series of 18-inch and 24-inch diameter downdrains. Downdrains are constructed at approximately 400-foot centers and discharge stormwater within the perimeter drainage channels. The top portion on the North Cell is designed to have a 4 percent slope to direct runoff to the downdrains. Energy dissipation is provided by U-Type concrete endwall baffles (FDOT Design Standards) at the discharge point of the downdrains to avoid scour within the perimeter drainage channels. Calculations demonstrating that the drainage terrace and downdrains are adequately sized for the 100-year, 24-hour design storm is included as an attachment in the North Cell Class I Closure Intermediate Modification Permit Application.

Placement of final cover is limited to the portions of the North Cell where the maximum permitted elevation has been obtained. These areas will be covered with sod immediately after construction of the final cover and will significantly reduce the amount of erosion that will occur on the side slopes.

Access for maintenance of the North Cell final cover will be provided by a permanent access road that will be located on the western and southwestern slopes as shown on Sheet C-03 of the Closure Design Drawings. The drainage terraces will provide a means for vehicles to access the side slope for repairs and maintenance.

2.4.6 Final Cover Design

As previously indicated, placement of final cover will be limited to the areas of the North Cell where the maximum permitted elevation has been achieved. The proposed North Cell final cover profile is provided on Sheet C-06 of the Closure Design Drawings. The final cover includes, from the top down: sod, 6 inches of topsoil, 18 inches of protective cover soil, bi-planar geocomposite drainage net, a 40-mil LLDPE textured geomembrane, and 12 inches of initial soil cover (grading layer). The components of the final cover system shall meet the requirements of FAC 62-701.600(3)(g) as demonstrated by the technical specifications for the components contained in Appendix D of this permit application.

The potential for deep seated rotational or translational failures through the waste and final cover was addressed in the geotechnical report submitted with the original North Class I Cell construction permit application. In January 2001, the County applied for a permit to substantially modify the construction of the North Class I cell. The January 31, 2001 permit application included a slope stability analysis for the re-designed cell. The computer program

PCSTABLE5, developed by Purdue University, was used to analyze the potential for wedge and rotational failures. A factor of safety of 2.2 for wedge failure and 1.5 for rotational failure was achieved by the proposed design.

The April 2002 application for a permit to construct the East Cell also contained a geotechnical report evaluating the potential for circular and wedge failure. This report concluded that the design met or exceeded the minimum allowable factor of safety of 1.5.

The interface stability of the final cover system was demonstrated in the Closure Permit Application approved on May 30, 2007.

2.4.7 Final Cover Installation Plans

Final cover installation plans for the North Cell are provided in the Closure Design Drawings. Final cover will be placed over the areas of the North Cell where the maximum permitted elevation has been reached and no future expansion is planned. As previously discussed, the final cover has been designed to minimize infiltration of rainfall and subsequent generation of leachate.

The final cover will be installed in accordance with the Construction Quality Assurance (CQA) Plan provided in Appendix C of the Closure Permit Application. The CQA Plan meets the requirements of FAC 62-701.400(7) and (8).

The final cover will be vegetated with rolled sod to control erosion and provide a moisture infiltration seal. The sod will be a native species of drought resistant grass that will have roots that will not penetrate the final cover.

The final cover has been designed to maximize runoff and minimize erosion considering total fill height and expected subsidence caused by decomposing waste, and has been designed to prevent ponding or low spots. The top portion of the North Cell is designed to have a 4 percent slope to promote good drainage after settlement.

Borrow soil required for maintenance of the North Cell final cover during the remaining operational life of the TFRL Class I landfill and the post closure care period will be obtained from the permitted borrow areas located within the TFRL site. The County is committed to developing and maintaining sources for cover soil to support the on-going landfill operations. It is anticipated that additional on-site borrow pits will be developed within the 3500-acre landfill property. In the event that the borrow areas are no longer available, the County will make arrangements for material to be obtained from other off site sources. The borrow soil will be used to repair erosion damage, filling areas of subsidence or other depressions, maintaining berms, and general maintenance of the facility.

2.4.8 Stormwater Control

Surface water management in the North Cell is designed to prevent intrusion of stormwater runoff into areas with municipal solid waste. Surface runoff from the landfill sideslopes is directed through downdrains to the perimeter ditch that surrounds the landfill on the west, east and south sides. On the north side, the downdrains discharge directly into the flooded borrow pit

that provides detention and treatment of stormwater runoff. Drainage calculations for the closure are provided with Attachment O.2.h.

2.4.9 Access Control

The TFRL facility will remain in operation after the North Cell closure is completed; therefore the current measures for limiting access to the facility will be maintained. This site is open and staffed seven days per week. The site is fenced to prevent unauthorized access and the gates are locked during the hours when the site is not open.

2.4.10 Proposed Final Use

Currently, there are no planned final uses identified for the North Cell of the TFRL Class I Landfill except for the potential possibility of continuing to fuel the landfill gas to energy facility on site. Any final uses will be permitted through FDEP prior to their implementation.

2.4.11 Gas Management System

The County installed a comprehensive LFG collection and control system in the closed South Cell Class I disposal area. This system includes a series of vertical wells, lateral and header piping, and condensate management features. Collected LFG is piped through a transmission line to the gas recovery facility. At the gas recovery facility, the LFG is either combusted in the LFG-to-energy system, the enclosed flare, and/or the utility flare.

The County has completed installation of a LFG collection and control system in the North Cell, as authorized by permit SO64-00078767-018. The LFG collected from the North Cell is either sent to the new blower and utility flare station located southwest of the North Cell or conveyed by a pipeline to the existing LFG recovery facility. The County intends to expand this LFG collection system as the North Cell is developed further.

2.5 Closure Operation Plan

This Closure Operation Plan is provided as part of the closure permit application. The information provided below is required by FAC 62-701.600(4).

2.5.1 Actions Required to Close Landfill

Construction will not begin until a closure construction permit is obtained from FDEP. Prior to final cover construction, elements of the landfill gas collection and control system that are to be installed below the final cover liner will be installed. These components include vertical and horizontal extraction wells, headers and laterals. Sedimentation and erosion control measures will also be installed in accordance with the Florida Erosion and Sediment Control Manual. Grading of the side slopes will then take place to ensure that a minimum of 18 inches of soil exists above the waste (6 inches of initial cover and 12 inches of intermediate cover compacted to a minimum of 95 percent Standard Proctor maximum density) and to provide a smooth surface suitable for placement of the 40 mil LLDPE geomembrane liner. At this time, trenches of the 18-inch and 24-inch diameter downdrains will be excavated into the waste at terrace locations and backfilled with a minimum of 18 inches of compacted soil to support the

geomembrane liner. Also the permanent access road shown in the closure design drawings will be graded to the design elevations shown.

The County will receive bids for the furnishing and installing the final cover, including the liner materials, geocomposites, piping, and other materials required for closing.

The 40 mil textured LLDPE geomembrane liner will be installed after the grading of the subgrade is complete and been accepted for depth of cover, compaction, and grade. When relevant, the final cover geomembrane will be tied into the existing liner system geomembrane that would already be installed during previous closure sequences of the North Cell as shown in the closure design drawings. A detail of this tie-in is provided on Sheet C-07. The final cover geocomposite layer will be installed over the final cover geomembrane with careful attention to daylight. The geocomposite will allow drainage from the top of the landfill, drainage bench, and base of the landfill as shown on detail sheets C-09 and C-11.

The protective cover soil will be installed over the geosynthetic components of the final cover which have been already installed, inspected, and tested. At this time, final grading of the access road and terrace swales will occur. Installation of the down drain pipes and energy dissipaters will also take place. After 18 inches of protective cover is installed; 6 inches of topsoil will be installed over the closure area. The access road will be paved with flexible pavement. Sod will be placed over the topsoil.

After the final cover is in place, the final elements of the landfill gas collection system and stormwater management system will be installed. Removal of the sedimentation and erosion control measures that were installed for the North Cell closure construction will take place after it is evident that the North Cell closure side slopes have been stabilized. Any accumulated sediment resulting from the closure project will be removed from drainage benches, perimeter stormwater channels, and stormwater pond.

An as-built survey of the completed closure will be prepared and submitted to the FDEP along with the certificate of completion of closure construction for the portion of closure has been completed.

2.5.2 Closure Schedule

North Cell closure construction is currently estimated to begin in January 2011 based on anticipated waste disposal rates, compacted waste densities, and remaining airspace estimates. Certification of closure completion is estimated at this time to occur near April 2016. This date may change due to fluctuations in any of the previously mentioned variables.

Final cover will be installed over the remaining portions of the North Cell as indicated in the closure sequence plan included in the permit drawings. Long term care of the North Cell closure is anticipated to extend through the remaining life of the TFRL Class I landfill in addition to the 30 year regulatory post closure period that will begin after all phases of the landfill are closed.

The long-term-care permit shall be renewed every 10 years until the monitoring well analyses have stabilized and the FDEP notifies the County in writing that the permit renewal will not be required.

2.5.3 Supporting Documents

Other supporting documents to this Closure Operation Plan include the current FDEP Operation Permit No. SO64-0078767-023 for the TFRL North Cell – Phase I Class I landfill, the current FDEP Environmental Resource Permit (ERP) No. 64-020632-002EI and associated documents supporting these permits.

2.5.4 Demonstration of Financial Responsibility

Volusia County currently demonstrates financial responsibility for the closure and long term care of the South and North Cells of the TFRL Class I landfill using an escrow accounting method.

2.5.5 Water Quality Monitoring Plan

Discussion of the Water Quality Monitoring Plan required by FAC 62-701.510 for the North Cell closure is provided in Section 2.3.3 of the Closure and Long Term Care Plan.

2.5.6 Gas Management System

Discussion of the gas management system required by FAC 62-701.530 for the North Cell closure is provided in Section 2.3.5 of the Closure and Long Term Care Plan.

2.5.7 Additional Equipment and Personnel Needed for Closure

Closure construction for installation of the landfill gas system and final cover for the North Cell will be performed by qualified contractors selected through the County's procurement system. Volusia County will also retain the services of consulting engineering companies to perform Construction Quality Assurance (CQA) services and Engineer of Record (EOR) services which will include construction oversight and certification.

The administration of the North Cell closure project is not anticipated to require the County to hire additional personnel or purchase additional construction equipment.

3.0 CLOSURE PROCEDURES

The following section describes the procedures that will be followed in accordance with 62-701.610, F.A.C., for closure of the North Cell of the TFRL Class I landfill.

The County will submit a Certification of Closure Construction completion, signed, dated and sealed by a professional engineer to the FDEP after completion of closure of the North Cell. All substantial deviations from the permitted closure plans will be noted.

3.1 Survey Monuments

Concrete monuments will be installed to mark the boundaries of the landfill property and other permanent markers will be installed to outline the general location of the waste disposal areas after the Tomoka Farms Road Landfill is closed. These markers will be tied to one or more of the boundary markers by a survey performed by a registered land surveyor. The location and elevation of all markers will be shown on a site plan filed with the "Declaration to the Public" described in paragraph

3.2 Final Survey Report

A final survey report or aerial map of the constructed North Cell closure will be conducted in compliance with 62-701.610(6), F.A.C. The final survey report or aerial map will be prepared by a registered land surveyor and will be submitted to the FDEP to verify that the final contours and elevations are in accordance with the plans approved in the closure permit. The contours in the final survey will be shown at no greater than 5-foot intervals. The County will submit this report to the FDEP in accordance with the closing schedule.

3.3 Closure Construction Certifications

In accordance with 62-701.610(6), F.A.C., a signed, dated, and sealed Certificate of Closure Construction Completion by the engineer of record will be submitted to the FDEP upon completion of North Cell closure construction. This certificate will indicate any deviations from the permitted closure plans.

3.4 Declaration to the public

After closure operations are inspected and approved for the entire TFRL Class I landfill by the FDEP, the Volusia County Solid Waste Division will file a declaration to the public in the deed records of Volusia County. The declaration will include a legal description of the property and a site plan specifying the area actually filled with solid waste. The declaration will not be submitted after closure of the North Cell since the landfill will remain in operation.

3.5 Official date of closing

The requirements identified in Sections 3.2 and 3.3 will be submitted to the FDEP after closure of each phase. The declaration to the public described in Section 3.4 will be completed when all phases are closed and the TFRL ceases waste disposal operations. Upon receipt, the FDEP will notify the Volusia County Solid Waste Department in writing that the notice of termination of operations and closure of the facility has been received. The official date of the landfill closing will be the date of the FDEP letter.

3.6 Closed Landfill Use

No use has been designated for the closed North Cell landfill area. In accordance with 62-701.610(7), F.A.C., Volusia County will consult with the FDEP before conducting activities at the closed landfill. Volusia County acknowledges that the FDEP retains regulatory control over any activities that may affect the integrity of the environmental protection measures of the landfill.

3.7 Relocation of Wastes

If at any time after closure the Volusia County Solid Waste Division intends to relocate waste within the footprint of the landfill, a permit modification application will be submitted to the FDEP for approval.

3.8 Temporary Final Cover

No temporary closure of the North Cell will be required.

4.0 LONG-TERM CARE REQUIREMENTS

The Volusia County Solid Waste Division will be responsible for monitoring and maintaining the South Cell and North Cell closure areas in accordance with the FDEP-approved closure plan for a minimum of 30 years from the date of closing of the Class I landfills. The long-term-care period may be extended by FDEP to be consistent with 62-701.620(1), F.A.C.

If the landfill site is sold or leased to another authority, Volusia County will ensure that the long-term care requirements of the permit are adhered to by contractual agreement or by retention of access rights. Any lease or transfer of property will include specific conditions to delineate the following responsibilities:

- Volusia County is responsible for closure and shall maintain any required proof of financial responsibility until the person acquiring ownership, possession, or operation of the landfill establishes the required proof of financial responsibility with FDEP.
- Responsibility for the continuance of monitoring, maintenance, and correction of deficiencies or problems.
- Mineral rights attached to the property and the rights to any recoverable materials that may be buried on the property or landfill gases that may be produced. An FDEP permit shall be required if any onsite operations subsequent to closing of a landfill involve disturbing the landfill.

Volusia County is obligated to retain the right of entry and to make provisions for access to the landfill property and the closed area of the landfill for the long-term-care period for inspection, monitoring, and maintenance of the site. Supervising the closed landfill is the responsibility of a person experienced in the closure requirements of a solid waste management facility.

Closed landfill areas, if disturbed, are a potential hazard to public health, groundwater, and the environment. Therefore, FDEP retains regulatory control over any activities that may affect the integrity of the environmental protection measures, such as the landfill cover, drainage, monitoring system, or stormwater controls. Consultation with the FDEP is required before conducting activities at the closed landfill.

The closure permit will be renewed every 10 years until the groundwater monitoring well analyses have stabilized and the FDEP notifies the applicant in writing that renewal is not required. Volusia County, in accordance with 62-701.620(3)(a) through (d), F.A.C., will demonstrate the required stabilization criteria.

Inspections of the closed landfill cells will include daily, monthly, and quarterly inspections as discussed below.

Daily Inspections

During on-going landfill operations, County staff will observe the South Cell and closed portions of the North Cell. If unusual conditions such as the following are observed, a report will be made to the site superintendent:

- Erosion or seepage through the soil cover
- Damage or blockage of drainage structures, including downdrains

- Damage to the vegetative cover
- Unusual odors
- Smoke or flames
- Damage to groundwater monitoring wells
- Damage to gas collection wells
- Damage to gas header or condensate pipelines
- Damage to the gas flare

No specific procedure or checklist is used for daily observations of the closed cell and no record of daily observations is maintained except for reports of unusual conditions. Corrective actions or repairs that are undertaken as a result of an unusual condition report should be described in a separate report attached to the unusual condition report.

Weekly Inspections

The site supervisor should ensure that the closed cell is inspected at least once each week for each of the conditions discussed above. In addition, the weekly inspection should check for the following:

- Damage to the perimeter or service roads
- High or unusually low water levels in the drainage facilities
- Water levels in the leachate ponds
- Low spots retaining water after rain events
- Leachate pump operation
- Approximate height of grass on closed landfill exceeding 18 inches
- Litter

No specific form is used for weekly inspections of the closed cell and no record of weekly inspections is maintained except for reports of unusual conditions. Corrective actions or repairs that are undertaken as a result of an unusual condition report should be described a separate report attached to the unusual condition report.

Quarterly Inspections

The closed cell should be inspected on a quarterly basis for each of the conditions discussed above. In addition, the quarterly inspection should include the following:

- Condition of signage
- Condition of caps and locks on perimeter gas probes and groundwater monitor wells
- Condition of gas collection wells
- Growth of vegetation or accumulation of silt or debris around culverts
- Growth of vegetation around wells, and other structures
- Evidence of siltation in the stormwater channels

The date of the quarterly inspection and the name of the individual conducting the inspection should be recorded and a record kept of any insufficiencies noted. Items requiring attention are noted on the form and brought to the attention of the Volusia County landfill manager. Corrective actions or repairs that are undertaken as a result of a quarterly inspection should be described a report attached to the quarterly

inspection report. The quarterly inspection report is used to ensure compliance with the long-term-care requirements and provide a log of landfill inspection activities including inspection and maintenance of the stormwater management system, landfill cap, groundwater and gas monitoring systems, gas collection wells, and other site structures.

4.1 Maintenance and Repair of Final and Temporary Final Cover System.

The Volusia County Solid Waste Division will inspect and maintain the South Cell and North Cell closure areas to minimize impacts to the function and/or integrity of the final cover system. The County will provide for site access control, erosion control, grass cover maintenance, and prevention of ponding. Primary focus during the inspection will be the condition of the surface vegetation, landfill cap, gas collection and monitoring system, stormwater system, and monitoring devices. Monitoring of groundwater and landfill gas is addressed in Part L and Part N, respectively, of the North Cell Closure Construction Intermediate Modification Permit Application.

Table 1 is a schedule for notification if corrective actions are required. Records of discovery will also be kept on the quarterly inspection reports.

Table 1 Schedule for Notification and Corrective Actions

Activity	Initial Notification	Written Notification/Corrective Action Plan	Corrective Action
Sinkhole within 500 ft	Within 24 hours of discovery	Within 7 days of discovery, including description, location, size shown on plan sheet, corrective action plan	Based on proposed schedule
Fire/Explosion	Within 24 hours of discovery	Within 7 days of discovery, including remedial measures and schedule of activities	Based on proposed schedule
Damage to Facilities/Failure of Systems	Within 24 hours of discovery with explanation	Within 7 days of discovery, including details of damage/failure, remedial measures, schedule of repairs	Based on proposed schedule
Damage to Groundwater Monitoring System	Within 24 hours of discovery with explanation	Within 7 days of discovery, including details of damage/failure, remedial measures, schedule of repairs	Based on proposed schedule
Damage to Stormwater system	Within 24 hours of discovery with explanation	Within 7 days of discovery, including details of damage/failure, remedial measures, schedule of repairs	Within 30 days of written notification
Erosion of Final Cover System > 6-inches in depth	N/A	Description on Inspection Log	Within 72 hours of discovery
Leachate not accepted by Disposal Facility	Same as Written Notification	Within 3 days of cessation of leachate acceptance, including explanation of contingency measures and schedule of disposal	Within 7 days of cessation of acceptance

4.2 Grass

Grass cover maintenance will include mowing, fertilizing, seeding, mulching, and filling areas of subsidence. Mowing, fertilizing, seeding, mulching, and filling will continue to be performed as needed. The following is a general schedule and description of grass maintenance activities.

4.2.1 Mowing

The height of the grass will also be observed during monthly inspections. If the grass is found to be approximately 18 inches high, mowing will be scheduled before the next inspection. Caution will be exercised while mowing to keep heavy equipment away from the gas collection wells and monitoring devices.

4.2.2 Fertilizing

The general recommendations for commercial fertilizer are 12-8-2 formulation (nitrogen-potassium-phosphorus), of which 60% of the nitrogen is to be in the urea-formaldehyde form and in conformance with state laws. It should be applied in the early spring (March) and mid-summer (July) on an as-needed basis. The spread rate should be 8 to 10 pounds per 1,000 square feet, or as instructed on the package. The local USDA extension office should be called to verify these recommendations.

4.2.3 Seed and Sod

Damaged areas or other areas where grass cover is sparse must be reseeded or sodded. Sod is generally recommended for use in all areas such as on steep slopes and in highly eroded or bare spots. Sod should be staked in place with sod pegs where necessary. Sod pegs shall extend no more than 12 inches into the ground to avoid damage to the final cover geomembrane liner.

Seeding, if done on relatively flat areas (i.e. top deck), should be performed in the early spring and late fall as needed in the following manner:

Early spring

- Scarified bahia with 20% bermuda seed.
- Minimum percent pure seed - 95
- Minimum percent germination and hard seed - 80
- Bahia seed will not germinate until overnight temperatures stay above 70° Fahrenheit.

Late fall - Italian rye

- Minimum percent pure—95
- Minimum percent germination and hard seed—90
- Seed will not germinate until overnight temperatures stay below 70° Fahrenheit and above 40° Fahrenheit.
- Bahia Sod—16-inch-by-24-inch slabs with 1-1/2-inch root bed

4.2.4 Seed Rates

The following are general recommendations for maintenance and replacement growth. High erosion areas and bare patches should be seeded more heavily. Spread rates may vary for different grass seeds from different suppliers. The instructions on the seed bags should be followed. Maintenance seeding should be used where the grass is healthy and full. Replacement seed rates should be used on bare or thin grass growth areas.

Maintenance Seed Rates

- Spring ½ pound per 1,000 square feet
- Fall ½ pound per 1,000 square feet

Replacement Seed Rates

- Spring 3-5 pounds per 1,000 square feet
- Fall 3-5 pounds per 1,000 square feet

4.2.5 Watering

Volusia County should water newly established grass as required to maintain the health of the grass until it matures; daily watering should never be necessary. If the blades of the grass begin to wilt and lose resiliency when walked on, water needs to be applied. The water that is applied should be clean.

4.3 Erosion Control

Avoiding erosion is probably the most cost-effective means of protecting the closure cap. A relatively minor eroded area combined with a severe storm event can cause degradation of the final cover. The best way to avoid erosion is to maintain a healthy stand of grass and keep drainage swales free of silt and sediment. Cleaning the drainage swales will prevent overflow and backflow and reduce the risk of erosion from these causes. Large amounts of silt or sediment removed from the drainage swales may indicate damage to the closure cap. Soil for erosion control and maintenance of the cap system will be obtained from the on-site borrow area.

4.4 Stormwater Structures

All stormwater structures should be clean of all silt or soil deposits. All soil settlement surrounding these items should be brought to the attention of the Solid Waste Operations Manager and then repaired in a manner consistent with the surrounding area. Grass should be maintained, replaced, reseeded, and mowed as indicated in the section on grassing. The drainage swales will be cleaned annually as needed.

4.5 Landfill Cap

Post-closure maintenance of the cover system is to include inspecting the system in those landfill areas that have a differential settlement of 5 feet or more in a horizontal distance of 100 feet. The system shall be repaired in those areas as necessary. Any differential settlement at the landfill is to be corrected to allow drainage paths to remain intact. Differential settlement is defined as one area of the closure subsiding or settling faster than the surrounding area. Differential level checks will be performed if

evidence of settlement is detected during routine site inspections. Differential level check information will be kept on file and will be made available for FDEP review.

If the final cover requires replacement, repair will follow the original design specifications. Repairs to the final cover will be under the supervision of a professional engineer. Accounts of all repairs to the final cover system and test results will be documented in Daily Observation Reports and maintained by the Volusia County Solid Waste Division. Repairs to any layer of the final cap system shall be in accordance with the Construction Quality Assurance (CQA) Plan and specifications for landfill cover construction included in Appendices C and D, respectively, of the closure permit application. FDEP will be notified of any damage to cover system that requires repairs.

4.6 Landfill Access and Landfill Signs

The boundary of the landfill property is fenced. Access to the site is to be restricted to prevent unauthorized entry and dumping. As part of the routine check-list procedure, all of the fencing and signage is inspected for damage and repaired, repainted, and replaced if necessary to maintain the integrity of these items.

If any of the landfill survey monuments are damaged or destroyed, corrective actions will be taken.

The site roadways are also inspected as part of the routine checklist procedure. If any of the access roads are severely damaged, corrective actions will be taken to maintain passable and safe roads on the site.

The County will continue to make the site available for inspection by the FDEP after closure.

4.7 Management of Collection and Monitoring Devices

This section includes descriptions of procedures for maintaining and repairing groundwater and gas monitoring devices. The locations of the monitoring devices are provided on Sheet 00C-01 of the North Cell Class I Closure Intermediate Modification Permit Application drawing set. Groundwater monitoring is to continue at the Facility with the potential for periodic revisions following evaluation of the laboratory reports.

4.7.1 Groundwater Monitoring Wells

If a monitoring well becomes inoperable, Volusia County will notify the FDEP within 24 hours and follow up with written notice within 7 days, as shown in Table 1. The written notice will provide a detailed description of the problem that has occurred and what remedial actions will be taken. If deemed necessary, the damaged monitor well will be properly abandoned and a new well will be constructed close to the abandoned well. Monitoring well design and replacement will be approved by the FDEP before abandonment and installation. Copies of the well abandonment permit and site inspection will be provided to FDEP for abandoned wells. Upon completion of the construction of the monitoring well, the following information will be provided to the FDEP.

- Well Identification.
- Driller's Lithologic Log.
- Latitude/Longitude.
- Total Well Depth.

- Aquifer Monitored.
- Casing Diameter.
- Screen Type and Slot Size.
- Casing Type and Length.
- Elevation at Top of Pipe.
- Well Construction Permit Number.
- Elevation at Land Surface.

The newly constructed monitor well will be developed and included in the routine monitoring.

Groundwater monitoring will only be conducted by an individual trained in groundwater monitoring and reported to the FDEP as required by the closure permit. Care should be taken when equipment is near any monitor well so that no damage is done.

4.7.2 Gas Collection and Monitoring

Gas monitoring is to continue at the Class I landfill in accordance with the current Operations Plan. Monitoring for LFG migration will continue through the long-term care period of the landfill cells, unless FDEP approves any future County request to reduce the long-term care schedule. Soil monitoring probes will be replaced and repaired in accordance with 62-701.530, F.A.C. FDEP will be notified of maintenance repair activities.

The NSPS requires that the gas collection and control system be in operation for at least 15 years. After this time, if gas generation rates and emission potential have diminished per the requirements of 40 CFR 60.752(b)(2)(iv), the system may be taken offline.

4.8 Record-Keeping Requirements

Records of information used to develop or support the permit applications and any supplemental information submitted to the FDEP shall be kept for the design life of the landfill. Records of monitoring information, including calibration and maintenance records, all original chart recordings for continuous monitoring instrumentation, and copies of all reports required by permit, will be kept for at least 10 years. Background water quality records will be kept for the design life of the landfill. Annual estimates of the remaining life and capacity and site life will be maintained. Annual estimates will be based on a summary of the heights, lengths, and widths of the solid waste disposal units and will be submitted annually to the FDEP. Records more than 5 years old, which are required to be retained, may be archived provided they can be retrieved within 7 days.

4.8.1 Records of Monitoring

Records of water quality monitoring information are to include the following:

- Facility name and WACS identification number, and identification number of the surface water, groundwater monitoring, and leachate sampling locations.
- The date, exact place, and time of sampling or measurements.
- The person responsible for performing the sampling or measurements.
- Water levels before sampling.

- The date(s) analyses were performed.
- The person responsible for performing the analyses.
- The analytical techniques or methods used and method detection limits and applicable water quality standards.
- STORET code numbers for parameters analyzed.
- The results of such analyses.
- Electronic data.

Water quality monitoring reporting and evaluations, including routine sampling events, will be consistent with the pertinent requirements of 62-701.510(9), F.A.C.

Biennial reporting will be performed by a professional engineer or hydrogeologist experienced in hydrogeologic investigations. The biennial report will be updated at the time of permit renewals. The biennial report will meet requirements of 62-701.510(a), F.A.C., and will include the following:

- Tabular displays of data.
- Trend analyses.
- Comparisons of shallow-, middle-, and deep-zone wells.
- Correlation of parameters and discussions of data correlations.
- Interpretations of groundwater contour maps and flow rates.
- Evaluation of the adequacy of water quality monitoring frequency and sampling locations.

4.8.2 Inspection Reports

Inspections of the final cover and stormwater system will be documented and kept on file at the Volusia County Solid Waste Division Office.

Deficiencies observed in the fencing and security, access roads, monitoring devices, stormwater system, or final cover system will be documented by Volusia County during inspections of the landfill. The extent of damaged areas, the extent of the areas repaired, and a detailed description of the repair work will be recorded.

4.9 Stabilization Reports

Since only portions of the North Cell are receiving final cover and the remaining North Cell landfill is active, the North Cell will not enter the long-term care period in accordance with the official date of closing requirements (Rule 62-701.600(8), F.A.C.), therefore, the stabilization report will be required until the facility enters the long-term care period.

Stabilization reports will be submitted every five years after issuance of the long-term care permit.

4.10 Completion of Long Term Care

After the FDEP acknowledges that the facility has been closed, the County will continue to monitor and maintain the facility for at least 30 years, unless specific release from all or part of these requirements is granted by the FDEP. Monitoring activities will include inspection of the side slopes, soil cover, and drainage facilities, monitoring for gas formation, ground and surface water monitoring, and checking for

unauthorized use of the site for debris disposal. The thirty-year long-term care period is not expected to begin for the North Cell until after all closure sequences are complete.

Long-term maintenance consists of periodic inspection, repairing erosion damage to the side slopes, maintaining and re-establishing the vegetative cover, mowing, repair and replacement of groundwater monitor wells, and cleaning and maintenance of the stormwater control structures. The County will conduct these activities with County forces and equipment in conjunction with the other maintenance and repair activities required at the Tomoka Farms Road Landfill site.

Following completion of the long-term care period, the County will submit a certification, signed and sealed by a professional engineer, verifying that long-term care has been completed in accordance with the closure plan has been placed in the operating record.



Volusia County
Solid Waste Division

Tomoka Farms Road Landfill North Cell Closure CQA Plan

Prepared for:

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A handwritten signature in blue ink, which appears to read "Mark Roberts", is written over the date "8/24/10". The signature and date are written in a cursive, slanted style.

Mark Roberts, P.E.
Florida P.E. No.: 54187

HDR Project No. 0195-139929-002

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SECTION 1

INTRODUCTION

1.1 GENERAL

This plan addresses the construction quality assurance and quality control procedures and requirements for construction of the final cover system for the North and ~~East Cell Class I~~ disposal area ~~cells~~ at the Volusia County Tomoka Farms Road Landfill. The cell was initially permitted as the North Cell Class I Disposal Area and the East Cell Expansion. In accordance with a January 23, 2007 Request for Minor Modification, the operations permit combined the cells and the designation of "East Cell Expansion" changed to the "North Cell Expansion". The North Cell Expansion is separated into two phases, Phase 1 Expansion and Phase 2 Expansion. To be consistent with the current Operations Permit, the combination of the North Cell and expansion areas is to be designated as North Cell due to the contiguity of these disposal areas. The final cover system ~~includes both~~ consists of a -soil-covered geomembrane and exposed geomembrane cover (EGC). The plan addresses earth materials, geosynthetics, piping and other structures. The plan supplements the project plans and Specifications and has been prepared to meet requirements set forth in the Florida Administrative Code (FAC), Chapter 62-701.400.

SECTION 2

DEFINITIONS

2.1 CONSTRUCTION QUALITY CONTROL (CQC)

A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC is normally performed by the geosynthetic installer, or for natural soil materials by the earthwork contractor, and is necessary to achieve quality in the constructed or installed system. CQC refers to measures taken by the installer or contractor to determine compliance with the requirements for materials and workmanship as stated in the plans and Specifications for the project.

2.2 CONSTRUCTION QUALITY ASSURANCE (CQA)

A planned system of activities that provides the owner and permitting agency quality assurance that the facility was constructed as specified in the design. CQA includes construction observation and monitoring, materials testing, verifications, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. CQA refers to measures taken by the CQA organization to assess if the installer or contractor is in compliance with the plans and Specifications for a project.

2.3 MANUFACTURING QUALITY CONTROL (MQC)

A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract plans.

2.4 MANUFACTURING QUALITY ASSURANCE (MQA)

A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract plans. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract plans for a project.

SECTION 3

QUALIFIED PARTIES AND RESPONSIBILITIES

The principal parties involved in the CQA and CQC of the facility include the Permitting Agency, Owner, Designer, CQA Consultant, Earthwork Contractor, Soils CQA Laboratory, Geosynthetics Manufacturer, Geosynthetics Installer, and Geosynthetics Laboratory. The general responsibilities of each of these parties is described in the following subsections. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific needs as construction progresses.

3.1 PERMITTING AGENCY

The Permitting Agency is authorized to issue the permit for construction based on review and acceptance of the permit application. The Permitting Agency must have issued a permit for the project prior to the commencement of construction. As construction progresses, the Permitting Agency has the responsibility and authority to review and accept design revisions or requests for variance submitted by the Owner.

3.2 OWNER

The Owner is responsible for the facility, including coordinating the design and construction of the landfill features. This responsibility includes compliance with the permit and the submission of CQA documentation demonstrating that the facility was constructed in accordance with the permit documents and the design plans and Specifications.

The Owner has the authority to contract and manage parties charged with design, CQA, and construction activities. The Owner also has the authority to accept or reject design plans and Specifications, CQA plans, reports, and recommendations of the CQA Consultant, and the materials and workmanship of contractors.

3.3 DESIGNER

The Designer, or Engineer, is responsible for the preparation of the design, including Drawings, plans and project Specifications for construction, and this CQA plan.

The Designer is responsible for performing the engineering design and preparing the associated Drawings and Specifications and for approving all design and Specification changes and making design clarifications necessitated during construction. The Designer shall be a professional skilled in the appropriate discipline, certified or licensed as required by regulation. The Designer shall be familiar with the construction details and applicable regulatory requirements.

3.4 CQA CONSULTANT

The CQA Consultant is a party independent of the Owner and Contractor(s) and is responsible for field testing, observing, and documenting activities related to the construction and/or permit documents and the CQA Plan. The CQA Consultant is represented on-site by the CQA monitoring personnel and supporting on-site CQA monitoring personnel as appropriate. In general, the responsibilities and authorities of the CQA Consultant include:

- Understanding the permit documents, design plans, and Specifications in relation to all aspects of the CQA Plan.
- Scheduling, coordinating, and performing CQA activities.
- Performing independent on-site observation of the work in progress to assess compliance with the CQA Plan, permit documents, design plans and Specifications.
- Reporting deviations from the CQA Plan, permit documents, design plans and/or Specifications to the Owner. Secure documents from the Owner which approve the changes.
- Verifying that the Installer's test equipment meets testing and calibration requirements, and that tests are conducted according to procedures defined in the CQA Plan.
- Recording and maintaining test data.
- Verifying that corrective measures are implemented.
- Documenting and reporting CQA activities, and collecting data needed for record documentation, including photographs.
- Maintaining open lines of communication with other parties involved in the construction.
- Preparing the Final Documentation Report, complete with certification statements.

3.5 EARTHWORK CONTRACTOR

The Earthwork Contractor is responsible for excavation of soil and placement and compaction of soil and aggregate materials using procedures and equipment necessary to produce the results in conformance with the Contract Documents. The Earthwork Contractor may also be responsible for the preparation and completion of anchor trenches, dewatering, and other site-specific responsibilities as required by the Contract Documents.

3.6 GEOSYNTHETICS MANUFACTURER

The Geosynthetics Manufacturer(s) is responsible for the production of geosynthetics including geomembranes, geotextiles, and geocomposites. The Geosynthetics Manufacturer is responsible for providing adequate documentation regarding the characteristics of the raw material, final product, the testing performed to verify the characteristics and the MQC measures taken during manufacturing.

The Geosynthetics Manufacturer(s) is responsible for the transportation of the geosynthetics from the manufacturing plant to the site. The Geosynthetics Manufacturer(s) is responsible for loading and transporting geosynthetics, and for damage to the geosynthetics which may occur during these operations.

3.7 GEOSYNTHETICS INSTALLER

The Geosynthetics Installer is responsible for unloading, field handling, storing, seaming, temporarily loading against wind and other aspects of the geosynthetics installation in accordance with this CQA plan and the Specifications.

The Geosynthetics Installer is responsible for the preparation of the panel layout drawing including dimensions and details, and for providing the installation schedule and a list of proposed field personnel and their qualifications. During installation, the Geosynthetics Installer is responsible for providing CQC documentation and subbase acceptance certificates. Upon completion of the installation, the Geosynthetics Installer shall provide the geomembrane certification, the Manufacturer's warranty, and the installation warranty.

3.8 CQA GEOSYNTHETICS LABORATORY

The CQA Geosynthetics Laboratory is responsible for performing the laboratory tests on geosynthetic materials as required by the Specifications. The CQA Geosynthetics Laboratory is also responsible for providing documentation of testing equipment used, analytical results and test methods followed. All results should be reported to the CQA Consultant.

3.9 CQA SOILS LABORATORY

The CQA Soils Laboratory is responsible for performing the laboratory testing on soils and aggregate required by the CQA Manual and for providing documentation of analytical results, test methods followed, and testing equipment used. Work of the CQA Soils Laboratory should be reported to the CQA Consultant.

SECTION 4

COMMUNICATIONS AND MEETINGS

Continuous communications between parties involved in the construction and CQA of this project, including the Owner, Geosynthetics Manufacturer, Geosynthetics Installer, Earthwork Contractor, CQA Consultant, and Permitting Agency, coupled with regularly scheduled meetings are necessary components of this plan. Such communication and meetings are intended to resolve construction quality and design issues as early as possible, to keep all parties informed of schedules, and verifying that the work is proceeding in accordance with Specifications, schedules and this CQA plan. At a minimum there should be a Pre-Construction Meeting, regular Progress Meetings, and Construction Resolution Meetings, as described below:

4.1 PRE-CONSTRUCTION MEETING

The Pre-Construction Meeting shall be held at least 1 week prior to start of construction and should be attended by the Owner's representative, Geosynthetics Installer superintendent, the Engineer, the CQA Consultant, and the Earthwork Contractor and surveyor. Specific topics at this meeting include, but are not limited to:

- Introduction of all personnel and review the responsibilities of each party, establish project communication, and delineate authority.
- Review the time schedule for construction, including material shipment and working hours.
- Review methods for documenting and reporting, and for distributing documents and reports.
- Establish protocols for testing, handling deficiencies, repairs, and retesting.
- Review seam testing and repair procedures, layout and numbering systems for panels and seams.
- Establish rules for writing on the geomembrane, i.e., who is authorized to write, what can be written and in what color.
- Outline procedures for packaging and storing archive samples.
- Establish locations for soil and geosynthetic materials stockpile.
- Review status of required submittals from Geosynthetics Installer and Earthwork Contractor.

The CQA Consultant shall record and distribute the meeting minutes to all parties involved.

4.2 PROGRESS MEETINGS

Progress Meetings shall be held at a mutually agreed upon day and time, usually once a week, and attended by representatives of the Geosynthetics Installer, Earthwork Contractor, CQA Consultant, Owner, and other parties that may be involved in specific activities occurring at that period of time. Meeting minutes shall be prepared by the CQA Consultant and distributed to all parties in attendance in addition to the established distribution list for project communications.

Topics for the Weekly Progress Meetings shall include, but are not limited to:

- Work progress to date, and scheduled activities for the subsequent week(s).
- Review of construction issues including questions on Specifications, design, materials test results, test failures, retests, procedures, weather conditions, working hours, holidays, communications, minutes from previous meetings, problems and resolutions, documentation, Material Quality Control (MQC) certificates, and other project related topics.

4.3 CONSTRUCTION RESOLUTION MEETINGS

In some cases, construction issues or problems arise that demand specific attention outside of the regular Progress Meetings, and may include parties not available at regular Progress Meetings. Such meetings shall be held as necessary to resolve construction problems or issues in a timely manner so that work can proceed. To the extent possible, these meetings shall be scheduled such that the key parties are available. Meeting minutes shall be prepared by the CQA Consultant and distributed to the established distribution list for project communications.

SECTION 5

EARTH MATERIAL QUALITY ASSURANCE

5.1 GENERAL

This section of the plan describes CQA procedures for earth material (e.g. soil and rock) components of the project.

5.2 TESTING PROGRAM

The two categories of quality assurance testing covered in this plan include Pre-Construction Testing and Construction Testing. Within these categories, quality assurance testing shall consist of the following:

- Material Evaluation.
- Construction Quality Evaluation.
- Special Testing.

5.3 MATERIAL EVALUATION

Pre-construction material evaluations shall be performed on samples from potential soil borrow sources to ascertain their acceptability as construction materials. Construction testing shall be performed during the course of the work to verify material compliance with the project Specifications. Unless otherwise indicated in the project Specifications the following tests shall be performed:

- Natural moisture content (ASTM D 2216).
- Particle Size Analysis (ASTM D 422).
- Atterberg Limits (ASTM D 4318).
- Proctor Compaction Test (ASTM D 698 (Standard) or D 1557(Modified)).

Criteria to be used for determination of acceptability of earth materials for use during construction shall be as defined in the project Specifications. All evaluation tests are to be performed in the CQA Soils Laboratory which has been approved for use by the Owner or his representative. Test reports will verify compliance with or state deviation from the applicable ASTM Standards or other accepted standards as outlined in the Specifications. Any testing deviations from requirements of Specifications shall be approved by Engineer prior to performing tests.

All soil materials shall meet or exceed the project Specifications.

5.4 CONSTRUCTION QUALITY EVALUATION

Construction quality evaluation shall be performed on all soil components of the construction. These evaluations shall be performed at the frequencies indicated in the Specifications. Criteria to be used for determination of acceptability of the construction work shall be as identified in the project Specifications.

Construction evaluation testing includes the visual observations of the work, layer bonding, and clod sizes; in-place density/moisture content testing; surveys of as-built conditions and elevations; thickness monitoring; and special testing. Observations of the construction work shall include the following:

- Clod size and other physical properties of the soil during processing, placement and compaction.
- Thickness of lifts as loosely placed and as compacted.
- Action of the compaction equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.).
- Procedures used to prevent desiccation of completed lifts and layers.

Determinations of in-place moisture and density shall be performed in accordance with the Specifications.

5.4.1 Deficiencies

If defects are discovered in the earthwork, the extent and nature shall be evaluated by the CQA Consultant. If a defect is indicated by a failing test, the CQA Consultant shall determine the limits of the affected area by additional tests, observations, a review of records, and other means deemed appropriate. If the defect is related to adverse site conditions, the CQA Consultant shall define the limits and nature of the defect.

5.4.2 Notification

The CQA Consultant shall notify the Owner and Earthwork Contractor after determining the nature and extent of the defect. Appropriate retests shall be scheduled by the CQA Consultant when the work deficiency is corrected.

5.4.3 Repairs and Retesting

Deficiencies shall be corrected by the Earthwork Contractor to the satisfaction of the CQA Consultant. The CQA Consultant shall also verify that all installation requirements have been met and that all submittals are provided.

5.5 SPECIAL TESTING

Special testing to determine the acceptability of materials shall be conducted at the direction of the Owner, the Engineer or their representative. Criteria to be used for the determination of acceptability shall be as established by the Owner, the Engineer or their representative.

SECTION 6

GEOSYNTHETIC MATERIAL QUALITY ASSURANCE

6.1 GEOMEMBRANES

This quality assurance testing program has been established to verify that the specified geomembrane is manufactured, installed and tested according to the project Specifications.

6.1.1 Manufacturer Quality Control Documentation

The Geomembrane Manufacturer shall provide documentation and certification that the material meets the requirements outlined in the Specifications and that adequate quality control measures have been implemented during the manufacturing process.

The following should be provided prior to shipment of the geomembrane:

- A properties value certification including at a minimum, guaranteed values for all geomembrane properties required by the Specifications.
- An inventory list of quantities with descriptions of materials which comprise the geomembrane shipment(s).

The CQA Consultant shall verify that the property values certified by the Geomembrane Manufacturer meet the test methods listed in of the Specifications and Manufacturer's guaranteed minimum values.

6.1.2 Manufacturer's Quality Control Certificate

Prior to shipment, the Geomembrane Manufacturer shall also provide the CQA Consultant with quality control certificates for the geomembrane, signed by a responsible party employed by the Geomembrane Manufacturer. The Manufacturer shall be required to perform, at a minimum, the tests listed in the Specifications.

The CQA Consultant shall review the certificates and verify that the quality control certificates have been provided at the specified frequencies for all materials and rolls. The CQA Consultant shall also review the quality control certificates and verify that the test methods meet the requirements included in the Specifications and the Manufacturer's guaranteed minimum values which were provided prior to shipment.

6.1.2.1 Delivery and Storage

Upon delivery to the site, visual inspection by the Installer and the CQA Consultant shall be conducted on all rolls for evidence of defects or damage. This inspection shall be done without unrolling the rolls unless damage or defects are detected.

During or following this visual inspection, the CQA Consultant, with the assistance of the Installer or Contractor, shall remove samples to be tested for conformance with the Specifications.

The Installer shall be responsible for the storage of the geomembranes on-site. The storage space shall provide protection from theft, vandalism, and traffic. The storage location shall be such that exposure to environmental factors, construction activities and handling are minimized.

6.1.2.2 Conformance Sampling and Testing

The CQA Consultant shall verify that the required number of conformance test samples are obtained for the geomembrane prior to delivery to the site. These samples shall be sent to the CQA Geosynthetics Laboratory for testing to verify conformance to the values listed in the Specifications. These tests shall be performed prior to installation.

Samples shall be selected by the CQA Consultant and shall not include the first complete revolution. The sample shall be a minimum four feet, as measured along the width of the roll, and extend three feet along the roll. Samples shall be taken at a rate of one per lot, but at a rate not less than one conformance test per 100,000 square feet or portion thereof.

Prior to the deployment of the geomembrane, the CQA Consultant shall review all conformance test results and report any nonconformance to the Owner. The CQA Consultant shall be responsible for verifying that all the test results meet or exceed the property values listed in the Specifications.

If failing test results may be the result of the sampling process or due to the CQA Geosynthetics Laboratory incorrectly conducting the test, the Manufacturer may request a retest to be conducted at the CQA Geosynthetics Laboratory in the presence of a representative of the Manufacturer.

All material from a lot represented by a failing test result shall be rejected, or additional conformance test samples may be taken to isolate the portion of the lot not meeting Specifications (this procedure is valid only when rolls in a lot are consecutively produced and numbered from one manufacturing line). Additional samples shall be taken from rolls either side of the failing roll, until passing test results are achieved, to establish the range of failure within the lot. All rolls lying within this range of failure shall be rejected.

6.1.3 Subgrade Preparation and Acceptance

The Earthwork Contractor shall be responsible for preparing the subgrade upon which the geomembrane will be placed according to the Specifications.

Prior to acceptance, the CQA Consultant shall verify that:

- A qualified land surveyor has verified all lines and grades.
- The supporting soil meets the density and moisture Specifications, and provides a firm, unyielding foundation.
- The surface to be lined is relatively smooth and free of stones, protrusions, irregularities, roots, loose soil, abrupt changes in grade, large desiccation cracks, or other conditions that may puncture or abrade the geomembrane.
- There is no standing water or areas excessively softened by high moisture content; large desiccation cracks.
- All subgrade density, moisture content, hydraulic conductivity tests, or other tests have been completed and meet Specification requirements, and that no other tests are necessary.

The Installer shall certify, in writing, that the surface on which the geomembrane will be installed is acceptable. A Certificate of Acceptance shall be given by the Installer to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration and a copy of this certificate provided to the Owner.

After the supporting soil has been accepted by the Installer, it shall be the Installer's responsibility to indicate to the CQA Consultant any change in the supporting soil condition that may require correction. If the CQA Consultant concurs with the Installer, then the Owner shall ensure that the supporting soil is repaired.

6.1.4 Subgrade Repair

At any time during the geomembrane installation, the CQA Consultant shall indicate to the Installer and Owner locations which may not provide adequate support to the geomembrane so the areas in question can be tested and, if necessary, repaired.

~~Special care shall be taken to avoid desiccation cracking of an underlying soil liner in a composite liner system. To that end, the soil surface shall be observed by the Installer and the CQA Consultant and the decision to repair cracks, if any, shall be made by the Owner's representative and the Designer.~~

6.1.5 Anchor Trenches

The CQA Consultant shall verify that the anchor trench has been constructed according to design Drawings and Specifications.

Rounded or smoothed corners shall be provided where the geomembrane enters the trench so as to avoid sharp bends in the geomembrane. No loose or excessively wet soil shall be allowed to underlie the geomembrane in the anchor trench.

The anchor trench shall be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. The anchor trench shall be carefully backfilled and compacted by the Earthwork Contractor or the Installer, as outlined in the Specifications. Care shall be taken when backfilling the trenches to prevent bridging of the geomembrane or damage.

6.1.6 Field Panel Identification

The CQA Consultant shall verify that each field panel is given a unique identification code (number or letter-numbered) consistent with the layout plan. This identification code shall be agreed upon by the Installer and CQA Consultant. The CQA Consultant and Installer shall establish a table or chart showing correspondence between roll numbers and field panel identification codes. The field panel identification code shall be used for all quality assurance documentation.

The CQA Consultant shall verify that field panels are installed at the location indicated in the Installer's layout plan, as approved or modified, and that the Installer has marked the identification code and roll number on each installed panel. The Installer and CQA Consultant shall also verify that the condition of the supporting soil has not changed detrimentally during installation. The CQA Consultant shall record the identification code, location, and date of installation of each field panel.

6.1.7 Field Panel Placement and Deployment

Geomembrane panel placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in areas of ponded water, or in the presence of strong winds. Manufacturer's recommendations or the Specifications should be followed, whichever is more stringent, for extreme ambient temperature conditions.

Panels shall be oriented according to the Installer's panel layout drawing as approved by the CQA Consultant and Owner. Seams shall be located outside of areas of potential high stress conditions, at slope intersections and corners, or other areas considered critical. Horizontal seams on slopes steeper than 10 (horizontal) to one (vertical) shall be avoided. The CQA Consultant shall review the seam orientations prior to seaming operations to determine if these conditions are satisfied.

The CQA Consultant shall verify that the geomembrane handling equipment used does not pose risk of damage to the geomembrane or subgrade, and that the Installer's personnel take care in handling the geomembrane at all times.

Contact between the soil liner and the geomembrane shall be maintained in all areas. The Installer shall take into account ambient temperature and its effect on the thermal expansion and contraction of the geomembrane. The geomembrane materials shall be deployed in a manner which minimize wrinkling. Partial backfilling of anchor trenches, adequate loading of the toe of slope during lower ambient temperatures is recommended to prevent displacement by bridging.

The CQA Consultant shall also verify and notify the Owner that:

- Equipment used does not damage the geomembrane during trafficking, handling, excessive heat or other means.
- The method of deploying the geomembrane does not cause excessive scratches or crimps in the geomembrane, and does not damage the approved subgrade surface.
- Personnel working on the geomembrane do not smoke or wear damaging shoes.
- The geomembrane is protected by appropriate means in areas of excessive traffic.
- Adequate ballast (e.g., sand bags) has been placed to prevent wind uplift and is not likely to damage the geomembrane. Continuous loading is recommended along edges of panels in high winds, or when work is terminated for several days or longer periods.

The CQA Consultant shall visually inspect each panel for defects or damage after placement and prior to seaming. Damaged panels or portions of damaged panels shall be marked and repaired, or removed from the work area. Repairs shall be made according to procedures described in the Specifications.

6.1.8 Field Seaming

6.1.8.1 Personnel Requirement

The Installer shall be prequalified in accordance with the Specifications and approved by the Owner.

The Installer's Superintendent shall be qualified based on previously demonstrated experience, management ability, and authority. The Superintendent is responsible for the Installer's field crew and will represent the Installer at all project meetings.

6.1.8.2 Seam Layout

Prior to the installation of geomembrane, the Installer shall provide the Owner and CQA Consultant with a panel layout drawing showing all expected major panel seams. The Owner or Owner's representative shall approve in writing the panel layout drawing.

6.1.8.3 Seaming Methods

Accepted seaming methods consist of those recommended by the Manufacturer of the geomembrane product, and which will result in seams that meet testing requirements as indicated in the Specifications for both destructive and non-destructive samples.

For polyethylene geomembranes, the accepted methods include extrusion and fusion-welding.

Proposed alternate methods shall be documented by the Installer and CQA Consultant. The CQA Consultant shall review all documentation regarding alternative seaming methods to be used. The Owner, Owner's representative, or Engineer shall approve in writing any alternative seaming methods.

Fusion-welding apparatus shall be an automated, roller-mounted device. The fusion-welding apparatus shall be equipped with gauges indicating the applicable temperatures and pressures. The CQA Consultant shall log ambient, seaming apparatus, and geomembrane surface temperatures as well as seaming apparatus pressures.

Extrusion-welding apparatus shall be equipped with gauges indicating the temperature in the apparatus and at the nozzle.

The Installer shall provide documentation regarding the extrudate to the CQA Consultant, and shall certify that the extrudate is compatible with the Specifications and is comprised of the same resin as the geomembrane sheeting.

The CQA Consultant shall log apparatus temperatures, extrudate temperatures, ambient temperatures, and geomembrane surface temperatures at appropriate intervals.

6.1.8.4 Seam Preparation

The CQA Consultant shall verify that:

- Seams are aligned with the fewest possible number of wrinkles and "fishmouths".
- Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

- If seam overlap grinding is required, the process is completed according to the Manufacturer's instructions within one hour of the seaming operation, and does not damage the geomembrane.
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to welding.
- A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
- The geomembrane is protected from damage in heavily trafficked areas.
- A movable protective layer (i.e., plywood, geomembrane) may be used as necessary directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets.
- The panels of geomembrane have a finished overlap of 4 inches for extrusion welding and 6 inches for fusion welding, but in any event sufficient overlap shall be provided to allow peel tests to be performed on the seam.
- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane.

6.1.8.5 Weather Conditions for Seaming

The Installer and CQA Consultant shall observe weather conditions during seaming operations to determine if excessive temperatures, moisture or humidity, or winds exist that could impact the welding process. Manufacturer's recommendations shall be followed for seaming under extreme weather conditions, unless otherwise approved by the Owner and CQA Consultant based on the Installer's experience and recommendations.

As indicated in the Specifications, welding shall not occur when ambient air temperatures measured one-foot above the geomembrane are below 32-degrees F or above 104-degrees F and as noted in the Specifications. Preheating of the seams may be used if trial seams have been performed using the same preheating method(s) and meet all criteria for acceptance. Wind conditions shall also be considered in determination of acceptable ambient conditions.

6.1.8.6 General Seaming Procedures

During seaming, the CQA Consultant shall verify the following conditions:

- Seaming shall extend to the outside edge of panels placed within the anchor trench.
- A firm substrate shall be provided using a flat board or similar hard surface directly under the seam overlap to achieve proper support, if necessary.

- "Fishmouths" or wrinkles at the seam overlap shall be cut along the ridge in order to achieve a flat overlap. The cut "fishmouth" or wrinkle shall be seamed and any portion where the overlap is inadequate shall be patched with an oval or round geomembrane patch that extends a minimum of 6 inches beyond the cut in all directions.
- Adequate lighting shall be provided if seaming operations are performed at night or during periods of diminished natural light.
- Startup testing is conducted and recorded prior to initiating welding.

6.1.9 Seam Testing

6.1.9.1 Nondestructive Testing of Field Seams

The Installer shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure test (double fusion seams only), or other approved method. The purpose of this testing is to determine the continuity of the seams only. Nondestructive testing shall be performed as work progresses, not at completion.

The CQA Consultant shall observe nondestructive testing procedures and inform the Installer and Owner of required repairs. The CQA Consultant shall record the location, date, name, and outcome of all testing.

The Installer shall complete required repairs in accordance with the Specifications. The CQA Consultant shall observe the repair and testing of the repair, document the repair and test results, and mark on the geomembrane that the repair has been completed. All repairs shall be shown on the record Drawings, ~~or if this is not practical, and~~ noted in repair logs and on daily reports.

Vacuum testing equipment and methods are discussed in the Specifications.

Air pressure testing procedures are applicable to fusion-welding that produces a double seam with an enclosed air channel. The equipment and methods are discussed in the Specifications.

6.1.9.2 Destructive Testing

Destructive seam tests shall be performed on seam samples cut from the geomembrane locations selected by the CQA Consultant. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

The CQA Consultant shall select locations where seam samples will be cut by the installer for laboratory testing. Those locations shall be established as follows:

- A minimum average frequency of one test location per 500 feet of seam length or one test location per seam, whichever is greater.
- At least one location for each seaming machine each day.
- At locations where the CQA Consultant suspects that inadequate seaming methods or conditions occurred or other factors causing to reduce seam strength exist.

The Installer shall not be informed in advance of the locations where the destructive seam samples will be taken.

6.1.9.3 Sampling Procedures

Samples shall be cut by the Installer at locations selected by the CQA Consultant as the seaming progresses, such that laboratory test results are available before the geomembrane is covered by another material.

The CQA Consultant shall observe the sample cutting, assign a number to each sample, and mark it accordingly, and record the sample location on the layout drawing.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with specified repair procedures. The continuity of the new seams in the repaired area shall be non-destructively tested according to procedures described herein.

The sample for laboratory testing shall be 12 inches wide across the seam by 42 inches long with the seam centered lengthwise. The sample shall be cut into three segments and distributed as follows:

- 12 inches x 14 inches to the Installer for laboratory testing.
- 12 inches x 14 inches to the CQA Geosynthetics Laboratory for testing.
- 12 inches x 14 inches to the Owner for archive storage.

The CQA Consultant is responsible for packaging and shipping samples to the CQA Geosynthetics Laboratory in a manner which will not damage the samples.

6.1.9.4 CQA Geosynthetics Laboratory

Testing shall include ASTM D 4437 "Practice for Determining the Integrity of Field Seams Used in Joining Polymer Sheet Membranes". The minimum acceptable values to be obtained in these tests are those indicated in the Specifications. At least five specimens shall be tested for each test method. Specimens shall be selected from the samples and tested alternately (i.e., peel, shear, peel, shear, etc.). For double wedge welds, both inner and outer seams shall be tested and determined to be acceptable.

The CQA Geosynthetics Laboratory shall provide verbal test results no more than 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as soon as they become available, and make appropriate recommendations to the Installer.

6.1.9.5 Procedures for Destructive Test Failures

All acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 feet (50 m) of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing.

The procedures outlined in the Specifications shall apply whenever a sample fails a destructive test, whether that test is conducted by the CQA Consultant, the Installer, the Contractors independent CQC laboratory, or by field tensiometer.

The CQA Consultant shall document all actions taken in conjunction with destructive test failures.

6.1.10 Defects, Repairs and Wrinkles

The entire geomembrane, including seams, shall be visually examined by the CQA Consultant for identification of visual defects, holes, blisters, undispersed raw materials and signs of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be swept or washed by the Installer if dust, mud or other matter inhibits examination. All areas having defects and/or requiring repairs shall be repaired.

Work shall not proceed with any materials which will cover locations which have been repaired until the CQA Consultant has re-examined the repaired area and applicable laboratory test results with passing values are available.

Panels or portions of panels which are, in the opinion of the CQA Consultant, damaged beyond repair shall be removed from the site and replaced. Damage, which in the CQA Consultant's opinion, can be repaired may be repaired or replaced.

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the CQA Representative, Installer, and Designer.

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using the methods described in the Specifications as appropriate. Repairs which pass the non-destructive test shall be taken as an indication of an adequate repair. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of the CQA Consultant. In the case of failed tests, the repair shall be redone and retested until a passing test results. The

CQA Consultant shall observe all repairs and all non-destructive testing of repairs, note on the membrane that it has been repaired, and document each repair thoroughly.

When seaming of the geomembrane is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying materials, the CQA Consultant shall indicate which wrinkles should be cut and re-seamed by the Installer. Wrinkle size shall be evaluated during the time of day and under conditions similar to those expected when overlying protective cover/drainage layer material is to be placed. All wrinkles higher than they are wide (across their base) or more than 6 inches high shall be removed by repair methods and retested.

6.2 GEOTEXTILES

This quality assurance testing program has been established to verify that specified geotextiles are manufactured, installed and tested according to project Specifications.

6.2.1 Manufacturer Quality Control Documentation

The Geotextile Manufacturer shall provide the CQA Consultant with the following information prior to the installation of the geotextile:

- A list of materials which comprise the geotextile and a Specification for the geotextile which includes all properties contained in the project Specifications measured using the appropriate test methods.
- Written certification that the minimum average roll values given in the Specification are guaranteed by the Manufacturer.
- Written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle free.
- Quality control certifications, which shall include roll identification numbers, sampling procedures, and quality control test results signed by a responsible party employed by the Manufacturer. At a minimum, results shall be given for:
 1. Mass per unit area, oz/yd² (ASTM D 5261)
 2. Apparent Opening Size, US sieve (ASTM D 4751)
 3. Flow Rate, gpm/ft² (ASTM D 4491)
 4. Puncture Strength, lb (ASTM D 4833)
 5. Trapezoidal Tear Strength, lb (ASTM D 4533)
 6. Grab Tensile, lb (ASTM D 4632)

Results of quality control tests conducted by the Manufacturer to verify the geotextile meets the project Specifications.

Quality control tests shall be performed in accordance with test methods and frequencies required by the project Specifications.

All rolls of geotextile shall be identified by the Manufacturer with the following:

- Manufacturer's Name.
- Roll Number.
- Product Identification.
- Roll Dimensions.

The CQA Consultant shall review these documents to verify that:

- Property values certified by the Manufacturer meet all Specifications listed in the Specifications.
- The Manufacturer's measurements of properties are properly documented and test methods used acceptable.
- Rolls are properly labeled.
- Project Specifications shall be met with the certified minimum average roll properties.
- Quality control certificates have been provided at the specified frequency for all rolls.

Any discrepancies shall be reported to the Owner and Manufacturer.

6.2.2 Conformance Sampling and Testing

The CQA Consultant shall verify that the required number of conformance test samples are obtained for the geotextile prior to delivery to the site. At a minimum, geotextile conformance tests performed are as follows:

- Mass per unit area, oz/yd² (ASTM D 5261)
- Apparent Opening Size, US sieve (ASTM D 4751)
- Flow Rate, gpm/ft² (ASTM D 4491)
- Puncture Strength, lb (ASTM D 4833)

The CQA Consultant shall select the rolls to be tested. Samples shall be three feet long by the width of the roll, and shall not include the first complete revolution of the roll. Samples shall not include any portion of a roll which has been subjected to excess pressure or stretching. All lots of material and the particular test sample that represents each lot shall be defined before the samples are taken.

Samples shall be taken at a rate of one per lot, but not less than one conformance test per 100,000 square feet of geotextile or portion thereof.

The CQA Consultant shall review all conformance test results and accept or reject the roll prior to deployment. All nonconforming test results shall be reported to the Owner and Installer. The CQA Consultant is responsible for reviewing test results to verify that the property values meet or exceed values listed in the project Specifications.

If any failing test results may be the result of the CQA Geosynthetics Laboratory incorrectly conducting the test, the Manufacturer may request a retest to be conducted at the CQA Geosynthetics Laboratory in the presence of a representative of the Manufacturer.

All material from a lot represented by a failing test should be rejected or additional conformance test samples may be taken to isolate the portion of the lot not meeting Specifications. (This procedure is only valid when rolls in a lot are consecutively produced and numbered from one manufacturing line). Additional samples shall be taken from rolls either side of the failing roll, until passing test results are achieved, to establish the range of failure within the lot. All rolls lying within this range of failure shall be rejected.

6.2.3 Geotextile Storage, Handling and Placement

Geotextile shall be protected from ultraviolet light exposure, precipitation, mud, puncture, cutting, or other deleterious conditions during shipment, handling and storage. Geotextile rolls shall be shipped and stored in relatively opaque and watertight wrapping which shall be removed shortly before deployment.

The Installer shall handle all geotextile in such a manner as to minimize damage, and the following shall be complied with:

- All deployed geotextile shall be stabilized with sandbags or the equivalent ballast in the presence of wind. Such sandbags shall remain until replaced with cover material.
- The entire surface of the geotextile shall be visually inspected to ensure that no potentially harmful foreign objects are present.
- On slopes, the geotextiles shall be securely anchored in the anchor trench and rolled down the slope in such a manner as to continually keep the geotextile sheet in tension.
- Geotextiles shall be cut using an approved geotextile cutter only. If in place, special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.
- The Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.

- Care shall be taken not to entrap stones, excessive dust, or moisture within the geotextile that could damage the geomembrane, result in clogging of drains or filters, or hamper subsequent seaming.
- After installation, a visual examination of the geotextile shall be carried out over the entire surface, to verify that no potentially harmful foreign objects, such as needles or staples, are present.

6.2.4 Seaming Procedures

Geotextile shall be overlapped in accordance with the requirements of the Specifications. On slopes steeper than 10 feet horizontal to 1 foot vertical (10H:1V), all geotextiles shall be continuously sewn. In general, no horizontal seams shall be allowed on side slopes, except as part of a patch.

Sewing shall be done using polymeric thread with chemical or ultraviolet light resistant properties equal to or greater than those of the geotextile.

6.2.5 Defects and Repairs

Holes or tears in the geotextile shall be repaired with a patch of the same geotextile double-sewn or heat-tacked into place. Repairs occurring on slopes steeper than 10H:1V shall be double-sewn in place. Should any tear exceed ten percent of the width of the roll, that roll shall be removed and replaced. Soil or other material which may have penetrated the torn geotextile shall be removed.

The CQA Consultant shall observe any repairs and report any noncompliance to the Owner.

6.2.6 Placement of Soil Materials

The Earthwork Contractor or Installer shall place all soil materials on top of a geotextile in such a manner as to minimize:

- Damage to the geotextile.
- Slippage of the geotextile on underlying layers.
- Excess tensile stresses in the geotextile.

Any noncompliance shall be noted by the CQA Consultant and reported to the Installer and Owner.

6.3 GEOCOMPOSITES

6.3.1 Manufacturer Quality Control Documentation

This quality assurance testing program has been established to verify that specified geocomposites are manufactured, installed and tested according to Specifications.

The geocomposite manufacturer shall provide the CQA Consultant with a list of guaranteed properties for the type of geocomposite to be supplied, with a written certification signed by an officer or the Quality Control Manager that the geocomposites delivered have properties which meet or exceed the guaranteed properties.

The CQA Consultant shall examine all manufacturer's certifications to verify that the property values listed on the certifications meet or exceed those specified. Any deviations shall be reported to the Owner and Manufacturer.

The geocomposite manufacturer shall identify all rolls of geocomposites with the following:

- Manufacturer's name.
- Product identification.
- Lot number.
- Roll number.
- Roll dimensions.

The CQA Consultant shall examine rolls upon delivery and any deviation from the above requirements shall be reported to the Owner and Manufacturer.

6.3.2 Shipment and Storage

Geocomposite cleanliness is essential to their performance and geocomposite rolls should be wrapped in polyethylene sheets or otherwise protected against dust and dirt during shipping and storage. The wrapping should be removed less than 1 hour before placement. The CQA Consultant shall verify that geocomposites are free of dirt and dust just before installation and report the outcome of this verification to the Owner. If the geocomposites are judged dirty or dusty, they shall be washed by the Installer prior to installation. Washing operations shall be observed by the CQA Consultant.

6.3.3 Conformance Sampling and Testing

Upon delivery of the rolls of geocomposites, or prior to shipment to the jobsite, the CQA Consultant shall verify that samples are removed and forwarded to the CQA Geosynthetics Laboratory for testing, at the frequency indicated in the Specifications.

Samples shall be taken across the entire width of the roll and shall not include the first complete revolution of the roll. Unless otherwise specified, samples shall be 3 feet wide by the roll width long. The CQA Consultant shall mark the machine direction on the samples with an arrow.

Unless otherwise specified, samples shall be taken at a rate of one per lot or one per 100,000 square feet, or portion thereof, whichever is the greater frequency.

The CQA Consultant shall examine all results from laboratory conformance testing and shall report any nonconformance to the Owner.

6.3.4 Handling and Placement

The Installer shall handle all geocomposites in such a manner as to minimize damage to the geocomposites. The following shall be complied with:

- During placement of geocomposites, care shall be taken not to entrap any dirt or excessive dust in the geocomposite that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geocomposite, it should be hosed clean prior to placement of the next material on top of it.
- On slopes, the geocomposites shall be secured in the anchor trench and the material rolled down the slope in such a manner as to continually keep the geocomposite sheet in tension. If necessary, the geocomposite shall be positioned by hand after being unrolled to minimize wrinkles. Geocomposites can be placed in the horizontal direction (i.e., across the slope) in some special locations (e.g., at the toe of a slope, if an extra layer of geocomposite is required, this extra layer of geocomposite can be placed in the horizontal direction). Such locations shall be identified by the Designer in the design Drawings.
- In the presence of wind, all geocomposites shall be weighed with sandbags or the equivalent. Such sandbags shall be placed during placement of the geocomposite and shall remain until replaced with cover material.
- The Installer shall take necessary precautions to prevent damage to underlying layers during placement of the geocomposite.

The CQA Consultant shall note any noncompliance and report it to the Owner.

6.3.5 Repair

Holes or tears in the geocomposite shall be repaired by placing a patch extending 2 feet beyond the edges of the hole or tear. The patch shall be secured to the original geocomposite by spot welding or tying every 6 inches.

SECTION 7

DOCUMENTATION

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

The CQA Consultant shall maintain at the site a complete file of design plans, project Specifications, test procedures, daily logs, and other pertinent documents.

7.1 REPORTS

Standard reporting procedures shall include preparation of a daily report which, at a minimum, shall consist of:

- A daily summary report including memoranda of meetings and discussions with the Owner and/or site contractors.
- Observation logs detailing construction activities for the day, and test results, as appropriate.

Other forms of daily record keeping to be used as appropriate include construction problem and solution data sheets and photographic reporting data sheets. This information shall be regularly submitted to and reviewed by the Owner.

7.1.1 Daily Logs and Summary Reports

The CQA Consultant shall prepare daily logs and summary reports which shall include the following information:

- An identifying report number for cross referencing and document control.
- Date, project name, location, and other identification.
- Data on weather conditions.
- Information on meetings held or discussions which took place including:
 1. Names of parties to discussion.
 2. Relevant subject matter or issues.
 3. Decisions reached.

4. Activities and their schedule.

- A reduced-scale site plan or sketch showing 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 or reference to specific observation logs and/or test data sheets where such information can be found.
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets.
- Calibrations of test equipment.
- 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.
- The CQA Consultant's signature.

7.1.2 Observation and Testing Reports

The CQA Consultant shall record observations of construction and CQA-related activities on project specific observation and testing reports. At a minimum, the observation and testing reports shall include the following information:

- An identifying sheet numbered for cross referencing and document control.
- Date, project name, location, and other identification.
- Description or title of activity monitored.
- Location of activity and locations of samples collected.
- Locations of field tests performed and their results.
- Results of laboratory tests received.
- Results of monitoring activity in comparison to Specifications.
- The CQA Consultant's signature.

Reports describing problem identification, corrective measures reports or special construction situations shall be prepared by the CQA Consultant and cross-referenced to specific observation and testing reports. These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control.

- A detailed description of the situation or deficiency.
- The location and probable cause of the situation or deficiency.
- How and when the situation or deficiency was found or located.
- Documentation of the response to the situation or deficiency.
- Final results of any responses.
- Any measures taken to prevent a similar situation from occurring in the future.
- The signature of the CQA Consultant and the signature of the Owner or Owner's representative indicating concurrence.

The Owner shall be made aware of any significant recurring nonconformance with the project Specifications. The Owner shall then determine the cause of the nonconformance and recommend appropriate changes in procedures or Specifications. These changes will be submitted to the Design Engineer for approval. When this type of evaluation is made, the results shall be documented, and any revision to procedures or project Specifications will be approved by the Owner, Design Engineer, and, if necessary, the Permitting Agency.

7.2 PHOTO DOCUMENTATION AND REPORTING DATA SHEETS

Photo documentation and reporting data sheets shall be cross-referenced with observation and test reports and/or problem identification and corrective measure reports.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; ~~negatives~~ digital files shall be stored on CD, or DVD, or flash drive in a separate file in chronological order. These records will be presented to the Owner upon completion of the project.

In support of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities.

7.3 DESIGN AND/OR SPECIFICATION CHANGES

Design and/or project Specification changes may be required during construction. In such cases, the CQA Consultant shall notify the Owner and the Design Engineer. The Owner shall then notify the Permitting Agency if necessary.

Design and/or project Specification changes shall be made only with the written agreement of the Owner and the Design Engineer, and shall take the form of an Addendum to the project Specifications.

7.4 PROGRESS REPORTS

The CQA Consultant shall prepare a progress report at time intervals established at the Pre-construction meeting and submit to the Owner. At a minimum, this report shall include the following information:

- An identifying sheet numbered for cross referencing and document control.
- Date, project name, location, and other identification.
- 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.
- A summary of test results, failures, and retests.
- The signature of the CQA Consultant.

The Owner shall distribute copies of the Progress Reports to the Permitting Agency and, upon request, Geosynthetics Installer and Earthwork Contractor or as decided at the Pre-construction Meeting.

7.5 AS-BUILT DRAWINGS

As-Built Drawings shall include, but are not limited to the following:

- Scale plans depicting the location of construction.
- Details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, over excavation, etc.).
- Grid to confirm elevation of waste, top of grading layer, and top of protective soil.
- Base maps required for the development of the record plans shall be done by a qualified land surveyor.
- Each layer of geomembrane identifying panels with appropriate numbers, destructive seam samples locations, patches, and repairs locations.
- Pipe, swale, and ditch inverts.
- Tolerances.

- Pertinent details.
- Changes from the construction Drawings.

7.6 FINAL DOCUMENTATION REPORT AND CERTIFICATION

At the completion of the work, the CQA Consultant shall submit to the Owner the signed Final Documentation Report. At a minimum, the Final Documentation Report shall include:

- Summaries of all construction activities.
- Observation logs and test data sheets including sample location plans and supporting field and laboratory test results.
- Construction problems and solutions reports.
- Changes from design and material specifications.
- As-Built Drawings.
- If required by the regulatory agency, a summary statement sealed and signed by a professional engineer registered in the state that the construction has been completed that the project has been completed in substantial conformance with project Specifications and design plans.

SCS ENGINEERS DAILY FIELD REPORT

Project: _____ Project Number: _____

Owner: _____ Contractor: _____

Date: _____ Contract Day: _____ Contract Duration: _____
Days Remaining: _____

Weather

Temperature: (AM)_____ (PM)_____ Rain:_____ Duration of Rain:_____

Description of weather: _____

List of Equipment on site: (A) for active (I) for idle

Personnel on site:

No. of Superintendents	No. of Skilled	No. of Laborers
Description of Construction Activity		

[illegible]

List of Subcontractors

List of Materials Delivered

List of Quantities installed this date:

Item Description	Quantity	Accumulated Quantity

Field Representative _____

SCS ENGINEERS DAILY FIELD REPORT

Project:_____ **Project Number:**_____

Owner: _____ Contractor: _____

Date: _____ Contract Day: _____ Contract Duration: _____

Contract Duration:_____

Days Remaining: _____

Description of Construction Activity

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Field Representative _____ Date _____

SCS ENGINEERS

CERTIFICATE OF SUB-BASE ACCEPTANCE

Installer: _____ Project name: _____
Address: _____ Project location: _____

Owner: _____

I, THE UNDERSIGNED, DULY AUTHORIZED REPRESENTATIVE OF _____
(Geosynthetic Installer)
DO HEREBY ACCEPT THE AREA OF SOIL SURFACE AS DESCRIBED BELOW.

(SKETCH OR DESCRIBE)

Acceptance of the soil surface for which the geomembrane will be placed is based upon visual observations.
Acceptance of the subgrade surface considers that at the time the geomembrane is placed, the structure of the underlying soil surface, which is the responsibility of others, meets or exceeds the project specifications.

_____ NAME	_____ TITLE
_____ SIGNATURE	_____ DATE

Certification received by SCS

_____ NAME	_____ TITLE
_____ SIGNATURE	_____ DATE

GEOMEMBRANE PLACEMENT LOG

0

SIGNATURE:

SCS EN

EERS

SHEET

PROJECT TITLE

PROJECT NO.

DATE _____

of

GEOMEMBRANE SEAMING LOG

[illegible]

PRINT NAME:

SIGNATURE:

NON-DESTRUCTIVE TEST LOG

0

SIGNATURE:

SCS ENGINEERS

DESTRUCTIVE TEST LOG

SHEET:

of

PROJECT TITLE:

PROJECT NO:

DATE:

[illegible]

PRINT NAME:

SIGNATURE:

GEOMEMBRANE REPAIR LOG

PROJECT TITLE

PROJECT NO.

DATE _____

O

DEFECT CODES:

PRINT NAME:

SIGNATURE:

TRIAL WELD LOG

SHEET
PROJECT TITLE
PROJECT NO.
DATE

of

[illegible]

PRINT NAME:

SIGNATURE:

TABLE OF CONTENTS

DIVISION 2 - SITE WORK

02701	LLDPE GEOMEMBRANE LINER
02930	GEOCOMPOSITE

SECTION 02701

LLDPE GEOMEMBRANE LINER

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work specified in this Section includes manufacturing and installing textured Linear Low Density Polyethylene (LLDPE) geomembrane liner as part of the final cover system as shown on the drawings and as specified herein.
- B. All materials shall conform to the following requirements and shall be of new stock of the highest grade available, free from defects, and recently manufactured.
- C. All installation shall be in conformance with the manufacturer's recommendations and with current industry standards.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheet
 - 2. D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
 - 3. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
 - 4. D 1603 Test Method for Carbon Black in Olefin Plastics
 - 5. D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
 - 6. D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
 - 7. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
 - 8. D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
 - 9. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
 - 10. D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
 - 11. D 6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
 - 12. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

- B. Geosynthetic Research Institute

- ~~1. GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes~~
1. GRI GM-14 Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes
2. GRI GM 17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

1.03 DEFINITIONS

- A. Lot- A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
- B. Construction Quality Assurance Consultant (CONSULTANT) - Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- C. ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- D. Geomembrane Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geomembrane rolls.
- E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY)- Party, independent from the OWNER, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
- F. INSTALLER- Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.
- G. Panel- Unit area of a geomembrane that will be seamed in the field that is larger than 100 ft².
- H. Patch- Unit area of a geomembrane that will be seamed in the field that is less than 100 ft².
- I. Subgrade Surface- Soil layer surface which immediately underlies the geosynthetic material(s).

1.04 SUBMITTALS POST AWARD

- A. Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material:
 - 1. Resin Data shall include the following.
 - a. Certification stating that the resin meets the specification requirements (see Section ~~1.09~~2.01)
 - 2. Geomembrane Roll
 - a. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).
- B. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:
 - 1. Installation layout drawings
 - a. Must show proposed panel layout including field seams and details
 - b. Must be approved prior to installing the geomembrane
 - 1. Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
 - 2. Installer's Geosynthetic Field Installation Quality Assurance Plan
- C. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
 - 1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
 - 2. Material and installation warranties
 - 3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1.05 QUALITY ASSURANCE

- A. The OWNER will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.06 QUALIFICATIONS

A. MANUFACTURER

- 1. Geomembrane shall be manufactured by the following:
 - a. GSE Lining Technology, Inc.
 - b. Poly-Flex, Inc.
 - c. Agru/America, Inc.
 - d. approved equal.
- 2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane.

B. INSTALLER

1. INSTALLER shall have installed a minimum of 2,000,000 square feet of LLDPE geomembrane during the last 5 years.
2. INSTALLER shall have worked in a similar capacity on at least 6 projects similar in complexity to the project described in the contract documents, and with at least 250,000 square feet of LLDPE geomembrane installation on each project.
3. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
4. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
 - a. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.07 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

- A. Labeling - Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
 - a. manufacturer's name
 - b. product identification
 - c. thickness
 - d. length
 - e. width
 - f. roll number
- B. Delivery- Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- C. Storage- The on-site storage location for geomembrane material, provided by the INSTALLER to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:
 - a. level (no wooden pallets)
 - b. smooth
 - c. dry
 - d. protected from theft and vandalism
 - e. adjacent to the area being lined
- D. Handling- Materials are to be handled so as to prevent damage.

1.08 WARRANTY

- A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 520 years from the date of geomembrane installation.

- B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

PART 2 - PRODUCTS

2.01 GEOMEMBRANE

- A. Material shall be textured LLDPE geomembrane as shown on the drawings.
- B. Resin
1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
 2. Natural resin (without carbon black) shall meet the following minimum requirements:

Property	Test Method	Value
Density [g/cm ³]	ASTM D 1505	0.915
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤ 1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100

- C. Geomembrane Rolls
1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
 2. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
 3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating roll number, thickness, length, width and MANUFACTURER.
 4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Table 1 and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.
- D. Textured surfaced geomembrane shall meet the requirements shown in Table 1.
- E. Extrudate Rod or Bead
1. Extrudate material shall be made from same type resin as the geomembrane.
 2. Additives shall be thoroughly dispersed.
 3. Materials shall be free of contamination by moisture or foreign matter.

PART 3 – EXECUTION

3.01 EQUIPMENT

- A. Welding equipment and accessories shall meet the following requirements:
 - 1. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
 - 2. An adequate number of welding apparatus shall be available to avoid delaying work.
 - 3. Power source must be capable of providing constant voltage under combined line load.

3.02 DEPLOYMENT

- A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.
- B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
- C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
 - 1. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).
 - 2. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
 - 3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
 - 4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi.
 - 5. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- D. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

3.03 FIELD SEAMING

- A. Seams shall meet the following requirements:
 - 1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.

2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
 3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.
 4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER.
 5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly suggested.
- B. During Welding Operations
1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.
- C. Extrusion Welding
1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
 2. Clean geomembrane surfaces by disc grinder or equivalent.
 3. Purge welding apparatus of heat-degraded extrudate before welding.
- D. Hot Wedge Welding
1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
 2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
 3. Protect against moisture build-up between sheets.
- E. Trial Welds
1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
 2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
 3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
 4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
 5. Quantitatively test specimens for peel adhesion, and then for shear strength.
 6. Trial weld specimens shall pass when the results shown in ~~Table 3~~Table 2 are achieved in both peel and shear test.
 - a. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
 - b. The break is ductile.
 7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
 8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

- F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.
- G. Defects and Repairs
 - 1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
 - 2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.04 FIELD QUALITY ASSURANCE

- A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.
- B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.
- C. Field Testing
 - 1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
 - a. Vacuum Testing
 - 1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
 - b. Air Pressure Testing
 - 1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
 - c. Other approved methods.
 - 2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
 - a. Location and Frequency of Testing
 - 1) Collect destructive test samples at a frequency of one per every ~~1500~~ 500 lineal feet of seam length.
 - 2) Test locations will be determined after seaming.
 - 3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute) to minimize test samples taken.
 - b. Sampling Procedures are performed as follows:

- 1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
 - 2) CONSULTANT will number each sample, and the location will be noted on the installation as-built.
 - 3) Samples shall be twelve (12) inches wide by ~~minimal by the seam and fortyfour (44) inches longlength~~ with the seam centered lengthwise.
 - 4) Cut a 2-inch wide strip from each end of the sample for field-testing.
 - 5) Cut the remaining sample into ~~two~~three parts for distribution as follows:
 - a) One portion for INSTALLER, 12-inches by ~~12-14~~ inches
 - b) One portion for the Third Party laboratory, 12-inches by ~~18~~14-inches
 - c) ~~Additional samples may be archived if required.~~One portion for archive storate, 12-inches by 14-inches.
 - 6) Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
 - 7) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
 - 8) Repair and test the continuity of the repair in accordance with these Specifications.
3. Failed Seam Procedures
- 1) If the seam fails, INSTALLER shall follow one of two options:
 - a) Reconstruct the seam between any two passed test locations.
 - b) Trace the weld to intermediate location at least 10 feet minimum or where the seam ends in both directions from the location of the failed test.
 - 2) The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
 - 3) If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
 - 4) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

3.05 REPAIR PROCEDURES

- A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

- C. INSTALLER shall be responsible for repair of defective areas.
- D. Agreement upon the appropriate repair method shall be decided between CQA CONSULTANT and INSTALLER by using one of the following repair methods:
1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
 2. Abrading and Re-welding- Used to repair short section of a seam.
 3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
 4. Capping- Used to repair long lengths of failed seams.
 5. Remove the unacceptable seam and replace with new material.
- E. The following procedures shall be observed when a repair method is used:
1. All geomembrane surfaces shall be clean and dry at the time of repair.
 2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
 3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.
- F. Repair Verification
1. Number and log each patch repair (performed by CONSULTANT).
 2. Non-destructively test each repair using methods specified in this Specification.

Table 1: Minimum Values for Textured LLDPE Geomembranes

Property	Test Method	Value
Thickness, mil (mm)	ASTM D 5994	
Minimum Average		40 (1.0)
Lowest Individual Reading		36 (0.91)
Density, g/cm ³	ASTM D 1505	0.92
Carbon Black Content, %	ASTM D 1603, modified	2.0
Carbon Black Dispersion	ASTM D 5596	Note 2
Tensile Properties ⁽¹⁾ : (each direction)	ASTM D 6693	
Strength at Break, lb/in (kN/m)		100 (18)
Elongation at Break, %	(2.0" gauge length)	500
Tear Resistance, lb (N)	ASTM D 1004	22 (100)
Puncture Resistance, lb (N)	ASTM D 4833	48 (214)
Oxidative Induction Time, min.	ASTM D 3895	100

¹ These tensile properties are average roll values.

² 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

Table 2: Minimum Weld Values for LLDPE Geomembranes

Property	Test Method	Value
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	48 (8.4)
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	50 (8.8)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	60 (10.5)

END OF SECTION

SECTION 02930 GEOCOMPOSITE

PART 1 - GENERAL

1.01 SUMMARY

- A. The WORK specified in this Section includes the manufacture, fabrication, testing, and installation of geocomposite (i.e., composite geonet). The Plans call for a bi-planar geocomposite, which is a three-layer material comprised of an inner core of bi-planar high density polyethylene (HDPE) geonet between an upper and lower layer of non-woven geotextile. The geotextile is thermally fused to both sides of the geonet.
- B. All testing specified in this section is quality control (QC) testing and is the CONTRACTOR's responsibility and all costs shall be included in the bid price. The OWNER is responsible for the Quality Assurance (QA) testing described in the FDEP approved CQA Plan.

1.02 MANUFACTURER'S QUALIFICATIONS

- A. Single Source: All products, or components of the products, used for construction shall be obtained from a single manufacturer. Fusion of the geonet and geotextile, for each product, shall be completed by a single manufacturer.

1.03 SUBMITTALS

- A. Data showing manufacturer has a minimum of 5,000,000 ft² of experience.
- B. Product Information: The CONTRACTOR shall submit to the ENGINEER field and laboratory test data prior to importing and/or prior to any construction using the geocomposite. Submit the following information for each product prior to installation, to the ENGINEER for approval:
 - 1. Prequalification: Submit independent laboratory test results demonstrating compliance with the material properties listed in Table 02930-1, Table 02930-2, and Table 02930-3. In addition, the manufacturer must provide a certificate of compliance which states that the material to be installed will use the same manufacturing techniques, resin type, and formulation as that for which test results are submitted.
 - 2. Transmissivity: Submit manufacturers test data that indicates transmissivity values shown in Table 02930-3 can be met.

3. ~~Roll Layout Drawings: Submit at a minimum, a roll layout drawing and installation details. The roll layout drawing shall be drawn to scale, and shall be coordinated with the geomembrane panel layout.~~ Installation Details: Installation details shall include cross sections, temporary anchorage, anchor trenches, and other terminations.
4. Protection from Wind and Weather: Submit methodology to protect each product from wind, dirt, and direct sunlight. At a minimum, the methodology shall reflect that materials shall be shipped and stored in rolls furnished at the manufacturing facility to prevent exposure of the geotextile to ultraviolet light, precipitation, moisture, mud, dirt, dust, puncture, or other damaging conditions.
5. Rolls of products shall not be stacked upon one another to the extent that deformation of the core occurs. If stored outdoors, they shall be elevated from the ground and protected with a waterproof cover. Outdoor storage should not be allowed to exceed six months. For storage for more than six months, a temporary enclosure shall be constructed so that the geocomposite rolls are stored inside an enclosed facility.
6. Material Data: Submit complete manufacturer's specifications, descriptive drawings, and literature for each product, including the product identification and suppliers of the polymer resin and recommended method for handling and storage of all materials prior to installation. Describe the manufacturer's methodology to comply with the requirements specified for manufacturing quality control.
7. Manufacturing Quality Control: Submit a complete description of the manufacturer's formal quality control/quality assurance programs for manufacturing, fabricating, handling, installing, and testing. The description shall include, but not be limited to, polymer resin supplier and product identification, acceptance testing, production testing, installation inspection, installation techniques, repairs, and acceptance. The document shall include a complete description of methods for both roll end and roll side joining.
8. Installation Instructions: Submit samples of the product with a complete set of specifications, and manufacturer's complete written instructions for storage, handling, installation and joining.
9. Qualifications: Submit manufacturer's qualifications for each product.
10. Geonet Resin: Submit the name of the HDPE resin supplier, the production plant, the brand name, and name of resin used to manufacture the product.

C. Manufacturing Quality Control: Submit the following manufacturing quality control information to the QA Consultant prior to material shipment:

1. Production Dates: Submit statement of production dates for each product.
2. Test Reports: See Part 2 of this Section for tests and test frequencies.

PART 2 - PRODUCTS

2.01 GEONET

- A. The geonet shall be GSE Fabinet, as manufactured by GSE Lining Technology, Inc. or a ENGINEER approved substitution.
- B. The geonet shall be manufactured by extruding two or three sets of strands to form a structure to provide planar water flow meeting the requirements listed in Table 02930-1.
- C. The geonet shall consist of new, first-quality products designed and manufactured specifically for the intended purpose designated in this specification, as satisfactorily demonstrated by prior use. The geonet shall contain stabilizers to prevent ultraviolet light degradation. The HDPE shall be unmodified HDPE containing no plasticizer, fillers, chemical additives, reclaimed polymers, or extenders. Approximately 2 percent carbon black shall be added to the resin for ultraviolet resistance. The only other allowable compound elements shall be anti-oxidants and heat stabilizers, of which up to 1.5 percent total, as required for manufacturing, may be added.

2.02 GEOTEXTILE

- A. The geotextile shall meet the requirements listed in Table 02930-2.

2.03 BI-PLANAR GEOCOMPOSITE

- A. The final product material shall meet the requirements listed in Table 02930-3.
- B. Manufacturer: The geocomposite shall be fabricated by heat bonding the geotextile to both sides of the geonet. No burn-through of geotextiles shall be permitted. No glue or adhesive shall be permitted. The bond between the geotextile and the geonet shall meet the requirements listed in Table 02930-3.
- C. Labels: Geocomposite shall be supplied in rolls, marked or tagged with the following information:
 1. Manufacturer's name.
 2. Product identification.

3. Lot number.
4. Roll number.
5. Roll dimensions.

D. Roll Dimensions: The product shall be supplied as a continuous sheet with no factory seams. During installation, the roll length shall be maximized to provide the largest manageable roll for the fewest field seams.

PART 3 - EXECUTION

3.01 MANUFACTURING QUALITY CONTROL TESTING

- A. All of the specified tests are the CONTRACTOR's responsibility. Testing during manufacturing shall be accomplished by the manufacturer's laboratory.
- B. HDPE resin shall be tested at a frequency of one test per resin batch for compliance with Table 02930-1. One batch is defined as one rail car load of resin. The finished rolls shall be identified by a roll number corresponding to the resin batch used. The following minimum test frequencies shall be observed:

<u>Property</u>	<u>Test Method</u>	<u>Minimum Frequency</u>
Polymer Density	ASTM D 1505	1 per batch
Polymer Melt Index	ASTM D 1238	1 per batch

- C. The geonet shall be tested during manufacturing for compliance with Table 02930-1. The following minimum test frequencies shall be observed:

<u>Property</u>	<u>Test Method</u>	<u>Minimum Frequency</u>
Polymer Density	ASTM D 1505	1/100,000 sf
Mass per Unit Area	ASTM D 3776	1/100,000 sf
Thickness	ASTM D 1777	1/100,000 sf

- D. Geotextile shall be tested during manufacturing for compliance with Table 02930-2. The following minimum test frequencies shall be observed:

<u>Property</u>	<u>Test Method</u>	<u>Minimum Frequency</u>
Mass per Unit Area	ASTM D 3776	1/100,000 sf
AOS	ASTM D 4751	1/100,000 sf
Grab Tensile	ASTM D 4632	1/100,000 sf
Trapezoidal Tear Strength	ASTM D 4533	1/100,000 sf
Puncture Resistance	ASTM D 4833	1/100,000 sf

- E. Upon fusion of the geotextile and geonet, the product shall be tested during manufacturing for compliance with Table 02930-3. The following minimum test frequencies shall be observed:

<u>Property</u>	<u>Test Method</u>	<u>Minimum Frequency</u>
Transmissivity	ASTM D 4716	1/100,000 sf
Ply Adhesion (minimum)	ASTM D7005	1/100,000 sf

- F. The CONTRACTOR shall inspect every roll for bonding integrity between the geonet and the geotextile. All poorly bonded and/or delaminated material shall be rejected.

3.02 FIELD QUALITY CONTROL

- A. Field Joining: The CONTRACTOR shall inspect all roll end joints and roll side joints. The results of these inspections shall be documented in the daily reports. Field joints shall comply with the requirements of Table 02930-4.
- B. Quality Control Reporting Procedures: All information regarding the installation of the geocomposite will be recorded in the CONTRACTOR's daily report. This information shall include:
1. Reference to product submittals, certifications, substitutions and approvals.
 2. Dates of installation.
 3. Location and quantity of materials installed.
 4. Statement of whether materials were installed in accordance with the Technical Specifications.
 5. Additional information as required.
 6. All product certifications, filed appropriately for future reference.

3.03 MANUFACTURER'S RECOMMENDATIONS

- A. Each Product shall be installed in accordance with the plans, specifications, and the manufacturer's recommendations. In case of a conflict between these documents, the more stringent requirements shall apply.

3.04 CLEANLINESS

- A. The interface between the geocomposite and the geomembrane shall be clean, dry, and free of dirt and dust during installation. If dirt, dust, or water are present, the CONTRACTOR shall clean the work area. Products which are clogged with silts shall be discarded and shall not be installed.

3.05 ROLL JOINING METHODS

- A. Table 02930-4 summarizes acceptable roll joining methods.
- B. Lap Seams: The bottom layer of geotextile shall be lap seamed. Lap seaming is accomplished by overlapping adjacent geotextile a minimum of 6 inches.
- C. Nylon Ties: The geonet shall be overlapped and fastened with nylon ties. Nylon ties shall be yellow or white in color to facilitate inspection.
- D. Machine Sewn Seams: The top layer of geotextile shall be sewn. Sewing shall be accomplished with a lock-stitching sewing machine. The thread shall be polymeric thread which complies with manufacturer's recommendations. The seam shall be placed at a minimum of 4 inches from the geotextile edges. The finished seam shall be folded to one side.

3.06 ROLL JOINING REQUIREMENTS

- A. The minimum requirements for joining rolls are specified in Table 02930-4.
- B. Roll Ends: The end of each roll of geocomposite shall be overlapped a minimum of six inches. The geonet portion shall be shingled, with the uphill end overlapping the downhill end. The geonet portion shall be tied 2 feet on center at a minimum. The bottom layer of geotextile shall be overlapped a minimum of 6 inches. The upper layer of geotextile shall be machine sewn. Where the geocomposite is to terminate, the upper geotextile shall be folded over the ends with a minimum of 12 inches of geotextile placed under the geocomposite.
- C. Adjacent Roll Sides: At roll sides, the material shall be overlapped a minimum of 4 inches. The bottom geotextile shall be overlapped. The geonet shall be overlapped and tied a minimum of 5 feet on center with nylon ties as described above. The upper layer of geotextile shall be machine sewn as described above.

3.07 INSTALLATION

- A. The product shall be installed in accordance with the manufacturer's recommendations or as specified herein, whichever is more stringent.
- B. Orientation:
 - 1. Geocomposite shall be rolled down the slope in such a manner as to continually keep the material in tension. If necessary, the material shall be positioned by hand after unrolling to minimize wrinkles. The material shall not be unrolled laterally (i.e., across the slope).

- C. The CONTRACTOR shall provide sufficient ballast and temporary anchorage to protect the product. The CONTRACTOR is responsible for protecting the product from damage due to weather at all times.
- D. Physical Damage:
 - 1. Personnel walking on the product shall not engage in activities or wear footwear that could damage the material. Smoking shall not be permitted on or near the geosynthetics.
 - 2. Vehicular traffic shall not be permitted on the geosynthetics. Equipment shall not damage the material by handling, trafficking, or leakage of hydrocarbons. The surface shall not be used as a work area for preparing patches, storing tools and supplies, or other uses.
- E. Bridging: The product shall be installed to avoid bridging.
- F. Corners: In corners, where overlaps between rolls are staggered, an extra roll shall be installed from the top to the bottom of the slope.
- G. Weather Protection: Each product shall be protected from direct sunlight or precipitation prior to installation. After installation this product shall not be exposed to direct sunlight and shall be covered within 30 days of installation. Product which is exposed to direct sunlight for 30 days or more shall be replaced at the CONTRACTOR's expense.
- H. It is the CONTRACTOR's responsibility to provide all labor and materials for protection of the product during the period of time prior to installation of overlying soils. The CONTRACTOR's protection method is subject to the approval of the ENGINEER.

3.08 REPAIRS

- A. Limitations - In general, damaged, soiled, or delaminated products shall be discarded. Products which have major damage, which require extensive repairs or replacement, shall be discarded at the CONTRACTOR's expense.
- B. Minor Damage - Minor damage is defined as a hole 2 inches or smaller in diameter in the product. Minor damage shall be repaired by snipping out protruding geonet and machine sewing or thermal bonding a geotextile patch over the hole. The patch shall be a minimum of 12 inches larger than the damaged area in all directions. If thermal bonding is conducted, care shall be taken to prevent excessive heat damage to the surrounding geosynthetics.

- C. Major Damage - Major damage is defined as a hole larger than 2 inches in diameter through the product. Major damage shall be repaired by replacing the entire panel width.

TABLE 02930-1. GEONET PROPERTIES

Property	Qualifier	Unit	Test Method	Specified Value
Transmissivity	Minimum Average	m ² /sec	ASTM D 4716	8 x 10 ⁻³
Thickness	Minimum Average	mil	ASTM D 5199	300
Tensile Strength (machine direction)	Minimum Average	lbs/in	ASTM D 5035	75
Carbon Black	Range	percent	ASTM D 1603	2-3
Polymer Density, Resin	Minimum Average	g/cm ³	ASTM D 1505	0.930

TABLE 02930-2 GEOTEXTILE PROPERTIES

Property	Qualifier	Unit	Test Method	Specified Value
Fabric Weight	MARV	oz/yd ²	ASTM D 3776	7.1
Grab Strength	MARV	Lbs	ASTM D 4632	210
Puncture Resistance	MARV	Lbs	ASTM D 4833	95
Water Flow Rate	MARV	gpm/ft ²	ASTM D 4491	110
AOS	MaxARV	sieve size(mm)	ASTM D 4751	#70 (0.210)

TABLE 02930-3. GEOCOMPOSITE PROPERTIES

Property	Qualifier	Unit	Test Method	Specified Value
Transmissivity (Note 1)	Minimum Average	m ² /s	ASTM D 4716	9.0x10 ⁻³
Ply Adhesion	Average	lbs/inch	ASTM D7005	1.0

Notes:

1. Per ASTM D 4716 with a normal stress of 1,000 psf; water at 20°C (68°F); with a gradient of 0.1; between stainless steel plates, and a test time period of 15 minutes.

TABLE 02930-4. GEOCOMPOSITE JOINING METHODS

Location	Layer	Joining Method	Min. Overlap	Tying Frequency
Roll End (See Note 1)	Upper geotextile	Machine sewing	4"	N/A
	Geonet	Nylon ties	6"	2' on center
	Lower geotextile	overlap	6"	N/A
Roll Side	Upper geotextile	Machine sewing	4"	N/A
	Geonet	Nylon ties	4"	5' on center
	Lower geotextile	overlap	6"	N/A
Repair of minor damage (See Note 2)	Upper geotextile	Machine sewing/thermal bonding	12"	N/A
	Geonet	N/A	N/A	N/A

1. At termination of geocomposite fold over upper geotextile as defined in Part 3.06.
2. Minor damage is defined in Part 3.08.

- END OF SECTION -