Post Closure Plan Narrative for Winyah Generating Station's New Class 3 CCR Landfill Area 1

40 CFR Part 257
Operating Criteria
§257.104(d)

CONTENTS

Revision and Copy Control

Revision No.	Date	Reason for Change
0	November 1, 2018	Original document created to comply with CCR Rule
1	August 11, 2021	Addition of Appendix B which is supplemental to the original post-closure plan to provide details for an alternative final cover. The Discussion section in the narrative below has been updated to reflect this addition.

1. INTRODUCTION

The United States Environmental Protection Agency (EPA) promulgated regulations (40 CFR Part 257) regarding coal combustion residuals (CCRs). The CCR rule was published in the Federal Register on April 17, 2015 and became effective on October 19, 2015. The Class Three CCR Landfill is subject to the CCR Rule as a new landfill as defined in 40 CFR §257.53. A requirement of the CCR rule is to prepare a written post-closure plan (§257.104(d)) for new CCR landfills. This plan must be placed in the facility operating record no later than the date of the initial receipt of CCR in the CCR unit as required by §257.104(d)(2)(ii). The owner or operator may amend the initial or any subsequent written closure plan at any time per §257.102(d)(3)(i).

This document serves as certification that the written post-closure plan for the new CCR landfill Area 1 at Winyah Generating Station in Georgetown, South Carolina meets the requirements of §257.104. The written post-closure plan is documented in the Winyah Generating Station Class Three Landfill Permit Application approved by the South Carolina Department of Health and Environmental Control (DHEC) on 15 September 2017 (Permit #LF3-00042). The written post-closure plan meets the requirements of the South Carolina solid waste management regulation R.61-107.19 as certified by the design engineer-of- record, Scott M. Graves, P.E., Geosyntec Consultants, Inc.. The South Carolina Department of Health and Environmental Control issued a permit to construct on September 15, 2017 with an effective date of September 30, 2017. A closure plan supplement for an alternative final cover option was prepared and certified by the design engineer-of-record, Scott M. Graves, P.E., Geosyntec Consultants, Inc and is provided as Appendix B. The South Carolina Department of Health and Environmental Control issued approval for this alternative final cover system on September 4, 2020.

2. DISCUSSION

Title 40 CFR §257.104(d)(1)(i) through (iii) specify the minimum required information that must be included in the written post-closure plan. Each requirement is stated below, followed by the specific post-closure plan information, in addition to any supplemental information that may be required. The written post-closure plan must include, at minimum, the following:

257.104(d)(1)(i) A description of the monitoring and maintenance activities required in paragraph (b) of this section for the CCR unit, and the frequency at which these activities will be performed. Paragraph (b) of this

section (§257.104(b)) states that following closure of the CCR unit, the owner or operator must conduct post-closure care for the CCR unit, which must consist of at least the following:

(b)(1) Maintaining the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;

The chosen final cover system for the Winyah Class 3 Landfill Area 1 is Option 3 – ClosureTurf® as described in the closure plan. The final cover system will be inspected on a quarterly basis. Inspection items will include observations of erosion (rills, sand infill deposits, loss of infill, etc.), animal burrows, areas of wrinkles or folds in the engineered turf, areas of turf in tension, evidence of movement or shifting of the engineered turf, damaged/cut/torn engineered turf, areas of exposed geomembrane, or changes in turf color or condition of synthetic grass blades. Following each inspection, a summary report of the condition of the cap and any items of concern will be recorded in the post-closure logbook for the facility. Any items of concern will be addressed immediately. Repairs will be performed under the supervision of the post-closure maintenance manager. If there are indications of partial loss of sand infill, measurements may be taken to delineate the thickness of remaining sand infill and to establish the area of erosion. If UV degradation is suspected to the extent that it may compromise the performance of the final cover system, a sample of the turf may be removed for testing. All maintenance/repairs will be completed in a timely fashion to correct the observed damage or adverse effects stemming from erosion, wind uplift, instability/movement of the synthetic turf, settlement or subsidence of underlying waste materials, vehicle traffic, vandalism, animal activity, or other events.

The erosion and sedimentation control system will also be inspected on a quarterly basis and after significant storm events. The components of the system, including perimeter berms, drainage terraces, downdrain pipe features, perimeter drainage channels, and culverts will be checked for obstructions and damage. Perimeter drainage channels will be inspected for obstructions, erosion of the side slopes, lack of vegetation, shifting of rip-rap, buildup of sediment, or any item that may compromise the performance of the channel. Stormwater piping & culverts will be checked for blockages and the inlets and outlets inspected for disruption, undercutting, and/or rutting. Following each inspection, a summary report will be entered into the landfill post-closure record along with photographs of any items of concern. Maintenance and/or repairs will be performed in a timely fashion as determined necessary by the inspectors or as prescribed upon follow-up observations. Any repairs or maintenance activities will be recorded.

(b)(2) If the CCR unit is subject to the design criteria under §257.70, maintaining the integrity and effectiveness of the leachate collection and removal system and operating the leachate collection and removal system in accordance with the requirements of §257.70;

The new Class Three CCR Landfill has an operating leachate collection system and it will be inspected on a monthly basis and routinely maintained for ongoing collection and disposal during the post-closure period. Periodic repair and cleaning of the leachate management system components, including riser pipes, pumps, clean-outs, and related mechanical/electrical controls and flow

recording devices, will be conducted to ensure functionality of the system during the post-closure period. Leachate flows to the industrial cooling pond (for leachate treatment prior to discharge) will be observed and monitored. Any disruptions will be recorded in a logbook. In the event of an interruption to leachate flow, the collection lines may be observed using video monitoring equipment, and the lines jet cleaned. Following each inspection, a summary report will be entered into the landfill post-closure record along with photographs of any items of concern. Maintenance and/or repairs will be performed in a timely fashion as determined necessary by the inspectors or as prescribed upon follow-up observations. Any repairs or maintenance activities will be recorded.

(b)(3) Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§257.90 through 257.98.

The post-closure activities associated with the groundwater monitoring system are described in detail in the groundwater monitoring plan which was developed to comply with §§257.90 through 257.98. Groundwater will be monitored in accordance with the requirements of §§257.90 through 257.98 throughout the duration of the post-closure period.

257.104(d)(1)(ii) The name, address, telephone number, and email address of the person or office to contact about the facility during the post-closure period

Facility contact information during the post-closure period is as follows:

South Carolina Public Service Authority
Class Three Landfill Winyah Generating Station
One Riverwood Drive
P.O. Box 2946101
Moncks Comer, SC 29461

Attn: Darla Barnette, Manager Generating Station
darla.bamette@santeecooper.com
843-761-8000

257.104(d)(1)(iii) A description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this subpart.

There is no current planned use for the landfill property during the post-closure period. The property will continue to be maintained by Santee Cooper, and public access will be prohibited.

257.104(d)(4) The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written post-closure plan meets the requirements of this section.

See Section 4.

3. CONCLUSIONS

The existing permitted post-closure plan for the new Class Three CCR Landfill Area 1 at Winyah Generating Station in Georgetown, South Carolina, and supplemental information included in this report, satisfy the written post-closure plan requirements outlined in Title 40 CFR §257.104.

4. CERTIFICATION

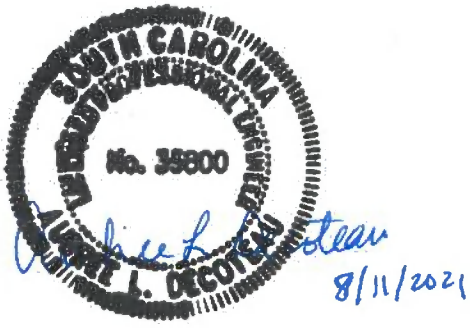
Certification for Post-Closure Plan

Federal CCR Rule: 40 CFR §257.104

CCR Unit: **WGS Class Three Landfill Area 1 - New CCR Landfill**

I, the undersigned Professional Engineer registered in good standing in the State of South Carolina, do hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration, and that, based on my inquiry of the individuals responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I certify, for the above-referenced CCR Unit, that the written post-closure plan contained herein is in accordance with the requirements of Title 40 CFR §257.104.

Seal and Signature:



Printed Name: Aubree L. Decoteau

P.E. License Number: 35800 State of South Carolina

APPENDIX A

Permitted Post-Closure Plan

Prepared for

Santee Cooper Power
1 Riverwood Drive
Moncks Corner, South Carolina 29461

POST-CLOSURE PLAN

WINYAH GENERATING STATION
PERMIT APPLICATION
NON-COMMERCIAL CLASS THREE LANDFILL
Georgetown, South Carolina

Prepared by

Geosyntec consultants

engineers | scientists | innovators

104 South Main Street, Suite 115
Greenville, South Carolina 29601

Project Number GSC5242

August 2016

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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 33535 SCOTT M. GRAVES 8/9/2016

SOUTH CAROLINA GEOSYNTEC CONSULTANTS, INC. No. 773 CERTIFICATE OF AUTHORIZATION

1. INTRODUCTION

1.1 Terms of Reference

This Post-Closure Plan (Plan) has been prepared by Geosyntec Consultants (Geosyntec) for the Class Three Landfill at Santee Cooper's Winyah Generating Station (WGS) located in Georgetown County, South Carolina. Geosyntec prepared this Plan on behalf of the permit applicant – the South Carolina Public Service Authority doing business as (d.b.a.) Santee Cooper (Santee Cooper). The Class Three Landfill will be composed of two areas, referred to as "Landfill Area 1" and "Landfill Area 2". Collectively these areas are referred to as the "Class Three Landfill". Detailed drawings illustrating the Class Three Landfill features including the components described herein are presented on the Engineering Drawings that accompany the permit application.

1.2 Purpose of This Post-Closure Plan

This Plan serves as the Post-Closure Plan required for Class Three Landfills by Part V, Subpart H.5.b.(16) of South Carolina Department of Health and Environmental Control (DHEC) Regulation R.61-107.19. The purpose of this Plan is to provide details of the required monitoring and maintenance activities that will be performed during the post-closure period at the Class Three Landfill to satisfy the applicable post-closure care provisions Part V, Subpart F, Section 258.61 of R.61-107.19. A post-closure cost estimate is also included, pursuant to Part I, Section E.2 of R.61-107.19.

Following DHEC approval of this Plan, Santee Cooper will amend this Plan within 60 days prior to a planned change in the operation of the Class Three Landfill that would substantially affect or cause a deviation from the approved Plan, or no later than 60 days after an unanticipated event necessitates a revision of the approved Plan. Once post-closure activities have commenced at the Class Three Landfill, amendments to the approved Plan will be completed no later than 30 days following the triggering event. Plan amendments will be submitted to DHEC for review and approval prior to implementation. Any updates to this Plan, and any maintenance records and monitoring results as required by Part V, Subpart F, Section 258.61 of R.61-107.19, will be placed in the Class Three Landfill Operating Record.

1.3 Initiation of Post-Closure Care and Duration of Post-Closure Care Period

Following closure of each Class Three Landfill area, Santee Cooper shall conduct post-closure care. The minimum length of the post-closure care period is 30 years. This timeframe maybe be increased at the direction of DHEC if DHEC determines that a lengthened period is necessary to protect human health and the environment (e.g., if the landfill is operating under an assessment monitoring program that necessitates a longer post-closure care period).

1.4 Overview of Post-Closure Care Activities and Plan Contents

In general, post-closure care will consist of the following activities:

- maintenance of the integrity and effectiveness of the final cover system, including vegetation and the surface-water management system;
- maintenance of the integrity and effectiveness of the leachate collection system, and operation of the leachate collection and management system; and
- groundwater monitoring, including maintenance of the groundwater monitoring system.

The remainder of this Plan includes the following:

- a description of the required monitoring and operation and maintenance (O&M) activities during post-closure care and the frequency at which these activities will be performed;
- contact information for the person/office responsible for post-closure care activities;
- a description of the planned uses of the property during the post-closure care period;
- a description of the post-closure notification and certification to be submitted to DHEC following completion of the post-closure care period.

2. MAINTENANCE AND MONITORING ACTIVITIES

This section describes the maintenance and monitoring activities that will be conducted during the post-closure care period for the Class Three Landfill.

2.1 Maintenance and Monitoring Frequencies

The frequencies of the maintenance and monitoring activities to be conducted during the post-closure care period for the Class Three Landfill are presented below in Table 1. Details of the activities are provided subsequently in this section.

Table 1
Schedule of Post-Closure Maintenance and Monitoring Activities

Activity	Minimum Frequency
Landfill Inspections (final cover system, surface-water management system, facility vegetation, and general site conditions and access control)	Quarterly
Leachate Management System Inspections	Monthly
Groundwater Monitoring Well Inspections	When Sampled
Mowing of Landfill Final Cover	Semi-Annual
Leachate Management System Operation and Maintenance	Ongoing collection, storage, and disposal during post-closure care period
Groundwater Monitoring Events	Frequency per the approved Groundwater Monitoring Plan.
Facility Maintenance and Repairs (final cover system, surface-water management system, landfill vegetation, access controls, leachate management system, and groundwater monitoring system)	Maintenance and repairs as needed

2.2 Final Cover System

Santee Cooper will inspect the final cover system during each landfill inspection event, at the frequency identified above in Table 1, to assess its integrity and effectiveness. Maintenance will be conducted as needed to correct the effects of settlement, subsidence, erosion, stressed or dead vegetation, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover. Mowing of the final cover system and adjacent vegetated berms and channels at the Class Three Landfill will be conducted at the frequency identified in Table 1.

The final cover system maintenance activities during post-closure care will include the following:

- The final cover system vegetation will be mowed routinely to maintain healthy vegetation, avoid die-out due to shading, eliminate woody-stemmed vegetation, and provide for adequate inspection of the final cover system.

- The final cover system will be inspected for conditions that could impact cover integrity, including settlement, subsidence, ponding water, burrowing animals, erosion, stressed or dead vegetation, and leachate seeps.

- Settled, depressed or eroded areas will be filled with soil, graded to provide positive drainage, and then revegetated. Repair materials will be placed in a manner consistent with the original final cover system construction.

- Areas with stressed or dead vegetation will be evaluated to determine the problem, and appropriate actions will be taken, such as reseeding the areas.

2.3 Surface Water Management System

Santee Cooper will inspect the landfill surface water management system during each landfill inspection event, at the frequency identified above in Table 1, to ensure functionality of the surface water management system and related erosion and sedimentation controls and verify that surface run-on or run-off is not eroding or otherwise damaging the final cover system. Maintenance will be conducted as necessary. It is anticipated that the required level of maintenance will decrease over time during the post-closure period as vegetation placed during closure becomes

increasingly established. The surface water management system monitoring and maintenance activities during post-closure care will include the following:

- Inspections of all components for damage, silting, and erosion.
- Periodic repair as needed, of damaged or washed-out drainage terraces, downdrain pipe features, perimeter drainage channels, and culverts; to restore functionality.
- Periodic removal as needed, of excess sediment, weeds, and other debris from drainage terraces, downdrain pipe features, perimeter drainage channels, and culverts; to restore their design configuration and functionality, followed by revegetation of disturbed areas as appropriate.
- Repair of eroded areas as needed, by grading and revegetation.

2.4 Leachate Management System

During the post-closure period, the leachate management system (leachate collection system, removal system, and storage/disposal operations) will continue to be maintained and operated as described in the Operations and Maintenance (O&M) Plan. The system will be routinely inspected at the frequency given in Table 1 of this Plan. The leachate management system monitoring and maintenance activities during post-closure care will include the following:

- Inspections of the leachate collection system (riser pipes, pumps, clean-outs, and related mechanical/electrical controls and flow recording devices).
- Inspections of the leachate removal, transmission, and storage components, including the integrity of the lined storage pond.
- Periodic repair and cleaning as needed, of damaged leachate management system components, to restore proper leachate collection and ensure functionality of the system.

- Periodic maintenance and repair/replacement of mechanical/electrical components as needed (e.g., pumps, sensors, electrical systems) that typically have a finite service life.

- Notation of any abnormally high or low leachate flows, which may include temporarily instituting an increased inspection frequency, performing a video inspection of leachate system piping, and/or jet-cleaning of affected piping.

2.5 Groundwater Monitoring System

During the post-closure period, the groundwater monitoring system will be maintained and monitored in the same manner as during the active life of the Class Three Landfill, in accordance with Part V, Subpart E of R.61-107.19 and the approved Groundwater Monitoring Plan. The monitoring wells will be inspected during each groundwater monitoring/sampling event as described in the Groundwater Monitoring Plan. Specific inspection and sampling/monitoring requirements and procedures for groundwater monitoring wells are given in the Groundwater Monitoring Plan. Maintenance will be conducted as necessary.

2.6 Landfill Gas

As discussed in the Engineering Report and O&M Plan, the large majority of the wastes that will be disposed of at the facility are coal combustion product (CCP) wastes. The wastes will be non-putrescible and not of a type expected to biodegrade; municipal solid waste will not be accepted. Thus, the composition of the waste that will be disposed at the landfill is not expected to generate methane or other explosive landfill gases. Therefore, neither a methane monitoring system, nor a methane control system, are proposed for this Class Three Landfill. As a result, landfill gas monitoring and maintenance is not applicable to this Post-Closure Plan.

2.7 Post-Closure Maintenance and Monitoring Documentation

Following each monitoring and inspection activity described herein, Santee Cooper will prepare a summary report detailing the condition of the applicable Class Three Landfill components and the items of concern, if any. Documentation and reporting of groundwater monitoring activities will be in accordance with the approved Groundwater

Monitoring Plan. Items and/or areas that require further attention should be photographed and identified on a map. The summary report, relevant photographs, and field maps will be incorporated into a landfill post-closure log book. To facilitate review and in change of personnel, the post-closure log book should be kept in a standardized format that allows for personnel to easily review the results of past post-closure monitoring events and inspections of the Class Three Landfill.

As mentioned, actions should be taken immediately to address any items of concern identified during the routine monitoring and inspections. Repairs should be performed under the supervision and direction of Santee Cooper. If an item of concern requires further evaluation to determine the appropriate course of action, the design engineer should be consulted.

3. OTHER INFORMATION

3.1 Post-Closure Contact Information

The contact information of the office responsible for overseeing the post-closure management of the Class Three Landfill is as follows:

South Carolina Public Service Authority
Winyah Generating Station
661 Steam Plant Dr.
Georgetown, SC 29440
(843) 546-4171
Attn: Manager, Generating Station

3.2 Planned Land Use During Post-Closure Care Period

At the time of this Plan, there is no current planned land use for the Class Three Landfill areas at the WGS site during the post-closure care period. The WGS site will remain Santee Cooper property, public access will be prohibited, and the Class Three Landfill will be maintained as vegetated open space during the post-closure period.

Any post-closure use of the Class Three Landfill shall not disturb the integrity of the final cover, liners, or any other components of the containment system, or the function of the monitoring systems unless necessary to comply with the maintenance requirements described in this Plan. DHEC may approve any other disturbance of the containment system if Santee Cooper demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment. Such a demonstration will be certified by a qualified professional engineer and will be placed in the Operating Record upon DHEC's approval.

3.3 Notification and Certification of Completion of Post-Closure Care Period

Within 60 days of completion of the post-closure care period for each Class Three Landfill area and in accordance with the requirements of Part V, Subpart F, Section 258.61.e of R.61-107.19, Santee Cooper will prepare and submit to DHEC for review and approval, a notification package informing DHEC that post-closure care has been completed. This notification package will include a certification that is signed by a

duly-licensed South Carolina professional engineer (other than the design engineer), verifying that post-closure care has been completed in accordance with this Plan. . After DHEC approval, the notification/certification will be placed in the Operating Record, and post-closure care activities will end.

3.4 Financial Assurance

A detailed written cost estimate for post-closure care is provided as Attachment A of this Plan. This cost estimate is in current dollars and is based on hiring a third party to conduct post-closure care for the landfill in accordance with this Plan and for a period of 30 years. Santee Cooper will adjust the estimate annually for inflation and any changes to this Plan. Additionally, Santee Cooper will provide a demonstration of financial assurance, using an allowable mechanism, for the Class Three Landfill in accordance with the requirements of Part I, Section E.2 of R.61-107.19.

If conditions call for a reduction in the amount to be financially assured, Santee Cooper will submit justification to DHEC for review and approval prior to officially reducing the amount. Financial assurance for post-closure activities will be maintained until DHEC approves the certification of completion of the post-closure care period and Santee Cooper is released from financial assurance requirements.

ATTACHMENT A

POST-CLOSURE COST ESTIMATE

Attachment A

Post-Closure Cost Estimate

Class Three Landfill

Winyah Generating Station, Georgetown County, South Carolina

Date Prepared: August 2016

Total Class Three Landfill Area: 106.6 AC

Length of Post-Closure Care (Years): 30

Item Number	Description	Estimated Event Quantity		Unit Price Per Event	Extended Total	Annual Quantity	Annual Costs	Total Post-Closure Cost
1	Administration/Recordkeeping	80	hrs.	$130	$10,400	1	$10,400	$312,000
2	Groundwater Monitoring and Reporting	19	Well	$1,600	$30,400	2	$60,800	$1,824,000
3	Groundwater Analytical Testing	1	EA	$4,750	$4,750	2	$9,500	$285,000
4	Leachate Samples	1	EA	$1,000	$1,000	1	$1,000	$30,000
5	Mowing	106.6	AC	$125	$13,325	2	$26,650	$799,500
6	Stormwater Structures Maintenance	1	EA	$5,000	$5,000	1	$5,000	$150,000
7	Leachate Collection System Maintenance	106.6	AC	$80	$8,528	1	$8,528	$255,840
8	Final Cover System Repair	1	EA	$8,000	$8,000	1	$8,000	$240,000
9	Groundwater Well Maintenance	1	LS	$6,000	$6,000	1	$6,000	$180,000
10	Annual Contingency	5%		$135,878	$6,794	1	$6,794	$203,817
					Total Post-Closure Cost		**$142,672**	**$4,280,157**
					Post-Closure Cost per Acre (for informational purposes)		*$1,338*	*$40,152*

APPENDIX B

Permitted Closure Plan Supplement
For ClosureTurf® Final Cover System Option

Prepared for

Santee Cooper Power
1 Riverwood Drive
Moncks Corner, South Carolina 29461

CLOSURE PLAN SUPPLEMENT

for

CLOSURETURF® FINAL COVER SYSTEM OPTION

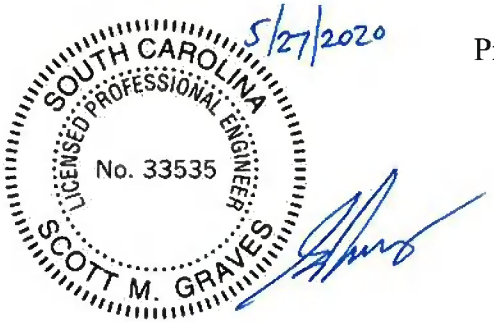
WINYAH GENERATING STATION
NON-COMMERCIAL CLASS THREE LANDFILL
Georgetown, South Carolina

Prepared by

Geosyntec consultants

engineers | scientists | innovators

201 E. McBee Avenue, Suite 201
Greenville, South Carolina 29601



Project Number GSC5242

May 2020

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1. INTRODUCTION

1.1 Purpose

This Closure Plan Supplement, hereafter referred to as the "Supplemental Package" has been prepared by Geosyntec Consultants (Geosyntec) for the Class Three Landfill at Santee Cooper's Winyah Generating Station (WGS) located in Georgetown County, South Carolina. Geosyntec prepared this Supplemental Package on behalf of the permit applicant – the South Carolina Public Service Authority doing business as (d.b.a.) Santee Cooper (Santee Cooper).

The purpose of this Supplemental Package is to add an alternative final cover system using a synthetic-turf type of product known as ClosureTurf® as an allowable final cover system option for closure of the Class Three Landfill.

The approved Closure Plan included in the Class Three Landfill permit application addresses the steps necessary to close the landfill, and addresses the information required by Section 258.60.c of R.61-107.19, Part V, Subpart F. The Closure Plan also explains the related closure requirements that will apply, pursuant to Sections 258.60.d. through o. of these regulations. As required by Section 258.60.d., this Supplemental Package represents an update (as a supplement) to the approved closure plan pertaining to the proposed addition of the ClosureTurf® final cover system option.

This Supplemental Package has been prepared to address the applicable Closure requirements for an alternative final cover, pursuant to South Carolina Department of Health and Environmental Control (DHEC) Regulation R.61-107.19, Part V, Subpart F, Section 258.60.b. Other than the final cover system design and construction changes presented herein for the ClosureTurf® final cover system option, the overall closure provisions required by the approved Closure Plan shall continue to apply.

1.2 Contents of This Supplemental Package

The following information is provided in the remainder of this Supplemental Package:

- a description of the proposed alternative final cover system option using ClosureTurf®;

- methods and procedures that will be used to install the cover, along with associated construction quality assurance/quality control (QA/QC) procedures and material specifications;
- surface water management system performance;
- final cover system equivalency;
- post-installation inspection and maintenance procedures; and
- closure and post-closure cost estimates using the ClosureTurf® final cover system.

2. CLOSURETURF® FINAL COVER SYSTEM DESIGN

2.1 Introduction

The WGS Class Three Landfill permit currently allows two final cover system options (identified in the approved permit application as "Option 1" and "Option 2"). Final cover system Options 1 and 2 are described in the approved Closure Plan, and are illustrated on the approved set of Engineering Drawings. This Supplemental Package proposes to add a third final cover system option (i.e., "Option 3") as described below.

The main feature of Option 3 is the use of a type of alternative geomembrane/artificial turf system known as ClosureTurf®. Therefore, Option 3 will be referred to hereafter as the "ClosureTurf® final cover system option".

2.2 Engineering Design Drawings

A series of engineering design drawings for the ClosureTurf® final cover system option is included as Attachment A to this Supplemental Package. These drawings present the engineering details that will apply to closure using the ClosureTurf® final cover system option. The engineering details included in Attachment A present an illustration of the ClosureTurf® system (see Drawing 1, Detail 1), along with various details presenting cross-sectional views of various landfill slopes and perimeter areas, tie-ins, and surface water management features on the final cover.

2.3 Description of the ClosureTurf® Final Cover System Option

ClosureTurf® is a patented engineered cover system product offered by Watershed Geosynthetics LLC (WatershedGeo), made up of three components consisting of, from bottom to top: (i) a structured linear low-density polyethylene (LLDPE) geomembrane (50-mil nominal thickness) that also integrates an approximately 130-mil thick studded drainage layer on the top, and with spikes on the bottom of the geomembrane; (ii) an engineered-turf protective layer consisting of high-density polyethylene (HDPE) grass blades adhered to a woven geotextile backing; and (iii) a thin layer (about 0.5 inches [in.] thick) of sand infill which is primarily used for ballasting.

As illustrated on Detail 1 of Drawing 1 in Attachment A, the geomembrane component of the ClosureTurf® system will be placed directly on top of either an 18-inch thick low

permeability compacted soil infiltration layer (with $k \leq 1 \times 10^{-5}$ cm/sec), or a needlepunched reinforced geosynthetic clay liner (GCL).

The use of a GCL in lieu of the 18-inch low permeability compacted soil infiltration layer is already approved for the current permit, and GCL equivalency to this compacted soil has already been demonstrated in an appendix to the approved Engineering Report. GCL equivalency is not repeated herein; however, please note that a ClosureTurf®-specific equivalency demonstration *is* provided subsequently in this Supplemental Package.

2.2 Alternative Final Cover System Design Criteria

The ClosureTurf® final cover system is designed and will be constructed to:

- provide long-term minimization of infiltration of precipitation into disposed wastes within the landfill, namely to:
    - achieve an equivalent reduction in infiltration as the infiltration layer specified in paragraphs a.(1) and a.(2) of Section 258.60.a of R.61-107.19, Part V, Subpart F;
    - include a composite barrier (geomembrane placed directly on an infiltration layer) that meets or exceeds the composite barrier specified in Section 258.60.k of R.61-107.19, Part V, Subpart F;
- promote drainage while minimizing erosion of the final cover, namely to
    - provide equivalent protection from wind and water erosion as the erosion layer specified in paragraph a.(3) of Section 258.60.a of R.61-107.19, Part V, Subpart F; and
- function with minimal maintenance over the post-closure period.

3. CLOSURETURF® INSTALLATION

3.1 QA/QC Report

The approved Class Three Landfill permit application includes a comprehensive QA/QC Report. The QA/QC Report includes a Construction Quality Assurance (CQA) Plan and Technical Specifications. These existing documents present the requirements for final cover system installation and for associated observation, documentation, and testing – culminating with preparation and submittal of a certification of closure construction (construction certification report).

The approved Technical Specifications and CQA Plan address the comprehensive requirements that will apply during closure construction of the ClosureTurf® final cover system option. This Supplemental Package provides additions to the Technical Specifications and CQA Plan to include information specific to the ClosureTurf®, as discussed below.

3.2 Construction Quality Assurance (CQA)

A CQA Plan Supplement, specific to ClosureTurf®, is provided in Attachment B of this package. The CQA Plan Supplement provides the requirements for monitoring, testing, and documenting the materials and construction/installation of the ClosureTurf® final cover system components that are not already covered in the main CQA Plan.

3.3 Technical Specification

A ClosureTurf® Technical Specification is provided in Attachment B of this Supplemental Package. Installation of the ClosureTurf® final cover system will be performed in accordance with the design presented on the attached Engineering Drawings and the standards outlined in the attached Technical Specification. This specification also includes the required material properties. This specification was developed consistent with guidance provided in the *ClosureTurf® Installation Guidelines Manual* by WatershedGeo, dated December 2018. Within the attached specification, reference is made that requires installation in accordance with manufacturer recommendations.

4. SURFACE WATER MANAGEMENT SYSTEM

4.1 Overview of Surface Water Management System

The layout of the surface water management system features on the Class Three Landfill areas is not changing as a result of the ClosureTurf® final cover system option. The manner in which stormwater run-off will be conveyed off the final cover is summarized below.

- The final cover system surface for the ClosureTurf® option will be the synthetic turf (engineered-turf and sand ballast – with the visible appearance of a grass-like surface). The landfill areas are designed with sideslopes inclined at 3 horizontal to 1 vertical (3H:1V) in-between drainage terraces and top surface slopes (top deck areas) are inclined at a nominal 3 to 5 percent slope.

- The final cover sideslopes have drainage terraces spaced approximately every 30 feet vertically, and with typical drainage profile slopes at 2 percent.

- The drainage terraces will convey water to downdrain pipes spaced periodically around each landfill area.

- Downdrain pipes will outlet into either constructed perimeter drainage channels/culverts, or will directly outlet into existing site drainage features (i.e., the discharge canal or cooling pond).

The engineering drawings included in Attachment A of this supplement illustrate the configuration of these surface water management components using/in conjunction with the ClosureTurf® final cover system.

4.2 ClosureTurf®-Specific Surface Water Management System Calculations

Not surprisingly, the ClosureTurf® system with its artificial turf surface, produces greater runoff volumes at higher rates than for a conventional final cover system with a soil surface layer and grassy vegetation. Attachment C of this Supplemental Package presents calculations of hydrology and hydraulics (H&H) analyses to estimate the rates of runoff from the ClosureTurf® system generated by the design storm. The calculations also evaluate the hydraulic design/sizing necessary for the surface water management system conveyances (terraces, downdrain pipes, perimeter

channels/culverts) to adequately manage flows from the design storm. The outcome of these calculations is the proper sizing of these conveyances, demonstrating that the surface water management features for the ClosureTurf® final cover system option, as presented on the engineering drawings included with this Supplemental Package, are adequate to manage the design storm.

5. FINAL COVER SYSTEM EQUIVALENCY

5.1 Standard Final Cover System

The approved Class Three Landfill permit application includes a "standard" (i.e., regulatory prescriptive) final cover system. The aforementioned "Option 1" final cover system for this facility uses this standard final cover system, which is composed of the following components (from top to bottom):

- a 2-ft thick layer of soil capable of supporting native vegetation (further subdivided into an upper 6-inch thick topsoil layer and a lower 18-inch thick protective cover soil layer);
- a geocomposite drainage layer (geotextile filters bonded to both sides of a geonet drainage core);
- a flexible membrane liner (FML), which will be a 20-mil (minimum) thick LLDPE geomembrane liner, textured on both sides; and
- an 18-inch thick infiltration layer of compacted soil with a maximum hydraulic conductivity of 1×10^{-5} cm/sec and capable of providing a suitable foundation for the FML.

5.2 Hydraulic Barrier Equivalency of the ClosureTurf® Final Cover System

The ClosureTurf® final cover system has a composite cover barrier infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer of the approved Option 1 final cover system listed above (which is the standard composite barrier layer prescribed by R.61-107.19, Part V, Subpart F, Section 258.60.k.). A demonstration of hydraulic equivalency is provided in Attachment D of this Supplemental Package. The evaluation in Attachment D demonstrates that the ClosureTurf® final cover system provides equivalent (and in fact, superior) hydraulic barrier performance based on its calculated lower rate of infiltration through the final cover than the infiltration through the standard final cover system.

5.3 Erosion Layer Equivalency of the ClosureTurf® Final Cover System

The surface water management system calculations for final cover conditions using ClosureTurf® are included in Attachment C of this supplemental package. These calculations demonstrate that the surface water management features are adequately sized to manage and convey stormwater off the ClosureTurf® final cover system.

Also, with respect to erosion and wind resistance, the ClosureTurf® final cover system option includes a synthetic engineered-turf material as the upper layer of the final cover system that has been shown through laboratory testing and field performance to provide superior resistance to wind and water erosion as compared to the erosion layer of the standard (regulatory prescribed) final cover. This information is documented in the *ClosureTurf® Design Guidelines Manual* by WatershedGeo, dated March 2019.

The resulting WGS Class Three Landfill-specific design of the ClosureTurf® final cover system option is consistent with the above-referenced developer/manufacturer's design guidelines manual. This includes the incorporating the recommended sand infill gradation that has been found able to withstand higher rainfall intensities larger than those expected at this site, and using slope lengths and steepness that are well within design guidelines. Also, the drainage terraces will be lined with an enhanced ballast layer as shown on the engineering drawings in Attachment A, providing further erosion resistance for the stormwater flow velocities and stresses.

With respect to wind resistance and stability, the design guidelines manual includes the results of wind tunnel testing that showed low uplift pressures (i.e., 0.12 psf) on the engineered-turf component of the ClosureTurf® system when exposed to 120 mph winds. The sand infill layer of the ClosureTurf® system will provide ballast well in excess of these uplift pressures (i.e., about 4.5 psf), thus indicating a substantial factor of safety against wind uplift. The wind tunnel testing also showed even less uplift pressures at even higher wind speeds due to a downward-force-effect of very high winds (> 120 mph) on the blades of grass.

Based on the foregoing, the ClosureTurf® final cover system will provide equivalent (or superior) protection from wind and water erosion as the erosion layer specified for the regulatory prescribed standard final cover.

6. POST-INSTALLATION INSPECTIONS AND MAINTENANCE

This section addresses the inspections and maintenance that will be performed for the ClosureTurf® final cover system after it is installed. This includes inspections and maintenance on increments of installed final cover, as well as inspections and maintenance after final closure of the facility during the post-closure care period.

6.1 Inspection and Maintenance Frequency

After the ClosureTurf® final cover system is installed, it will be inspected on a quarterly basis. Maintenance will be conducted as needed (i.e., when results of the inspections reveal the need for repairs). Details of the inspections and maintenance activities are described below.

6.2 Inspection and Maintenance Procedures

Santee Cooper will inspect installed areas of the ClosureTurf® final cover system at the frequency indicated above, to assess its integrity and effectiveness. Inspections will be to monitor for final cover system damage or adverse effects that could compromise the ability of the final cover from providing the level of protection required by the regulations. Inspections will include monitoring of the components and features described below.

- Sand Infill Observations. Walk along the landfill perimeter toe-of-slope, each drainage terrace, and on landfill top-areas, and observe the adjacent final cover surfaces for indications of erosion of the sand infill. Indications include visible signs of:
    - erosion rills;
    - areas with a loss of infill (synthetic turf without ballast); or
    - down-slope/down-gradient areas of deposited sand infill (indicative of washout/erosion occurrence).
- Sand Infill Documentation and Measurements.

- Maintain a written log (e.g., checklist or form) of inspections, including notes describing any observed loss of infill. Locate such areas on a site plan figure, and include photographic documentation.

- If there are indications of partial loss of sand infill, measurements may be taken to delineate the thickness of remaining sand infill and to establish the area of erosion. These measurements may be performed using a blunt probe and manually measuring sand infill thickness to the nearest tenth of an inch.

- Such measurements may also be considered on a periodic/repeat basis (e.g., every few years) to check for rate of soil loss as a forecasting tool for scheduling preventative maintenance.

- Engineered-Turf Observations. During the inspection walk of the landfill perimeter toe-of-slopes, drainage terraces, and landfill top-areas, also observe the condition of the engineered-turf for indications of shifting/movement/instability, and for other damage or deterioration. Indications include visible signs of:

  - areas of wrinkles/ripples or folds in the engineered-turf;

  - areas of turf in tension;

  - evidence of movement or shifting of the engineered-turf, or similarly, loose strands of fabric or yarn;

  - damaged, cut, or torn engineered-turf;

  - areas of exposed geomembrane; or

  - changes in turf color or condition of synthetic grass blades (potentially indicative of ultraviolet (UV) damage)

- Engineered-Turf Documentation and Measurements.

  - Document the condition of the engineered-turf using the written log described previously (accompanied by figure(s), photographs).

- If UV degradation is suspected to the extent it may compromise the performance of the final cover system, a sample of the turf may be removed for testing to compare the in-service properties to the manufactured properties that were documented as part of installation.

Maintenance/repairs will be conducted as needed to correct areas of concern that could negatively impact the ability of the final cover from providing the level of protection required by the regulations. Such maintenance/repairs will be to correct the observed damage or adverse effects described above, stemming from erosion, wind uplift, instability/movement of the synthetic turf, settlement or subsidence of underlying waste materials, vehicle traffic, vandalism, animal activity, or other events; and to prevent run-on and run-off from eroding or otherwise damaging the final cover.

7. CLOSURE AND POST-CLOSURE COST ESTIMATES

Closure and Post-Closure Cost Estimates for the ClosureTurf® final cover system option are provided as Attachment E of this Supplemental Package.

The basis for these cost estimates is consistent with the assumptions used to generate the current-permitted cost estimates (current dollars, based on hiring a third party to close the largest area of the landfill ever requiring final cover at any time during the active life (when the extent and manner of its operation would make closure the most expensive), based on the planned incremental closure sequence).

ATTACHMENT E

CLOSURE AND POST-CLOSURE COST ESTIMATES

CLOSURETURF® FINAL COVER SYSTEM OPTION

Post-Closure Cost Estimate

Class Three Landfill

Winyah Generating Station, Georgetown County, South Carolina

Date Prepared: May 2020

Total Class Three Landfill Area: 106.6 AC

Length of Post-Closure Care (Years): 30

Item Number	Description	Estimated Event Quantity		Unit Price Per Event	Extended Total	Annual Quantity	Annual Costs	Total Post-Closure Cost
1	Administration/Recordkeeping	80	hrs.	$141	$11,263	1	$11,263	$337,882
2	Groundwater Monitoring and Reporting	19	Well	$1,733	$32,922	2	$65,844	$1,975,311
3	Groundwater Analytical Testing	1	EA	$5,144	$5,144	2	$10,288	$308,642
4	Leachate Samples	1	EA	$1,083	$1,083	1	$1,083	$32,489
5	Stormwater Structures Maintenance	1	EA	$5,415	$5,415	1	$5,415	$162,443
6	Leachate Collection System Maintenance	106.6	AC	$87	$9,235	1	$9,235	$277,063
7	Final Cover System Maintenance and Repair	106.6	AC	$250	$26,650	1	$26,650	$799,500
8	Groundwater Well Maintenance	1	LS	$6,498	$6,498	1	$6,498	$194,932
9	Annual Contingency	5%		$136,275	$6,814	1	$6,814	$204,413
					Total Post-Closure Cost		**$143,089**	**$4,292,676**
					Post-Closure Cost per Acre (for informational purposes)		*$1,342*	*$40,269*

Notes:

1. This cost estimate is based on post-closure care using Final Cover System Design Option 3.

2. Costs are in 2020 dollars. For items in-common with the original 2016 Post-Closure Cost Estimate, those unit prices were inflated to 2020 rates; for new items, 2020 unit prices were obtained.