Cross Generating Station

Class 2 Landfill

Amended Closure Plan

40 CFR 257.102(b)(1)

January 5, 2016

Date	Revision
2013-03-04	Original Plan
2015-03-02	Revised top deck
2016-01-05	Amended with PE certifications

CLOSURE AND POST CLOSURE PLAN

FOR

CLASS TWO LANDFILL

SANTEE COOPER CROSS GENERATING STATION
CROSS, SOUTH CAROLINA

MAY 2011 / Rev OCT 2011
CONSENT AGREEMENT
WORK PLAN

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1.0 INTRODUCTION

This Closure and Post Closure Plan describes the steps, the design concepts, and the rationale to close the on-site Class Two Landfill owned and operated by South Carolina Public Service Authority (Santee Cooper). The landfill is located in Berkeley County at the Cross Generating Station, near Cross, South Carolina and regulated under the South Carolina Department of Health and Environmental Control's (SCDHEC) Solid Waste Management regulations. The original permit was issued October 5, 1982, and modified on November 13, 1997, as an Industrial Solid Waste Class One Landfill (Permit, No. 08337-1601). When Regulation 61-107.19 became effective on May 23, 2008, the Landfill was administratively converted to a Class Two landfill.

This Closure and Post Closure Plan also describes the steps necessary to partially or entirely close the landfill at any point during its active life or at the end of its operating life. Included are the major activities that will be performed to inspect, maintain, and monitor the facility during the post closure period. This document was originally prepared for Santee Cooper by EarthTech in accordance with the SCDHEC Industrial Solid Waste Landfill Regulation R.61-107.16. It was subsequently amended to incorporate the closure and post closure activities outlined the revised SCDHEC Solid Waste Landfill Regulation 61-107.19; and, Consent Agreement 11-14-SW, executed on April 29, 2011. This Plan will be updated if any changes occur at the facility which requires a deviation from the approved Closure and Post Closure Plan.

1.1 FACILITY DESCRIPTION

This non-commercial solid waste management facility was constructed above ground by placing and compacting a thick layer of Poz-o-Tec, a coal combustion byproduct. The landfill occupies a footprint area of approximately 91 acres. The site is bounded by drainage ditches and pine forest on all sides. All are within Santee Cooper's property. Access to the site is controlled by station security to prevent unauthorized access. Waste streams currently permitted for disposal in this Class 2 Landfill are lime fixated fly ash and flue gas desulphurization byproducts from the Cross Generating Station. These materials are proposed for future disposal at this facility and are addressed in the Waste Characterization and Treatment Plan (Special Waste Analysis and Implementation Plan). A copy of this plan is included with the work plan.

Poz-O-Tec has pozzolanic qualities that cause it to harden like cement and result in a very low permeability. The entire base of the existing landfill was constructed with a thick layer of Poz-O-Tec ranging from 10 to 20 feet thick. This layer is similar to a liner and can protect groundwater due to its thickness and low permeability.

As indicated in the current permit, the following type of sludge may also be landfilled at this site:

- During dry weather, a mixture of 0.5 to 1.0 parts or more of fly ash and 1.0 part of sludge (dry weight basis) with up to 5 percent lime may be placed in the landfill,
- During emergency situations (i.e., when FGD sludge is not available or during wet weather), a mixture of fly ash and up to 5 percent lime with a mixture normally equal to or greater than 20 percent solids may be placed in the landfill.

1.2 OPERATIONAL HISTORY

The Cross Generating Station is a coal fired power plant with four steam Units (#2 at 540 MW, #1 at 620 MW, #3 at 580 MW, and #4 at 580 MW) that were placed in operation in 1983, 1995, 2007, and 2008 respectively. The landfill was permitted in 1982 and started receiving waste in 1984. Poz-O-Tec was the original byproduct produced by operation of Units 2 and 1. It is a structurally stable material with a low permeability formed via the process of mixing scrubber sludge with fly ash and lime. Units 1 and 2 were retrofitted to also produce gypsum. Unit 3 and Unit 4 produce only gypsum. Today, the gypsum produced from these steam units is normally sent off-site to a vendor for alternate reuse rather than disposal in the landfill.

1.3 MAXIMUM INVENTORY OF WASTE

The estimated maximum inventory of waste over the active life of the landfill is estimated to be about 10.4 million cubic yards. This is based on the Final Cover Grading Plan previously prepared for Vertical Expansion of this facility. Upon final closure of this facility, Santee Cooper shall submit to SCDHEC an estimate of the maximum amount of waste that has been disposed in the landfill. This may be accomplished by comparing the initial and final contours of the facility or the use of volume reports completed during the active life of the landfill.

1.4 EXPECTED CAPACITY

Between 2001 and 2003 the average disposal rate was about 270,000 cubic yards per year. The annual disposal rate increased to about 541,000 cubic yards after Units 3 became operational in 2007 and to about 652,800 cubic yards after Unit 4 became operational in 2008. In a typical year the Cross Generating Station produces approximately 1,200,000 cubic yards of coal combustion byproducts which could be disposed of or sold for beneficial reuse. Disposing of the entire 1,200,000 cubic yards per year results in slightly more than three (3) years of physical capacity. In compliance with the Consent Agreement, Santee Cooper will submit an annual waste characterization report and an annual survey to verify the remaining capacity and fill progression to date to SCDHEC by October 1st for each year of operation. Santee Cooper will cease disposal of all waste in the Class Two Landfill upon reaching a maximum waste elevation of 210 feet MSL, or by no later than December 31, 2015, whichever occurs first.

2.0 CLOSURE PLAN

The purpose of this Closure Plan is to describe the steps necessary to close the landfill or portion thereof at any point during its intended operating life in accordance with the current SCDHEC regulations. These procedures apply to the final closing of the solid waste disposal cells during the landfill operation and at final closure of the landfill.

The purpose of final closure implementation is to preclude post closure release of pollutants to the environment. The final cover system will minimize infiltration of precipitation into the waste and erosion of the cap in order to protect public health and the environment. Final closure details may vary as design of the proposed contiguous Class Three landfill proceeds.

Within six (6) months prior to reaching the maximum waste elevation of 210 feet MSL but no later than December 31, 2014, Santee Cooper shall submit a plan to SCDHEC for the management of each class of solid waste generated by Cross Generating Station once waste acceptance in the Class Two Landfill has ceased.

2.1 NOTICE OF INTENT TO CLOSE

Santee Cooper shall begin closure of the Class Two Landfill, per the SCDHEC approved closure plan no later than within thirty (30) days after the last receipt of waste in the Class Two Landfill. Santee Cooper shall notify SCDHEC by letter the date closure of the Class Two Landfill begins, and, unless otherwise approved by SCDHEC, the application of final cover on the Class Two Landfill shall be completed within six (6) months of the last receipt of waste in the Class Two Landfill.

2.2 FINAL GRADING

The final surface of the landfill cover shall be graded to promote drainage, minimize erosion of cover, prevent ponding, and provide a surface drainage system consistent with the surrounding area without adversely affecting proper drainage from adjacent areas.

The side slopes of the landfill's final cover surface will not be any steeper than 3 horizontal to 1 vertical to prevent erosion and facilitate maintenance. The exterior side slope of this landfill vertical expansion will include up to 20-foot wide terraces to reduce the velocity of storm water runoff and minimize erosion of the final cover. The final grade maintained on top of the landfill between the crest of the side slope and the center of the landfill shall be at least 3 percent but not greater than 5 percent. An alternate final cover design may be submitted for SCDHEC review and approval.

The maximum height of the landfill will be approximately 130 feet above the base of the landfill and surrounding grade. This is at elevation 210 feet above msl. The final cover will be placed on top of the waste. Terraces will be constructed to convey storm water and will be sloped to drain storm water runoff from high points to down drains at low points on the terraces. Additional terraces will be located approximately every 20 feet of vertical rise in elevation.

The top of waste surface for the terraces will slope away from the landfill to allow for sheet flow of storm water runoff over the side slopes until the down drains and final cover on the terrace can be installed. The final cover surface on the drainage terraces will be built up above the surface of the waste to allow for the installation of the down drains and to divert storm water away from the side slopes. Grade and slope stakes will be set up as needed prior to placement of the final waste layers to assist the operator in placing the waste. This will ensure that the maximum disposal capacity of the landfill is fully utilized. Grade stakes will minimize the need to move waste or add fill soil to achieve final subgrade elevations. Santee Cooper will fill pockets or depressions in the final surface layer of waste or interim cover soil to provide a uniformly graded surface for placement of the final cover.

Down drains will be installed above the final cover on the side slope of the landfill to collect and convey storm water runoff from the upper terraces that have received final cover. However, to facilitate mowing on the final cover, the down drains will be constructed within a mound of compacted structural fill with vegetated cover. Following installation of the final cover, a mound of structural fill will be placed and compacted in thin lifts (approximately 8 inches thick) on the side slope of the landfill at the proposed location of the down drains. This mound will be at least 3 feet thick and wide enough to accommodate installation of all the down drains. The sides of the structural fill mound will taper at a 3 horizontal to 1 vertical or flatter into the existing side slope to facilitate mowing along the side slope of the final cover area. A trench will be excavated within the mound of structural fill to install bedding material, down drains, and compacted backfill. A minimum of 1 foot of cover soil will be placed over the down drains and vegetated with native grass. Down drains from the lower terrace will be joined to the down drains from the upper terrace. The down drain system is designed such that as the landfill is raised, the center down drains are extended upward to the top of the next terrace. Additional down drains would be added onto both ends of the set of down drains to divert storm water collected on the lower terraces.

2.3 TEMPORARY EROSION AND SEDIMENT CONTROL

Prior to the start of final cover construction, temporary erosion control features (i.e., silt fencing, temporary sediment control areas) will be installed. During final cover construction activities, the temporary erosion control features will be inspected every seven (7) calendar days until adequate vegetative cover is achieved; or, in compliance with the most current storm water regulation. Temporary erosion control features will be repaired or replaced if any such features have been damaged from runoff or if there is excessive sediment buildup behind the silt fence or other erosion control device that would impede the performance of the feature. When the inspection results show that a repair is required, the repair or replacement shall occur within 30 days of such a notice.

2.4 FINAL CLOSURE

The landfill will be progressively closed by constructing a final cover (*i.e.,* cap). Final cover shall be completed within 6 months, unless such activity is delayed by an event of force majeure, after last receipt of waste. Just prior to final closure, the landfill cell shall be surveyed to assist the landfill operator in placing and grading the final layers of waste. The site engineer shall develop a detailed set of Construction Drawings with control points for final closure of the landfill based on the approved closure plan and the actual survey data just prior to closure.

2.5 FINAL COVER DESCRIPTION

The final cover system or cap for the landfill will be designed to minimize infiltration and erosion, to serve as a barrier to the proposed adjacent Class Three Landfill, and improve the esthetics.

2.5.1 Final Cover

The final cover system for this landfill will consist of eighteen (18) inches of soil with a maximum permeability of 1 x 10-5 centimeters per second, and a minimum of one (1) additional foot of soil capable of supporting native vegetation or an alternative final cover system approved by the Department. This layer is designed to minimize infiltration through the closed landfill and prevent erosion of the landfilled material. This layer shall be free from deleterious material and consist of natural soils classified as MH, CH, CL, SC, ML or SC-SM according to the unified soil classification system, or approved equal. Soil used for the compacted earth cover shall be placed over the waste in loose lift thicknesses of 12 inches or less and compacted to 95 percent of its standard Proctor maximum dry density. If the underlying waste foundation is soft, a lesser degree of compaction may be acceptable provided it still meets the thickness requirement. The Construction Quality Assurance / Quality Control (CQA/QC) engineer should approve any compaction less than 95 percent.

2.5.2 Alternate Final Cover

The use of Geosynthetic materials and/or soil amendments such as lime, gypsum or other materials to enhance the native soils or materials readily available may be specifically requested as an alternate to a cohesive soil infiltration (barrier) layer. Final closure details may vary due to proposed permitting of a Class Three landfill contiguous with portions of the existing Class Two landfill. Santee Cooper will submit details of an alternate final cover design to the SCDHEC for review and approval prior to placement. The use of an alternate final cover will not result in non-compliance with the intent of the regulations. An alternate final cover may serve as both a final cover and all or a portion of a future liner as approved by SCDHEC.

In locations where the proposed Class Three landfill will be constructed above and/or adjacent to the closed landfill, a leachate barrier system shall be extended over the existing landfill and be designed and constructed, as required by Regulation R.61-107.19, to eliminate leachate migration into the closed landfill.

2.5.3 Vegetative Cover

Upon completion of the vegetative layer, seeding will be performed to establish vegetation to further restrict erosion of the final cover. The vegetative layer will be seeded with native grasses to promote evapotranspiration and minimize infiltration into the underlying waste. The surface of the erosion layer will be scarified, fertilized, seeded, and mulched in accordance with Section 810 "Seeding" of the *South Carolina Department of Transportation (SCDOT) Standard Specifications for Highway Construction (2000); or Supplemental SCDOT specification SC-M-810-2.* Temporary erosion control seeding in accordance with the temporary seeding chart and Specification 810 shall be used if it will be more than two weeks before permanent seeding can be applied, unless construction activity is scheduled to resume within 21 days.

2.6 TESTING REQUIREMENTS

Testing of the in-place compacted earth cover is required by SCDHEC. A minimum of four thickness checks per acre per lift will be conducted to verify the thickness of the infiltration layer is at least eighteen inches thick. Santee Cooper may also perform field density testing at the same time and location. A South Carolina Registered Professional Engineer must certify that the required thickness has been achieved.

2.7 RECORDING/NOTICE IN DEED TO THE PROPERTY

Following completion of closure activities, a notation will be placed on the property deed, or some other instrument normally examined during a title search, indicating in perpetuity that the property has been used for the disposal of solid waste. The notation will define the final boundaries of the waste disposal area including the latitude, longitude, and identify the type, location, and quantity of solid waste disposed of on the property.
Santee Cooper will also submit to the Department a plat showing the final boundaries of the waste disposal area of the closed landfill and a copy of the deed notation.

2.8 CLOSURE SCHEDULE

Santee Cooper will begin final closure activities no later than within thirty (30) days of receipt of the final load of waste at the landfill. Closure activities will be completed within six (6) months following the last receipt of waste.

2.9 CLOSURE CERTIFICATION

Santee Cooper shall notify SCDHEC by letter the date that closure of the Class Two Landfill begins, and, unless otherwise approved by SCDHEC, the application of final cover on the Class Two Landfill shall be completed within six (6) months of the last receipt of waste in the Class Two Landfill. Following closure of the entire landfill Santee Cooper will submit a certification to SCDHEC that the landfill has been properly closed. The Certification shall be signed and sealed by a South Carolina Registered Engineer, verifying that closure has been completed in accordance with the Closure Plan. Any deviations from the Closure Plan shall be identified and include an explanation. A copy of the certification will be kept on file in the facility operating record.

2.10 LARGEST AREA TO EVER REQUIRE FINAL CLOSURE

Currently none of the 91-acre landfill has received final cover or certificate of closure. Therefore the largest area to ever require final closure is the full 91 acres.

2.11 LANDFILL GEOMETRY VENEER SLOPE STABILITY

A veneer stability analysis was conducted by Earth Tech to check the stability of a 2.5-foot thick cap section on these 3 horizontal to 1 vertical side slopes. The consultant determined an adequate factor of safety exists to insure stability. If a Department approved alternative final cover is used, the veneer slope stability will be verified.

2.12 GAS GENERATION AND COLLECTION

Due to the inert nature of the material, gas generation is not anticipated and is not included in the final cover design. If conditions develop that warrant gas management, a passive gas venting system will be implemented within the final cover system.

3.0 POST CLOSURE CARE PLAN

Following closure of the Landfill, Santee Cooper must conduct post-closure care. The Post Closure Plan describes the activities involved in providing care for the facility during the post closure period. The minimum post closure care period for the Landfill is twenty (20) years from the date of final closure. This period may be decreased if Santee Cooper can provide technical rationale that the decreased post-closure period is sufficient to protect human health and the environment. Likewise, SCDHEC may increase the post closure period if they determine a lengthened period is necessary to protect health and the environment.

The objective of these post closure activities is to ensure that the landfill continues to effectively contain waste materials. The site will be inspected and monitored regularly to identify any adverse conditions that might lead to release of material from the landfill that may be harmful to human health or the environment. Routine maintenance and repairs shall be performed to the final cover and drainage system, as needed. All required inspections, maintenance activities, and monitoring activities will be conducted throughout the post closure care period and documented according to set procedures laid down in this plan. Section 3.6 describes the record keeping and reporting requirements.

3.1 INSPECTION, MAINTENANCE, AND MONITORING PROCEDURES

Inspection, maintenance, and environmental monitoring of the site will be performed during the post closure period. Routine maintenance activities will include vegetation management and routine cleaning of the storm water ditches. Environmental monitoring at this facility will include groundwater and surface water quality monitoring. Routine scheduled inspections and environmental monitoring of the site will be performed as described herein during the 20-year post closure care period.

3.1.1 Visual Inspection

During the post closure care period, the landfill will be inspected semi-annually to identify defects that may compromise the integrity of the final cover system. These inspections will include a walk of the entire site to look for evidence of settlement/subsidence; slope instability; animal burrows; exposed waste; erosion of final surface cover; ponding of water on the final cover of landfill; and any seepage from the side slopes. The groundwater monitoring wells will be inspected for damage. The access roads will also be inspected. Storm water features will be checked to see that they are free from sediment or debris that might keep the system from operating properly. Excess sediment or debris will be removed as required so that the system will operate properly. Any other maintenance or repairs required due to a deficiency will be documented and performed on an as needed basis.

3.1.2 Final Cover System Monitoring, Maintenance, and Contingency for Repairs

The final cover surface will be inspected for stressed vegetation, desiccation, erosion, subsidence, animal burrow, slope instability, and inadequate vegetative cover. To help identify potential areas of erosion and stressed vegetation, one inspection will be conducted when the vegetative growth is minimal, and a second inspection will be conducted during the period when the vegetation is well established. If an approved exposed geosynthetic cover system is used, the inspections will be in accordance with manufacturer's recommendations. If a defect in the final cover system is identified during an inspection, an investigation to identify the potential cause of the damage will also be performed. Repairs will be made as soon as possible within 7 days of detection to minimize further erosion. If a defect is severe and repairs cannot be implemented in a reasonable time period, interim measures will be taken to prevent the defect from getting worse.

Mowing operations will be appropriately scheduled during the growing season. Other vegetative management operations will be performed as needed in order to establish and maintain a 75% or greater vegetative ground cover with no substantial bare spots throughout the closure period. Vehicular traffic across the vegetated areas of the landfill will be restricted to avoid potential damage to the capping system. Maintenance equipment including lawn mowing equipment will be allowed to operate on the vegetated areas only when necessary.

When subsidence, erosion, or animal borrow holes are detected in the landfill final cover surface, the grades will be restored by backfilling and grading settled or low areas with soil. In accordance with the current regulations, the side slope of the landfill will not be any steeper than 3 horizontal to 1 vertical. A slope of at least 3 percent but not greater than 5 percent will be maintained on top of the landfill. The disturbed areas and areas with inadequate vegetative cover will be re-seeded to restore vegetation for erosion control.

The final cover system will also be inspected for undesirable vegetation such as trees and large shrubs. Undesirable vegetation will be removed and damage to the final cover surface will be repaired. The final contours of the cover will be maintained to provide positive drainage and prevent erosion of the final cover due to surface water runoff.

Signs of surface sloughing, bulging at the toe, tension cracks at the top of the slope, or seepage from the side slopes are usually an indication of potential slope instability. Signs of instability shall be reported to the engineer immediately for further evaluation and recommendations for remedial measures.

Appropriate corrective actions will be taken to repair any damage as soon as possible after being given direction by the engineer. Immediate temporary stabilization measures may include placing a buttress (e.g., large mound of soil or rock) at the toe of the slope to prevent further movement and covering the exposed waste. To restrict further propagation of the slope instability (*i.e.,* additional sloughing or cracking), temporary slope stabilization shall take place as soon as physically possible after detection.

3.1.3 Groundwater Monitoring System

During the post closure care period, groundwater will continue to be monitored as described in the SCDHEC approved Groundwater Monitoring Plan. It is noted, the current Groundwater Monitoring Plan may be modified to meet changing conditions and/or regulations. The condition of the groundwater monitoring wells associated with the landfill will be visually inspected semiannually and during each annual sampling event. Visual inspections include checking the cover, ensuring that the lock is in good working condition, and checking the outer casing of the well. Monitoring well structures, pumping systems, and tubing will be evaluated during annual sampling events. Defects identified during an inspection or sampling event are noted in a maintenance log and repairs made as required. Other maintenance includes maintaining access to the wells by removing excess vegetation from around the monitoring well locations.

3.1.4 Surface Water Management System

Surface water sampling and analysis will be continued after closure as required by SCDHEC. The surface water management system will be inspected semi-annually during the post-closure care period. Drainage features may be inspected more frequently such as after the 2-year, 24-hour storm event or greater. Storm water channels and ponds will be inspected for evidence they are free of erosion, excessive vegetation, sedimentation, and debris that would restrict the flow or prevent proper operation. Any blockage will be removed at the earliest opportunity to prevent damage to other parts of the facility.

3.1.5 Site Roads

The condition of the site access roads will be evaluated during the inspection. On-site access roads will be maintained in a passable condition. Road maintenance will be provided as necessary.

3.2 GROUNDWATER MONITORING

Throughout the post-closure care period for this landfill, the groundwater detection monitoring system will be performed as set forth in the SCDHEC approved Groundwater Monitoring Plan. Post-closure monitoring will be performed to determine if the closed landfill is affecting the quality of the ground water. The regulation requires Santee Cooper to maintain a groundwater monitoring system and conduct annual sampling and analysis throughout the post-closure period.

3.2.1 Groundwater Sampling

The groundwater monitoring wells POZ-1, POZ-2, POZ-3, POZ-4, and POZ-5D were installed per the conditions of the original permit. Groundwater monitoring well PM-1 was installed prior to construction of the landfill and is considered the background/upgradient well for the landfill. These wells will continue to be monitored during the post closure care period in accordance with the SCDHEC approved Groundwater Monitoring Plan. At least one groundwater sample will be collected and analyzed from each of these wells on an annual basis. These groundwater samples will be analyzed for the parameters listed below.

pH (field and lab)
Temperature (field)
Arsenic
Cadmium
Iron
Selenium
Nitrate
Chloride
Total Organic Carbon

Specific Conductance (field)
Water Level (field)
Barium
Chromium
Lead
Zinc
Sulfate
Total Dissolved Solids
Turbidity (field)

Note: Analyses of the metals is performed on unfiltered groundwater samples.

As a part of the groundwater quality monitoring activities, groundwater level measurements and the Total Depth (TD) will be obtained from each of the monitoring wells at the annual sampling events. This data will be reviewed to evaluate the groundwater flow patterns in the vicinity of the landfill to ensure and confirm that the system is performing as designed.

3.2.2 Groundwater Level Measurement

The groundwater level in each well will be measured with an indicator capable of accurately measuring to the nearest hundredth of a foot. The measurement is to be taken from the top of the polyvinyl chloride (PVC) casing to the groundwater surface and recorded. To deter cross contamination, the water level indicator will be decontaminated between wells. Decontamination consists of an initial wash with laboratory grade soap, rinse with demineralized water, isopropyl alcohol rinse, and final rinse with demineralized water. Nitrile disposal gloves are worn by sampling personnel at all times and changed whenever necessary, including the minimum of between each well, to further minimize cross contamination.

3.2.3 Monitoring Well Purging

Dedicated sample tubing will be lowered into the well and set to the midpoint of the screened interval, but at least 2 feet above the bottom of the well to minimize the mobilization of particulates at the bottom of the well. Dedicated sample tubing will be utilized to the pump head connection of the peristaltic pump to minimize the potential for cross contamination. The pump will be started at its lowest speed setting and slowly increased until discharge occurs. The pump speed will be adjusted until there is no water level drawdown (less than 0.3 ft). Note, the speed and drawdown will need to be monitored and may need to be adjusted after initial drawdown and recovery.

3.2.4 Field Data Collection

Specific conductivity (SC), pH, temperature, Eh, and turbidity are the indicator field measurements which will be collected using an appropriate analyzer. The analyzer(s) will be calibrated daily per manufacture's operating instruction. Purging will continue until these parameters are stabilized. A sample for readings will be collected every 3 to five minutes. A stabilized reading, which is to be achieved prior to collection of the groundwater sample, is specified as three consecutive readings for each parameter which do not vary more than 3 percent for SC, 0.1 for pH, 3 percent for temperature, and 10 percent for turbidity. Once the readings for these parameters have been stabilized, then a groundwater sample may be collected from the well and placed in the appropriate, laboratory supplied container.

3.2.5 Groundwater Sample Collection

When the appropriate volume has been removed and field measurement parameters have stabilized, samples are collected and stored in the designated laboratory sample bottles, and placed in an ice-filled cooler for transport to Santee Cooper's Water Quality lab or other SCDHEC certified laboratory for analysis. A chain of custody will be completed, which tracks the samples through the collection and analytical process.

Optionally, at the time of groundwater sampling, if the sampling apparatus is inoperable for an individual well, Santee Cooper may resort to traditional bailing and purging of the wells in an effort to provide a synoptic round of groundwater samples from the site. At least three well volumes will be removed with monitoring of the field parameters until they are stable. If this method is used, and the turbidity of the sample is greater than 50 NTU, a disposable polycarbonate filter (.45 micron) will be used to filter the groundwater sample.

3.2.6 Data Evaluation and Reporting

The data from the semi-annual detection groundwater sampling events will be evaluated and compared to historic data and the Federal Drinking Water Regulations for Maximum Contaminate Levels (MCL). The groundwater flow rate and direction will also be evaluated by a groundwater professional as part of the groundwater monitoring requirements.

In accordance with the landfill permit, the semi-annual data and evaluation will be summarized and included in the annual detection monitoring report to SCDHEC. If routine monitoring indicates a constituent concentration is above the MCL or PQL and exceeds the standards established by the Water Classification and Standards System (R.61-68), SCDHEC will be notified in writing within fourteen (14) days of making that determination. The impacted well(s) will then be resampled within thirty (30) days to determine the validity of the data. The results of this subsequent testing will be submitted to SCDHEC no later than forty-five (45) days following that sampling event. If the resampling results concur with the elevated concentrations and no other source for it is determined, then a qualified groundwater scientist will prepare an assessment plan to define the potential groundwater impact and the corrective action required. This plan will be submitted to SCDHEC within ninety (90) days of the possible groundwater impact verification. Upon SCDHEC's approval of the assessment plan the first phase of its implementation will be initiated. The purpose of this phase includes identifying the source, migration rate, extent and severity of the contaminant plume. A report will be prepared for addressing assessment work and for performing any additional assessment or corrective action work necessary. The report will detail the findings of the groundwater quality assessment and make conclusions and recommendations. Santee Cooper will proceed with whatever recommendations are approved by SCDHEC.

3.3 FACILITY CONTACT

During the post closure care period, appropriate contact for this facility may be reached at the following address:
Santee Cooper Public Service Authority
One Riverwood Drive
Moncks Corner, SC 29461-2901

Attn: Mr. J. D. Thorndyke, Manager
Cross Generating Station
(843) 761-8000 (ext. 2202)

3.4 FACILITY END USE

Any post-closure use of the closed site will not interfere with inspection, maintenance, and monitoring activities. SCDHEC may approve any disturbance of the cover and/or containment system if Santee Cooper demonstrates that disturbance of the final cover, or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment.

3.5 POST-CLOSURE CARE COMPLETION CERTIFICATION

Following completion of the post-closure care period for the landfill, Santee Cooper shall submit to SCDHEC a certification, signed by a South Carolina Registered Professional Engineer other than the design engineer, verifying post closure care has been completed in accordance with the Post Closure Plan. A copy of this certification will be placed in the facility operating record. At the end of the post closure care period, SCDHEC will inspect the closed Class 2 Landfill. The Professional Engineer Certification should include the following:

> ***Professional Engineer's Certification***
> *I hereby certify and attest that I am familiar with the facility and information contained in this Post Closure Plan and that to the best of my knowledge and belief such information is true, complete and accurate. Further, this plan has been prepared in accordance with good engineering practices.*
>
> ____
>
> *Registered Engineer*
>
> ________________________ ______________
>
> *Registration No.* *Date*

3.6 COST ESTIMATES AND FINANACIAL ASSURANCE

Closure Plans typically require a cost estimate for closing the landfill at the time when closure costs would be greatest. Post Closure Plans typically require a cost estimate for Post Closure Care activities over the post closure care period. These cost estimates are used as a basis for establishing the amount of financial assurance to be posted by the owner/operator. Cost estimates for closure and post closure care were previously submitted under separate cover.

3.7 RECORD KEEPING AND REPORTING

Santee Cooper will retain records of inspections and maintenance activities. The records will indicate the date and time of the inspection, the name of the inspector, the nature of the inspection or maintenance activity, notation of observations made and the nature of repairs needed. The inspector will assess the condition and need for repair of the final cover system, surface water control features, ground water monitoring wells, and site access roads. The results from environmental monitoring will be included in the annual report submitted to SCDHEC. All data will be kept for the 20-year post closure period.

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SANTEE COOPER

Cross Generating Station Class Three Solid Waste Landfill

Separation between Base Grade and Groundwater under Existing Landfills

108008-01330

CR34-0-LI-LF-0003

28 October 2011

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CROSS GENERATING STATION CLASS THREE SOLID WASTE LANDFILL
SEPARATION BETWEEN BASE GRADE AND GROUNDWATER UNDER EXISTING LANDFILLS

SYNOPSIS

This report documents the base grade elevation of the existing Class Two coal combustion residual (CCR) solid waste landfill (SWLF) and the Units 1 and 2 Construction and Demolition (C&D) landfills at Cross Generating Station, relative to the seasonal high groundwater level. The proposed Class Three solid waste landfill areas will 'piggy-back' each of the existing site landfill areas. In the case of the existing Class Two SWLF and the Unit 1 C&D landfill, the deflected base grade elevation will remain above the seasonal high groundwater level.

The older Unit 2 C&D landfill presently extends below the seasonal high groundwater level in some locations. An extensive geophysical and test pit investigation revealed the presence of a natural silty clay drainage barrier underlying the Unit 2 C&D landfill area and also confirmed that the waste itself primarily consists of limestone and concrete cores with small amounts of other inert waste that is not detrimental to groundwater quality. This is supported by the results of groundwater quality testing from nearby monitoring wells. These findings demonstrate that the proposed Class Three landfill areas will maintain adequate protection of human health and the environment where they are developed over the existing site landfill areas.

PROJECT 108008-01330 - CROSS GENERATING STATION CLASS THREE SOLID WASTE LANDFILL

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Issued for Use	F Wood	A Adeyefa	R Skiptunas	Oct 12 2011	N/A	
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No. 24767
FLETCHER M. WOOD

10/28/2011

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1. INTRODUCTION

Portions of the proposed Class Three solid waste landfill areas will ‘piggy-back’ existing site landfill areas. This includes proposed solid waste landfill Areas 1B and 1D, which will ‘piggy-back’ over the east and west slopes, respectively, of the existing Class Two solid waste landfill. This also includes proposed Class Three solid waste landfill Area 2, which will be developed on top of the existing construction and demolition landfills established in support of the original construction of Cross Generating Station Units 1 and 2.

The objective of this report is to document the base grade elevation of each existing landfill relative to the seasonal high groundwater level, including the original base grade at the time of construction, the current base grade elevation based on field testing, and the predicted future base grade as each existing landfill is ‘piggy-backed’ by the proposed Class Three solid waste landfill areas.

A full demonstration of the design methodology, including design calculations, will be provided as part of the Engineering Report to be included in the permit application.

2. EXISTING CLASS TWO SOLID WASTE LANDFILL

2.1 Original Base Grade of Existing Solid Waste Landfill

The existing solid waste landfill was constructed in two major phases. The eastern half was established first in 1984 to support the operation of the initial generating unit. The western half of the existing landfill was established in 1993. At present, the eastern half is approximately 40 feet above surrounding grade, or EL 120 ft. The western half is approximately 60 feet above grade, or EL 140 ft. Note that all elevations indicated in this report reference plant datum, which is set equal to NGVD 29.

Construction documentation for the eastern half of the landfill is limited. It is understood that the landfill base grade was set approximately equal to the natural existing grade in the area, with the exception that low areas were backfilled to provide positive drainage and prevent waste from being placed in standing water. Available records indicate that the area was cleared and grubbed, but that no topsoil stripping occurred. Four soil borings (B-228, B-229, B-231, and B-232) were completed within the footprint of the existing landfill prior to landfill construction. The ground surface indicated in the boring logs ranged between EL 80.2 ft and 82.1 ft. It is therefore reasonable to assume that the original base grade elevation over the eastern half of the existing landfill ranged between those values, with a conservative average between approximately EL 80.5 and EL 81 ft.

The western half of the landfill was constructed so that its base sloped away from the already-established eastern half of the landfill. The area was cleared and grubbed prior to topsoil stripping. Based on as-built survey data from 1993, the western half of the landfill base sloped east to west from EL 80.6 ft down to EL 80.0 ft along the western perimeter. The original base grade elevations, as well the four soil boring locations completed prior to landfill development, are shown on CR34-0-SK-LF-716-0004 in Appendix A of this report.

2.2 Current Base Grade of Existing Solid Waste Landfill

Four additional soil borings (LB-1 through LB-4) were completed in August 2011 in order to assess the current base grade elevation of the landfill. The locations of these borings are shown on CR34-0-SK-LF-716-0003 and CR34-0-SK-LF-716-0004 in Appendix A. Each boring extended down through the existing landfill, through the underlying soil, and terminated shortly after reaching the Santee Limestone. Careful attention was given to the depth of transition between the 'Poz-o-tec' material at the base of the existing landfill and the underlying natural soils through the use of continuous sampling. The landfill surface elevation corresponding to each boring location was surveyed, aided with the use of grade hubs installed by the driller.

Two of these soil borings (LB-3 and LB-4) were performed within the western half of the landfill. Based on the transition to natural soils, the current landfill base grades were detected at EL 78.6 ft and EL 79.2 ft, respectively. From the boring coordinates and knowledge of the original grading scheme within the western half of the landfill, it can be estimated that the original landfill base grade at each of these locations was EL 80.2 ft and EL 80.5 ft, respectively. A three inch thick layer of topsoil was detected in LB-3 at the transition to natural soils. No topsoil was detected in LB-4.

The other two borings (LB-1 and LB-2) were performed within the eastern half of the existing landfill. The current base grades measured EL 79.9 ft and EL 79.8 ft. As stated previously, knowledge of the grades prior to waste placement is limited over the eastern half of the landfill, but are assumed to have ranged roughly between been between EL 80.5 and 81. This provides a conservative range because, in the case of LB-2 for example, the original base grade is assumed to be EL 81, whereas the ground surface was at EL 81.6 at boring B-231, located approximately 45 feet from LB-2.

2.3 Seasonal High Groundwater Level

Based upon the *Site Hydrogeological Characterization Report* by Garrett & Moore, the seasonal high groundwater level within the landfill footprint varies between EL 77.5 ft and 78.3 ft. At boring locations LB-1 through LB-4, the seasonal high groundwater level is approximately EL 77.7, EL 78.2, EL 78.2, and EL 78.1, respectively. The seasonal high groundwater contours are included on CR34-0-SK-LF-716-0004 in Appendix A.

2.4 Predicted Future Base Grade of Existing Solid Waste Landfill

2.4.1 General Methodology

The general methodology used to predict the future base grade of the existing solid waste landfill due to the ‘piggy-backing’ of the proposed Class Three solid waste landfill areas 1B and 1D is as follows:

1. Develop generalized soil and rock profile based on range of conditions encountered in soil borings performed within the existing landfill footprint
2. Estimate range of predicted settlements assuming generalized soil and rock profile at maximum waste height and compare with original base grade elevation and seasonal high groundwater level
3. Develop individual soil and rock profiles for each soil boring location LB-1 through LB-4, compare predicted settlement to date with actual observed values, and compare final predicted landfill base grade with seasonal high groundwater level.

2.4.2 Generalized Soil and Rock Profile

The typical subsurface conditions within the footprint of the existing solid waste landfill can be estimated based on the subsurface investigations performed by Law Engineering Testing Company (LETCO) in 1979, Woodward-Clyde Consultants (WCC) in 1981, and WPC in 2011.

The geometry of the generalized soil and rock profile is developed from the soil borings completed within the actual footprint of the existing solid waste landfill. The soil properties are estimated based on correlations with flat plate dilatometer (DMT) test results obtained by WPC in comparable soil layers in the immediate vicinity of the existing landfill. The Limestone and Black Mingo properties are estimated based on numerous pressuremeter test results performed within these formations by LETCO and WCC.

The generalized soil and rock profile is summarized in Table 2-1 as follows:

Table 2-1 Generalized Soil and Rock Profile

Formation	Layer Description	Elevation MSL	Constrained Modulus (ksf)
Pleistocene Soils	Stiff to very stiff sandy clays	80 – 72	1,500 – 2,500
	Loose to medium dense silts / sands	72 – 63	300 – 500
	Very loose silts, very soft clays (1)	63 – 60	25 – 75
Santee Limestone	Weathered limestone	60 – 48	1,500 – 7,800
	Hard limestone	48 – 36	3,100 – 13,800
	Soft limestone	36 – 20	800 – 11,200
Black Mingo	Upper Unit 1 Black Mingo	20 – -30	1,000 – 2,600
	Lower Unit 1 Black Mingo	-30 – -85	2,200 – 4,000
	Deep Unit 2 Black Mingo	Below -85	5,200 – 8,600

(1) The layer of very loose silts and soft clays is not continuous throughout the landfill footprint. It is included in the generalized soil profile to provide a reasonably conservative upper bound estimate of settlement; however it should be noted that soil arching effects within stiffer soils adjacent to isolated pockets of softer soils would typically act to reduce predicted settlements.

The constrained modulus values presented above are derived from DMT and pressuremeter test values obtained prior to waste placement. As the stress on the soil and rock profile increases due to waste placement, the stiffness of the response increases. Typically the lower bound modulus for future loading of the existing landfill area is assumed equal to the midpoint of the range indicated above, with the upper bound modulus assumed to increase by approximately 50%.

2.4.3 Methodology of Settlement Estimation

Due to the limited number of test locations within the actual footprint of the existing solid waste landfill, a generalized approach to settlement analysis using the above soil profile and constrained modulus values is utilized. To overcome the uncertainty of the subsurface conditions, lower and upper bound values of constrained modulus are determined based on the actual range of DMT or pressuremeter test values observed within each soil or rock layer. Settlement analysis using constrained modulus is summarized as follows:

Constrained modulus M_{DMT} [MPa] is defined as the vertical drained confined tangent modulus at σ_{vo}. M_{DMT} is derived from the dilatometer and pressuremeter tests. The analysis is based on the Marchetti method.

The settlement of the i^{th} layer is provided by:

$$S_i = \frac{\sigma_{z,i} \cdot h_i}{M_{DMT}}$$

where: $\sigma_{z,i}$ - vertical component of incremental stress in the middle of i^{th} layer
h_i - thickness of the i^{th} layer
M_{DMT} - constrained modulus

2.4.4 Settlement Analysis for Generalized Soil and Rock Profile

Based on the generalized soil profile presented in Table 2-1, the total maximum settlement of the existing Class Two solid waste landfill base is estimated to be approximately 1.5 feet. The extreme range of predicted total settlement for the generalized soil profile based on all lower or upper-bound modulus values is between 0.8 and 1.9 feet, respectively. These settlement values include settlement that has already occurred due to self-weight as well as predicted future settlement as the proposed Class Three solid waste landfill areas are 'piggy-backed' over the east and west slopes to the final build-out height at EL 212. The results are presented in Appendix B in greater detail.

In general, over the eastern half of the existing landfill, the separation between the original base grade and the seasonal high groundwater level is estimated to range from 2.8 feet in the middle region to a high of 3.5 feet near the southeast corner. Over the western half of the existing landfill, the original separation is estimated to range from 1.8 feet along the western edge to about 2.9 feet at the southeast corner. Therefore, some degree of groundwater separation is expected to be maintained as the proposed Class Three solid waste landfill areas are 'piggy-backed' against the existing Class Two solid waste landfill.

Based on the generalized soil profile, the groundwater separation appears to approach a minimum in the area roughly bounded by the western perimeter of the existing landfill and soil borings LB-3 and LB-4. These locations are analysed further in Section 2.4.5, below.

2.4.5 Settlement Analysis at Individual Boring Locations

As an additional check of the methodology and results, a soil profile is created for each of the four boring locations LB-1 through LB-4. The stress state associated with the current height of the existing Class Two landfill at each discrete boring location is considered when calculating theoretical settlements to date. Similarly, the stress increase associated with achieving the final proposed height of the Class Three landfill at each location is used to predict the future settlements. The predicted settlements to date can be compared with observed settlements at each boring location, while the predicted future settlements can be used to compare the final deflected landfill base grade with the seasonal high groundwater level at each location.

Detailed settlement results are included in Appendix B. The results are summarized in Table 2-2 below:

Table 2-2 Predicted Settlements within Existing Class Two Solid Waste Landfill

Predicted Settlements (ft)			Eastern Half		Western Half	
Location		Generalized Profile	LB-1	LB-2	LB-3	LB-4
Occurred To Date	Average	0.8	0.6	1.0	0.8	1.1
	Range[1]	0.4 – 1.1	0.4 – 0.8	0.5 – 1.5	0.4 – 1.1	0.6 – 1.6
Future	Average	0.6	0.3	1.0	0.2	0.3
	Range[1]	0.4 – 0.8	0.2 – 0.4	0.7 – 1.3	0.2 – 0.3	0.2 – 0.4
Total	Average	1.4	0.9	2.0	1.0	1.4
	Range[1]	0.8 – 1.9	0.6 – 1.2	1.2 – 2.8	0.6 – 1.4	0.8 – 1.9

(1) The range of values is based on all lower or upper-bound modulus test results within a given soil and rock profile. Actual settlements are estimated to be closer to the average predicted values.

2.4.6 Predicted Future Base Grade of Existing Landfill and Discussion

Based on the generalized soil and rock profile, the existing landfill base grade is expected to deflect approximately 1.5 feet below its original base grade when the proposed landfill is developed to full height. The existing base grade therefore will remain above the seasonal high groundwater level.

Table 2-3 demonstrates the variation of the original, existing, and predicted future landfill base grade relative to the seasonal high groundwater table at all four discrete soil boring locations where the current base grade elevation was verified. The landfill base grade is predicted to remain above the seasonal high groundwater level at each location when the landfill has reached full height.

Table 2-3 Landfill Base Grade Elevations

Base Grade Elevations (MSL)	Eastern Half		Western Half	
Boring Location	LB-1	LB-2	LB-3	LB-4
Original Base Grade (1)	80.5	81	80.2	80.5
Predicted Current Base Grade	79.7 – 80.1	79.5 – 80.5	79.1 – 79.8	78.9 – 79.9
Actual Observed Current Base Grade	79.9	79.8	78.6	79.2
Predicted Future Settlement (ft)	0.2 – 0.4	0.7 – 1.3	0.2 – 0.3	0.2 – 0.4
Predicted Future Minimum Base Grade (2)	79.5 – 79.7	78.5 – 79.1	78.3 – 78.4	78.8 – 79.0
Seasonal High Groundwater	77.7	78.2	78.2	78.1
Predicted Final Separation between Base Grade and Seasonal High Groundwater (ft)	1.8 - 2	0.3 – 0.9	0.1 – 0.2	0.7 – 0.9

(1) The original base grade elevations within the eastern half of the landfill are estimated from nearby borings B-228 and B-231.

(2) The reference for predicted future base grade is the actual observed current base grade elevation minus predicted future settlement, i.e. the analysis considers actual observed settlements to date when predicting future settlements.

The soil profile observed in borings LB-3 and LB-4 within the western half of the landfill indicate the presence of primarily very stiff sandy clays and dense sands that are expected to undergo little future settlement.

Borings LB-1 and LB-2 indicate the presence of softer, looser soils within the eastern half of the landfill and therefore there is a greater potential for settlement at these locations, particularly at LB-2 where the final height of the landfill is greater and a very soft soil was detected immediately above the limestone. Such soils are occasionally classified as voids when attempting to sample with SPT because rod drops are common and sample recovery is difficult. CPT and DMT soundings have detected and characterized such soils within the site.

The predicted future settlement at LB-1 is not expected to be large, despite the relatively soft profile, primarily because it is located near the southeast corner of the existing landfill and as such will not be 'piggy-backed' to full height.

Similar to the settlement analysis completed for the generalized soil profile in Section 2.4.4, the above results indicate that the base grade of the existing Class Two solid waste landfill will remain above the seasonal high groundwater level after the proposed Class Three solid waste landfill 'piggy-back' is complete.

The soil profiles at boring locations LB-1 through LB-4 also were evaluated for liquefaction susceptibility during the design seismic event. The soil profiles at LB-3 and LB-4 are not liquefiable and therefore no liquefaction-induced settlement is predicted at these locations. Even though discrete layers within the soil profiles at LB-1 and LB-2 may be susceptible to liquefaction during the design seismic event, the calculated magnitude of the associated liquefaction-induced settlements is not sufficient to deflect the base grade of the existing Class Two landfill beneath the seasonal high groundwater level.

2.5 Poz-o-tec

2.5.1 General

For the first two decades of operation, the waste placed in the existing Class Two solid waste landfill consisted primarily of 'Poz-o-tec', a low permeability, structurally stable combination of fly ash, lime, and scrubber sludge from the generating station, formed by a process developed by Conversion Systems, Inc. A significant thickness of this material exists at the bottom of the existing landfill, thereby providing a stiff foundation and a drainage barrier to downward percolating leachate.

In 2005, EarthTech completed a total of 32 CPT soundings into the top of the existing Class Two solid waste landfill. The majority of these soundings refused or otherwise indicated very high tip stresses upon encountering the Poz-o-tec material. Based on this data, it is estimated that the thickness of Poz-o-tec at the base of the eastern half of the existing landfill ranges from approximately 38 feet at the south end to about 30 feet at the north end. The thickness in the western half is approximately 20 feet based on boring logs LB-3 and LB-4, however the strength is not consistently as high as it is in the eastern half of the landfill, as the CPT soundings typically refused approximately 5 to 16 feet above the base of the western half of the landfill moving from south to north, respectively.

2.5.2 Laboratory Test Data

Numerous samples of the Poz-o-tec material were obtained for laboratory testing during the 1980s and 1990s. Testing included permeability, dry unit weight, moist unit weight, unconfined compressive strength, and specific gravity. 52 permeability tests were run, however it was occasionally noted that retrieving and preserving intact Poz-o-tec samples was achieved with difficulty, and that great care had to be exercised to prevent bypass during permeability testing due to surface irregularities in the test specimens. Both are characteristics that tend to increase the measured laboratory permeability values. On the other hand, when careful sampling and specimen preparation was performed, very low permeabilities were observed. For example, Soil Consultants, Inc, noted in their April 1988 *Analysis of Landfill Material – Cross Generating Station*, that intact specimens that saturated for multiple days under pressure in a triaxial cell had no detectable permeability and were therefore assigned a value of $1x10^{-7}$ cm/sec. On the other hand, permeability test specimens for which little information was available regarding sampling and/or test method generally were associated with higher permeability values. All available test data is included in Table 2-4, below:

Table 2-4 Poz-o-tec Laboratory Test Results

		Approximate Elevation of Sample			
Test Type	No. Tests	120	100	90	80
Average Permeability (cm/sec)	52	$7.8x10^{-4}$	$3.5x10^{-4}$	$3.5x10^{-4}$	$2.8x10^{-5}$
Average Dry Unit Weight (pcf)	9	73.0			
Average Moist unit Weight (pcf)	9	99.6			
Average UC Strength (psi)	9	190.1 (range = 99 to 422)			
Average Specific Gravity	2	2.46			

The sample elevations included in Table 2-4 were inferred indirectly and should not be considered precise. They are included herein only to demonstrate that the permeability appeared to decrease with depth. Additionally, it is estimated that the actual in-situ permeability of the Poz-o-tec material may be as much as one or two order of magnitudes less than the values indicated in Table 2-4, and that the higher values obtained during laboratory testing are the results of sample disturbance and/or surface irregularities in the test specimens.

Therefore, even in the unlikely event that portion of the future base grade of the existing landfill is exposed to groundwater, the presence of the Poz-o-tec material will encourage leachate to move laterally upon reaching it as opposed to continuing to percolate downward towards the groundwater. Additionally, due to the inert nature of the material, it will not decompose, dissolve, or in any way form a contaminated leachate upon contact with ground water. Extensive studies have been performed that demonstrate the inert nature of Poz-o-tec material, and are summarized in a March 1991 report by Santee Cooper.

2.5.3 Poz-o-tec as Base Reinforcement

Another benefit of the Poz-o-tec material is its high strength relative to traditional CCR solid waste materials due to its pozzolanic nature, similar to a low strength concrete. Its presence acts as a thick layer of base reinforcement. There are multiple benefits with base reinforcement, including increased stability, decreased differential settlement, and the ability to span small weak areas or even voids under the base of the landfill. The *Santee Limestone Void Characterization Report* discusses the concept of base reinforcement in greater detail, and also defines the “design” void for the proposed adjacent Class Three landfill areas as a circular void with a diameter of 7.2 feet. Assuming a void of this size develops immediately underneath the base of the existing Class Two solid waste landfill, and assuming a conservative Poz-o-tec strength of 100 psi, the factor of safety against a portion of the overlying Poz-o-tec settling into this void ranges between 6 and 9 for a range of assumed failure modes. Therefore, the base of the existing landfill is not anticipated to deflect below the seasonal high groundwater level in the event that a design-size void develops underneath the existing landfill.

3. UNIT 1 C&D LANDFILL

The Unit 1 C&D landfill will be encapsulated by the western portion of the proposed Class Three solid waste landfill area 2. The location of the existing landfill is shown on CR34-0-SK-LF-716-0004 in Appendix A.

The Unit 1 C&D landfill received onsite waste associated with the construction of Cross generating station unit 1 during the early 1990's. In accordance with the original permit application dated January 10, 1992, the site was restricted to the disposal of inert waste material, including concrete, wire, rebar, scrap metal, wood crates and pallets, paper, cardboard, wrapping, and spent desiccant material.

The September 7, 2011 *Supplemental Geotechnical Data Report* by WPC included two test pits, TP21 and TP22, within the existing Unit 1 C&D landfill. The results of the test pits indicate that the contents of the landfill are consistent with the original permit application and that the current base grade of the Unit 1 C&D landfill is consistent with the original design base grade elevation of EL 80.5.

3.1 Subsurface Conditions

The soil and rock profile in the Unit 1 C&D landfill area is similar to the existing Class Two solid waste landfill discussed in Section 2. The various formation boundary elevations vary slightly between the landfill areas, but otherwise the Santee Limestone and Black Mingo characteristics are similar based on the subsurface investigations performed by LETCO in 1979 and WPC in 2011. Several area soil borings, cone penetrometer soundings, and DMT soundings were used to develop the soil and rock profile across the Unit 1 C&D landfill area. The compressibility of the upper soils varied from west to east across the existing landfill and was characterized from DMT soundings D-914 and D-915 performed at the west and east ends of the existing landfill, respectively. The DMT sounding locations are shown on CR34-0-SK-LF-716-0004 in Appendix A. The soil and rock profiles assumed in the settlement analysis are summarized in Tables 3-1 and 3-2 on the following page:

Table 3-1 Soil and Rock Profile at West End of Existing Unit 1 C&D Landfill

Formation	Layer Description	Elevation MSL	Constrained Modulus (ksf)
Pleistocene Soils	Dense Sandy Silt	80.5 – 75	1,800
	Med Dense Sands	75 – 66	600
	Very loose silt	66 – 58	25 – 75
Santee Limestone	Weathered limestone	58 – 50	1,500 – 7,800
	Hard limestone	50 – 25	3,100 – 13,800
	Soft limestone	25 – 10	800 – 11,200
Black Mingo	Upper Unit 1 Black Mingo	10 – -30	1,000 – 2,600
	Lower Unit 1 Black Mingo	-30 – -85	2,200 – 4,000
	Deep Unit 2 Black Mingo	Below -85	5,200 – 8,600

Table 3-2 Soil and Rock Profile at East End of Existing Unit 1 C&D Landfill

Formation	Layer Description	Elevation MSL	Constrained Modulus (ksf)
Pleistocene Soils	Med Dense Sands	80.5 – 79	850
	Med Dense Silts	79 – 69	500
	Loose Silty Sand	69 – 62	300
Santee Limestone	Weathered limestone	62 – 50	1,500 – 7,800
	Hard limestone	50 – 25	3,100 – 13,800
	Soft limestone	25 – 10	800 – 11,200
Black Mingo	Upper Unit 1 Black Mingo	10 – -30	1,000 – 2,600
	Lower Unit 1 Black Mingo	-30 – -85	2,200 – 4,000
	Deep Unit 2 Black Mingo	Below -85	5,200 – 8,600

3.2 Groundwater Conditions

Based upon the *Site Hydrogeological Characterization Report* by Garrett & Moore, the seasonal high groundwater level within the Unit 1 C&D landfill footprint varies between El 77.0 ft and 77.3 ft. The water encountered within test pits TP-21 and TP-22 is perched within the construction debris above a silty clay layer and should not be interpreted as representing the seasonal high groundwater level. The seasonal high groundwater contours are shown on CR34-0-SK-LF-716-0004 included in Appendix A.

3.3 Settlement Evaluation and Discussion

The proposed Class Three solid waste landfill Area 2 will have a maximum elevation of 212 ft. However, the maximum elevation of the proposed landfill over the footprint of the existing Unit 1 C&D landfill varies from west to east from a conservative average of approximately EL 130 ft at the west to a maximum of EL 210 ft at the east.

Table 3-3 summarizes the predicted settlement across the existing Unit 1 C&D landfill base grade due to the proposed Class Three solid waste landfill. Detailed results are available in Appendix B.

Table 3-3 Predicted Settlement of Unit 1 C&D Landfill Base Grade

		West End	East End
Predicted Settlement (ft)	Average	1.1	0.8
	Range(1)	0.6 – 1.7	0.7 – 1.0
Predicted Future Deflected Base Grade EL		78.8 – 79.9	79.5 – 79.8
Maximum Seasonal High Groundwater EL		77.3	77.3
Predicted Final Separation between Base Grade and Seasonal High Groundwater (ft)		1.5 – 2.6	2.2 – 2.5

(1) The range of values is based on all lower or upper-bound modulus test results within a given soil and rock profile. Actual settlements are estimated to be closer to the average predicted values.

Based on the above settlement analysis, the base grade of the Unit 1 C&D landfill is predicted to maintain groundwater separation after development of the proposed Class Three solid waste landfill area.

4. UNIT 2 C&D LANDFILL

The Unit 2 C&D landfill will be encapsulated by the south-eastern portion of the proposed Class Three solid waste landfill area 2. The location of the existing landfill is shown on CR34-0-SK-LF-716-0004 in Appendix A.

The Unit 2 C&D landfill received onsite waste associated with the construction of Cross generating station Unit 2 during the early 1980's. It is understood that the site received inert waste material, but limited documentation is available. The focus of the supplemental geotechnical investigation performed by WPC in August 2011 therefore was to better characterize the nature and limits of the waste within the Unit 2 C&D landfill.

The *Supplemental Geotechnical Data Report* by WPC included 22 test pits and EM31 conductivity testing performed over the entire existing Unit 2 C&D landfill footprint. The test pits indicate that the current base grade of the Unit 2 C&D landfill varies from El 76.3 ft to 80.6 ft. The observed range is consistent with second-hand accounts of the placement method. There was no requirement for groundwater separation when the landfill was established.

4.1 Subsurface Conditions

The soil and rock profile in the Unit 2 C&D landfill area is developed in a similar manner as the Unit 1 C&D landfill discussed in Section 3. Once again, the various formation boundary elevations vary slightly between the landfill areas, but otherwise the profile is very similar.

In this case, the compressibility of the upper soils varied from north to south across the existing landfill and was characterized from DMT soundings D-915 and D-916 performed near the north and south ends of the existing landfill, respectively. The DMT sounding locations are shown on CR34-0-SK-LF-716-0004 in Appendix A.

The soil and rock profiles assumed in the settlement analysis at the north end of the existing Unit 2 C&D landfill is identical to that shown for the east end of the existing Unit 1 C&D landfill in Table 3-2. The profile developed for the south end of the existing Unit 2 C&D landfill is summarized in Table 4-1 :

Table 4-1 Soil and Rock Profile at South End of Existing Unit 2 C&D Landfill

Formation	Layer Description	Elevation MSL	Constrained Modulus (ksf)
Pleistocene Soils	Loose Silt	80.5 – 79	150
	Med Dense Silt	79 – 69	300
	Loose Silt	69 – 62	80
Santee Limestone	Weathered limestone	62 – 50	1,500 – 7,800
	Hard limestone	50 – 25	3,100 – 13,800
	Soft limestone	25 – 10	800 – 11,200
Black Mingo	Upper Unit 1 Black Mingo	10 – -30	1,000 – 2,600
	Lower Unit 1 Black Mingo	-30 – -85	2,200 – 4,000
	Deep Unit 2 Black Mingo	Below -85	5,200 – 8,600

4.2 Groundwater Conditions

Based upon the *Site Hydrogeological Characterization Report* by Garrett & Moore, the seasonal high groundwater level within the Unit 2 C&D landfill footprint varies between El 77.0 ft and 77.3 ft. The seasonal high groundwater contours are included on CR34-0-SK-LF-716-0004 in Appendix A.

Of the 22 test pits excavated in August 2011, water was encountered from El 76.5 ft to 77.8 ft in three test pits within the construction debris overlying a consistent silty clay layer observed throughout the existing landfill, from El 69.5 ft to 70.7 ft in four test pits in the sand layer underlying the silty clay layer, and was not encountered in the remaining 15 test pits with termination depths varying from El. 74.8 ft to El. 79.2 ft.

The above results suggest that the silty clay layer observed throughout the existing Unit 1 C&D landfill area acts as a drainage barrier. The water encountered above the seasonal high groundwater level is perched above the silty clay layer and should not be interpreted as representing the seasonal high groundwater level. Similarly, the water observed deeper within the sand layer underlying the silty clay and the lack of observed water in test pits extending below the seasonal high groundwater level does not imply that the seasonal high groundwater should be lower in these areas. Rather, it suggests that the silty clay layer acts as a localized confining unit. The *Site Hydrogeological Characterization Report* by Garrett & Moore accurately represents the seasonal high groundwater level within the existing Unit 2 C&D landfill area.

4.3 Settlement Evaluation and Discussion

The proposed Class Three solid waste landfill Area 2 will have a maximum elevation of 212 ft. However, the maximum elevation of the proposed landfill over the footprint of the existing Unit 2 C&D landfill varies from a maximum of EL 190 at the north and west, down to EL 90 at the south and east. An average of EL 160 is assumed for the settlement analysis at the profile corresponding to the south end of the landfill. This is used because it is representative of the average proposed landfill height over a large percentage of the existing landfill, even though the actual applied pressures will be lower at the south end.

Table 4-2 summarizes the predicted settlement across the existing Unit 2 C&D landfill base grade due to the proposed Class Three solid waste landfill. Detailed results are available in Appendix B.

Table 4-2 Predicted Settlement of Unit 2 C&D Landfill Base Grade

		North End	South End
Predicted Settlement (ft)	Average	0.8	1.1
	Range	0.7 – 1.0	1.0 – 1.2
Predicted Future Deflected Base Grade EL		75.3 – 79.9	75.1 – 79.6
Maximum Seasonal High Groundwater EL		77.3	

Based on the above settlement analysis, portions of the existing Unit 2 C&D landfill base grade are likely to extend below the seasonal high groundwater table, both at present and after the proposed Class Three solid waste landfill is constructed.

The 22 test pits performed throughout the footprint of the existing Unit 2 C&D landfill confirmed the presence of a relatively small amount of inert waste mixed within a soil matrix. Where waste was encountered, it generally consisted of waste concrete and limestone caisson cores, with the occasional metal pipe, straps, rebar, wire, pvc, and wood. 16 of the 22 test pits encountered either no waste at all or were limited to chunks of concrete and/or limestone. This is consistent with the EM31 conductivity testing performed over the entire footprint of the landfill, which revealed very little buried metallic waste. The nature of the waste is such that the quality of groundwater will not be adversely affected upon contact, which is consistent with the understanding that Santee Cooper has not observed any indication of reduced groundwater quality due to the presence of the existing Unit 2 C&D landfill during historical and ongoing water quality testing on groundwater samples from the existing monitoring wells in the vicinity of the Unit 2 C&D landfill.

The EM31 conductivity testing suggested the presence of a consistent silty clay layer at varying depths over the footprint of the existing landfill. As discussed in Section 4.2, this silty clay layer appears to act as a drainage barrier, thereby significantly reducing or preventing the free movement of groundwater through waste that extends below the seasonal high groundwater level. This is supported by the fact that water was not encountered within several test pits unless the underlying sandier soils were reached, even when the excavation extended several feet below the seasonal high groundwater level. It is likely that any consolidation that occurs within the silty clay layer due to the additional loading of the proposed Class Three solid waste landfill would act to further reduce its permeability.

5. CONCLUSIONS

The existing Class Two solid waste landfill will be 'piggy-backed' on the east and west side slopes by proposed Class Three solid waste landfill areas 1B and 1D, respectively. The deflected base grade of the existing Class Two landfill will remain above the seasonal high groundwater level after the proposed Class Three landfill areas are developed.

Approximately the bottom 20 to 40 feet of the existing Class Two solid waste landfill consists largely of Poz-o-tec, a stable combination of fly ash, lime, and scrubber sludge which provides the additional benefit of acting as a drainage barrier to downward percolating leachate. The Poz-o-tec also provides a layer of base reinforcement that is capable of spanning the design-sized void beneath the base of the landfill. Additionally, it will not decompose, dissolve, or in any way form a contaminated leachate upon contact with ground water.

The existing Unit 1 C&D landfill will be 'piggy-backed' by the western portion of proposed Class Three solid waste landfill area 2. The deflected base grade of the existing Unit 1 C&D landfill will remain above the seasonal high groundwater level after the proposed Class Three landfill area 2 is developed.

The existing Unit 2 C&D landfill will be 'piggy-backed' by the eastern portion of proposed Class Three solid waste landfill area 2. The Unit 2 C&D landfill area was established prior to the development of regulations requiring separation between the landfill base grade and the seasonal high groundwater level. Portions of the existing Unit 2 C&D landfill presently extend below the seasonal high groundwater level.

An extensive geophysical and test pit investigation performed throughout the existing Unit 2 C&D landfill revealed the presence of a natural silty clay drainage barrier underlying the area. The presence of this silty clay will significantly reduce or prevent the free movement of groundwater through any waste that extends below the seasonal high groundwater level. The site investigation also confirmed that the waste itself primarily consists of limestone and concrete cores with small amounts of other inert waste that is not detrimental to groundwater quality. This is supported by the results of groundwater quality testing from nearby monitoring wells.

These findings demonstrate that adequate protection of human health and the environment will be maintained when the existing site landfills are 'piggy-backed' by the proposed Class Three landfill areas.

6. REFERENCES

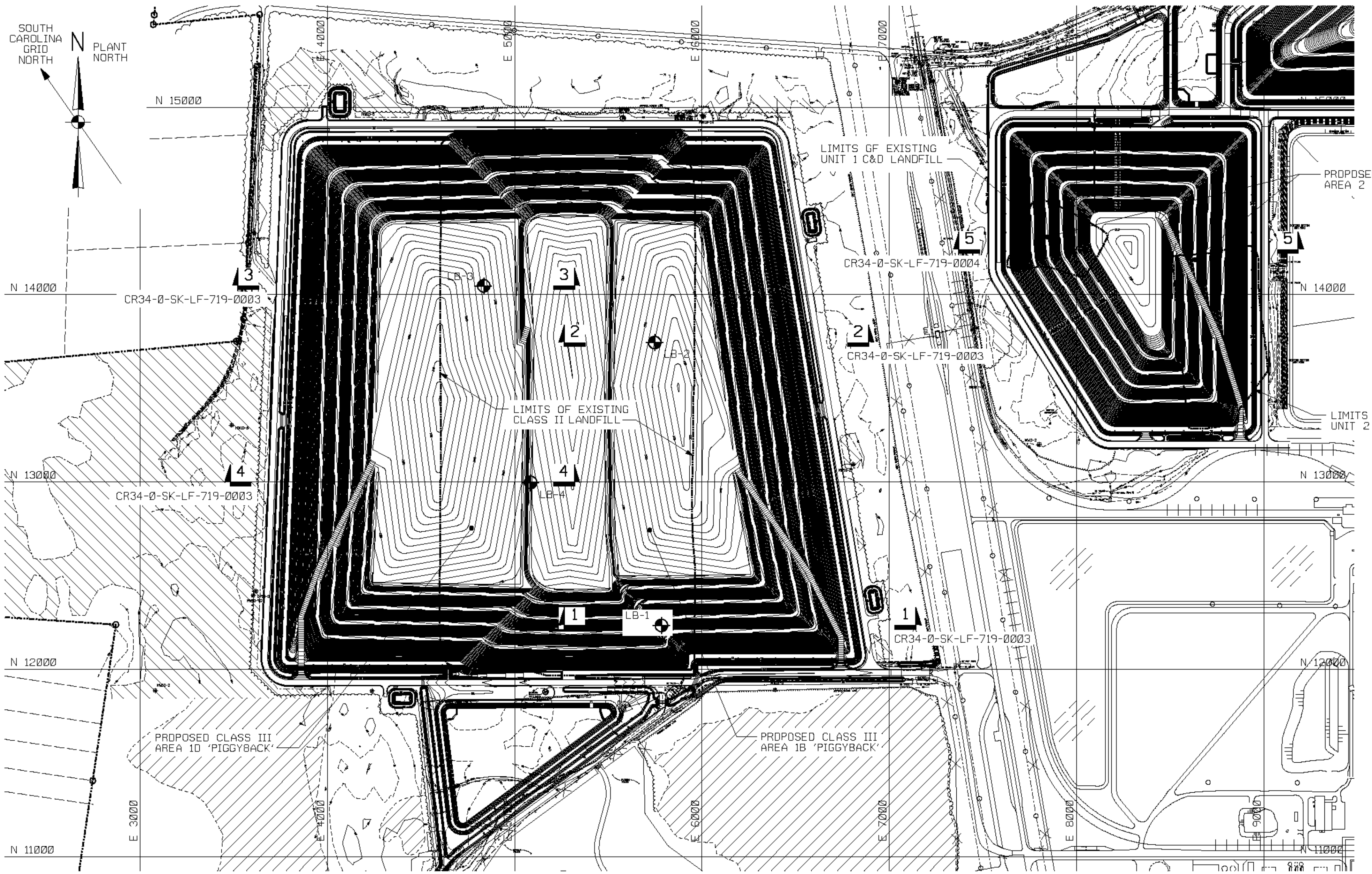
1. Garrett & Moore, Inc., April 2011, *Site Hydrogeological Characterization Report*
2. Law Engineering Testing Company, February 9, 1979, *Final Report - Cross Generating Station - Volume 2*
3. Law Engineering Testing Company, February 9, 1979, *Final Report - Cross Generating Station - Appendices to Volume 2 and Profiles*
4. *Marchetti S. (1999) The Flat Dilatometer and its applications to Geotechnical Design, Lecture notes (90 pp) International Seminar on DMT held at the Japanese Geot. Society, Tokyo, 12 Feb 1999*
5. Santee Cooper, March 22, 1991, *Poz-o-tec – Inert Waste Demonstration*
6. Santee Cooper, January 10, 1992, *Permit Application for Inert Landfill at Cross Generating Station*
7. Soil Consultants, Inc., April 27, 1988, *Analysis of Landfill Material – Cross Generating Station*
8. Woodward-Clyde Consultants, January 1981, *Volume One – Main Report – Unit 1 Subsurface Investigation - Cross Generating Station*
9. Woodward-Clyde Consultants, January 1981, *Volume Two – Appendices – Unit 1 Subsurface Investigation – Cross Generating Station*
10. WorleyParsons, September 2011, *Cross Generating Station Class Three Solid Waste Landfill – Santee Limestone Void Characterization Report*
11. WPC, A Terracon Company, April 12, 2011, *Geotechnical Data Report - Cross Generating Station - Solid Waste Landfill (SWLF) Expansion*
12. WPC, A Terracon Company, September 7, 2011, Supplemental *Geotechnical Data Report - Cross Generating Station - Solid Waste Landfill (SWLF) Expansion*

APPENDIX A

Groundwater Separation Plan

Existing Landfill ‘Piggy-back’ Plan

Existing Landfill ‘Piggy-back’ Cross Sections



PLAN
SCALE:1"=300'

NOTES:

1. GRID BASED ON PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.

LEGEND:

---80---	EXISTING CONTOURS
═80═	NEW GRADE CONTOUR
⊕ LB-1	TEST BORING
▨	ECOLOGICAL MAPPING SERVICES, LLC WETLANDS SURVEY DATED 12/14/09

REFERENCES:

CR34-0-SK-LF-716-0004	EXISTING LANDFILL GROUNDWATER SEPARATION PLAN
CR34-0-SK-LF-719-0003	EXISTING LANDFILL 'PIGGYBACK' LOCATION - CROSS SECTIONS
CR34-0-SK-LF-719-0004	EXISTING LANDFILL 'PIGGYBACK' LOCATION - CROSS SECTIONS

300 0 300 600 900
GRAPHIC SCALE IN FEET

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.J. MARTIN
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER R.J. MARTIN

PRELIMINARY STATUS	DATE	
LDE F.M. WOOD	10/10/11	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS	DATE	
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CLASS III SOLID WASTE LANDFILL
EXISTING LANDFILL 'PIGGYBACK'
LOCATION - PLAN

SCALE	DRAWING SIZE	JOB NO.
1"=300'	ARCH D (36" x 24")	10B008-01330

WORLEYPARSONS DWG. NO.	REV
CR34-0-SK-LF-716-0003	C

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
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B	09/27/11	KPF			FMW	FMW	ISSUED FOR REVIEW
A	09/19/11	KPF			FMW	FMW	ISSUED FOR REVIEW

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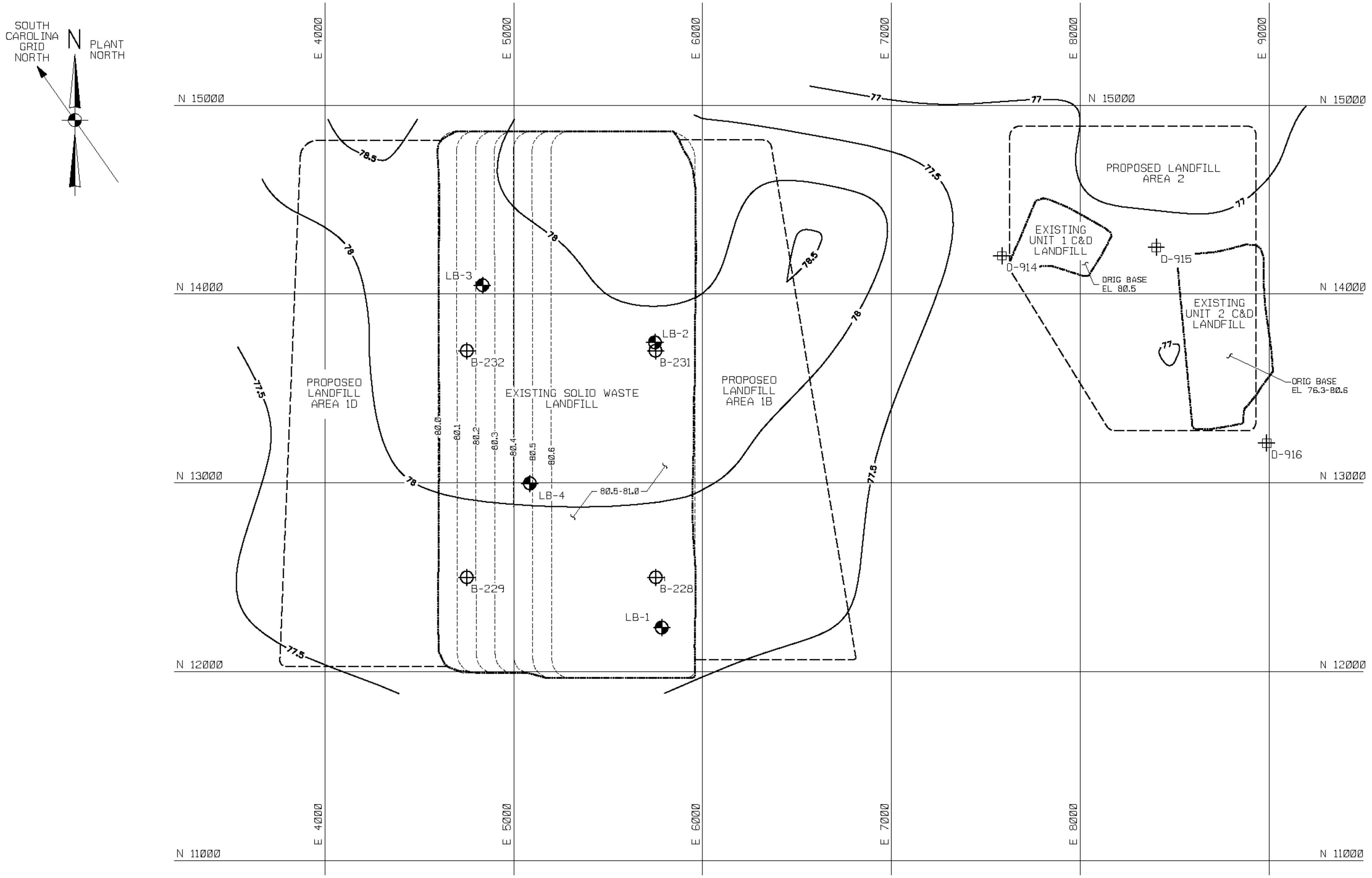

PLAN

SCALE:1'=300'

NOTES:

1. GRID BASED ON PLANT COORDINATE SYSTEM.
2. GROUNDWATER ELEVATIONS ARE BASED ON A HYDROGEOLOGIC STUDY PERFORMED BY GARRETT & MOORE, DATED APRIL 2011.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.

LEGEND:

——77——	SEASONAL HIGH GROUNDWATER ELEVATION CONTOUR
----80.0----	ORIGINAL CLASS II LANDFILL BASE GRADE ELEVATION CONTOUR (APPX)
● LB-1	EXISTING BORING (AUGUST 2011)
⊕ B-228	EXISTING BORING (1979)
⌖ D-914	EXISTING DMT TEST

REFERENCES:

CR34-0-SK-LF-716-0003	EXISTING LANDFILL 'PIGGYBACK' LOCATION - PLAN

300 0 300 600 900

GRAPHIC SCALE IN FEET

DRAWN BY LPC	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.J. MARTIN
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER R.J. MARTIN
PRELIMINARY STATUS DATE LDE F.M. WOOD 10/10/11	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
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A	09/26/11	LPC			FMW	FMW	ISSUED FOR REVIEW

CLASS III SOLID WASTE LANDFILL EXISTING LANDFILL GROUNDWATER SEPARATION PLAN

SCALE 1'=300'
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-SK-LF-716-0004
REV B

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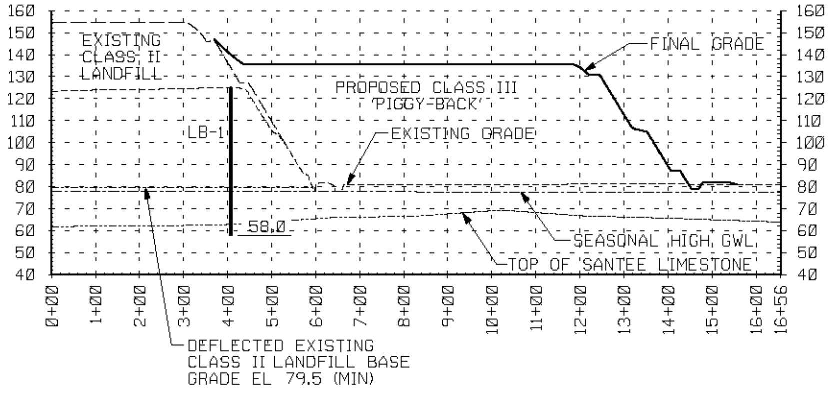
REFERENCES:

CR34-SK-LF-716-0003	EXISTING LANDFILL 'PIGGYBACK' LOCATION - PLAN



SECTION 1-1

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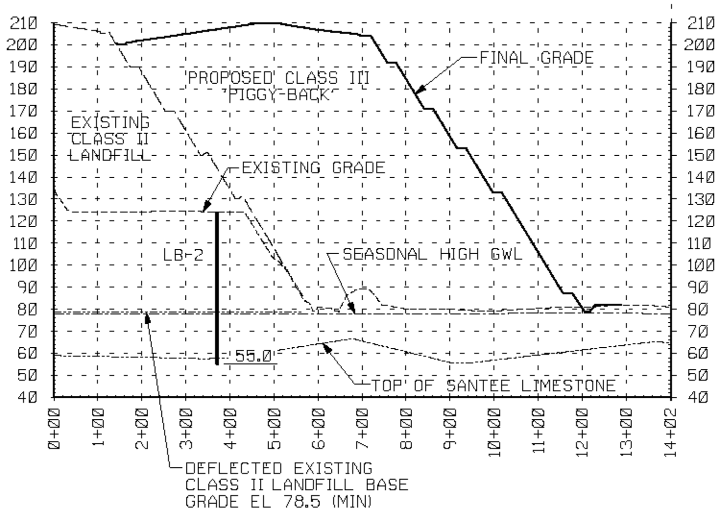
VERT: 1" = 40'



SECTION 2-2

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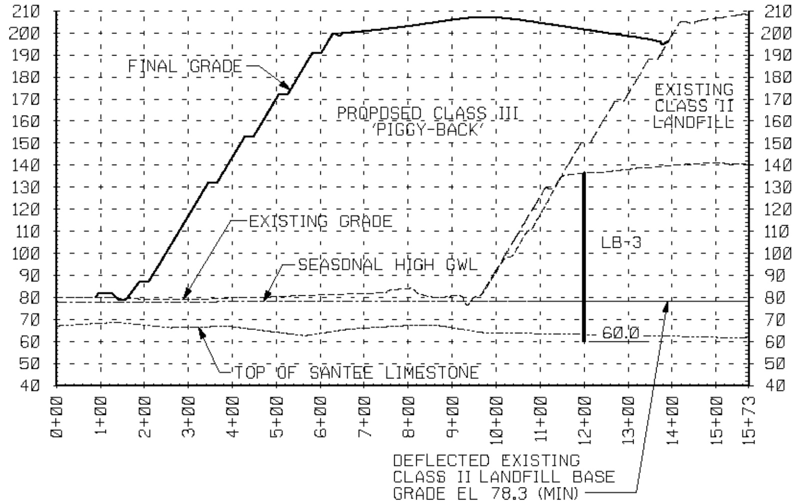

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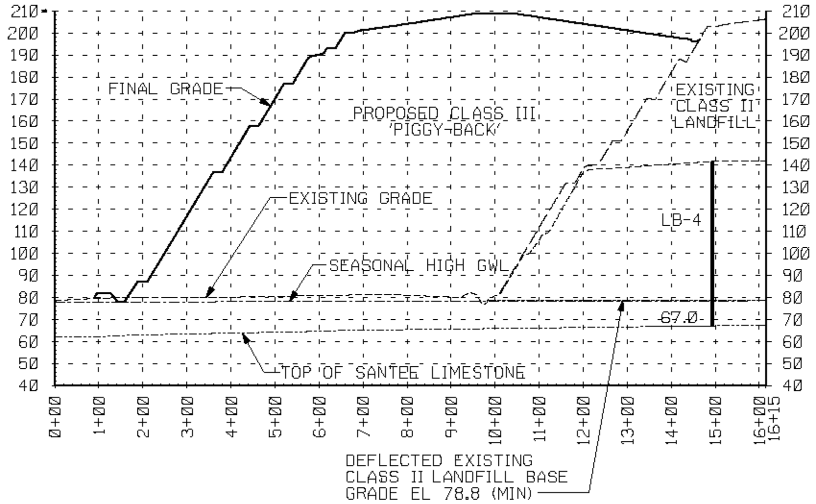

SECTION 4-4

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A	09/19/11	KPF		KPF	FMW	FMW	ISSUED FOR REVIEW

DRAWN BY SMF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.J. MARTIN
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER R.J. MARTIN

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EXISTING CLASS II SWLF
EXISTING LANDFILL 'PIGGYBACK'
LOCATION - CROSS SECTIONS

SCALE AS NOTED
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 10B008-01330
WORLEYPARSONS DWG. NO. CR34-0-SK-LF-719-0003
REV C

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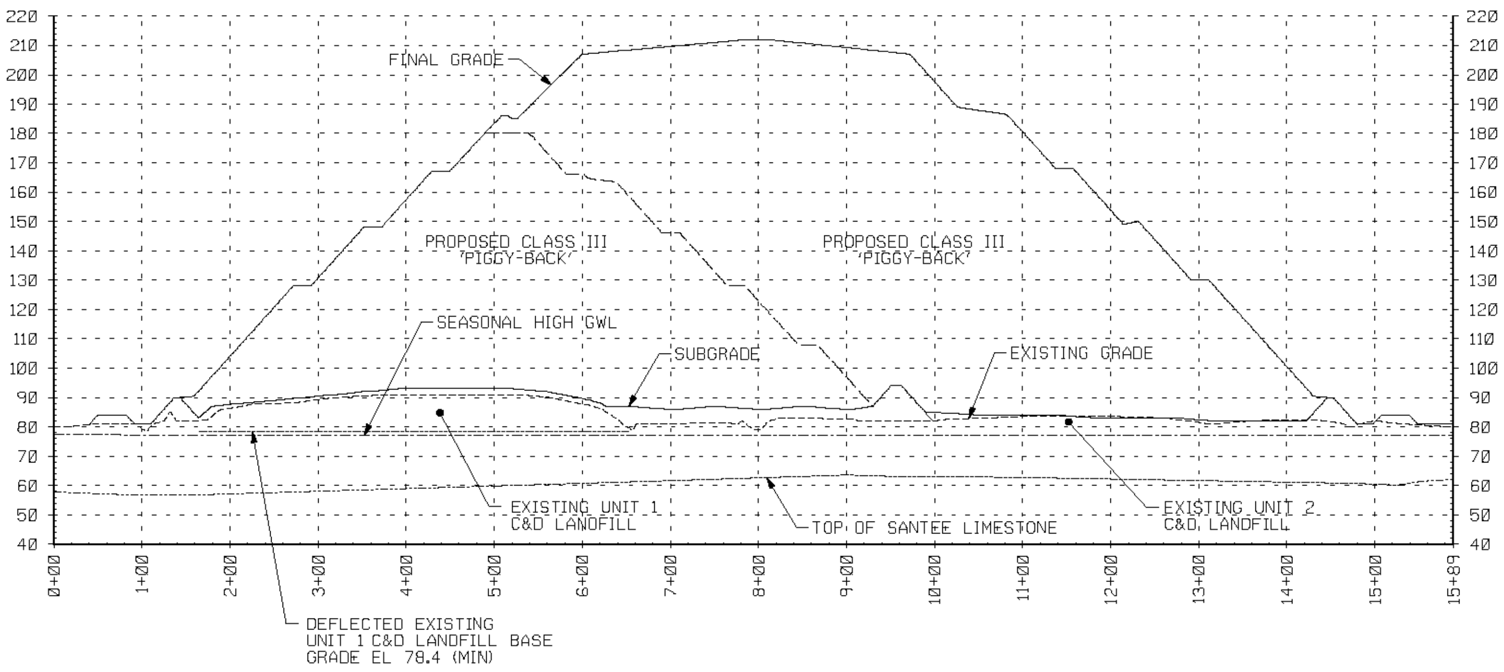
REFERENCES:

CR34-SK-LF-716-0003	EXISTING LANDFILL 'PIGGYBACK' LOCATION - PLAN



SECTION 5-5
SCALE: HORIZ: 1" = 100'
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CHECKED BY	PROJECT ENGINEERING MANAGER R.J. MARTIN
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER R.J. MARTIN
PRELIMINARY STATUS DATE LDE F.M. WOOD 10/10/11	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
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EXISTING CLASS II SWLF
EXISTING LANDFILL 'PIGGYBACK'
LOCATION - CROSS SECTION

SCALE AS NOTED	DRAWING SIZE ARCH D (36" x 24")	JOB NO. 10B008-01330
WORLEYPARSONS DWG. NO. CR34-0-SK-LF-719-0004		REV B

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APPENDIX B

Settlement Analysis Results

Existing SWLF Settlement - Generalized Soil Profile

2800	N/S Length of Landfill, ft
1200	E/W Width of Landfill, ft
3,360,000	Bearing Area, sq ft
212	Maximum Elevation of SWLF Expansion, ft
135	Top Elevation of Existing SWLF, ft
80	Bottom Elevation of SWLF, ft
100	Average Unit Weight of Existing Solid Waste pcf
90	Compacted Unit Weight of Solid Waste, pcf
5.5	Stress Increase at SWLF Base (due to existing load), ksf
6.93	Stress Increase at SWLF Base (due to additional load), ksf
90	Stress Redistribution Angle in Overburden, degrees
10	Stress Redistribution Angle in LS / BM, degrees

						Constrained Modulus		Constrained Modulus								
Layer	Desc	Top	Bottom	Midpoint	Thickness	Prior to Landfill Development		For Future Development		Stress	Stress Increase		Settlement to Date		Future Settlement	
		El	El	Depth		L Bound	U Bound	L Bound	U Bound	Ratio	to date	future	L Bound	U Bound	L Bound	U Bound
#		(ft)	(ft)	(ft)	(ft)	(ksf)	(ksf)	(ksf)	(ksf)		(ksf)	(ksf)	(ft)	(ft)	(ft)	(ft)
2	Firm SC / CL	80.0	72.0	4.0	8.0	1500	2500	2000	3000	1.00	5.50	6.93	0.018	0.029	0.018	0.028
3	Loose SM	72.0	63.0	12.5	9.0	300	500	400	600	1.00	5.50	6.93	0.099	0.165	0.104	0.156
4	VL SM / Soft CL	63.0	60.0	18.5	3.0	25	75	50	100	1.00	5.50	6.93	0.220	0.660	0.208	0.416
5	Weath LS	60.0	48.0	26.0	12.0	1500	7800	4650	11700	0.73	3.99	5.03	0.006	0.032	0.005	0.013
6	Hard LS	48.0	36.0	38.0	12.0	3100	13800	8450	20700	0.64	3.51	4.42	0.003	0.014	0.003	0.006
7	Soft LS	36.0	20.0	52.0	16.0	800	11200	6000	16800	0.55	3.05	3.84	0.004	0.061	0.004	0.010
8	Black Mingo	20.0	-30.0	85.0	50.0	1000	2600	1800	3900	0.41	2.27	2.86	0.044	0.113	0.037	0.079
9	Black Mingo	-30.0	-85.0	137.5	55.0	2200	4000	3100	6000	0.28	1.54	1.94	0.021	0.038	0.018	0.034
10	Black Mingo	-85.0	-285.0	265.0	200.0	5200	8600	6900	12900	0.14	0.76	0.95	0.018	0.029	0.015	0.028
													0.4	**1.1**	**0.4**	**0.8**

Existing SWLF Settlement - Boring LB-1

2800	N/S Length of Landfill, ft
1200	E/W Width of Landfill, ft
3,360,000	Bearing Area, sq ft
160	Maximum Elevation of SWLF Expansion, ft
126	Top Elevation of Existing SWLF, ft
80	Bottom Elevation of SWLF, ft
100	Average Unit Weight of Existing Solid Waste pcf
90	Compacted Unit Weight of Solid Waste, pcf
4.6	Stress Increase at SWLF Base (due to existing load), ksf
3.06	Stress Increase at SWLF Base (due to additional load), ksf
90	Stress Redistribution Angle in Overburden, degrees
10	Stress Redistribution Angle in LS / BM, degrees

Layer	Desc	Top	Bottom	Midpoint	Thickness	Constrained Modulus Prior to Landfill Development		Constrained Modulus For Future Development		Stress	Stress Increase		Settlement to Date		Future Settlement	
		El	El	Depth		L Bound	U Bound	L Bound	U Bound	Ratio	to date	future	L Bound	U Bound	L Bound	U Bound
#		(ft)	(ft)	(ft)	(ft)	(ksf)	(ksf)	(ksf)	(ksf)		(ksf)	(ksf)	(ft)	(ft)	(ft)	(ft)
1	Firm SC / CL	80.0	77.5	1.3	2.5	1500	2500	2000	3000	1.00	4.60	3.06	0.005	0.008	0.003	0.004
2	Sf/Sl CL	77.5	68.0	7.3	9.5	300	500	400	600	1.00	4.60	3.06	0.087	0.146	0.048	0.073
3	VL SC	68.0	58.0	17.0	10.0	100	200	150	250	1.00	4.60	3.06	0.230	0.460	0.122	0.204
4	Weath LS	58.0	48.0	27.0	10.0	1500	7800	4650	11700	0.72	3.30	2.20	0.004	0.022	0.002	0.005
5	Hard LS	48.0	36.0	38.0	12.0	3100	13800	8450	20700	0.64	2.93	1.95	0.003	0.011	0.001	0.003
6	Soft LS	36.0	20.0	52.0	16.0	800	11200	6000	16800	0.55	2.55	1.69	0.004	0.051	0.002	0.005
7	Black Mingo	20.0	-30.0	85.0	50.0	1000	2600	1800	3900	0.41	1.90	1.26	0.036	0.095	0.016	0.035
8	Black Mingo	-30.0	-85.0	137.5	55.0	2200	4000	3100	6000	0.28	1.28	0.85	0.018	0.032	0.008	0.015
9	Black Mingo	-85.0	-285.0	265.0	200.0	5200	8600	6900	12900	0.14	0.63	0.42	0.015	0.024	0.007	0.012
													0.4	**0.8**	**0.2**	**0.4**

Existing SWLF Settlement - Boring LB-2

2800	N/S Length of Landfill, ft
1200	E/W Width of Landfill, ft
3,360,000	Bearing Area, sq ft

207	Maximum Elevation of SWLF Expansion, ft
124	Top Elevation of Existing SWLF, ft
80	Bottom Elevation of SWLF, ft
100	Average Unit Weight of Existing Solid Waste pcf
90	Compacted Unit Weight of Solid Waste, pcf

4.4	Stress Increase at SWLF Base (due to existing load), ksf
7.47	Stress Increase at SWLF Base (due to additional load), ksf
90	Stress Redistribution Angle in Overburden, degrees
10	Stress Redistribution Angle in LS / BM, degrees

						Constrained Modulus		Constrained Modulus								
Layer	Desc	Top	Bottom	Midpoint	Thickness	Prior to Landfill Development		For Future Development		Stress	Stress Increase		Settlement to Date		Future Settlement	
		El	El	Depth		L Bound	U Bound	L Bound	U Bound	Ratio	to date	future	L Bound	U Bound	L Bound	U Bound
#		(ft)	(ft)	(ft)	(ft)	(ksf)	(ksf)	(ksf)	(ksf)		(ksf)	(ksf)	(ft)	(ft)	(ft)	(ft)
1	Firm SC / CL	80.0	72.0	4.0	8.0	1500	2500	2000	3000	1.00	4.40	7.47	0.014	0.023	0.020	0.030
2	MD SP-CL	72.0	61.0	13.5	11.0	300	500	400	600	1.00	4.40	7.47	0.097	0.161	0.137	0.205
3	Soft CL / ML	61.0	55.0	22.0	6.0	25	75	50	100	1.00	4.40	7.47	0.352	1.056	0.448	0.896
4	Weath LS	55.0	48.0	28.5	7.0	1500	7800	4650	11700	0.71	3.11	5.28	0.003	0.015	0.003	0.008
5	Hard LS	48.0	36.0	38.0	12.0	3100	13800	8450	20700	0.64	2.81	4.76	0.002	0.011	0.003	0.007
6	Soft LS	36.0	20.0	52.0	16.0	800	11200	6000	16800	0.55	2.44	4.14	0.003	0.049	0.004	0.011
7	Black Mingo	20.0	-30.0	85.0	50.0	1000	2600	1800	3900	0.41	1.81	3.08	0.035	0.091	0.040	0.086
8	Black Mingo	-30.0	-85.0	137.5	55.0	2200	4000	3100	6000	0.28	1.23	2.09	0.017	0.031	0.019	0.037
9	Black Mingo	-85.0	-285.0	265.0	200.0	5200	8600	6900	12900	0.14	0.61	1.03	0.014	0.023	0.016	0.030
													0.5	**1.5**	**0.7**	**1.3**

Existing SWLF Settlement - Boring LB-3

2800	N/S Length of Landfill, ft
1200	E/W Width of Landfill, ft
3,360,000	Bearing Area, sq ft

202	Maximum Elevation of SWLF Expansion, ft
136	Top Elevation of Existing SWLF, ft
79	Bottom Elevation of SWLF, ft
100	Average Unit Weight of Existing Solid Waste pcf
90	Compacted Unit Weight of Solid Waste, pcf

5.7	Stress Increase at SWLF Base (due to existing load), ksf
5.94	Stress Increase at SWLF Base (due to additional load), ksf
90	Stress Redistribution Angle in Overburden, degrees
10	Stress Redistribution Angle in LS / BM, degrees

Layer	Desc	Top	Bottom	Midpoint	Thickness	Constrained Modulus Prior to Landfill Development		Constrained Modulus For Future Development		Stress	Stress Increase		Settlement to Date		Future Settlement	
		El	El	Depth		L Bound	U Bound	L Bound	U Bound	Ratio	to date	future	L Bound	U Bound	L Bound	U Bound
#		(ft)	(ft)	(ft)	(ft)	(ksf)	(ksf)	(ksf)	(ksf)		(ksf)	(ksf)	(ft)	(ft)	(ft)	(ft)
1	V Stiff CL / SC	79.0	68.0	5.5	11.0	1500	2500	2000	3000	1.00	5.70	5.94	0.025	0.042	0.022	0.033
2	MD SP-CL	68.0	63.0	13.5	5.0	300	500	400	600	1.00	5.70	5.94	0.057	0.095	0.050	0.074
3	VL SP *	63.0	60.0	17.5	3.0	25	75	300	500	1.00	5.70	5.94	0.228	0.684	0.036	0.059
4	Weath LS	60.0	48.0	25.0	12.0	1500	7800	4650	11700	0.73	4.19	4.36	0.006	0.033	0.004	0.011
5	Hard LS	48.0	36.0	37.0	12.0	3100	13800	8450	20700	0.64	3.67	3.83	0.003	0.014	0.002	0.005
6	Soft LS	36.0	20.0	51.0	16.0	800	11200	6000	16800	0.56	3.19	3.32	0.005	0.064	0.003	0.009
7	Black Mingo	20.0	-30.0	84.0	50.0	1000	2600	1800	3900	0.42	2.37	2.47	0.046	0.119	0.032	0.069
8	Black Mingo	-30.0	-85.0	136.5	55.0	2200	4000	3100	6000	0.28	1.60	1.67	0.022	0.040	0.015	0.030
9	Black Mingo	-85.0	-285.0	264.0	200.0	5200	8600	6900	12900	0.14	0.79	0.82	0.018	0.030	0.013	0.024
													0.4	**1.1**	**0.2**	**0.3**

Existing SWLF Settlement - Boring LB-4

2800	N/S Length of Landfill, ft
1200	E/W Width of Landfill, ft
3,360,000	Bearing Area, sq ft

203	Maximum Elevation of SWLF Expansion, ft
142	Top Elevation of Existing SWLF, ft
79	Bottom Elevation of SWLF, ft
100	Average Unit Weight of Existing Solid Waste pcf
90	Compacted Unit Weight of Solid Waste, pcf

6.3	Stress Increase at SWLF Base (due to existing load), ksf
5.49	Stress Increase at SWLF Base (due to additional load), ksf
90	Stress Redistribution Angle in Overburden, degrees
10	Stress Redistribution Angle in LS / BM, degrees

						Constrained Modulus		Constrained Modulus								
Layer	Desc	Top	Bottom	Midpoint	Thickness	Prior to Landfill Development		For Future Development		Stress	Stress Increase		Settlement to Date		Future Settlement	
		El	El	Depth		L Bound	U Bound	L Bound	U Bound	Ratio	to date	future	L Bound	U Bound	L Bound	U Bound
#		(ft)	(ft)	(ft)	(ft)	(ksf)	(ksf)	(ksf)	(ksf)		(ksf)	(ksf)	(ft)	(ft)	(ft)	(ft)
1	V Stiff CL / SC	79.0	74.0	2.5	5.0	1500	2500	2000	3000	1.00	6.30	5.49	0.013	0.021	0.009	0.014
2	MD SP-CL	74.0	64.0	10.0	10.0	300	500	400	600	1.00	6.30	5.49	0.126	0.210	0.092	0.137
3	VL SP *	64.0	60.0	17.0	4.0	25	75	300	500	1.00	6.30	5.49	0.336	1.008	0.044	0.073
4	Weath LS	60.0	48.0	25.0	12.0	1500	7800	4650	11700	0.73	4.63	4.03	0.007	0.037	0.004	0.010
5	Hard LS	48.0	36.0	37.0	12.0	3100	13800	8450	20700	0.64	4.06	3.54	0.004	0.016	0.002	0.005
6	Soft LS	36.0	20.0	51.0	16.0	800	11200	6000	16800	0.56	3.52	3.07	0.005	0.070	0.003	0.008
7	Black Mingo	20.0	-30.0	84.0	50.0	1000	2600	1800	3900	0.42	2.62	2.28	0.050	0.131	0.029	0.063
8	Black Mingo	-30.0	-85.0	136.5	55.0	2200	4000	3100	6000	0.28	1.77	1.54	0.024	0.044	0.014	0.027
9	Black Mingo	-85.0	-285.0	264.0	200.0	5200	8600	6900	12900	0.14	0.87	0.76	0.020	0.033	0.012	0.022
													0.6	**1.6**	**0.2**	**0.4**

Existing C&D Landfill Settlement

1700	N/S Length of Landfill, ft
1200	E/W Width of Landfill, ft
2,040,000	Bearing Area, sq ft

West D-914	East D-915	South D-916	
130	210	160	Avg Max Elevation of Area 2, ft
80.5	80.5	80.5	Bottom Elevation of SWLF, ft
90	90	90	Compacted Unit Weight of Solid Waste, pcf
4.455	11.655	7.155	Stress Increase at SWLF Base (due to additional load), ksf

90	Stress Redistribution Angle in Overburden, degrees
10	Stress Redistribution Angle in LS / BM, degrees

West End of Unit 1 C&D / D-914

						Constrained Modulus					
Layer	Desc	Top	Bottom	Midpoint	Thickness	Prior to Landfill Development		Stress	tress Increas	ture Settlement	
		El	El	Depth		L Bound	U Bound	Ratio	future	L Bound	U Bound
#		(ft)	(ft)	(ft)	(ft)	(ksf)	(ksf)		(ksf)	(ft)	(ft)
1	D Sandy Silt	80.5	75.0	2.8	5.5	1800.00	1800.00	1.00	4.46	0.014	0.014
2	MD Sands	75.0	66.0	10.0	9.0	600.00	600.00	1.00	4.46	0.067	0.067
3	VL SM	66.0	58.0	18.5	8.0	25.00	75.00	1.00	4.46	0.475	1.426
4	Weath LS	58.0	50.0	26.5	8.0	1500	7800	0.68	3.03	0.003	0.016
5	Hard LS	50.0	25.0	43.0	25.0	3100	13800	0.55	2.46	0.004	0.020
6	Soft LS	25.0	10.0	63.0	15.0	800	11200	0.44	1.97	0.003	0.037
7	Black Mingo	10.0	-30.0	90.5	40.0	1000	2600	0.34	1.50	0.023	0.060
8	Black Mingo	-30.0	-85.0	138.0	55.0	2200	4000	0.23	1.01	0.014	0.025
9	Black Mingo	-85.0	-285.0	265.5	200.0	5200	8600	0.10	0.46	0.011	0.018
										0.6	1.7

East End of Unit 1 C&D / North End of Unit 2 C&D / D-915

						Constrained Modulus					
Layer	Desc	Top	Bottom	Midpoint	Thickness	Prior to Landfill Development		Stress	tress Increas	ture Settlement	
		El	El	Depth		L Bound	U Bound	Ratio	future	L Bound	U Bound
#		(ft)	(ft)	(ft)	(ft)	(ksf)	(ksf)		(ksf)	(ft)	(ft)
1	MD Sands	80.5	79.0	0.8	1.5	850	850	1.00	11.66	0.021	0.021
2	MD Silts	79.0	69.0	6.5	10.0	500	500	1.00	11.66	0.233	0.233
3	L Silty Sand	69.0	62.0	15.0	7.0	300	300	1.00	11.66	0.272	0.272
4	Weath LS	62.0	50.0	24.5	12.0	1500	7800	0.70	8.13	0.013	0.065
5	Hard LS	50.0	25.0	43.0	25.0	3100	13800	0.55	6.44	0.012	0.052
6	Soft LS	25.0	10.0	63.0	15.0	800	11200	0.44	5.14	0.007	0.096
7	Black Mingo	10.0	-30.0	90.5	40.0	1000	2600	0.34	3.92	0.060	0.157
8	Black Mingo	-30.0	-85.0	138.0	55.0	2200	4000	0.23	2.63	0.036	0.066
9	Black Mingo	-85.0	-285.0	265.5	200.0	5200	8600	0.10	1.20	0.028	0.046
										0.7	1.0

South End of Unit 2 C&D / D-916

						Constrained Modulus					
Layer	Desc	Top	Bottom	Midpoint	Thickness	Prior to Landfill Development		Stress	tress Increas	ture Settlement	
		El	El	Depth		L Bound	U Bound	Ratio	future	L Bound	U Bound
#		(ft)	(ft)	(ft)	(ft)	(ksf)	(ksf)		(ksf)	(ft)	(ft)
1	L ML	80.5	79.0	0.8	1.5	150	150	1.00	7.16	0.072	0.072
2	MD ML	79.0	69.0	6.5	10.0	300	300	1.00	7.16	0.239	0.239
3	L ML	69.0	62.0	15.0	7.0	80	80	1.00	7.16	0.626	0.626
4	Weath LS	62.0	50.0	24.5	12.0	1500	7800	0.70	4.99	0.008	0.040
5	Hard LS	50.0	25.0	43.0	25.0	3100	13800	0.55	3.95	0.007	0.032
6	Soft LS	25.0	10.0	63.0	15.0	800	11200	0.44	3.16	0.004	0.059
7	Black Mingo	10.0	-30.0	90.5	40.0	1000	2600	0.34	2.40	0.037	0.096
8	Black Mingo	-30.0	-85.0	138.0	55.0	2200	4000	0.23	1.62	0.022	0.040
9	Black Mingo	-85.0	-285.0	265.5	200.0	5200	8600	0.10	0.74	0.017	0.028
										1.0	1.2

SANTEE COOPER CROSS GENERATING STATION
CLASS TWO SOLID WASTE LANDFILL CLOSURE PLAN

NOTES:

1. ALL CLOSURE ACTIVITIES WILL BE PERFORMED IN ACCORDANCE WITH A DETAILED SET OF CONSTRUCTION DRAWINGS WITH CONTROL POINTS BASED ON THE APPROVED CLOSURE PLAN AND SURVEY DATA OBTAINED PRIOR TO CLOSURE.

VICINITY PLAN

DRAWING INDEX

CR34-0-DW-LF-716-0100	COVER SHEET
CR34-0-DW-LF-716-0101	CLOSURE PLAN - OVERALL SITE LAYOUT
CR34-0-DW-LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
CR34-0-DW-LF-716-0111	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
CR34-0-DW-LF-716-0112	CLOSURE PLAN - PHASE 1
CR34-0-DW-LF-716-0113	CLOSURE PLAN - PHASE 2
CR34-0-DW-LF-716-0114	CLOSURE PLAN - PHASE 3
CR34-0-DW-LF-716-0115	CLOSURE PLAN - PHASE 4
CR34-0-DW-LF-716-0116	CLOSURE PLAN - PHASE 5
CR34-0-DW-LF-716-0117	CLOSURE PLAN - PHASE 6
CR34-0-DW-LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
CR34-0-DW-LF-716-0119	CLOSURE PLAN - FINAL GRADING PLAN
CR34-0-DW-LF-719-0100	EXISTING, PHASING, AND FINAL GRADE - CROSS SECTIONS
CR34-0-DW-LF-719-0101	EXISTING, PHASING, AND FINAL GRADE - CROSS SECTIONS
CR34-0-DW-LF-719-0103	FINAL COVER - SECTIONS AND DETAILS
CR34-0-DW-LF-719-0108	NORTH DOWNDRAIN - SECTIONS AND DETAILS
CR34-0-DW-LF-719-0109	SOUTH DOWNDRAIN - SECTIONS AND DETAILS
CR34-0-DW-LF-719-0110	DOWNDRAIN - SECTIONS AND DETAILS

REV	DATE		DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER
C	02/25/13	ISSUED FOR REVIEW	JGM	RES	KPF	FMW	FMW
B	02/06/13	ISSUED FOR REVIEW	JGM	RES	KPF	FMW	FMW
A	01/11/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW

DRAWN BY JGM	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER

PRELIMINARY STATUS DATE
LDE F.M. WOOD 02/25/13
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS DATE
LDE
REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA WORLEY PARSONS GROUP INC. No. 1505 CERTIFICATE OF AUTHORIZATION

PROFESSIONAL ENGINEER'S SEAL

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
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LIC. NO.: ________ DATE: ______

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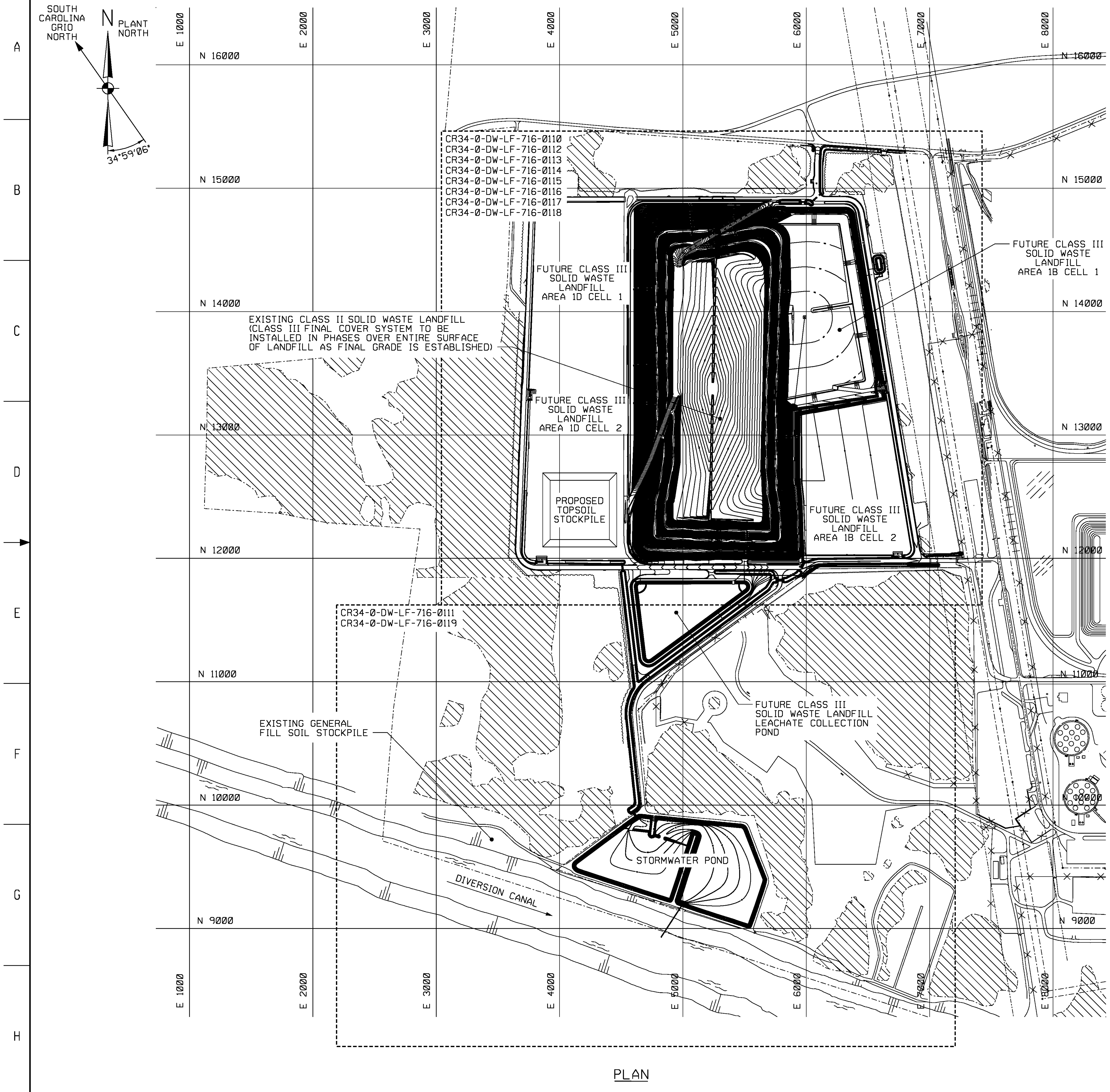
CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
COVER SHEET

SCALE NONE
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0100
REV C



PLAN

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. PROPOSED FUTURE CLASS III SOLID WASTE LANDFILL FACILITIES ARE SHOWN FOR REFERENCE ONLY. SOME OF THESE FACILITIES WILL BE INSTALLED CONCURRENTLY WITH CLASS II CLOSURE ACTIVITIES.

LEGEND:

- - - - - - - -	DRAWING LIMITS
▨	WETLAND AREA LIMITS

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITION PLAN
LF-716-0111	CLOSURE PLAN - EXISTING CONDITION PLAN
LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-716-0119	CLOSURE PLAN - FINAL GRADING PLAN

400 0 400 800 1200
SCALE IN FEET

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL

SOUTH CAROLINA WORLEY PARSONS GROUP INC. No. 1505 CERTIFICATE OF AUTHORIZATION

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CROSS GENERATING STATION

Santee Cooper SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
OVERALL SITE LAYOUT

SCALE	DRAWING SIZE	JOB NO.
1"=400'	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0101 REV B

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
A	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW

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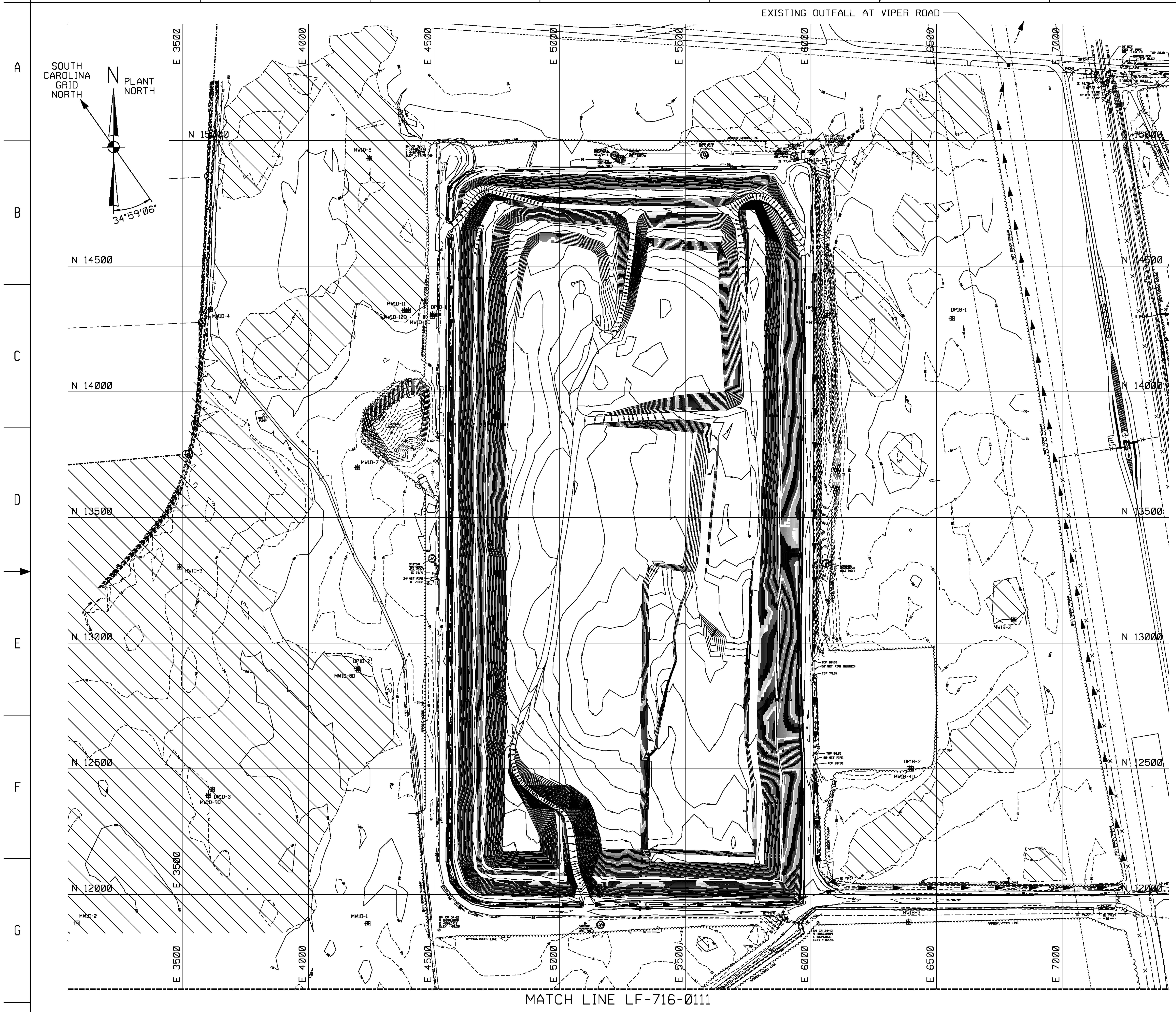

PLAN

SCALE:1"=200'

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY WITHIN LANDFILL IS BASED ON A SURVEY PERFORMED BY SANTEE COOPER, SOUTH CAROLINA PUBLIC SERVICE AUTHORITY, ONE RIVERWOOD DRIVE, MONCKS CORNER, SC DATED 05/24/12 AND OUTSIDE THE LANDFILL BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.
4. EXISTING CONTOURS REPRESENT TOP OF SOIL COVER ON SLOPES AND TOP OF WASTE AT TOP OF EXISTING LANDFILL.
5. ALL CONTACT WATER FLOWS TOWARDS EXISTING OUTFALL AT VIPER ROAD.

REFERENCES:

LF-716-0111	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN

200 0 200 400 600

SCALE IN FEET

LEGEND:

====80====	EXISTING CONTOURS
-·-►-·-►-·-	CONTACT WATER FLOW PATH
-··-··-··-	PROPERTY BOUNDARY
▨	WETLAND AREA LIMITS

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
WORLEY PARSONS GROUP INC. No. 1505	
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CROSS GENERATING STATION

Santee Cooper **SOUTH CAROLINA PUBLIC SERVICE AUTHORITY**

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
EXISTING CONDITIONS SITE PLAN

SCALE	DRAWING SIZE	JOB NO.
1"=200'	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO.	REV
CR34-0-DW-LF-716-0110	C

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
C	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW

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NOTES:

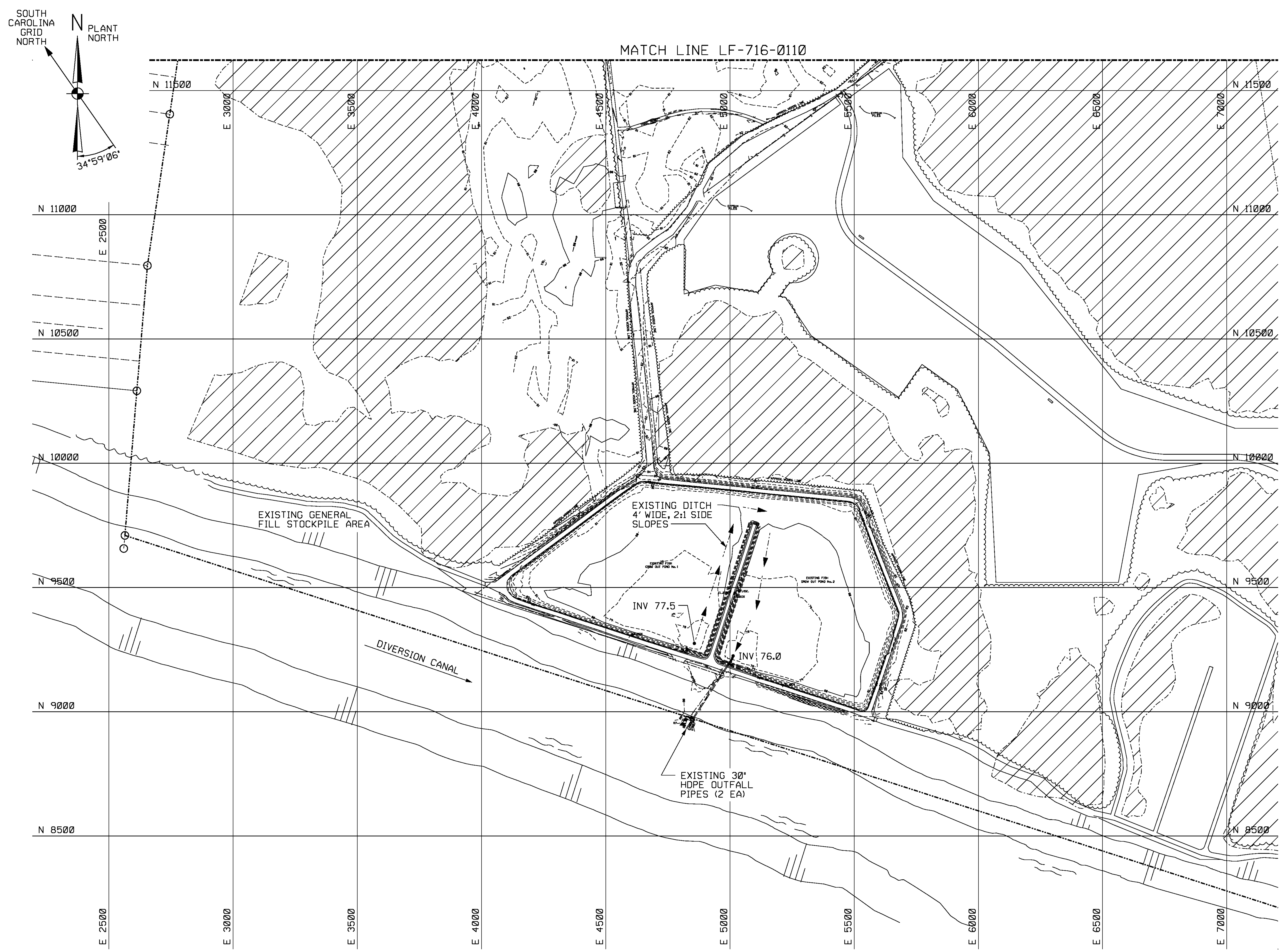
1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.

LEGEND:

===== 80 =====	EXISTING CONTOURS
-·-·-·-·-·-·-	PROPERTY BOUNDARY
▨	WETLAND AREA LIMITS

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0019	CLOSURE PLAN - FINAL GRADING PLAN



PLAN

SCALE:1"=200'

200 0 200 400 600

SCALE IN FEET

ISSUED FOR REVIEW	C	11/25/14	KPF	FMW	KPF	FMW	FMW
ISSUED FOR REVIEW	B	02/06/13	KPF	RES	KPF	FMW	FMW
ISSUED FOR REVIEW	A	01/11/13	KPF	RES	KPF	FMW	FMW
	REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
WORLEY PARSONS GROUP INC. No. 1505	
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CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA
PUBLIC SERVICE
AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
EXISTING CONDITIONS SITE PLAN

SCALE	DRAWING SIZE	JOB NO.
1"=200'	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO.	REV
CR34-0-DW-LF-716-0111	C

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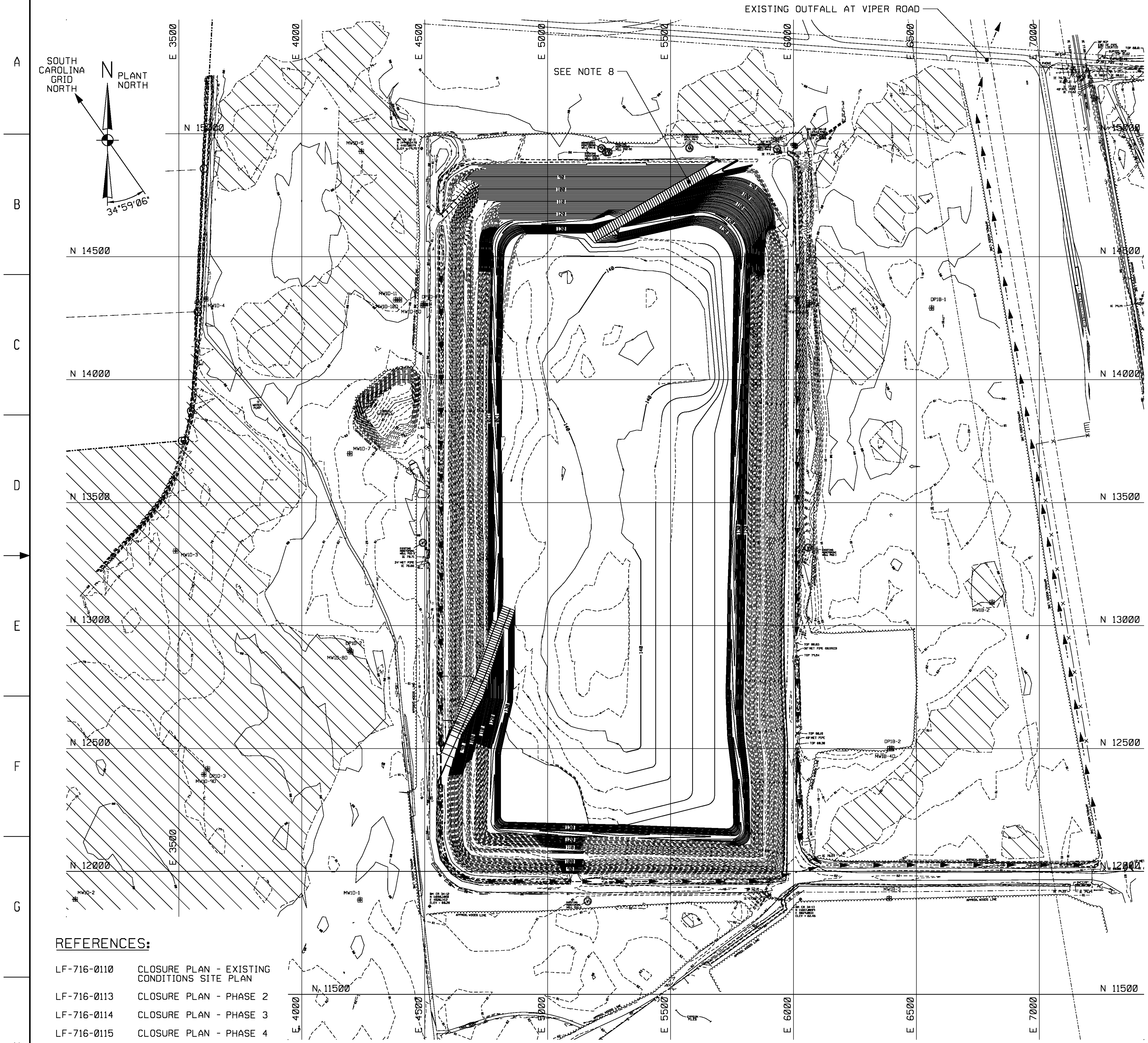

PLAN
SCALE:1"=200'

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY WITHIN LANDFILL IS BASED ON A SURVEY PERFORMED BY SANTEE COOPER, SOUTH CAROLINA PUBLIC SERVICE AUTHORITY, ONE RIVERWOOD DRIVE, MONCKS CORNER, SC DATED 05/24/12 AND OUTSIDE THE LANDFILL BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.
4. EXISTING CONTOURS REPRESENT TOP OF SOIL COVER ON SLOPES AND TOP OF WASTE AT TOP OF EXISTING LANDFILL.
5. ALL CONTACT WATER FLOWS TOWARDS EXISTING OUTFALL AT VIPER ROAD.
6. INTERIM COVER SHALL BE PLACED ON ALL SLOPES AS BENCH CONSTRUCTION PROGRESSES. INTERIM COVER INCLUDES LOCKDOWN CHEMICALS APPROVED FOR THIS USE BY SCDHEC OR 6 INCHES (MIN) OF CLEAN SOIL PLUS VEGETATION.
7. INTERIM PHASING DATES AND SEQUENCING MAY BE ADJUSTED AS CONTRACT SCOPES AND SCHEDULES ARE DEVELOPED.
8. ROUGH GRADING OF NORTH RAMP TO BE COMPLETED DURING PHASE 2 (CLOSURE CONTRACT SCOPE) TO COINCIDE WITH DOWNDRAIN INSTALLATION. EXISTING RAMP AT NORTHEAST CORNER OF LANDFILL (NOT SHOWN) USED DURING NORTH RAMP INSTALLATION.

LEGEND:

- - - 80 - - -	EXISTING CONTOURS
═══ 80 ═══	NEW CONTOURS
-·➤-·➤-·➤	CONTACT WATER FLOW PATH

200 0 200 400 600
SCALE IN FEET

PHASE 1:

WASTE PLACEMENT: JUL THROUGH DEC 2012

- ESTABLISH ROUGH GRADES FOR WEST RAMP
- FILL EXISTING SOUTH RAMP
- BEGIN FILLING LOW AREAS ON EASTERN SIDE OF LANDFILL TO ESTABLISH ROUGH GRADES OF FIRST BENCH AROUND LANDFILL

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
D	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW
C	02/14/13	JGM	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER

PRELIMINARY STATUS	DATE	
LDE F.M. WOOD	11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS	**DATE**	
LDE		REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

CERTIFICATE OF AUTHORIZATION

WORLEY PARSONS GROUP INC. No. 1505

PROFESSIONAL ENGINEER'S SEAL

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LIC. NO.:________ DATE:______

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Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
PHASE 1

SCALE	DRAWING SIZE	JOB NO.
1"=200'	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO.	REV
CR34-0-DW-LF-716-0112	D

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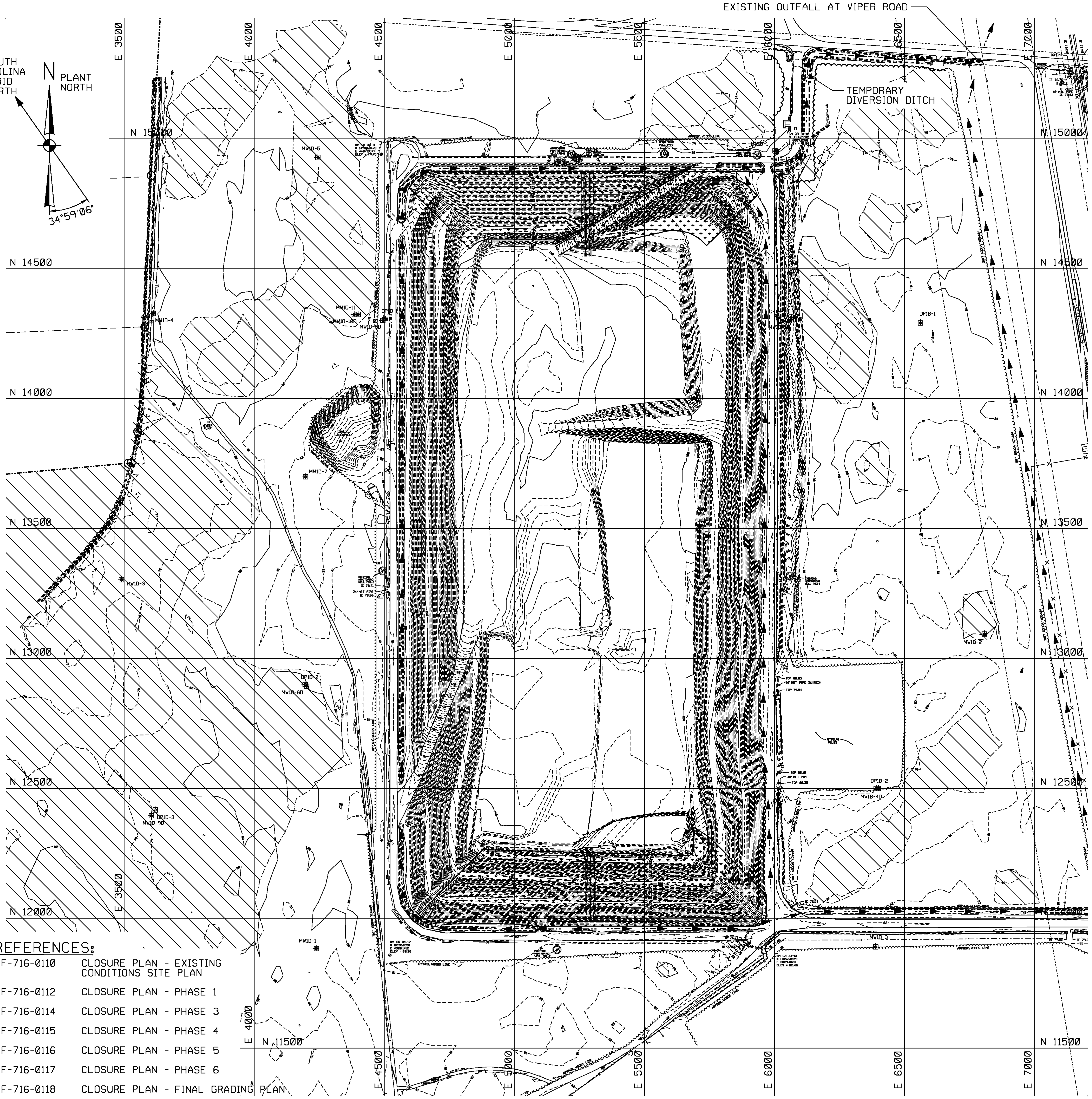

PLAN

SCALE:1"=200'

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY WITHIN LANDFILL IS BASED ON A SURVEY PERFORMED BY SANTEE COOPER, SOUTH CAROLINA PUBLIC SERVICE AUTHORITY, ONE RIVERWOOD DRIVE, MONCKS CORNER, SC DATED 06/25/13 AND OUTSIDE THE LANDFILL BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.
4. ALL CONTACT WATER FLOWS TOWARDS EXISTING OUTFALL AT VIPER ROAD.
5. INTERIM COVER SHALL BE PLACED ON ALL SLOPES AS BENCH CONSTRUCTION PROGRESSES. INTERIM COVER INCLUDES LOCKDOWN CHEMICALS APPROVED FOR THIS USE BY SCDHEC OR 6 INCHES (MIN) OF CLEAN SOIL PLUS VEGETATION.
6. INTERIM PHASING DATES AND SEQUENCING MAY BE ADJUSTED AS CONTRACT SCOPES AND SCHEDULES ARE DEVELOPED.
7. FOLLOWING CLOSURE OF PHASE 2 (AND WITHIN 30 DAYS OF COMPLETION OF GRADING AND SEEDING ACTIVITIES), SANTEE COOPER WILL SUBMIT A CERTIFICATION TO SCDHEC THAT PHASE 2 CLOSURE ACTIVITIES HAVE BEEN COMPLETED IN ACCORDANCE WITH THE CLOSURE PLAN. THE CERTIFICATION WILL BE SIGNED AND SEALED BY AN ENGINEER REGISTERED IN THE STATE OF SOUTH CAROLINA. A COPY OF THE CERTIFICATION WILL BE KEPT ON FILE IN THE FACILITY OPERATING RECORD.

LEGEND:

======80======	EXISTING CONTOURS
══════80══════	NEW CONTOURS
- - - - - - - -	NEW DOWNDRAIN PIPE
··–► ··–► ··–►	CONTACT WATER FLOW PATH
⁘	SOIL FINAL COVER SYSTEM (SCDHEC 258.60.a OR b)

200 0 200 400 600

SCALE IN FEET

PHASE 2:

WASTE PLACEMENT: JAN THROUGH SEP 2013

- FILL UP TO APPROXIMATELY EL 140-150 OVER ENTIRE LANDFILL
- ESTABLISH ROUGH GRADES OF SECOND BENCH OVER SOUTH FACE OF LANDFILL
- USE WEST RAMP TO HAUL WASTE DURING FINAL CLOSURE OF NORTH SLOPE

CLASS TWO CLOSURE CONTRACT: MAY THROUGH AUG 2013

- INSTALL E&S MEASURES AND DIVERSION DITCH DRAINING CONTACT WATER TOWARDS VIPER ROAD. MODIFY PERIMETER DITCH SYSTEM TO ALLOW FLOW TO NORTH.
- INSTALL NORTH ACCESS ROAD FROM VIPER ROAD AND ROAD NORTH OF EXISTING LANDFILL
- INSTALL DOWNDRAINS UP THROUGH BENCH 1 ON NORTH SLOPE - SEE DWG LF-719-0108, AND INSTALL SOIL FINAL COVER UP THROUGH BENCH 1 ON NORTH SLOPE - SEE DWG LF-719-0103
- INSTALL DOWNDRAINS UP THROUGH BENCH 2 ON SOUTH SLOPE - SEE DWG LF-719-0109, AND INSTALL SOIL FINAL COVER UP THROUGH BENCH 2 ON SOUTH SLOPE - SEE DWG LF-719-0103
- EXCAVATE CLASS THREE STORMWATER POND (SEE DWG LF-716-0119) IN PARALLEL WITH PHASE 2 FINAL COVER INSTALLATION. NO CLASS THREE AREAS OR WETLAND AREAS DISTURBED PRIOR TO RECEIPT OF FINAL CLASS THREE SOLID WASTE LANDFILL PERMIT. SOIL FROM POND EXCAVATION USED AS FINAL COVER MATERIAL AFTER QUALIFICATION WITH TEST PAD AREA

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-716-0119	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS
LF-719-0108	NORTH DOWNDRAIN - SECTIONS AND DETAILS
LF-719-0109	SOUTH DOWNDRAIN - SECTIONS AND DETAILS

REV	DATE		DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER
D	11/25/14	ISSUED FOR REVIEW	KPF	FMW	KPF	FMW	FMW
C	02/14/13	ISSUED FOR REVIEW	JGM	RES	KPF	FMW	FMW
B	02/06/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
A	01/11/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW

DRAWN BY
KPF
CHECKED BY

ENGINEER
F.M. WOOD
PROJECT ENGINEERING MANAGER
R.E. SKIPTUNAS

LEAD DESIGNER
K.P. FEEG
PROJECT MANAGER
D.F. BECKER

PRELIMINARY STATUS DATE
LDE F.M. WOOD 11/25/14
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS DATE
LDE
REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

CERTIFICATE OF AUTHORIZATION
WORLEY PARSONS GROUP INC. No. 1505

PROFESSIONAL ENGINEER'S SEAL

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LIC. NO. ________ DATE: ______

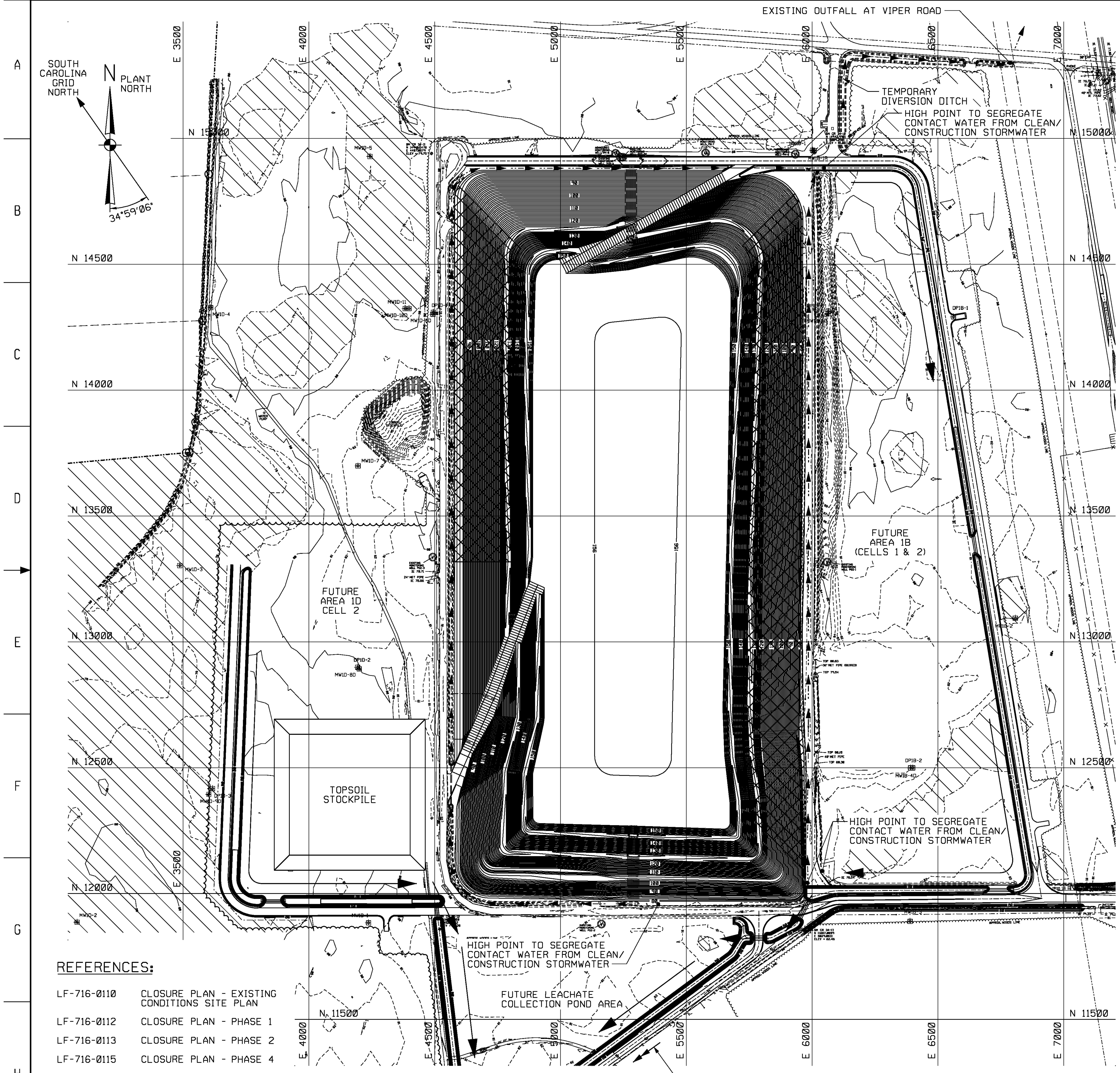
CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
PHASE 2

SCALE 1"=200'
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0113
REV D



PLAN

SCALE:1"=200'

LEGEND:

═ ═ ═ 80 ═ ═ ═	EXISTING CONTOURS
═══ 80 ═══	NEW CONTOURS
— — — — —	EXISTING DOWNDRAIN PIPE
- · ► - · ► - ·	CONTACT WATER FLOW PATH
───►	CLEAN OR CONSTRUCTION STORMWATER
▨	GCL/EXPOSED MEMBRANE (SCDHEC 258.60.b)

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.
4. ALL CONTACT WATER FLOWS TOWARDS EXISTING OUTFALL AT VIPER ROAD. ONLY CLEAN AND CONSTRUCTION STORMWATER FLOW THROUGH STORMWATER POND (NOT SHOWN) AND INTO DIVERSION CANAL.
5. INTERIM COVER SHALL BE PLACED ON ALL SLOPES AS BENCH CONSTRUCTION PROGRESSES. INTERIM COVER INCLUDES LOCKDOWN CHEMICALS APPROVED FOR THIS USE BY SCDHEC OR 6 INCHES (MIN) OF CLEAN SOIL PLUS VEGETATION.
6. INTERIM PHASING DATES AND SEQUENCING MAY BE ADJUSTED AS CONTRACT SCOPES AND SCHEDULES ARE DEVELOPED.
7. FOLLOWING CLOSURE OF PHASE 3, SANTEE COOPER WILL SUBMIT A CERTIFICATION TO SCDHEC THAT PHASE 3 CLOSURE ACTIVITIES HAVE BEEN COMPLETED IN ACCORDANCE WITH THE CLOSURE PLAN. THE CERTIFICATION WILL BE SIGNED AND SEALED BY AN ENGINEER REGISTERED IN THE STATE OF SOUTH CAROLINA. A COPY OF THE CERTIFICATION WILL BE KEPT ON FILE IN THE FACILITY OPERATING RECORD.

PHASE 3:

WASTE PLACEMENT: OCT 2013 THROUGH MAY 2014

- FILL TO APPROXIMATELY EL 150 OVER ENTIRE LANDFILL
- ESTABLISH ROUGH GRADES OF SECOND BENCH OVER ENTIRE LANDFILL

CLASS TWO CLOSURE CONTRACT: OCT 2013 THROUGH SEP 2014

- STRIP TOPSOIL AND INSTALL GCL/FLEXIBLE MEMBRANE FINAL COVER UP THROUGH BENCH 1 ON EAST SIDE OF LANDFILL (SOUTH OF BENCH 1 HIGH POINT). REGRADE BENCH 1 TO PROVIDE LONGITUDINAL DRAINAGE TOWARDS SOUTH END DOWNDRAINS - SEE DWG LF-719-0103 (BY JAN 2013)
- STRIP TOPSOIL AND INSTALL GCL/FLEXIBLE MEMBRANE FINAL COVER UP THROUGH BENCH 1 ON EAST SIDE OF LANDFILL (NORTH OF BENCH 1 HIGH POINT). REGRADE BENCH 1 TO PROVIDE LONGITUDINAL DRAINAGE TOWARDS NORTH END DOWNDRAINS - SEE DWG LF-719-0103 (BY APR 2014)
- STRIP TOPSOIL AND INSTALL GCL/FLEXIBLE MEMBRANE FINAL COVER UP THROUGH BENCH 1 ON WEST SIDE OF LANDFILL (NORTH OF BENCH 1 HIGH POINT). REGRADE BENCH 1 TO PROVIDE LONGITUDINAL DRAINAGE TOWARDS NORTH END DOWNDRAINS - SEE DWG LF-719-0103 (BY SEP 2014)

CLASS THREE CONTRACT(S): SUMMER 2013 THROUGH APR 2014

- INSTALL DITCHES AND ROADS FROM STORMWATER POND UP TO AND AROUND AREA 1B (CELLS 1 AND 2) AND AREA 1D (CELL 2)
- CLEAR AND GRUB SOIL STOCKPILE AREA IN AREA 1D CELL 2
- CLEAR AND GRUB (AND STRIP TOPSOIL) WITHIN AREA 1B (CELLS 1 AND 2). MAINTAIN SEGREGATION BETWEEN CONTACT WATER AND CONSTRUCTION STORMWATER ALONG EAST SIDE OF EXISTING LANDFILL
- CLEAR AND GRUB LEACHATE COLLECTION POND AREA
- INSTALL EARTHQUAKE DRAINS WITHIN AREA 1B CELL 1 (NOT SHOWN)
- COMPACT FILL WITHIN AREA 1B (CELLS 1 AND 2) AND GRADE TO DRAIN AT APPROXIMATE FUTURE BASE REINFORCEMENT ELEVATION (NOT SHOWN)

200 0 200 400 600
SCALE IN FEET

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS

DRAWN BY	ENGINEER
KPF	F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER
	R.E. SKIPTUNAS
LEAD DESIGNER	PROJECT MANAGER
K.P. FEEG	D.F. BECKER

PRELIMINARY STATUS	DATE	
LDE F.M. WOOD	11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS	DATE	
LDE		REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

CERTIFICATE OF AUTHORIZATION

WORLEY PARSONS GROUP INC. No. 1505

PROFESSIONAL ENGINEER'S SEAL

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PE: __________ STATE: ______
LIC. NO.: __________ DATE: ______

CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

REV		DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER
E	ISSUED FOR REVIEW	11/25/14	KPF	FMW	KPF	FMW	FMW
D	ISSUED FOR REVIEW	02/18/13	KPF	RES	KPF	FMW	FMW
C	ISSUED FOR REVIEW	02/14/13	JGM	RES	KPF	FMW	FMW
B	ISSUED FOR REVIEW	02/06/13	KPF	RES	KPF	FMW	FMW
A	ISSUED FOR REVIEW	01/11/13	KPF	RES	KPF	FMW	FMW

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
PHASE 3

SCALE	DRAWING SIZE	JOB NO.
1"=200'	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0114
REV E

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PLAN
SCALE:1"=200'

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS
LF-719-0109	SOUTH DOWNDRAIN - SECTIONS AND DETAILS

LEGEND:

====80====	EXISTING CONTOURS
━━80━━	NEW CONTOURS
– – – – –	EXISTING DOWNDRAIN PIPE
━ ━ ━ ━	NEW DOWNDRAIN PIPE
-·-►-·-►	CONTACT WATER FLOW PATH
───►	CLEAN OR CONSTRUCTION STORMWATER
░	SOIL FINAL COVER SYSTEM (SCDHEC 258.60.a OR b)
▨	GCL/EXPOSED MEMBRANE (258.60.b)

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.
4. ALL CONTACT WATER FLOWS TOWARDS EXISTING OUTFALL AT VIPER ROAD. ONLY CLEAN AND CONSTRUCTION FLOW THROUGH STORMWATER POND (NOT SHOWN) AND INTO DIVERSION CANAL.
5. INTERIM COVER SHALL BE PLACED ON ALL SLOPES AS BENCH CONSTRUCTION PROGRESSES. INTERIM COVER INCLUDES LOCKDOWN CHEMICALS APPROVED FOR THIS USE BY SCDHEC OR 6 INCHES (MIN) OF CLEAN SOIL PLUS VEGETATION.
6. INTERIM PHASING DATES AND SEQUENCING MAY BE ADJUSTED AS CONTRACT SCOPES AND SCHEDULES ARE DEVELOPED.
7. FOLLOWING CLOSURE OF PHASE 4 (AND WITHIN 30 DAYS OF COMPLETION OF GRADING AND SEEDING ACTIVITIES), SANTEE COOPER WILL SUBMIT A CERTIFICATION TO SCDHEC THAT PHASE 4 CLOSURE ACTIVITIES HAVE BEEN COMPLETED IN ACCORDANCE WITH THE CLOSURE PLAN. THE CERTIFICATION WILL BE SIGNED AND SEALED BY AN ENGINEER REGISTERED IN THE STATE OF SOUTH CAROLINA. A COPY OF THE CERTIFICATION WILL BE KEPT ON FILE IN THE FACILITY OPERATING RECORD.

PHASE 4:

WASTE PLACEMENT: JUN 2014 THROUGH APR 2015

- ESTABLISH DESIGN WASTE ELEVATION OVER SOUTH HALF OF LANDFILL TO EXTENT POSSIBLE
- USE NORTH RAMP TO HAUL WASTE DURING CLOSURE ACTIVITIES AT WEST RAMP
- PHASE 4 NET WASTE PLACEMENT VOLUME IS APPROXIMATELY 525,000 CY
- WASTE PLACEMENT IS ESTIMATED ASSUMING WASTE FROM CROSS GENERATING STATON AT A RATE OF 350K CY PER YEAR AND AN ADDITIONAL 225,000 CY FROM WINYAH GENERATING STATION
- NORTH HALF OF EXISTING LANDFILL MAY STILL BE USED FOR STAGING OF WASTE DURING PHASE 4 WASTE PLACEMENT, BUT SOUTH HALF OF EXISTING LANDFILL SHOULD BE FILLED BY APRIL 2015

CLASS TWO CLOSURE CONTRACT: OCT 2014 THROUGH MAR 2015

- STRIP TOPSOIL OVER NORTH SLOPE FROM BENCH 1 UP THROUGH BENCH 2 (EAST SIDE ONLY, INCLUDING LOW POINTS)
- INSTALL DOWNDRAINS ON NORTH SLOPE FROM BENCH 1 UP THROUGH BENCH 2 - SEE DWG LF-719-0109
- INSTALL SOIL FINAL COVER ON NORTH SLOPE FROM BENCH 1 UP THROUGH BENCH 2 (EAST SIDE ONLY, INCLUDING BENCH LOW POINTS) - SEE DWG LF-719-0103
- RE-GRADE BENCH 2 ON EAST SLOPE TO PROVIDE LONGITUDINAL DRAINAGE TOWARDS NORTH AND SOUTH DOWNDRAINS. INSTALL GCL/FLEXIBLE MEMBRANE ON EAST SLOPE UP THROUGH BENCH 2 - SEE DWG LF-71-0103
- STRIP TOPSOIL OVER WEST SLOPE UP THROUGH BENCH 2 (SOUTH OF BENCH HIGH POINTS)
- RE-GRADE WEST SIDE OF LANDFILL THROUGH BENCH 2 TO PROVIDE LONGITUDINAL DRAINAGE TOWARDS SOUTH END DOWNDRAINS (SOUTH OF BENCH HIGH POINTS)
- INSTALL GCL/FLEXIBLE MEMBRANE UP THROUGH BENCH 2 ON WEST SIDE OF LANDFILL (SOUTH OF BENCH HIGH POINTS) - SEE DWG LF-719-0103

CLASS THREE CONTRACT(S): MAY 2014 THROUGH FEB 2015

- COMPLETE AREA 1D PERIMETER ROAD AND CLEAR AND GRUB AREA 1D CELL 1
- INSTALL BASE REINFORCEMENT
- CONTINUE FILL WITHIN AREA 1B CELL 1, WORKING TOWARDS DESIGN LANDFILL SUBGRADE ELEVATION
- SUBGRADE PREP AND BEGIN COMPACTION OF GENERAL DIKE FILL WITHIN LEACHATE COLLECTION AND SUMP POND AREAS
- BEGIN INSTALLATION OF ELECTRICAL AND PIPING SYSTEMS

200 0 200 400 600
SCALE IN FEET

DRAWN BY KPF	ENGINEER F.W. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL

WORLEY PARSONS GROUP INC. No. 1505

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CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

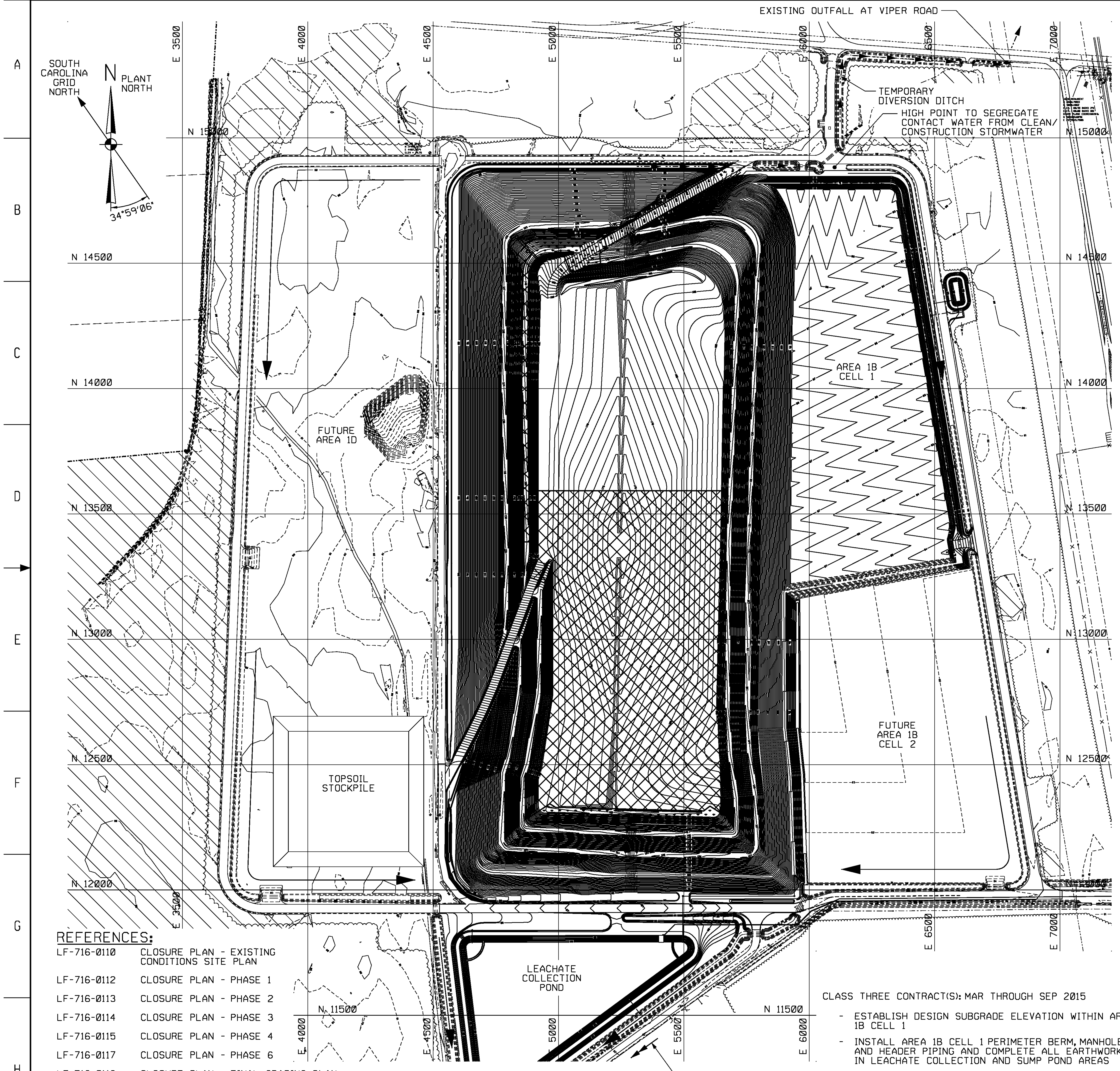
CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
PHASE 4

SCALE	DRAWING SIZE	JOB NO.
1"=200'	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0115 REV D

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
D	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW
C	02/14/13	JGM	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

...\cr34-0-dw-lf-716-0115.dgn
11/25/2014 3:21:54 PM



PLAN
SCALE:1"=200'

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS
LF-719-0108	NORTH DOWNDRAIN - SECTIONS AND DETAILS
LF-719-0109	SOUTH DOWNDRAIN - SECTIONS AND DETAILS

LEGEND:

═══ 80 ═══	EXISTING CONTOURS
━━━ 80 ━━━	NEW CONTOURS
– – – – –	EXISTING DOWNDRAIN PIPE
— — — —	NEW DOWNDRAIN PIPE
- ► - ► -	CONTACT WATER FLOW PATH
──►	CLEAN OR CONSTRUCTION STORMWATER
░	SOIL FINAL COVER SYSTEM (SCDHEC 258.60.a OR b)
▨	GCL/EXPOSED MEMBRANE (SCDHEC 258.60.b)

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.
4. ALL CONTACT WATER FLOWS TOWARDS EXISTING OUTFALL AT VIPER ROAD. ONLY CLEAN AND CONSTRUCTION FLOW THROUGH STORMWATER POND (NOT SHOWN) AND INTO DIVERSION CANAL.
5. INTERIM COVER SHALL BE PLACED ON ALL SLOPES AS BENCH CONSTRUCTION PROGRESSES. INTERIM COVER INCLUDES LOCKDOWN CHEMICALS APPROVED FOR THIS USE BY SCDHEC OR 6 INCHES (MIN) OF CLEAN SOIL PLUS VEGETATION.
6. TEMPORARY DIVERSION ADJACENT TO SOUTH DOWNDRAINS MAY BE REMOVED ONCE SOIL FINAL COVER IS COMPLETED OVER SOUTH HALF OF LANDFILL. PERMANENT STORMWATER DITCHES AND GRADING ASSOCIATED WITH CLASS THREE SOLID WASTE LANDFILL AND LEACHATE COLLECTION POND MAY BE FINALIZED AT THIS TIME, WHILE ENSURING NO CONTACT STORMWATER RUNOFF DRAINS SOUTH TOWARDS CANAL.
7. INTERIM PHASING DATES AND SEQUENCING MAY BE ADJUSTED AS CONTRACT SCOPES AND SCHEDULES ARE DEVELOPED.
8. FOLLOWING CLOSURE OF PHASE 5 (AND WITHIN 30 DAYS OF COMPLETION OF GRADING AND SEEDING ACTIVITIES), SANTEE COOPER WILL SUBMIT A CERTIFICATION TO SCDHEC THAT PHASE 5 CLOSURE ACTIVITIES HAVE BEEN COMPLETED IN ACCORDANCE WITH THE CLOSURE PLAN. THE CERTIFICATION WILL BE SIGNED AND SEALED BY AN ENGINEER REGISTERED IN THE STATE OF SOUTH CAROLINA. A COPY OF THE CERTIFICATION WILL BE KEPT ON FILE IN THE FACILITY OPERATING RECORD.

PHASE 5:

WASTE PLACEMENT: MAY THROUGH OCT 2015

- FILL TO TOP DECK ELEVATION EVERYWHERE AROUND PERIMETER OF NORTH HALF OF LANDFILL. REMAINING WASTE PLACEMENT WILL BE USED TO ESTABLISH FINAL GRADES WITHIN THE NORTH HALF OF THE TOP DECK
- USE WEST RAMP TO HAUL WASTE WHEN INSTALLING FINAL COVER OVER NORTH RAMP, AND VICE-VERSA
- PHASE 5 NET WASTE PLACEMENT VOLUME IS APPROXIMATELY 350,000 CY
- WASTE PLACEMENT IS ESTIMATED ASSUMING WASTE FROM CROSS GENERATING STATION AT A RATE OF 350K CY PER YEAR AND AN ADDITIONAL 175,000 CY FROM WINYAH GENERATING STATON

CLASS TWO CLOSURE CONTRACT: APR THROUGH OCT 2015

- INSTALL ALL REMAINING DOWNDRAINS ON NORTH AND SOUTH SLOPES (UP TO BENCH 3/TOP OF LANDFILL) - SEE DWG LF-719-0109)
- INSTALL SOIL FINAL COVER ON NORTH AND SOUTH SIDE UP THROUGH BENCH 3 - SEE DWG LF-719-0103
- RE-GRADE BENCH 2 ON WEST SLOPE TO PROVIDE LONGITUDINAL DRAINAGE TOWARDS NORTH END DOWNDRAINS (NORTH OF BENCH HIGH POINT)
- INSTALL GCL/FLEXIBLE MEMBRANE ON WEST SLOPE UP THROUGH BENCH 2 (NORTH OF BENCH HIGH POINT)
- FINE GRADE 5:1 SLOPES ON EAST AND WEST SIDES (SOUTH OF BENCH 2 HIGH POINTS)
- INSTALL GCL/FLEXIBLE MEMBRANE ON EAST AND WEST SLOPES (SOUTH OF BENCH 2 HIGH POINTS) UP TO TOP OF LANDFILL
- FINE GRADE TOP OF LANDFILL (SOUTH HALF ONLY)
- INSTALL GCL/SOIL ALTERNATE FINAL COVER SYSTEM ON TOP OF LANDFILL (SOUTH HALF ONLY)

CLASS THREE CONTRACT(S): MAR THROUGH SEP 2015

- ESTABLISH DESIGN SUBGRADE ELEVATION WITHIN AREA 1B CELL 1
- INSTALL AREA 1B CELL 1 PERIMETER BERM, MANHOLES, AND HEADER PIPING AND COMPLETE ALL EARTHWORK IN LEACHATE COLLECTION AND SUMP POND AREAS
- FINISH INSTALLATION OF ELECTRICAL AND PIPING SYSTEMS
- FINISH INSTALLATION OF ALL AREA 1B CELL 1 AND POND LINER SYSTEMS

200 0 200 400 600
SCALE IN FEET

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL

WORLEY PARSONS GROUP INC. No. 1505

OneWay™ to zero harm

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: ____________ STATE: ______
LIC. NO. __________ DATE: ______

CROSS GENERATING STATION

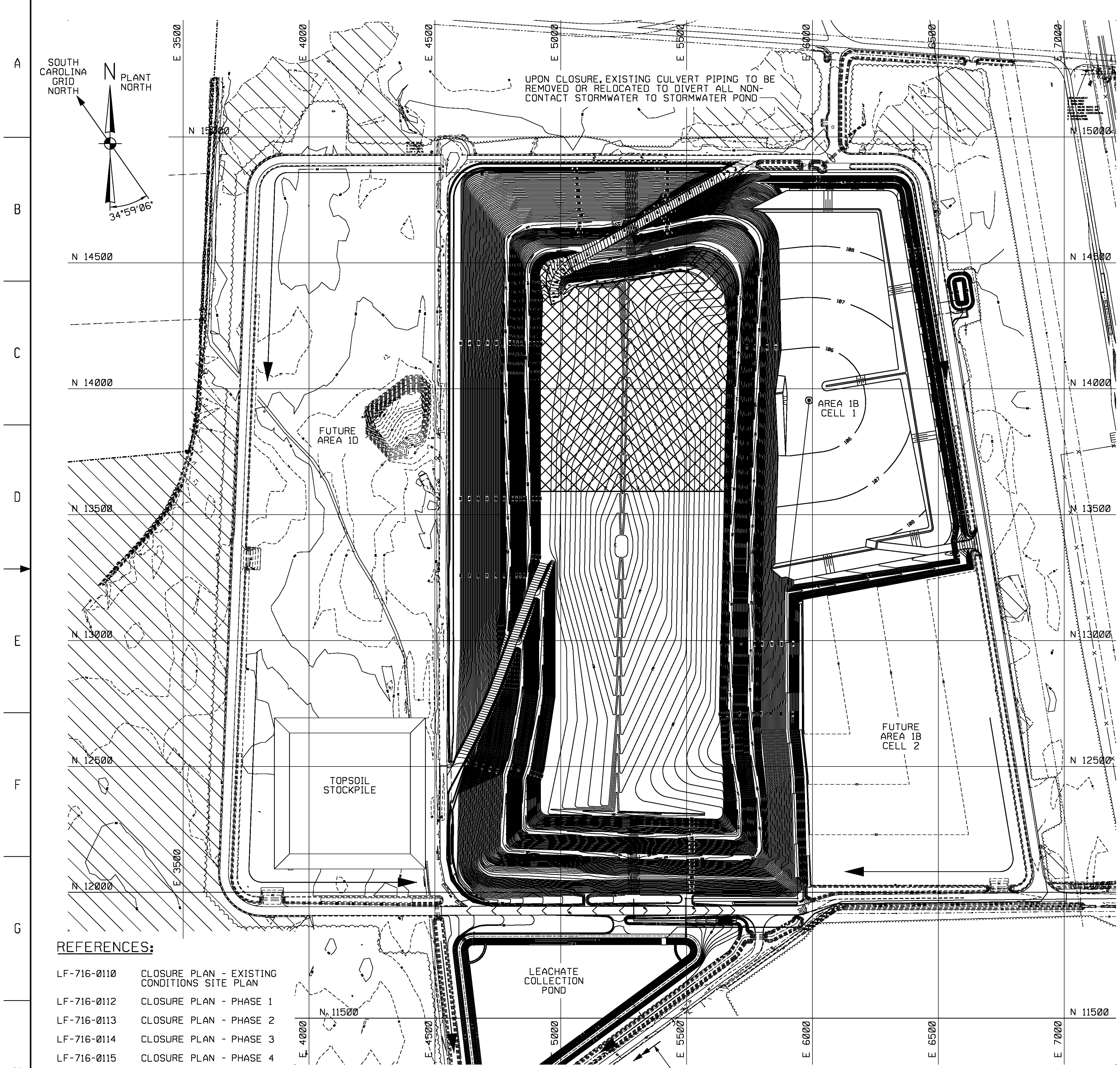
Santee Cooper SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
PHASE 5

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
D	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW
C	02/14/13	JGM	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

SCALE 1"=200'
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0116
REV D



PLAN

SCALE:1"=200'

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS
LF-719-0108	NORTH DOWNDRAIN - SECTIONS AND DETAILS

LEGEND:

═ ═ 80 ═ ═	EXISTING CONTOURS
══ 80 ══	NEW CONTOURS
– – – – –	EXISTING DOWNDRAIN PIPE
— — — —	NEW DOWNDRAIN PIPE
⟶	CLEAN OR CONSTRUCTION STORMWATER
░	SOIL FINAL COVER SYSTEM (SCDHEC 258.60.a OR b)
▨	GCL/EXPOSED MEMBRANE (SCDHEC 258.60.b)

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.
4. TEMPORARY DIVERSION DITCH IS REMOVED ONCE FINAL COVER ON EXISTING LANDFILL IS COMPLETE. ALL CONTACT WATER FROM CLASS III LANDFILL ENTERS LEACHATE COLLECTION POND. ALL CLEAN STORMWATER FLOWS THROUGH STORMWATER POND (NOT SHOWN) AND INTO DIVERSION CANAL.
5. INTERIM COVER SHALL BE PLACED ON ALL SLOPES AS BENCH CONSTRUCTION PROGRESSES. INTERIM COVER INCLUDES LOCKDOWN CHEMICALS APPROVED FOR THIS USE BY SCDHEC OR 6 INCHES (MIN) OF CLEAN SOIL PLUS VEGETATION.
6. INTERIM PHASING DATES AND SEQUENCING MAY BE ADJUSTED AS CONTRACT SCOPES AND SCHEDULES ARE DEVELOPED.
7. FOLLOWING CLOSURE OF PHASE 6 (AND WITHIN 30 DAYS OF COMPLETION OF GRADING AND SEEDING ACTIVITIES), SANTEE COOPER WILL SUBMIT A CERTIFICATION TO SCDHEC THAT ALL CLOSURE ACTIVITIES HAVE BEEN COMPLETED IN ACCORDANCE WITH THE CLOSURE PLAN. THE CERTIFICATION WILL BE SIGNED AND SEALED BY AN ENGINEER REGISTERED IN THE STATE OF SOUTH CAROLINA. A COPY OF THE CERTIFICATION WILL BE KEPT ON FILE IN THE FACILITY OPERATING RECORD.

PHASE 6:

WASTE PLACEMENT: NOV THROUGH DEC 31, 2015

- ESTABLISH DESIGN WASTE ELEVATION OVER NORTH HALF OF LANDFILL
- PHASE 6 NET WASTE PLACEMENT IS APPROXIMATELY 50K CY (NOT SHOWN)
- WASTE PLACEMENT IS ESTIMATED ASSUMING WASTE FROM CROSS GENERATING STATION ONLY, AT A RATE OF 350K CY/YR
- BEGIN WASTE PLACEMENT IN AREA 1B CELL 1 UPON CLASS THREE LANDFILL CERTIFICATION
- CLASS TWO LANDFILL MUST CEASE RECEIVING WASTE UPON CERTIFICATION OF CLASS THREE LANDFILL OR BY DECEMBER 31, 2015, WHICHEVER COMES FIRST

CLASS TWO CLOSURE CONTRACT: NOV 2015 THROUGH JUN 30, 2016

- FINE GRADE 5:1 SLOPES ON EAST AND WEST SIDES (NORTH OF BENCH 2 HIGH POINTS)
- INSTALL GCL/FLEXIBLE MEMBRANE ON EAST AND WEST SLOPES (NORTH OF BENCH 2 HIGH POINTS) UP TO TOP OF LANDFILL - SEE DWG LF-719-0103
- FINE GRADE TOP OF LANDFILL (NORTH HALF ONLY)
- INSTALL GCL/SOIL ALTERNATE FINAL COVER SYSTEM ON TOP OF LANDFILL (NORTH HALF ONLY) - SEE DWG LF-719-0103
- REDIRECT STORMWATER FROM NORTH DIVERSION DITCH TO DRAIN TO FINAL PERIMETER DITCH SYSTEM
- FINAL GRADES SHOWN INDICATE 4% MAXIMUM SLOPES WITH HIGH POINT AT EL 175. FINAL SLOPES AND HIGH POINT MAY BE ADJUSTED DOWN, HOWEVER A MINIMUM 3% SLOPE SHALL BE MAINTAINED

CLASS THREE CONTRACT(S): OCT THROUGH DEC 2015

- COMPLETE INSTALLATION OF AREA 1B CELL 1 DRAINAGE LAYER AND LEACHATE COLLECTION PIPING AND CLEANOUTS, AND ALL OTHER WORK REQUIRED FOR LANDFILL OPERATION AND CERTIFICATION
- CLASS THREE LANDFILL AREA 1B CELL 1 CERTIFICATION
- INSTALL DECANT STRUCTURE AND ESTABLISH GRAVITY SURFACE FLOW TO DECANT STRUCTURE UPON CERTIFICATION (2016)

200 0 200 400 600

SCALE IN FEET

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED 'HOLD' RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
WORLEY PARSONS GROUP INC. No. 1505	
OneWay to zero harm Copyright © WorleyParsons Services Pty Ltd	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: ____ STATE: ____ LIC. NO.: ____ DATE: ____

CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
PHASE 6

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
D	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW
C	02/14/13	JGM	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

SCALE 1"=200'	DRAWING SIZE ARCH D (36" x 24")	JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0117		REV D

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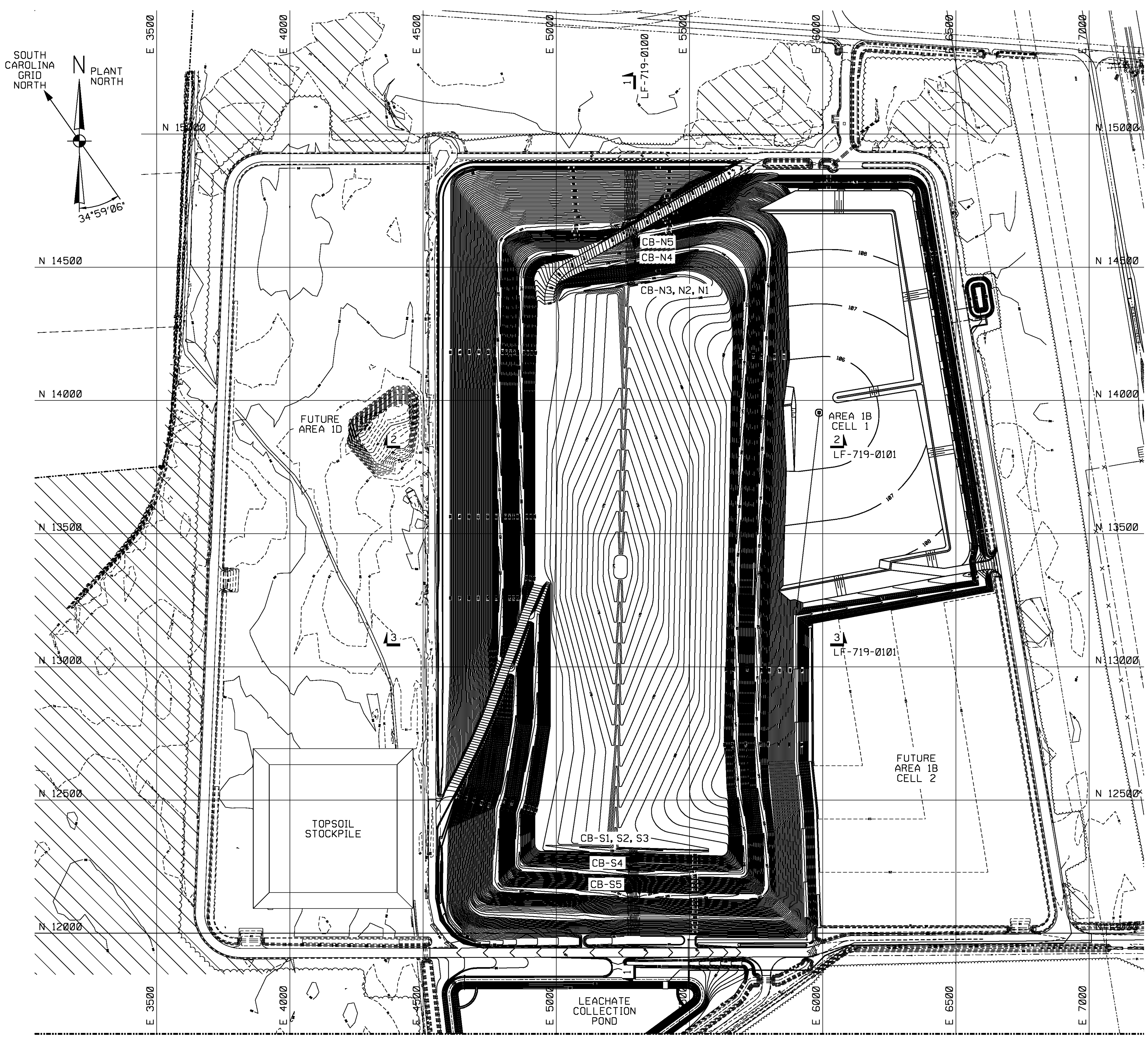

MATCH LINE LF-716-0119

PLAN
SCALE:1"=200'

LEGEND:

==80==	EXISTING CONTOURS
══80══	NEW CONTOURS
– – – – –	EXISTING DOWNDRAIN PIPE
☐ CB-N5	NEW CATCH BASIN

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.
4. FINAL GRADING AS-BUILT SURVEY WILL BE PROVIDED WITHIN 180 DAYS AFTER LAST RECEIPT OF WASTE (OR WITHIN 180 DAYS AFTER ACHIEVING FINAL ELEVATIONS).
5. UPON COMPLETION OF ALL CLOSURE ACTIVITIES, A PLAT WITH FINAL BOUNDARIES OF WASTE DISPOSAL, AND DEED NOTATION INDICATING IN PERPETUITY THAT PROPERTY HAS BEEN USED FOR WASTE DISPOSAL, WITH LAT/LONG/TYPE/LOCATION/QUANTITY OF WASTE DISPOSAL WILL BE PROVIDED.
6. ADJUSTMENTS TO FINAL TOP DECK GRADES MAY BE REQUIRED TO ENSURE 3-5% CLOSURE SLOPES ARE MAINTAINED BASED ON FINAL CLASS TWO WASTE VOLUME, AND TO ENSURE ALL CLASS THREE LANDFILL REQUIREMENTS ARE MET IN PIGGYBACK AREAS.

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0019	FINAL GRADING PLAN
LF-719-0100	EXISTING, PHASING AND FINAL GRADE - CROSS SECTIONS
LF-719-0101	EXISTING, PHASING AND FINAL GRADE - CROSS SECTIONS

200 0 200 400 600
SCALE IN FEET

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
WORLEY PARSONS GROUP INC. No. 1505	

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ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: ____________ STATE: ______
LIC. NO.: ________ DATE: ______

CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
FINAL GRADING PLAN

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
C	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

SCALE 1"=200'
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0118
REV C

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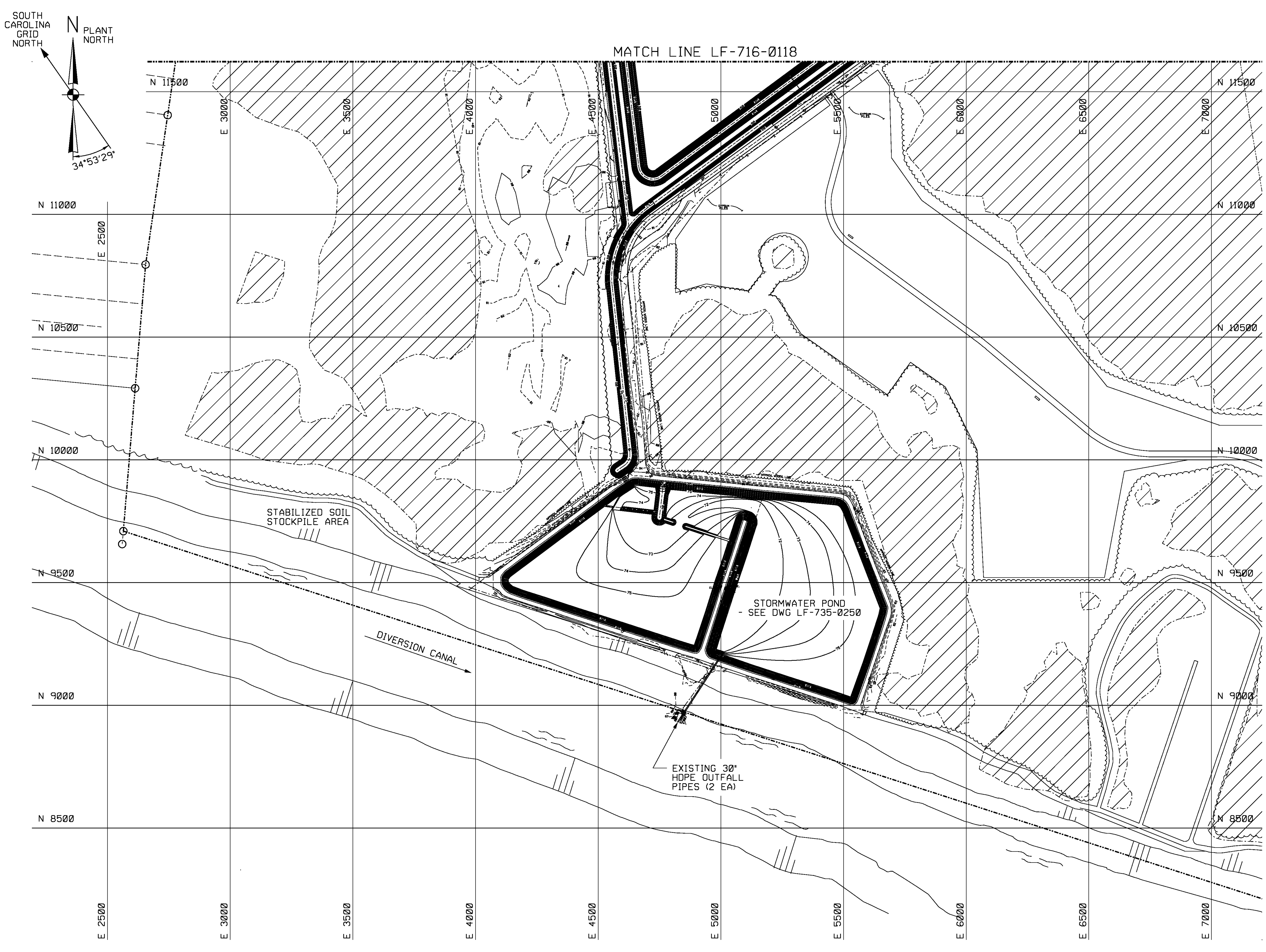

PLAN
SCALE:1"=200'

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
3. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.

LEGEND:

------80------	EXISTING CONTOURS
══════80══════	NEW CONTOURS
-·-·-·-·-·-·	PROPERTY BOUNDARY
▨	WETLAND AREA LIMITS

200 0 200 400 600
SCALE IN FEET

REFERENCES:

LF-716-0110	CLOSURE PLAN - EXISTING CONDITIONS SITE PLAN
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-735-0250	SEDIMENTATION POND PLAN - AREA 1B & 1D

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 02/06/13	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
WORLEY PARSONS GROUP INC. No. 1505	
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CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
FINAL GRADING PLAN

SCALE	DRAWING SIZE	JOB NO.
1"=200'	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO.
CR34-0-DW-LF-716-0119
REV
B

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

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SECTION 1-1

SCALE: HORIZ: 1" = 100'
VERT: 1" = 20'
(LF-716-0118)

NOTE:

1. STORMWATER DROP INLETS AND DOWNDRAINS ARE NOT SHOWN ON THIS DRAWING. SEE DRAWINGS LF-719-0108, 0109, AND 0110 FOR TYPICAL DOWNDRAIN LAYOUT AND BACKFILL SECTIONS AND DETAILS. TOP OF WASTE WILL BE DEPRESSED LOCALLY TO ALLOW FOR DOWNDRAIN INSTALLATION WHILE MAINTAINING REQUIRED INFILTRATION LAYER THICKNESS UNDER DOWNDRAINS.
2. FUTURE CLASS THREE LANDFILL AREAS 1B AND 1D TO PIGGYBACK OVER TOP OF EXISTING LANDFILL (WITH VOLUMES EQUAL TO PERMITTED AREA 1B/AREA 1D VOLUMES, AND WITH REDUCED OVERALL TOP DECK FINAL GRADE ELEVATION.
3. CLOSED TOP DECK OF CLASS TWO LANDFILL WILL SLOPE AT 3-5%. PRIOR TO PIGGYBACK WITH CLASS THREE SOLID WASTE LANDFILL, ALL NON-CONTACT STORMWATER WILL BE CONVEYED THROUGH DOWNDRAINS TO BASE OF LANDFILL. WHEN A GIVEN CLASS THREE LANDFILL AREA PIGGYBACKS OVER THE TOP DECK OF THE EXISTING LANDFILL, ALL CONTACT WATER AND LEACHATE WILL BE COLLECTED AND CONVEYED TO THE LEACHATE COLLECTION POND. NON-CONTACT STORMWATER WILL REMAIN SEGREGATED FROM CONTACT WATER/LEACHATE AT ALL TIMES.

REFERENCES:

LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS
LF-719-0108	NORTH DOWNDRAIN - SECTIONS AND DETAILS
LF-719-0109	SOUTH DOWNDRAIN - SECTIONS AND DETAILS
LF-719-0110	DOWNDRAIN - SECTIONS AND DETAILS

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
C	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL

WORLEY PARSONS GROUP INC.
No. 1505

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ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: ____________ STATE: ______
LIC. NO. ____________ DATE: ______

CROSS GENERATING STATION

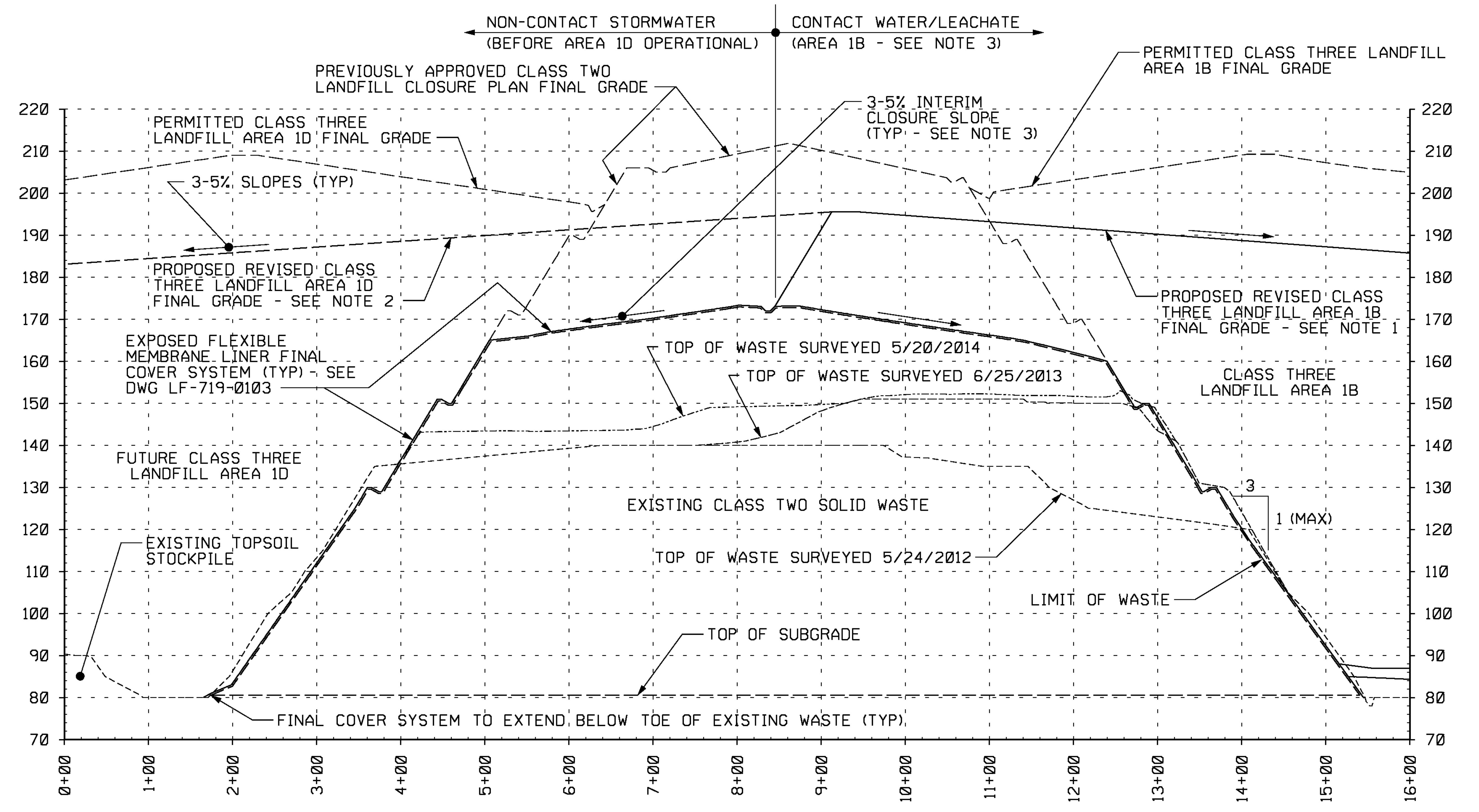
Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
EXISTING, PHASING AND FINAL GRADE
CROSS SECTIONS

SCALE	DRAWING SIZE	JOB NO.
AS NOTED	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO.	REV
CR34-0-DW-LF-719-0100	C



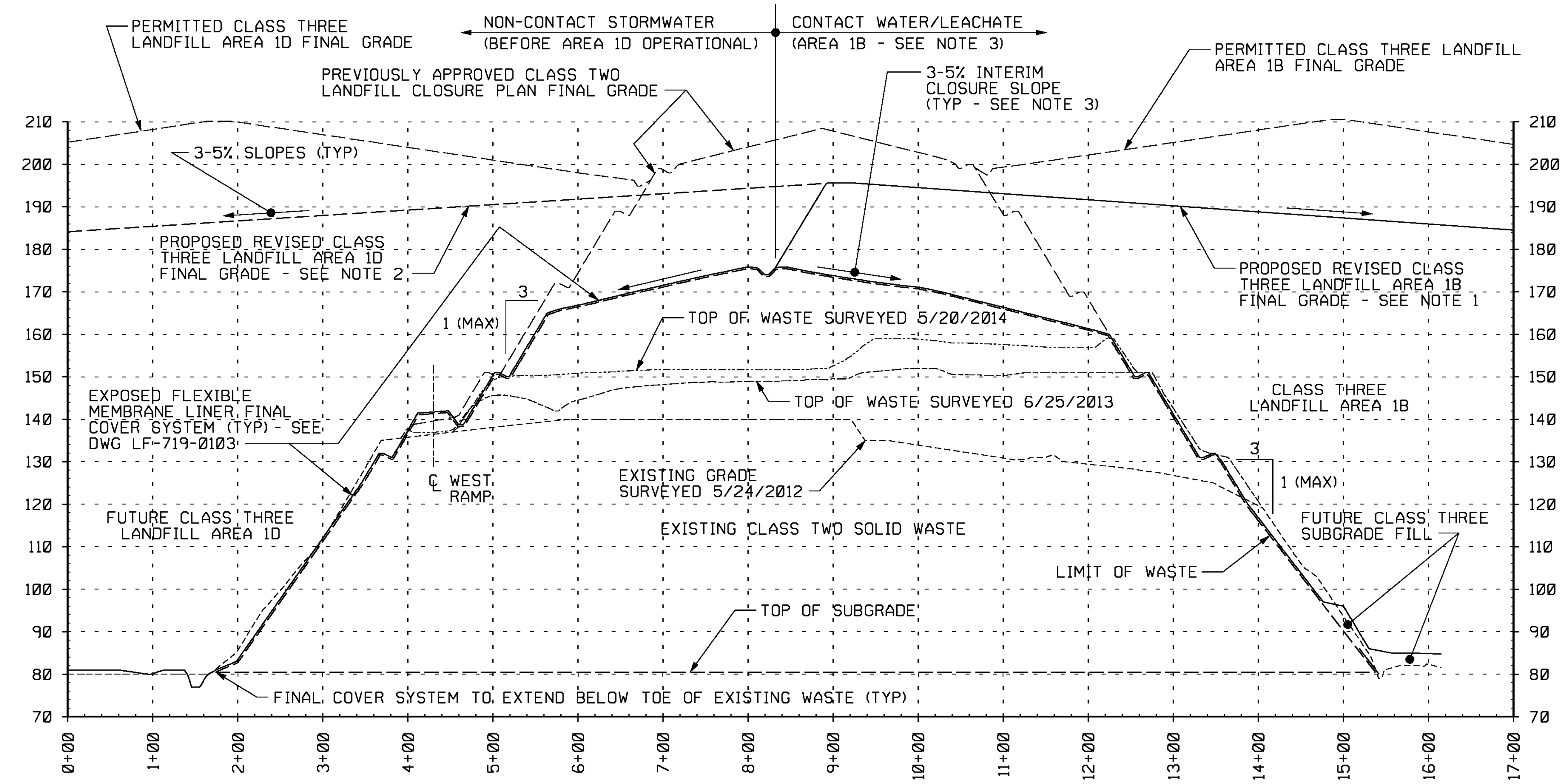
SECTION 2-2
SCALE: HORIZ: 1" = 100'
VERT: 1" = 20'
(LF-716-0118)

NOTES:

1. FUTURE CLASS THREE LANDFILL AREA 1B TO PIGGYBACK OVER TOP OF EXISTING LANDFILL (WITH VOLUME EQUAL TO PERMITTED AREA 1B VOLUME, AND WITH REDUCED OVERALL TOP DECK FINAL GRADE ELEVATION).
2. FUTURE CLASS THREE LANDFILL AREA 1D TO PIGGYBACK OVER TOP OF EXISTING LANDFILL AND SIDE SLOPE OF AREA 1B (WITH VOLUME EQUAL TO PERMITTED AREA 1D VOLUME, AND WITH REDUCED OVERALL TOP DECK FINAL GRADE ELEVATION).
3. CLOSED TOP DECK OF CLASS TWO LANDFILL WILL SLOPE AT 3-5%. PRIOR TO PIGGYBACK WITH CLASS THREE SOLID WASTE LANDFILL, ALL NON-CONTACT STORMWATER WILL BE CONVEYED THROUGH DOWNDRAINS TO BASE OF LANDFILL. WHEN A GIVEN CLASS THREE LANDFILL AREA PIGGYBACKS OVER THE TOP DECK OF THE EXISTING LANDFILL, ALL CONTACT WATER AND LEACHATE WILL BE COLLECTED AND CONVEYED TO THE LEACHATE COLLECTION POND. NON-CONTACT STORMWATER WILL REMAIN SEGREGATED FROM CONTACT WATER/LEACHATE AT ALL TIMES.

REFERENCES:

LF-716-0112	CLOSURE PLAN - PHASE 1
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS



SECTION 3-3
SCALE: HORIZ: 1" = 100'
VERT: 1" = 20'
(LF-716-0118)

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
WORLEY PARSONS GROUP INC. No. 1505	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: __________ STATE: ______ LIC. NO.: __________ DATE: ______

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CROSS GENERATING STATION

Santee Cooper SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
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CLASS II SOLID WASTE LANDFILL
EXISTING, PHASING AND FINAL GRADE
CROSS SECTIONS

REV	DATE		DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
C	11/25/14		KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13		KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13		KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

SCALE AS NOTED
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-719-0101
REV C

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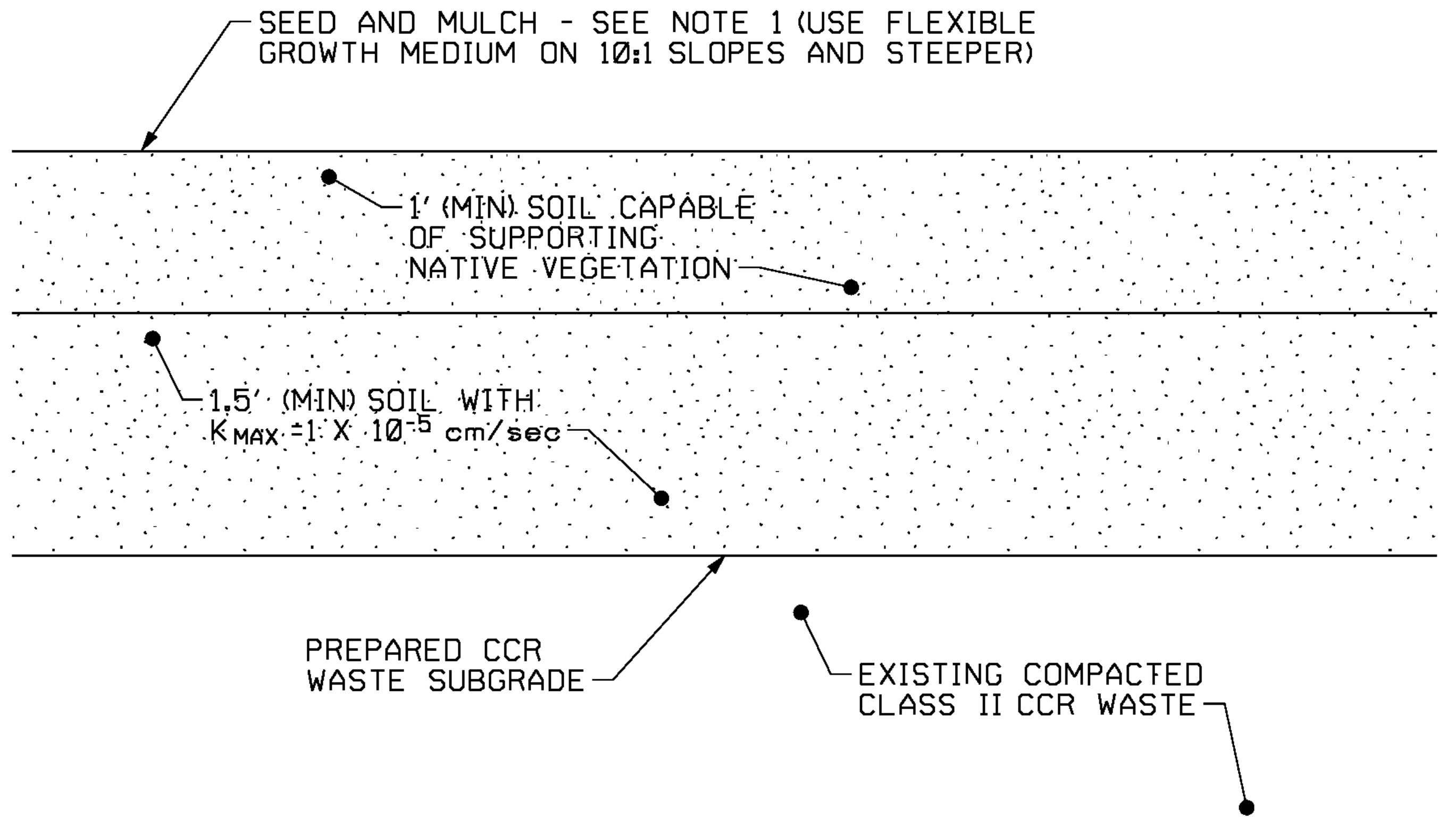
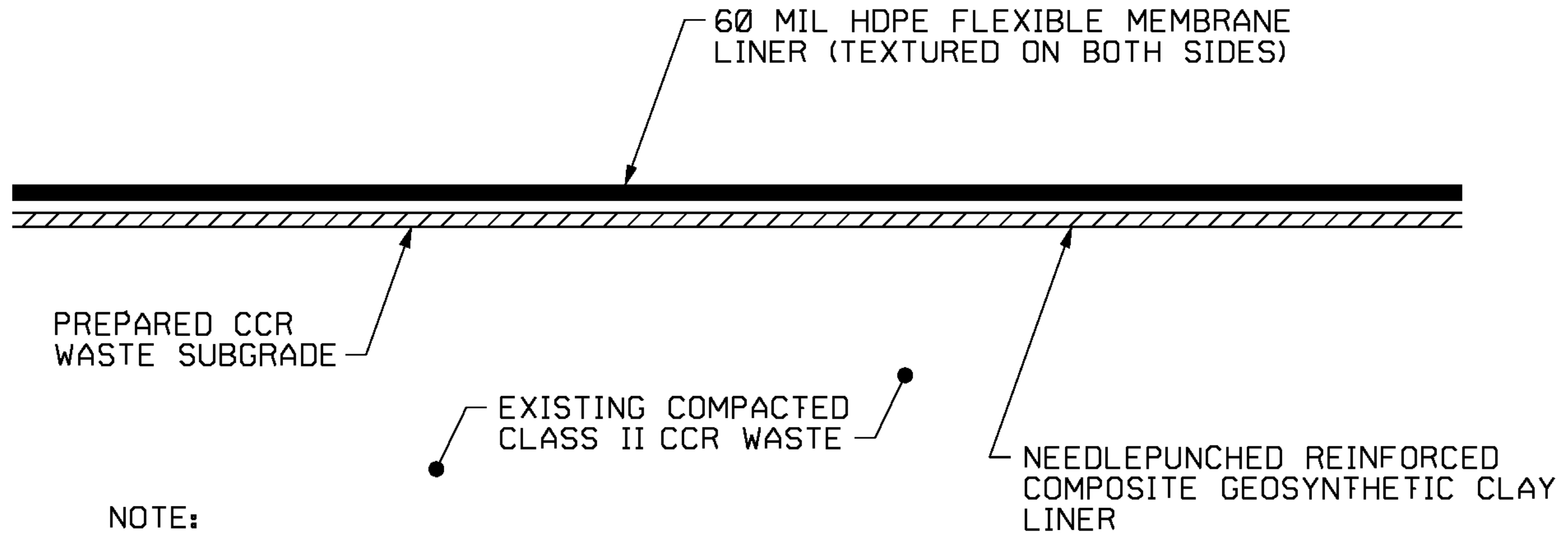


CLASS III STANDARD SOIL FINAL COVER SYSTEM
DHEC R.61-107.19 258.60.a
NOT TO SCALE



NOTE:

THIS IS THE ONLY FINAL COVER OPTION THAT WILL BE CONVERTED TO CLASS THREE LINER IN THE FUTURE - SEE NOTE 2.

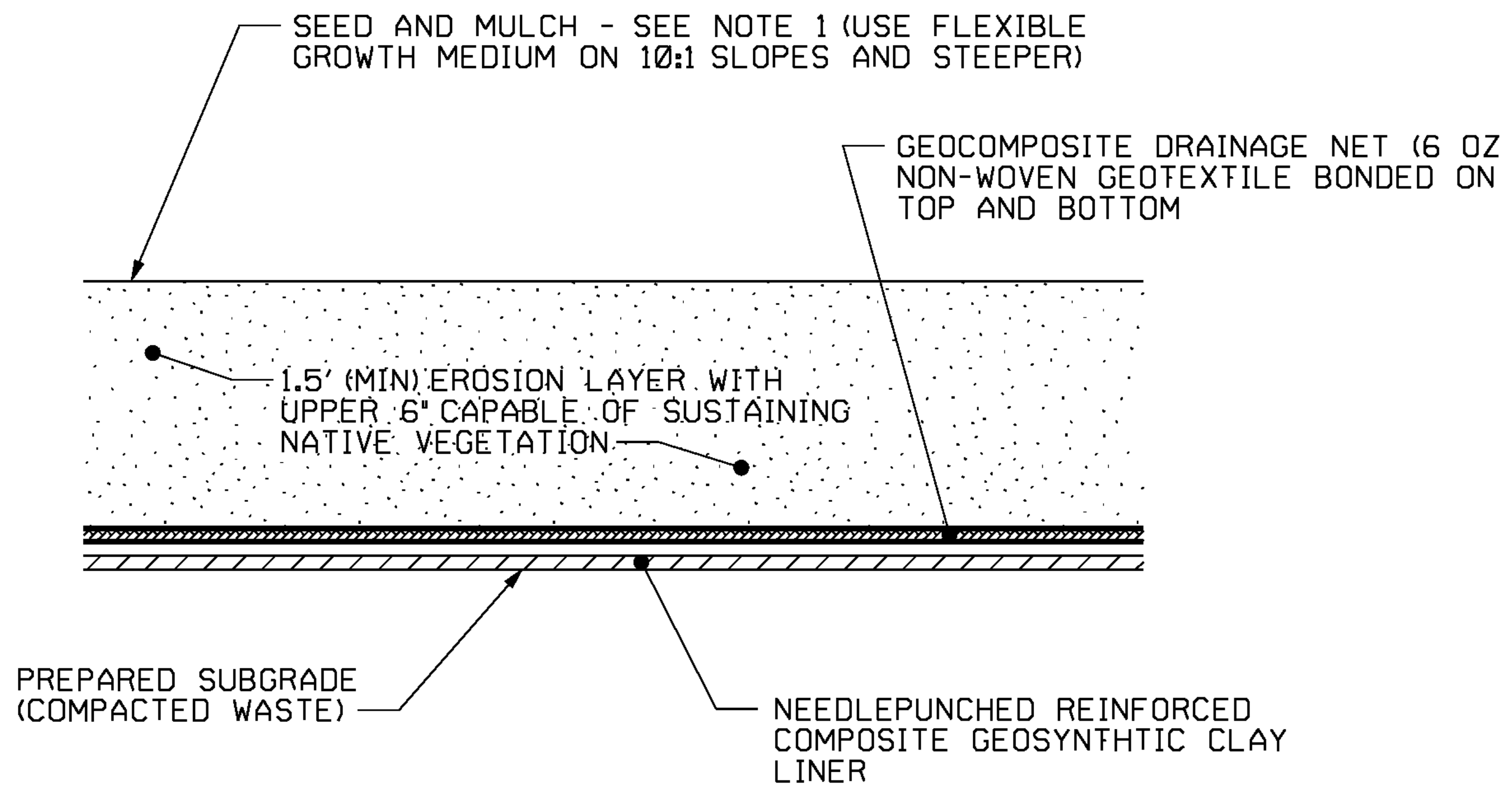
CLASS III EXPOSED FLEXIBLE MEMBRANE LINER FINAL COVER SYSTEM
DHEC R.61-107.19 258.60.b
NOT TO SCALE

NOTES:

1. FINISHED SURFACES OF THE DISPOSAL AREA WITH SOIL COVER SHALL BE SEEDED WITH NATIVE GRASSES OR OTHER SUITABLE GROUND COVER WITHIN 15 DAYS OF THE COMPLETION OF THAT PORTION OF THE LANDFILL.
2. WHERE THE FINAL COVER SYSTEM WILL BE TEMPORARILY EXPOSED AND LATER CONVERTED TO A CLASS THREE LINER SYSTEM, HORIZONTAL AND VERTICAL TRENCH ANCHORING SYSTEMS WILL BE DESIGNED TO COUNTERACT WIND UPLIFT FORCES. MATERIALS, OVERLAPS, AND INSTALLATION METHODS WILL BE DESIGNED TO PREVENT SEAM SEPARATION AND RESIST UV DEGRADATION.

REFERENCES:

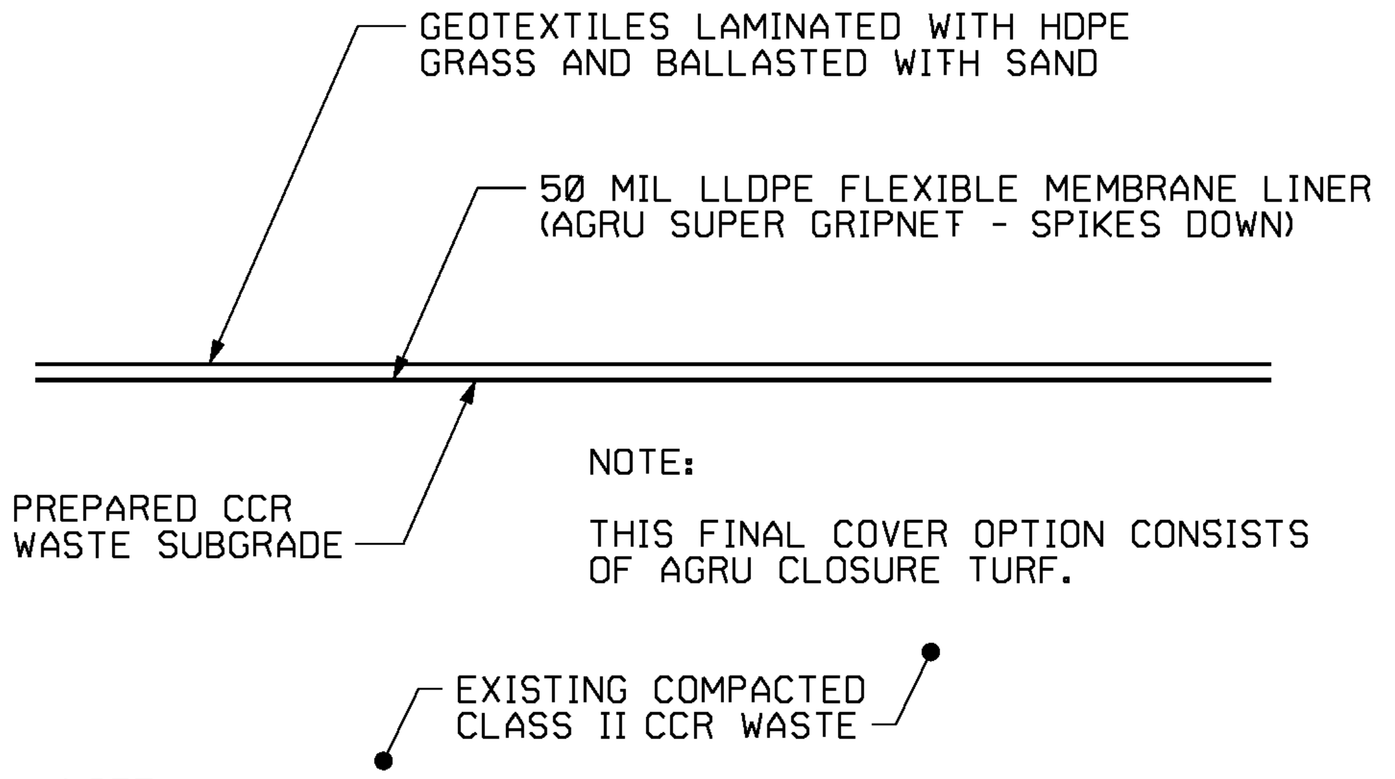
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0114	CLOSURE PLAN - PHASE 3
LF-716-0115	CLOSURE PLAN - PHASE 4
LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6



NOTE:

CLASS III GCL/SOIL FINAL COVER SYSTEM MAY BE USED IN LIEU OF CLASS III STANDARD SOIL FINAL COVER SYSTEM ONLY, BUT MAY NOT BE USED IN AREAS TO BE CONVERTED TO A CLASS THREE LINER IN THE FUTURE.

CLASS III GCL/SOIL FINAL COVER SYSTEM
DHEC R.71-107.19 258.60.b
NOT TO SCALE



NOTE:

THIS FINAL COVER OPTION CONSISTS OF AGRU CLOSURE TURF.

NOTE:

CLASS III FLEXIBLE MEMBRANE LINER FINAL COVER SYSTEM MAY BE USED IN LIEU OF CLASS III STANDARD SOIL FINAL COVER SYSTEM ONLY, BUT MAY NOT BE USED IN AREAS TO BE CONVERTED TO A CLASS THREE LINER IN THE FUTURE.

CLASS III FLEXIBLE MEMBRANE LINER FINAL COVER SYSTEM
DHEC R.71-107.19 258.60.b
NOT TO SCALE

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
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C	02/25/13	JGM	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
WORLEY PARSONS GROUP INC. No. 1505	
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CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
FINAL COVER
SECTIONS AND DETAILS

SCALE	DRAWING SIZE	JOB NO.
NONE	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO.
CR34-0-DW-LF-719-0103
REV
D

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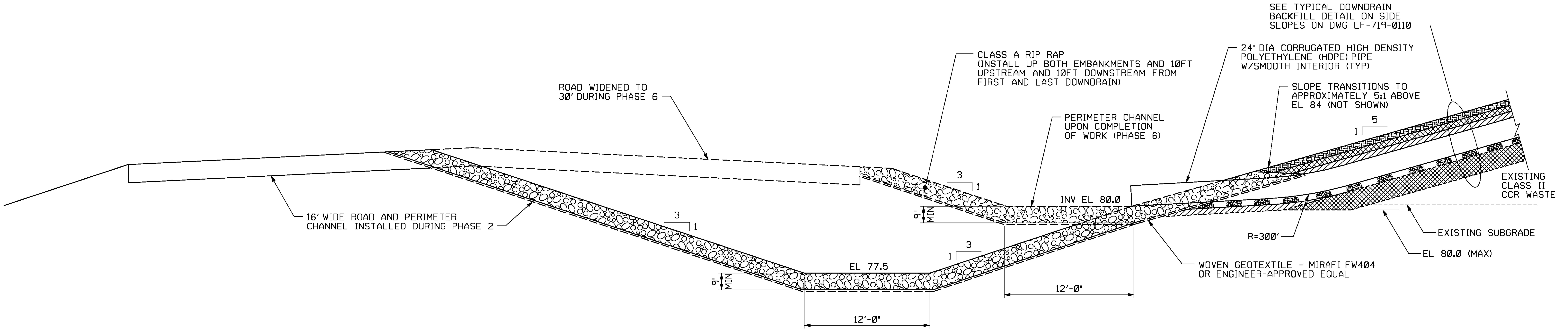
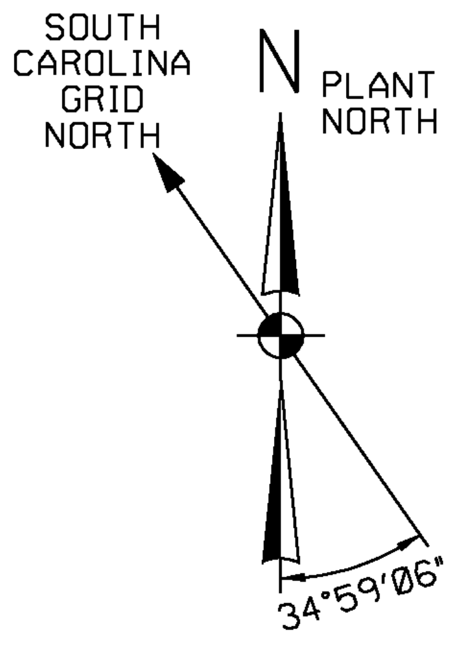


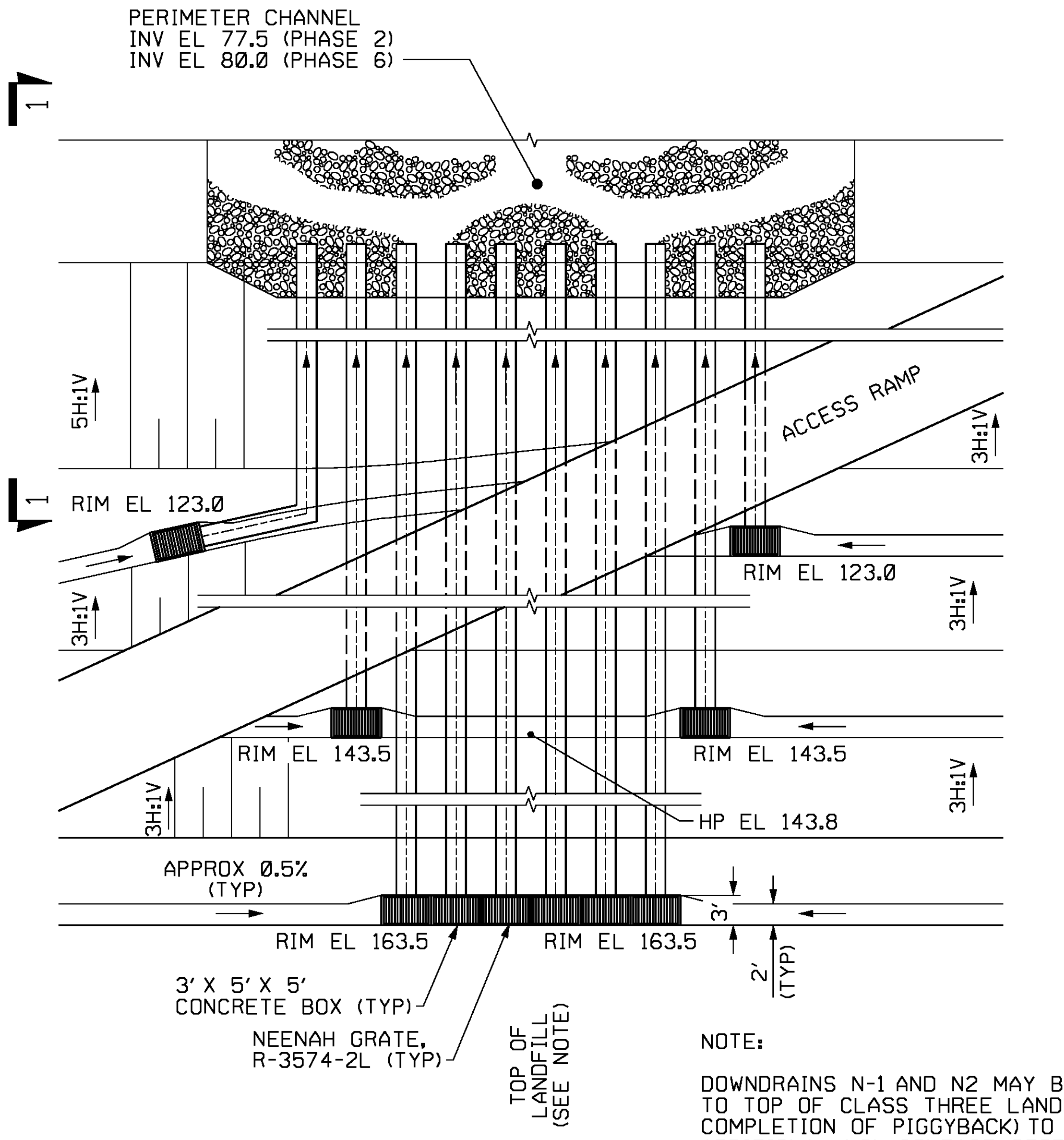
SECTION 1-1
NORTH STORMWATER DOWNDRAIN OUTFALL INTO PERIMETER CHANNEL

NOT TO SCALE



REFERENCES:

LF-716-0113	CLOSURE PLAN - PHASE 2
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS
LF-719-0110	DOWNDRAIN - SECTIONS AND DETAILS



NOTE:

DOWNDRAINS N-1 AND N2 MAY BE EXTENDED TO TOP OF CLASS THREE LANDFILL (UPON COMPLETION OF PIGGYBACK) TO RECEIVE ADDITIONAL NON-CONTACT STORMWATER FROM TOP DECK AREA.

EXISTING LANDFILL
NORTH STORMWATER DOWNDRAIN LAYOUT

NOT TO SCALE

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
WORLEY PARSONS GROUP INC. No. 1505	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE:______ STATE:______ LIC. NO.:______ DATE:______

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CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
NORTH DOWNDRAIN
SECTIONS AND DETAILS

SCALE	DRAWING SIZE	JOB NO.
NONE	ARCH D (36" x 24")	108008-01330

WORLEYPARSONS DWG. NO.	REV
CR34-0-DW-LF-719-0108	D

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
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C	02/14/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

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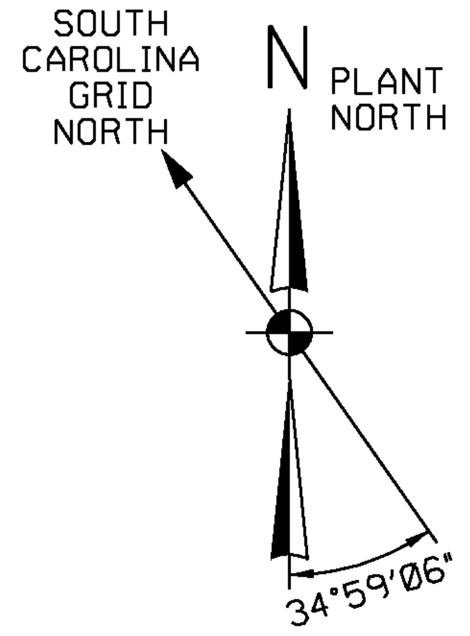
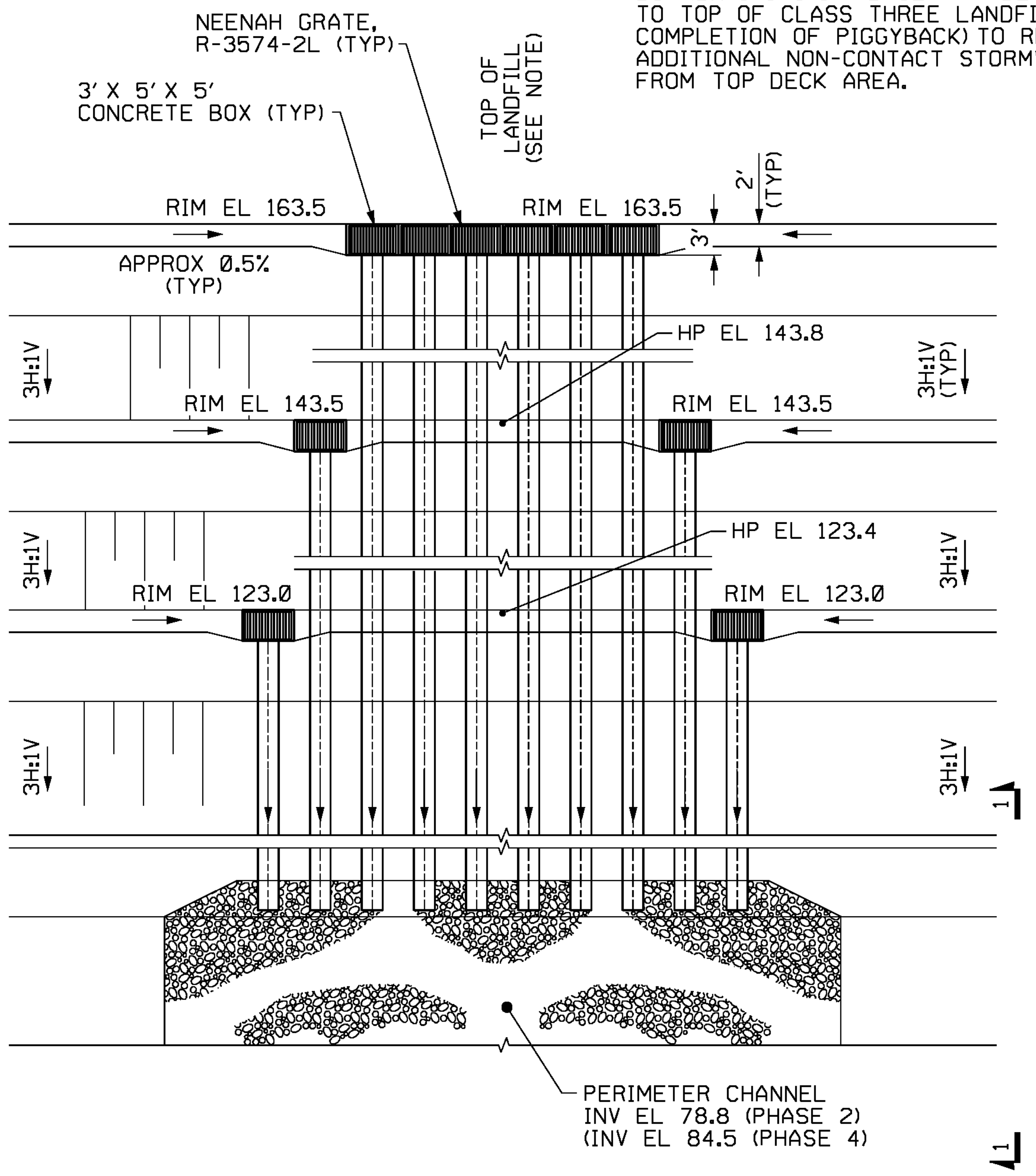


REFERENCES:

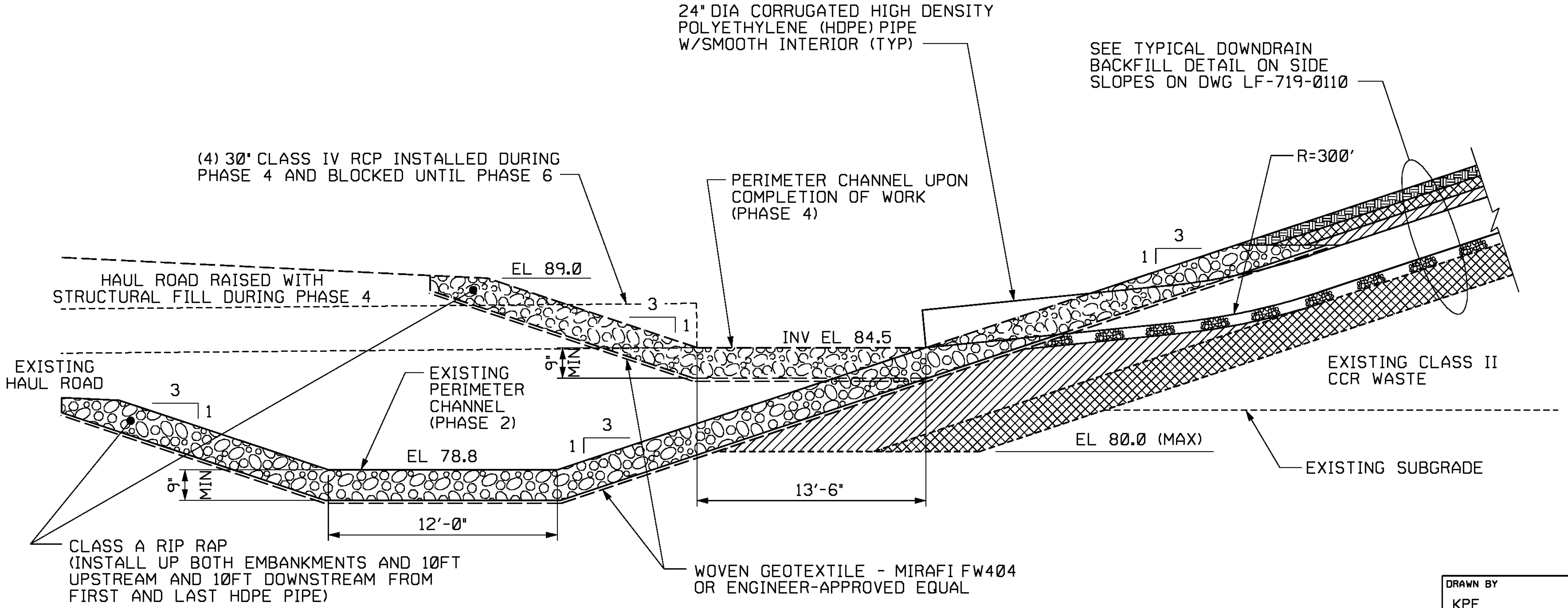
LF-716-0113	CLOSURE PLAN - PHASE 2
LF-719-0115	CLOSURE PLAN - PHASE 4
LF-719-0117	CLOSURE PLAN - PHASE 6
LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0103	FINAL COVER - SECTIONS AND DETAILS
LF-719-0110	DOWNDRAIN - SECTIONS AND DETAILS

NOTE:

DOWNDRAINS S-1 AND S2 MAY BE EXTENDED TO TOP OF CLASS THREE LANDFILL (UPON COMPLETION OF PIGGYBACK) TO RECEIVE ADDITIONAL NON-CONTACT STORMWATER FROM TOP DECK AREA.



EXISTING LANDFILL
SOUTH STORMWATER DOWNDRAIN LAYOUT
NOT TO SCALE



SECTION 1-1
SOUTH STORMWATER DOWNDRAIN OUTFALL INTO PERIMETER CHANNEL
NOT TO SCALE

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD 11/25/14	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL

WORLEY PARSONS GROUP INC. No. 1505

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PE: __________ STATE: ______
LIC. NO. __________ DATE: ______

CROSS GENERATING STATION

Santee Cooper **SOUTH CAROLINA PUBLIC SERVICE AUTHORITY**

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
SOUTH DOWNDRAIN
SECTIONS AND DETAILS

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
D	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW
C	02/14/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

SCALE NONE
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-719-0109
REV D

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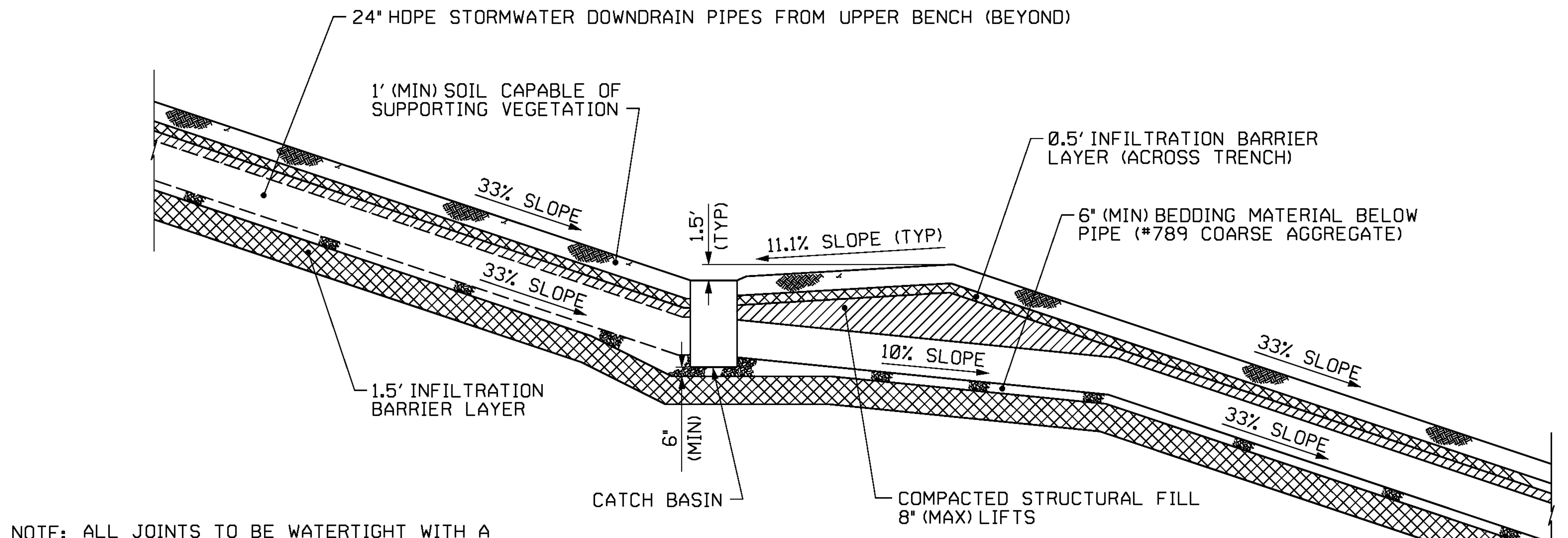
REFERENCES:

LF-716-0118	CLOSURE PLAN - FINAL GRADING PLAN
LF-719-0108	NORTH DOWNDRAIN - SECTIONS AND DETAILS
LF-719-0109	SOUTH DOWNDRAIN - SECTIONS AND DETAILS

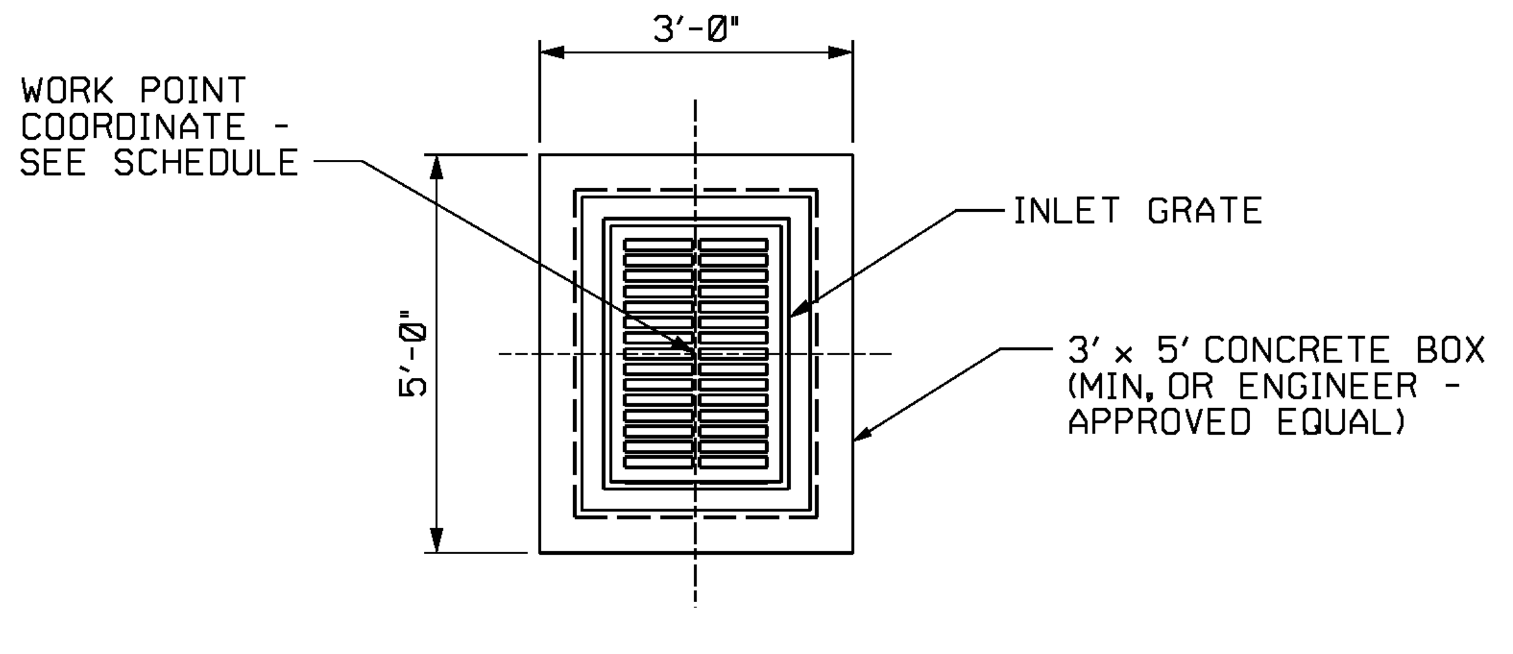


NOTE: ALL JOINTS TO BE WATERTIGHT WITH A WEDLED INTERNAL CYLINDER ON THE SPIGOT END OF THE PIPE AND WRAPPED WITH A DOUBLE WIDE MARMAC COUPLER, OR ENGINEER-APPROVED EQUAL.

NOTE: ALL JOINTS TO BE WELDED.

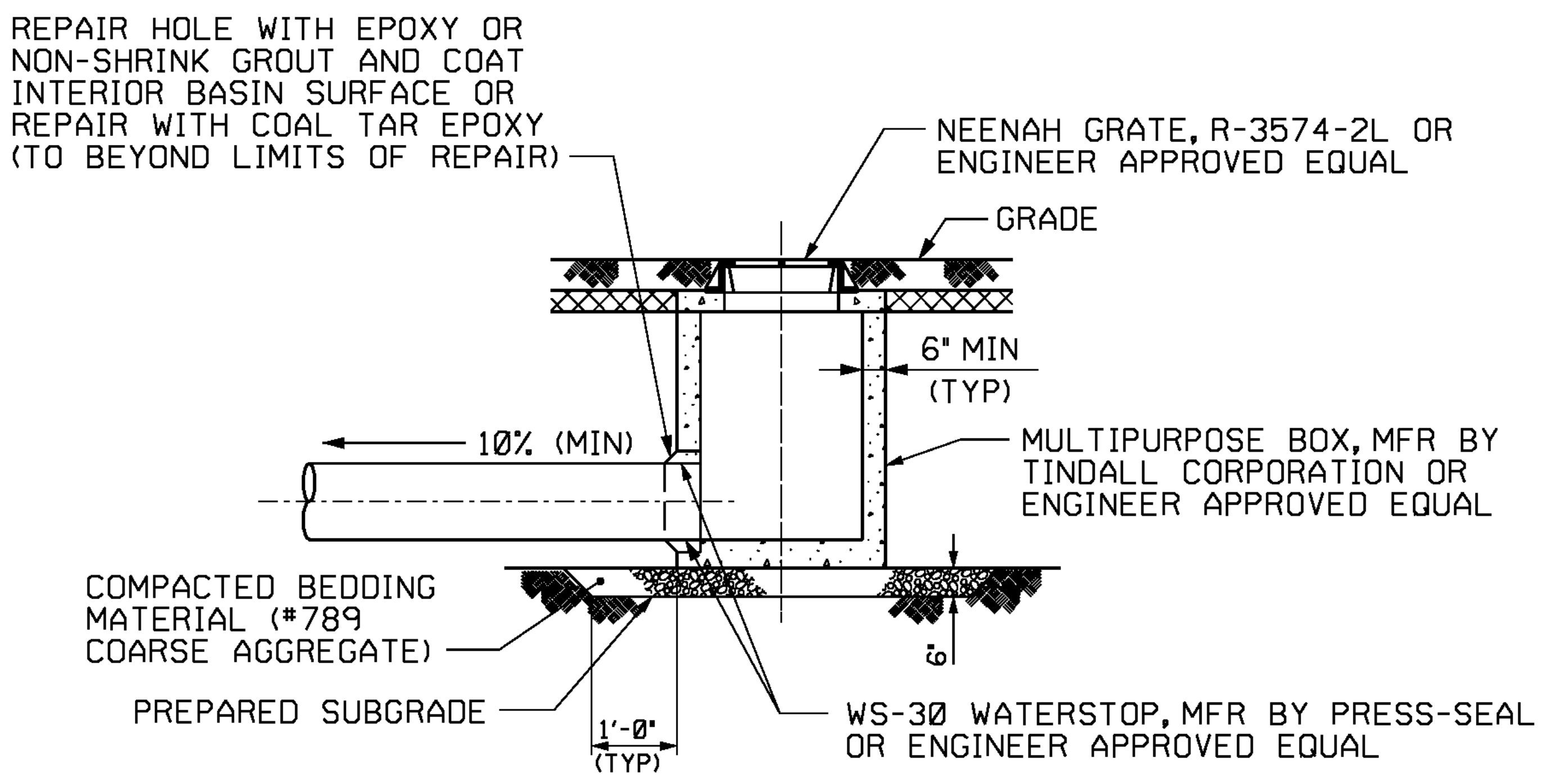
BENCH AT DOWNDRAIN CONNECTION POINT

NOT TO SCALE



PLAN - CATCH BASIN

NOT TO SCALE

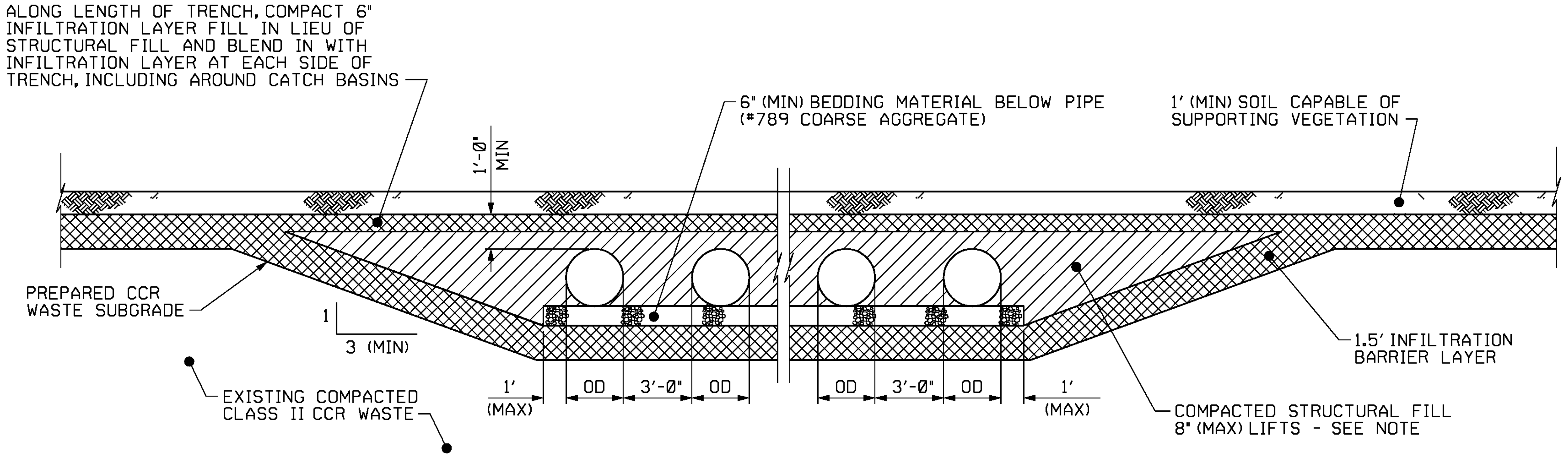


CATCH BASIN NOTE:

1. ALL MATERIALS SHALL BE INSTALLED AND COMPACTED IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.

ELEVATION - CATCH BASIN

NOT TO SCALE



NOTE: CAREFULLY COMPACT BEDDING MATERIAL OR STRUCTURAL FILL UNDER HAUNCHES OF PIPE TO ENSURE BACKFILL IS FREE OF VOIDS OR LOOSE ZONES ALONG LENGTH OF PIPE.

TYPICAL DOWNDRAIN BACKFILL DETAIL ON SIDE SLOPES

NOT TO SCALE

CATCH BASIN SCHEDULE

No.	COORDINATE		TOP OF EL	INV OUT
	NORTH	EAST		
CB-N1	14441.6	5289.9	163.5	158.5
CB-N2	14439.7	5279.9	163.5	158.5
CB-N3	14437.2	5270.0	163.5	158.5
CB-N4	14517.3	5262.9	143.5	138.5
	14522.3	5297.7	143.5	138.5
CB-N5	14655.3	5224.2	123.0	118.0
	14613.6	5303.5	123.0	118.0
CB-S1	12309.3	5299.1	163.5	158.5
CB-S2	12309.3	5289.2	163.5	158.5
CB-S3	12309.3	5279.4	163.5	158.5
CB-S4	12233.0	5272.2	143.5	138.5
	12231.9	5306.8	143.5	138.5
CB-S5	12151.5	5267.2	123.0	118.0
	12150.5	5312.5	123.0	118.0

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	
A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
C	11/25/14	KPF	FMW	KPF	FMW	FMW	ISSUED FOR REVIEW

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER

PRELIMINARY STATUS DATE
LDE F.M. WOOD 11/25/14
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS DATE
LDE
REPRESENTS REVIEWED AND APPRDVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

CERTIFICATE OF AUTHORIZATION
WORLEY PARSONS GROUP INC. No. 1505

PROFESSIONAL ENGINEER'S SEAL

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PE:__________ STATE:______
LIC. NO.:________ DATE:______

CROSS GENERATING STATION

Santee Cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

CLASS II SOLID WASTE LANDFILL
DOWNDRAIN
SECTIONS AND DETAILS

SCALE NONE
DRAWING SIZE ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-719-0110
REV C

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EcoNomics™

SANTEE COOPER

Cross Generating Station

Class 2 CCR Landfill

Notice of Intent to Close

CROSS-0-LI-044-0001

31 Dec 2015

WorleyParsons Group Inc.
2675 Morgantown Road,
Reading, PA, 19607
USA
Telephone: +1 610 855 2000
Facsimile: +1 610 855 2727
www.worleyparsons.com

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SANTEE COOPER
CROSS GENERATING STATION
CLASS 2 CCR LANDFILL

NOTICE OF INTENT TO CLOSE

PROJECT – CROSS GENERATING STATION

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Issued for Use	F Wood	L Catalano	F Wood	31 Dec 2015	N/A	

SANTEE COOPER
CROSS GENERATING STATION
CLASS 2 CCR LANDFILL

NOTICE OF INTENT TO CLOSE

CONTENTS

1 INTRODUCTION 1
2 NOTICE OF INTENT TO CLOSE 2
3 FINAL COVER SYSTEM DESIGN CERTIFICATION 3
4 CONSTRUCTION SCHEDULE 6

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
WORLEY PARSONS GROUP INC.
No. 1505

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 24767
FLETCHER M. WOOD

Fletcher Wood

31 DECEMBER 2015

SANTEE COOPER
CROSS GENERATING STATION
CLASS 2 CCR LANDFILL

NOTICE OF INTENT TO CLOSE

1 INTRODUCTION

The purpose of this document is to comply with notification and certification requirements in accordance with the federal EPA Coal Combustion Residuals (CCR) rule, 40 CFR Part 257.

§ 257.102(g) requires that a notification of intent to close a CCR Unit be placed in the facility's operating record upon initiation of closure activities. **This document is intended to serve as the notice of intent to close the existing Class 2 CCR Landfill at Cross Generating Station in Pineville, SC**. Included herein is a certification by a qualified professional engineer for the design of the final cover system, as required by § 257.102(d)(3)(iii).

2 NOTICE OF INTENT TO CLOSE

Pursuant to § 257.102(e)(1)(i):

> *The owner or operator must commence closure of the CCR unit no later than 30 days after the date on which the CCR unit receives the known final receipt of waste, either CCR or any non-CCR waste stream.*

The known final receipt of waste at the Class 2 CCR Landfill at Cross Generating Station occurred December 31, 2015.

Furthermore, in accordance with § 257.102(e)(3)(ii):

> *Closure of the CCR unit has commenced if the owner or operator has ceased placing waste and* …has *submitted a completed application for any required state or agency permit or permit modification.*

Closure plans and details for the Class 2 CCR Landfill at Cross Generating Station were provided to South Carolina Department of Health and Environmental Control in March 2013 and amended February 2015. Because this action was previously completed, the known final receipt of waste represents the initiation of closure activities.

§ 257.102(g) requires the following:

> *No later than the date the owner or operator initiates closure of a CCR unit, the owner or operator must prepare a notification of intent to close a CCR Unit. The notification must include the certification by a qualified professional engineer for the design of the final cover system as required by § 257.102(d)(3)(iii), if applicable. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(i)(7).*

Therefore, the purpose of this document is to serve as the Notice of Intent to Close the Class 2 CCR Landfill at Cross Generating Station. The above-referenced certification by a qualified professional engineer for the design of the final cover system as required by § 257.102(d)(3)(iii) is provided in the following section.

3 FINAL COVER SYSTEM DESIGN CERTIFICATION

General

Pursuant to § 257.102(d)(3)(iii):

> *The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this section.*

This section summarizes the final cover system design requirements as outlined in § 257.102(d)(3), describes the proposed final cover system design for the Class 2 CCR Landfill at Cross Generating Station, and provides a written certification that the proposed design satisfies the requirements.

Design Requirements

Pursuant to § 257.102(d)(3):

> *If a CCR unit is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.*

The prescriptive final cover system outlined in § 257.102(d)(3)(i) requires the following:

- final cover system permeability must be less than or equal to that of any bottom liner system or natural subsoils present, or a permeability no greater than 1 x 10^{-5} cm/sec, whichever is less;
- infiltration through the final cover system must be minimized by using an infiltration layer consisting of a minimum of 18 inches of earthen material;
- erosion of the final cover system must be minimized by using an erosion layer consisting of a minimum of six inches of earthen material capable of sustaining native plant growth; and
- the disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

§ 257.102(d)(3)(ii) allows for the use of an alternative final cover system design, provided the alternative final cover system is designed and constructed to provide equivalent performance as the prescriptive final cover system outlined above with respect to infiltration, erosion, and settling and subsidence.

Proposed Design:

The proposed final cover system design for the Class 2 CCR Landfill at Cross Generating Station includes two types of final cover. These are outlined below:

Final Cover System Type 1:

A prescriptive final cover system will be installed on the north and south slopes of the Class 2 CCR Landfill. From the bottom up, the design consists of an 18-inch thick earthen infiltration layer with a maximum permeability of 1×10^{-5} cm/sec, and a 12-inch thick earthen erosion layer capable of sustaining native plant growth. The existing landfill is unlined, with the permeability of the natural subsoils exceeding that of the final cover system infiltration layer. The design accommodates settling and subsidence in order to minimize any disruption of the integrity of the final cover system.

The proposed Type 1 final cover system design therefore meets the requirements set forth in § 257.102(d)(3)(i).

Final Cover System Type 2:

An alternate composite liner final cover system will be installed over the remainder of the Class 2 CCR Landfill (east and west slopes and top deck) in areas where the existing landfill will be "piggybacked" by future Class 3 landfill cells. From the bottom up, the design in these areas consists of a geosynthetic clay liner with a maximum permeability of 5×10^{-9} cm/sec, and a 60 mil HDPE geomembrane liner. The composite liner will meet or exceed the performance of the prescriptive final cover system with respect to minimizing infiltration. The geomembrane component of the final cover system is designed for exposure to the elements (including sun, wind, and water), and will meet or exceed the performance of the prescriptive final cover system with respect to resistance to erosion. Final grades across the top deck will be a minimum of 3%, which is consistent with MSW landfill final cover requirements for which much greater settlement and subsidence is typically anticipated. The design therefore accommodates settling and subsidence in order to minimize any disruption of the integrity of the final cover system.

The proposed Type 2 final cover system design therefore meets the requirements set forth in § 257.102(d)(3)(ii).

Certification:

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 those individuals immediately 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 proposed design of the final cover system meets the requirements of 40 CFR 257.102(d)(3).

WORLEY PARSONS GROUP INC.
No. 1505

No. 24767
FLETCHER M. WOOD
Fletcher Wood

31 DECEMBER 2015

Fletcher Wood
Printed Name of Professional Engineer

Fletcher Wood
Signature of Professional Engineer

24767
South Carolina License #

4 CONSTRUCTION SCHEDULE

Pursuant to § 257.102(f)(1)(i), the owner or operator must complete closure of the CCR unit:

> *For existing and new CCR landfills and any lateral expansion of a CCR landfill, within six months of commencing closure activities.*

Final closure of the Class 2 CCR Landfill at Cross Generating Station will be completed by June 30th, 2016, in accordance with the above requirement.

SANTEE COOPER
CROSS GENERATING STATION
CLASS 2 CCR LANDFILL

WRITTEN CLOSURE PLAN

Certification:

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 those individuals immediately 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 closure plan, as amended January 5, 2016, meets the requirements of 40 CFR 257.102(b)(1).

No. 18485
DENISE A. BUNTE-BISNETT

January 5, 2016
Date

Denise A. Bunte-Bisnett
Printed Name of Professional Engineer
Title: Principal Engineer
Santee Cooper

Denise A. Bunte-Bisnett
Signature of Professional Engineer